# ADOPTION, IMPACT AND SPATIAL DIFFUSION OF CONSERVATION FARMING AMONG THE SMALL-SCALE FARMERS IN CHIPATA DISTRICT: THE CASE OF SOUTHERN AGRICULTURAL FARMING BLOCK.

**BY**

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## DECLARATION

I Kenneth Phiri declare that this dissertation represents my own work, and that it has not previously been submitted for a degree, diploma or other qualification at this or any other University. All published work or material from other sources which have been incorporated have been specifically acknowledged and adequate reference thereby given.

Signed:

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Date:

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## APPROVAL

This dissertation of Kenneth Phiri has been approved as partial fulfilment of the requirements for the award of the Master of Science degree in Geography, by the University of Zambia.

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## ABSTRACT

Since 2006 the Conservation Farming Unit (CFU) of the Zambia National Farmers Union (ZNFU) has been promoting Conservation Farming (CF) in Chipata District among the Small-scale Farmers (SsF) and in 2008 the Government of the Republic of Zambia also stepped up the promotion of CF among the small-scale farmers.

The aim of this study was to find out the channels of communication through which the SsF received CF messages and the extent of the adoption of CF in the Southern Agricultural Farming Block of Chipata. The objectives of the study were to: (i) find out the rate of adoption of CF and CF practices by the SsF, (ii) examine the impact of CF among the SsF in the study area. (iii) Identify barriers to adoption of CF among the SsF and (iv) to determine the spatial pattern of adoption of CF in the study area.

Data were collected by interviewing a sample of SsF and some key informants who included CFU Officers, the District Agriculture officer, Agriculture Extension Officers, Farmer Coordinators and Lead/Contact farmers. The analysis of quantitative data involved the use of the Statistical Package for Social Sciences (SPSS 11). Pearson's Product-Moment Correlation Co-efficient and the Student's t test were used to test correlations between age and adoption of CF, period of stay in the area and adoption of CF and the significant difference of maize production between basins and ridges respectively.

Results revealed that there is a gradual increase in the rate of adoption of CF by the SsF in the Southern Agricultural Farming Block. However, it has also been noted that CF has impacted positively on the production of crops, particularly maize and cotton, by the small-scale farmers. Thus where farmers practised CF, they were able to harvest more crop than where conventional methods of farming were practised. In terms of the extent of diffusion, CF has covered the entire study area and this has taken place mainly through hierarchical diffusion. This was from CFU to Farmer Coordinators, to Contact farmers and finally to all small-scale farmers or from MACO to Agriculture Extension Officers, to Lead farmers and finally to all small-scale farmers.

The prevailing situation in the Southern Agricultural Farming Block (SAFB) was that the small-scale farmers who adopted CF on one hand had also continued with conventional farming (Conv.F). However, the persistence of these conventional methods of farming and the Field Day Demonstration centre (FDD) (Mtenguleni) which is not at the mean travel distance to all farmers in the farming block and the unreliable maize market act as barriers to adoption of CF.

In view of these findings the following recommendations were made:

- SsF should not base adoption of CF on what they are to be given by the promoters but on the benefits arising from practising it such as high production of maize.
- CFU should open up other Field Day Demonstration centres in the study area.
- Government should ensure that all Agriculture Camps (ACs) have Agriculture Extension Officers (AEOs) so that the ratio between the small-scale farmers and these officers is minimal in their respective catchment areas.

## ACKNOWLEDGEMENTS

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Last but not the least my thanks go to my family members for their support materially and spiritually and for their perseverance during my absence from them. I know it was not easy and I say thank you.

## DEDICATION

To my wife Margaret who did not bother about my absence from home. She forged ahead with the responsibility of looking after our children alone. Yes you are my queen and my heroine without whom I would not have managed to pull through in this task.

## OPERATIONAL DEFINITIONS OF TERMS

**Head of Household…**This is a person who is in charge of making day to day decisions concerning the running of the household and is regarded as such by all household members (CSO, 2000).

**Household…** A group of persons who normally live and eat together. These people may or may not be biologically related to each other and make common provision for food and other essentials for living (CSO, 2000).

**Urban…** An area having a population of 5000 or above supported with a minimum of social facilities and services like piped water, electricity, banking facilities, post office and many other social services that may be offered, (CSO,2000).

**Small-Scale Farmer…**This is a farmer who cultivates less than 5hectares of land (CSO, 2000)**.**

**Conservation farming…**A farming practice which involves hoe dug planting basins or Magoye-Ripper made planting furrows. No ploughing or ridging is done (CFU, 2007).

**Diffusion…** A process by which an innovation is communicated through certain channels over time among the members of a social system (Rodgers, 1962).

**Adoption….** A process that involves five stages namely; knowledge, persuasion, decision, implementation and confirmation in the use of an innovation (Rodgers, 1962).

**Rate of adoption..** Is the relative speed with which an innovation is adopted by members of a social system. It is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation (Rodgers, 1962).

**Zero tillage…**This simply means that neither ploughing nor ridging of the land is done before planting (CFU, 2007).

**Barriers…**These are factors that hinder or block the spread of an innovation to other areas (Abler *et al*.,1971).

**Ripping…**This is the opening up of shallow furrows (lines) in the soil for planting using a Magoye Ripper (CFU, 2007).

**Basins...** Dag up shallow holes not more than 15cm deep for planting (CFU, 2007).

**Contact farmers….**These are immediate supervisors to fellow small-scale farmers whose role is to educate them on CF and also monitor them to ensure that they apply CF practices correctly. They report to Farmer Coordinators (CFU, 2007).

**Chaka hoe**… This is a farming tool that was designed by CFU for digging planting basins which is sold to small-scale farmers. It is shaped in such a way that makes it easy to dig basins even on dry soils (CFU, 2007).

**Farmer Coordinators…**These are immediate supervisors to Contact farmers whose duty is to conduct trainings to Contact farmers and also to all farmers on CF. They report to CFU Field Officers ( CFU, 2007).

**Field Officers….**CFU Officers, whose role is to monitor fields of farmers, conduct trainings to Coordinators and at times to all farmers. They also organize field day demonstrations for small-scale farmers (CFU Officer, 2010).

**Laggards…**The last individuals to adopt an innovation. They have typically an aversion to change-agents and tend to be advanced in age. They show little to no opinion leadership (Rodgers, 1962).

**Early majority…** Adopt an innovation after a varying degree of time. They tend to be slower in the adoption process, have above average social status, contact with early adopters, and seldom hold positions of opinion leadership in a system (Rodgers, 1962).

**Late majority….**Adopt an innovation after the average member of the society. They approach an innovation with a high degree of skepticism and after the majority of the society has adopted the innovation (Rodgers, 1962).

**Early Adopters…**Second fastest category of individuals who adopt an innovation. They have highest degree of opinion leadership among the other adopter categories. They are more discrete in adoption choices than innovators (Rodgers, 1962).

**Innovators...** The first individuals to adopt an innovation. They are willing to take risks, youngest in age, have the highest social class, have great financial lucidity, very social and have closest contact to scientific sources and interaction with other innovators (Rodgers, 1962).

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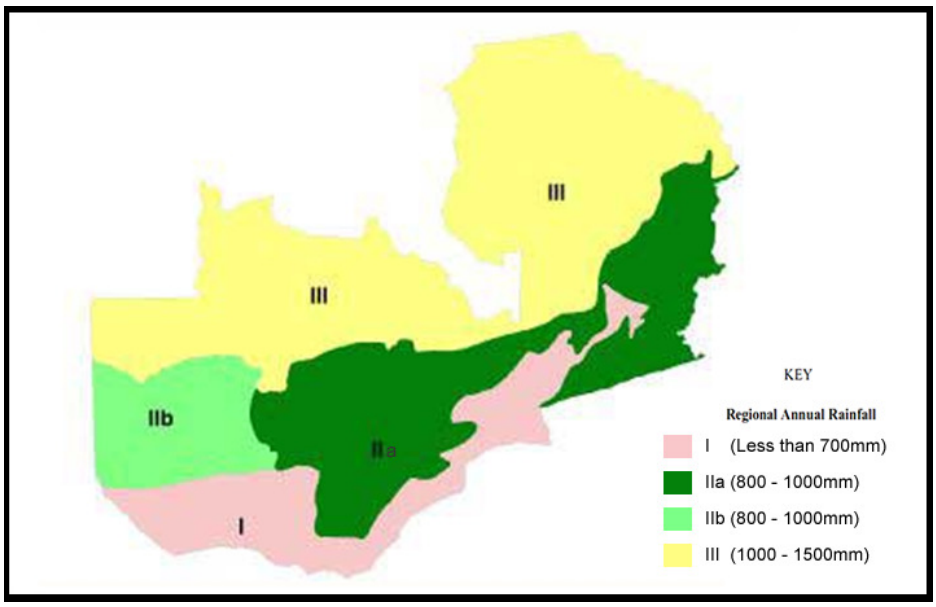
# CHAPTER 1: INTRODUCTION

## 1.1 Introduction

Ideas, materials or technology, move from the area where they are generated or initiated to another where they are yet to be known or adopted. There are different ways through which the movement of ideas or information from one area to another is done. The ways could be through audio, visual and or print media. Other ways could be the deliberate effort which the organization concerned makes to ensure that a certain idea or technology gets to the targeted people through short trainings, seminars and workshops.

Conservation Farming (CF) too may be an idea which is known in one area and may not be known in another. However, it has been spreading through out the country since 1996 when it was initiated in Monze District of Southern Province by the Conservation Farming Unit (CFU) of Zambia National Farmers Union (ZNFU). The Ministry of Agriculture and Co-operatives (MACO) and other Non Governmental Organizations (NGO's) also joined in the dissemination of CF practices through out the country. CF implied in this study is the use of a Chaka hoe to dig planting basins and the use of a Magoye Ripper to make planting furrows. Thus there is no ploughing or ridging of the land during preparation for cultivation in this type of farming. However, diffusion of CF has been slow and there are some variations in terms of its adoption in all the provinces of Zambia. The conventional methods of farming are still highly practised. In Eastern Province for example only 1.4% of small-scale farmers have adopted planting basins and only 1.0% of them have adopted ripping. On the other hand farmers who are still ploughing constitute 27.1% and ridging 40.8% (CSO, 2008). This is inspite of the deliberate efforts made by CFU and other NGO's in promoting CF practices. It has been noted, however, that CF basins appeal most to small-scale farmers where rainfall proves erratic and unreliable such as in agro-ecological zones I and IIa (Figure 1.1) where annual rainfall is between 800 and 1000mm.

**Figure 1.1 Agro-Ecological Zones of Zambia.**




**Sources: CFA, Zambia Branch homepage**

## 1.2 Statement of the Problem.

Some NGO's such as the Co-operative League of the United States of America (CLUSA), Every Home for Christ (EHC) and CFU have been supporting CF in Chipata District for more than ten years. However, according to Central Statistical Office (CSO) (2008), the number of farmers practising CF in Chipata district is still quite low as evidenced by the following statistics: planting basins 1.1%, ripping 1.3% but conventional methods of tillage such as conventional hand hoeing constitute 26.3%, ploughing at 14.9% and ridging at 52.0%. This study therefore seeks to find out the causes of the low adoption rates of CF in the Southern Agricultural Farming Block of Chipata District.

## 1.3 Aim of the Study

The study aimed at finding out the channels of communication through which the small-scale farmers received CF messages and the extent of its adoption and impact in the Southern Agricultural Farming Block of Chipata District.

## 1.4 Objectives

1. To find out the rate of adoption of CF and the adopted CF practices by the small-scale farmers.

2. To examine the impact of CF among the small-scale farmers in the study area.
3. To identify the barriers to adoption of CF among the Small-scale farmers.
4. To determine the pattern of adoption of CF in the study area.

### 1.5 Hypotheses

i. There is significant difference between production of maize using CF (basins) and conventional farming practices (ridges).

ii. There is significant correlation between the ages of small-scale farmers and adoption of CF.

### 1.6 Significance of the Study

In the midst of the global climate change, it is important for farmers to adopt cultivation technologies where one is able to produce more crop per hectare with moderate application of inputs. So far, CFU (2OO7), has identified CF as part of the answer to the global climate change.

Therefore, the findings of this study will offer the rural community practical solutions that can help them address some negative impacts of the local climatic challenges. This is because CF improves water infiltration, provides good root development, and harvest water in years of sporadic rainfall. Farmers also plant early due to dry season land preparation and the gradual build up of soil organic matter leads to increased yields.

Since Chipata is in an agro-ecological zone where rainfall is between 800 and 1000mm per annum, CF has a potential for increased crop production and retention of soil fertility. According to CFU (2007), there are promising results for the small-scale farmers who have already adopted CF. On the other hand some research works such as for Hagghblade and Tembo (2003), so far do not indicate clearly adoption patterns of CF in the study area, hence the significance of this study.

### 1.7 Organization of the Dissertation

The dissertation is arranged as follows: Chapter one is the introduction; the review of literature is covered in chapter two; the description of the study area is undertaken in

chapter three; Methodology is covered in chapter four; Chapter five presents and discusses the findings of the study and chapter 6 covers the conclusion and recommendations.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Maintenance of soil fertility in Zambia.

Before the advent of colonialism in Zambia, agricultural activities were based on traditional technology which was associated with shifting cultivation. Mlay *et al.,* (2003), observe that low population density permitted long periods of fallow which facilitated not only soil fertility regeneration but also allowed forest regeneration. Chondoka (1992), also notes that during this time mixed farming was practised, i.e. a combination of pastoral and arable activities.

During the Colonial period shifting cultivation continued and the improvement of soil fertility was done by the use of ash which was obtained by burning of the tree branches (Hellen, 1968). However, ash also neutralized the acidity of the soil in high rainfall areas of North-western, Northern and Luapula Provinces. Trapnell (1996), observes that even if there was no shifting cultivation in some areas like the lake basin of Northern Province, the villages concentrated on growing cassava on the mounded gardens. As for the Lozi people of Western Province Trapnell (1996), notes that they systematically fertilized their gardens with cattle manure. Dodge (1977), argued that the Colonial Administraion also introduced Peasant Farming Schemes and African Improved Farming Schemes in which participating farmers were expected to adopt fallows, contour ridges, maintain conservation works and adopt European standards of cultivation and weed control.

However, after the attainment of independence in 1964, the United Independence Party (UNIP) Government provided fertilizer subsidies to Family Settlement Schemes, Rural Reconstruction Centres (RRC), Operation Food Production Program (OFPP), and Intensive Development Zones (IDZ) and to the Lima Programme where conventional methods of farming involving ploughing and ridging were encouraged. Wood (1990), even argued that conventional farming was reinforced by subsidized land preparation through Government mechanization tractor units.

## 2.2 The Concept of Diffusion of an Innovation

World development is dependent on the transfer of ideas and technology. Edmund and Baker (2004), noted that since civilization began, these ideas and technology, as they transfer, from one place to another get adopted and adapted with varying levels of success. However, according to Haggett (1983), much geographic interest in diffusion studies, stemmed from the work of the Swedish geographer Torsten Hagerstrand and his colleagues at the University of Lund. Haggett (1983), notes that Hagerstrand, in his early studies of a contagious diffusion process, suggested a four-stage model for the passage of what he termed innovation waves. The four stages that he identified were: the primary stage which marks the beginning of the diffusion process. Centres of adoption are established and then there is a strong contrast between these Centres of innovation and remote areas. Then secondly, is the diffusion stage which signals the start of actual diffusion process. Thirdly, the condensing stage which shows that, the relative increase in the number accepting an item is equal in all locations regardless of their distance from the innovation centre. Finally, the saturation stage which is marked by a slowing and eventual cessation of the diffusion process. Thus, the item being diffused has been accepted through out the entire country so that there is very little variation.

Earlier, Haggett (1979), gave two distinct meanings of diffusion: A process by which information, materials and other things, spread from one place to the other. This he referred to as expansion diffusion; the other was relocation diffusion, which is a similar process of spatial spread but things diffused leave the areas where they originate, as they move to new areas. In a similar vein, Abler *et al*., (1971), argued that, for expansion diffusion, as the idea or innovation, gets known by a few people, then soon it is communicated to others and those tell their acquaintances in turn, and gradually the idea/innovation spreads through out the population. Thus an idea is communicated by some one who knows about it, to one who does not know, and the total number of people knowing increases through time. Abler *et al.,* (1971), also note that, expansion diffusion occurs in two ways: contagious diffusion, which is influenced by frictional effect of distance and the other, hierarchical diffusion, where simple geographic distance is not always the strongest influence in a diffusion process, for some ideas or innovations seem to

leap over many intervening people and places, but in which large places or important people tend to get the news first, transmitting it later to others down the hierarchy.

However, Blaut (1977), also observes that before diffusion takes place, a landscape is empty of a given trait and after diffusion; the trait has diffused through out the landscape. He takes diffusion as an incident of cultural change, and culture change is an exceedingly complex process. Thus, technological innovations tend to be rejected not through ignorance, but through incompatibility with the existing cultural system as a whole. In another view, Blaut (1987), also argues that, certain places are permanent loci of innovation or invention and thus are more advanced and more progressive than other places. In his view all communities have equal potential for invention and innovation regardless of whether in the landscape as a whole the ability to invent is low or high. Therefore, all communities possess the same underlying potential to create, to invent and to innovate as they are distributed along side one another across a landscape.

Much clearer works on diffusion was done by Rodgers (1962), in which he defines diffusion as a process by which an innovation is communicated through certain channels over time among members of a social system. Rodgers (2003), in his presentation transcript also notes four main elements that influence the spread of new idea: the innovation, which is an idea, practice, or object perceived as new by an individual or other unit of adoption; communication channels, the means by which messages get from one individual to another; time, the process in which an individual passes from first knowledge of an innovation, to a formation of an attitude toward it, to a decision to accept or reject it, to implementation and use of the new idea and to confirmation of this decision knowledge; social system, which is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. He further notes that there are five steps or stages in the diffusion of an innovation namely: knowledge, in which the individual first is exposed to an innovation but lacks information about the innovation and has not been yet inspired to find more information about the innovation; persuasion, the individual is interested in the innovation and actively seeks information/detail about the innovation; decision, the individual takes the concept of change and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation; implementation, where the individual employs the innovation to a varying degree depending on the

situation and the individual determines the usefulness of the innovation and may search for further information about it; confirmation, the individual finalizes his/her decision to continue using the innovation and may end up using it to its fullest potential.

Rodgers (1962), also suggests five categories of adopters in order to standardize the usage of adopter categories in diffusion research which he terms: innovators, early adopters, early majority, late majority, and laggards. In fact, Rodgers (1962), was the first to coin the term, 'early adopters.' However, Rodgers (1962), suggests the five adopter categories because he argues that, through out the diffusion process, there is evidence that not all individuals exert an equal influence over all individuals. Thus, according to him, there are opinion leaders who are influential in spreading either positive or negative information about an innovation. In addition, Rodgers (1962), observes that, opinion leaders have a set of characteristics that set them apart from their followers and other individuals, and that they typically have exposure to the mass media, more cosmopolitan, greater contact with change agents, more social experience and exposure, higher socioeconomic status and are more innovative.

### 2.2.1 Factors Influencing Diffusion of an Innovation

Rodgers (1962), identifies 5 factors that influence an individual's decision to reject or adopt an innovation. These are: Relative advantage, which means how improved an innovation is over the previous generation, Compatibility; the level at which an innovation has to be assimilated into an individual's life, Complexity or simplicity; if the innovation is too difficult to use an individual is not likely to use or adopt it, Triability; how easily an innovation may be experimented with as it is being adopted. Thus if a user has a hard time using and trying an innovation, this person is less likely to adopt it. Observability; the extent to which an innovation is visible to others. Thus an innovation that is more visible will drive communication among the individual's peers and personal networks and will in turn create more positive or negative reactions.

In relation to CF, Nowak and Korsching (1985), identify three conditions that could influence diffusion of CF; the degree of development in the technologies that make up a conservation tillage system; how supporting technologies are distributed among farmers as generation of technologies and distribution are different processes; social and economic

factors surrounding farmers' adoption decisions as farmers' decisions about conservation tillage are strongly influenced by their social standing in the community, available resources and the type of profitability of the farm operation. Nowak and Korsching (1985), further observe that the rate of diffusion of CF within an agricultural community also relates to community characteristics; such as available support from conservation organizations, formal communication channels for disseminating information and the informal communication networks among farmers. However, Nowak and Korsching (1985), also note that how these factors, translate into meaningful support programmes is not very well understood and as such, programmes are often created and implemented around the doctrine that adoption depends on regulating the farmer.

### 2.2.2 Barriers to Diffusion of an Innovation

The diffusion processes do not move over smooth and homogeneous surfaces because geographic space is seldom close to the ideal transportation surface where movement is equally easy in all directions. According to Abler *et al*., (1971), this is due to barriers which slow down and warp the pure forms of diffusion and barriers have three effects: upon hitting an absorbing barrier, a purse of innovation is stopped in the vicinity of a barrier. All the energy is completely absorbed, so that the process of diffusion is halted; sometimes an innovation wave will hit a barrier and then bounce off it, such barriers are termed reflecting and they can often channel the energy of a diffusion process and intensify it in a local area.

Abler *et al*., (1971), also agree with Rodgers (1962), that, in any area through which an innovation diffuses, there will always be some early innovators, who adopt it first, and once they set the example, they are quickly followed by a group which may be called the early majority, and in turn their example brings in the late majority and finally comes the laggards at the tail end when nearly every one else has adopted the new practice/innovation. The distribution of the innovators and laggards can be described by using a normal curve just like a logistic curve which could be done by plotting the proportion of people adopting an innovation along the vertical axis and the time taken of adoption along the horizontal axis. Haggett (1979), establishes that, the resistance of a population to adopting an innovation usually follows an S-shaped curve.

## 2.3 CF in Southern Africa

### 2.3.1 CF in ward 21 of Chivi South District in Zimbabwe

A study was conducted on small holder farmers who were practising CF in the South of Chivi District by Gukurume and others in 2010. The study was to find out and evaluate the villagers' perceptions on CF as a sine qua non to their threatened food security in the era of climate change (Gukurume *et al.,* 2010). According to Gukurume *et al.,* (2010), the study also examined the relationships between all the participating stake holders in CF. However, implications of such relationships on adoption of the innovation, agricultural productivity, sustainable development and rural livelihoods were also investigated.

In their findings, Gukurume *et al.,* (2010), observed that CF did not actually ameliorate rural poverty and let alone improved food security in the South of Chivi District. The authors also argued that the NGO's which supported CF failed to consider the various life worlds and lived realities of the beneficiaries of development. Thus even if to the NGO's CF was the most efficient farming technique which suited smallholder farmers in drought prone regions, the villagers in ward 21 had a negative perception towards it. The majority of them according to Gukurume *et al.,* (2010), considered CF as a backbreaking programme which did not warrant the effort given to it. Gukurume *et al*., (2010), also noted that CF required a lot of human capital which ultimately is invested in digging basins, searching for organic fertilizers, mulching, weeding and other related tasks that go with CF. Thus the only way CF could have succeeded as argued by Gukurume *et al.,* (2010), was the provision of education to smallholder farmers and the availing of herbicides and other equipment in order to reduce the need for intensive labour. As observed by Gukurume *et al*., (2010), the NGOs supporting CF also needed to treat the smallholder farmers as subjects of development than objects. Thus smallholder farmers were taken to be passive recipients of development interventions than knowledgeable actors who had the capacity to define and improve their position.

Other factors which made the people of ward 21 not to adopt CF in Chivi District as observed by Gukurume *et al.,* (2010), were their traditional perceptions of the zero tillage system. Most of the villagers in ward 21 were cattle herders and also kept donkeys and

thus saw no need in digging basins instead of making ridges and ploughing. The authors however, further observed that in order to get the much needed seeds and fertilizers the people in ward 21 pretended to fully embrace CF. According to these researchers, the majority of the smallholder farmers said that, they thrived on misleading the NGOs into believing they were full members of the project in order to get the much needed seed and fertilizers. Thus, once they got such inputs from the Promoters of CF, they reverted to the conventional methods of farming.

Gukurume *et al*., (2010), further found out that fear of the future was another factor that compelled the smallholder farmers to join CF, although their level of commitment was questionable. The fear therefore, was that if they opted out of the programme, they would be left out of future programmes by the NGOs. Thus, as observed by Gukurume *et a*l., (2010), their participation in the project, or programme, was merely 'cosmetic' than genuine, since they participated out of fear of disappointing the NGOs that had been aiding them for a long time during times of need.

Further more, Gukurume *et al*., (2010), identified various actors with regards to CF in ward 21 of Chivi South District. The actors included the Government, the NGOs, the Extension workers, traditional authorities and the local farmers themselves. According to the authors, these actors had diverging and often conflicting interests towards the CF programme. The NGOs wanted their project to be successful so that they could continue to receive funding from the Donors. The Government and the Extension workers on the other hand as well as the local authority were more inclined towards the project because of the number of benefits also accrued to them for taking such a stance towards CF. Gukurume *et al*., (2010), were of the view that they did so primarily because they received more benefits than the local farmers and in most cases; they received allowances from NGOs, since NGOs were desperate to see the programme to fruition. Therefore, it could be argued that the farmers in Chivi District only adopted CF for the sake of accessing farming inputs otherwise they may not have been interested.

This was why Gukurume *et al*., (2010), argued that the rural farmers in ward 21 of Chivi South District, however, did not have an understanding of how CF could have been an engine for moving them out of the food insecurity quagmire confronting them. Thus, the

researchers note that even if the NGOs argued that the digging of basins helps to keep the soil intact, keep the soil away from soil erosion, and conserve the much needed soil moisture, to the extent that even with minimum rainfall productivity is enhanced, the local farmers however, held contradicting and conflicting perceptions on CF. The majority of them strongly believed that basins did not conserve moisture, but just exposed their crops to the scorching sun. Gukurme *et al*., (2010), further noted that, to cement their position, the smallholder farmers argued that, in previous years, when they used conventional methods of farming their yields were much better compared to those under CF.

The researchers suggest that, when designing programmes, the NGOs need to consider geographical peculiarities and particularities, culture, history and other important characteristics if such development interventions are to have meaning in such communities and achieve the intended objectives. They further argued that meaningful development could have only been realized through embracing the local villagers' culture and knowledge systems.

### 2.3.2 CF in Zambia

By the 1990s it was discovered that Zambia's agricultural land had declined in fertility and ultimately its productivity was affected adversely. This was due to many years of heavy fertilizer application which made soils quite acidic and persistent ploughing and ridging which compacted soils thereby making hard pans (Hagghblade and Tembo, 2003). The soil hard pans inhibited both root and water penetration. According to the Institute of Economic and Social Research (INESOR) (1999), other causes for loss of soil fertility were the inappropriate farming practices by the small-scale farmers such as repeated cultivation which led to soil erosion and soil compaction.

There were also other reasons that led to the introduction of CF in Zambia. The droughts that characterized the 1990s had also a negative impact on the small-scale farmers. Hagghblade and Tembo (2003), cite 1991/1992 growing season when there was a serious drought which significantly lowered production by the small-scale farmers as they depended entirely on seasonal rainfall. Also the fertilizer subsidies were discontinued when the Movement for Multiparty Democracy (MMD) took over power from UNIP in 1991 and

this presented a big challenge to the small-scale farmers in as far as maize cultivation and other crops was concerned.

Therefore, Hagghblade and Tembo (2003), note that, in order to address this problem, some NGOs came together in the early 1990s to find a way of improving soil fertility which ultimately would improve production among the small-scale farmers. The NGOs included: CFU of ZNFU, Institute of Agriculture Environmental Engineering (IMAG) project and Golden Valley Agricultural Research Trust (GART). Other private organizations involved were: Dunavant Cotton Company, CLUSA, and Land Management and Conservation Farming (LMCF) together with their partners at the extension service of MACO, the Catholic Archdioces of Monze, and Development Aid from People to People (DAPP), Care International and Africare. These came up with more sustainable management systems to respond to the changing farming conditions. The management systems were;

i. Minimum tillage commercial farming
ii. Hand hoe conservation farming package
iii. Agricultural engineering and development of the Magoye Ripper
iv. Improved furrows

However, these CF practices, emerged as a by-product of international technology transfer by large-scale commercial farmers. This was after the South African and Zimbabwean farmers visited the United States of America (USA) which had advanced in CF technologies. When they came back they launched their own research programmes during the 1980s (Ellwell, 1995). Oldrieve (1993), noted that, commercial farmers imported minimum tillage systems for their own use. However, he observed that these systems later became important versions for the 440,000 Zambian small-scale farmers living in low and medium rainfall zones. Ellwell (1995), also argued that, Zimbabwe Agricultural Research Trust (ZART) was influential on the Zambian commercial farmers in as far as the introduction of CF was concerned.

Therefore, in 1998, the Ministry of Agriculture Food and Fisheries (MAFF), now (MACO), formally embraced CF as an official policy of the Zambian Government. This led their partners at LMCF to step up promotional efforts for both CF furrows and hand

hoe basins. As such by 2001 MACO's technical branch established a National CF steering committee with representation from all stakeholders in the agricultural sector to help coordinate flows and facilitate collaboration (Hagghblade and Tembo, 2003). Further more the adoption by the government of CF practices as a policy strengthened the diffusion process in the country (MAFF, 2001).

### 2.4 CF Practices

In this type of farming, the farmers do not plough the land for cultivation. Minimum or zero tillage is involved (CFU, 2007). Minimum tillage is a way of planting crops by ripping the land just to a depth of about 15cm and this gives it a distinctive feature to conventional farming. It is also noted that minimum tillage reduces soil and moisture loss, improves soil fertility and soil structure and then reduces labour at land preparation.

According to Hagghblade and Tembo (2003), CF in Zambia was developed for small-scale hoe and ox-farmers. Thus for hoe farmers it is based on the preparation of a precise grid of permanent basins (holes) about 1580 of them per hectare. This preparation of basins is done during the dry season immediately after harvest. The farmers who own cattle (oxen) rip planting furrows using a locally developed Magoye Ripper, also during the dry season. Fenster and Mannering (1983) have noted that zero tillage is a method of planting crops that require no seed bed preparation other than the soil for seed placement at the intended depth. CFU (2007a), terms this practice of planting as flat culture.

However, Hagghblade and Tembo (2003), further observe that CF contains a package of several other key practices such as; dry season land preparation using minimum tillage systems, crop residue retention, seeding and input application in fixed planting stations and nitrogen fixing crop rotations. Legumes are usually used in the rotations because they fix nitrogen, improve soil fertility, break up hard soil pans and are an excellent source of proteins for the family. These practices of minimum tillage, zero tillage and mulch tillage according to Magleby *et al.,* (1985), retain at least 30% of crop residue cover on the soil surface after planting. Thus they are Conservation Tillage (CT) practices. Lesoing and Sahs (1985), also observe that, combining manure application with a crop rotation involving legumes could be an effective crop management system in CF.

## 2.5 Distribution of Adopters of CF and Conv.F practices for the 2008-2009 growing season in Zambia.

In spite of the continued deliberate promotions of CF by the Government and the private sector, there were some regional variations of adoption. The percentage distribution of adoption practices in the provinces according to CSO (2008), was as presented in Table 2.1 below.

**Table2. 1 Distribution of Adopters of CF and Conv.F Practices by Province in Zambia**

| PROVINCE | BASINS (%) | RIPPING (%) | ZERO TILL (%) | BUNDING % | CONVENTIONAL HANDHOE (%) | PLOUGHING (%) | RIDGING (%) |
|---|---|---|---|---|---|---|---|
| Copper-belt | 0.2 | 1.1 | 0.5 | 1.1 | 49.0 | 7.7 | 40.4 |
| Eastern | 1.4 | 1.0 | 14.4 | 0.0 | 15.3 | 27.1 | 40.8 |
| Central | 1.2 | 0.1 | 0.4 | 0.1 | 38.0 | 57.7 | 2.6 |
| Luapula | 0.6 | 0.2 | 1.6 | 24.4 | 9.4 | 0.2 | 63.6 |
| Lusaka | 3.2 | 0.9 | 4.1 | 0.5 | 45.8 | 43.1 | 2.4 |
| Northern | 0.2 | 0.1 | 0.2 | 1.5 | 24.8 | 2.9 | 70.2 |
| Southern | 1.2 | 0.1 | 0.7 | 0.0 | 8.9 | 89.1 | 0.0 |
| Western | 0.7 | 0.1 | 0.1 | 0.0 | 29.3 | 69.9 | 0.0 |
| North-western | 0.3 | 1.3 | 0.4 | 1.3 | 37.5 | 5.0 | 55.2 |

**Source: CSO, 2008**

Table 2.1 suggests that Lusaka Province led in planting basins at 3.2% while Eastern, Central and Southern were at 1.4%, 1.2% and 1.2% respectively. The four Provinces had higher percentages of adoption of CF planting basins because of the arable land which is suitable for cultivation of crops. However, these Provinces are also found in agro-ecological zone IIa in which annual rainfall is between 800 and 1000mm. Provinces such as Lusaka and Eastern have agriculture as the main economic activity. Lusaka may have some industries but cannot absorb the entire population for employment-hence some rural and urban people are engaged in farming. North-Western, Copper-belt and Eastern Provinces led in ripping at 1.3%, 1.1% and 1% respectively. This means that a number of small-scale farmers who owned cattle also owned Magoye Rippers. In the other Provinces both ripping and planting basins percentage adoptions were below 1%. Eastern Province led in zero tillage farming system at 14.4%.

Table 2.1 also indicates that conventional methods of farming involving ploughing and ridging were still high in the country. Northern Province led in ridging at 70.2% where as Eastern Province ranked 4th in ridging after Luapula and North-western Provinces respectively. Northern Province led in ridging because after independence chitemene system of cultivation was discouraged. Small-scale farmers were particularly encouraged to adopt the Lima programme which also encouraged use of a lot of inputs such as chemical fertilizers in the cultivation of maize. So there was much agricultural commercialization in Northern Province according to Sharpe (1990). The other reason is that the Northern Province is also in the high rain fall zone as a result soils leach rapidly as noted by Mcphillps and Wood (1990). Southern Province led in ploughing at 89.1% and the least was Luapula Province at 0.2%. Eastern Province came 5th after Western, Central and Lusaka in that progression. The leadership of Southern Province in ploughing could be attributed to the fact that people own a lot of cattle which are used as draught animals. This could be attributed to the Missionaries like the Jesuits and others who were responsible for the introduction of animal draught power among the Tonga. According to Milimo *etal* (1990) Southern Province became the earliest and largest concentration of African ox-plough cultivation in the country. As such by 1931 ox-plough cultivation had replaced hoe cultivation. Milimo *et al.,* (1990), also noted that after independence plough cultivation was reinforced by subsidized tractor ploughing services which were run from Government mechanization units.

### 2.5.1 Adoption of CF by Small-scale Farmers in Chipata District.

According to the CFU Officer of the Chipata branch there were 13054 small-scale farmers who had adopted CF methods in Chipata district by 2010. The number of these farmers had increased this much, because CFU based in Chipata in 2006 had set itself a target of 15,550 small-scale farmers to practise CF by the year 2011. Therefore to achieve this target CFU had been carrying out sensitization campaigns on CF since then. Table 5.2 presents the number of small-scale farmers in each growing season who adopted CF practices.

**Table2. 2 Adoption of CF in Chipata District since 2006**

| Growing Season | Male | Percent | Female | Percent | Total | Percent |
|---|---|---|---|---|---|---|
| 2006-2007 | 2131 | 29.2 | 1991 | 34.5 | 4122 | 31.6 |
| 2007-2008 | 1683 | 23.1 | 1701 | 29.5 | 3384 | 25.9 |
| 2008-2009 | 1515 | 20.8 | 925 | 16.1 | 2440 | 18.7 |
| 2009-2010 | 1962 | 26.9 | 1146 | 19.9 | 3108 | 23.8 |
| Total | 7291 | 100 | 5763 | 100 | 13054 | 100 |

**Source: Field Data, CFU-Officer (March, 2010)**

It is clear to note from Table 2.2 that at the start of CFU promotion of CF, the number of small-scale farmers practising CF was higher than that for all of the subsequent growing seasons. However, from 2007-2008 growing season, the number of farmers began to decline. This reduction in the number of farmers practising CF from 2007 to 2008 growing season could be attributed to the fact that, quite a number of them had began practising CF with a view to receiving some incentives from the Promoters. Therefore when there were no incentives given to them by the Promoters they resorted to conventional methods of farming in the subsequent farming season. For example, it is noted from Table 2.2 that the number of women who had adopted CF dropped to 1146 from 1991 by 2009-2010 growing season. Similarly the number of men had dropped from 4122 to 3108 in the same period. For the women this picture was discouraging because it is believed that a woman is usually at the centre of food provision in any household.

However, for the 2009-2010 growing season, the number of CF farmers began to increase, because the small-scale farmers probably had began to realize that CF was the only way to sustain their livelihoods. Thus as they adopted CF they were now able to understand that they were not adopting CF for the sake of the Promoters but for their own good. Another contributing factor to the increase was that there were some of the farmers who had been consistent with CF since they adopted it and their production of crops particularly that of maize had been consistent too, in every growing season. This may have encouraged the other small-scale farmers to adopt CF too.

### 2.6 The Impact of CF on the Environment and the Farmers

There are both positive and negative impacts of CF on the environment and the farmers

#### 2.6.1 The Positive Impact of CF

Soil quality is one of the fundamental foundations of environmental quality. Thus maintaining soil quality can reduce problems of land degradation, decreasing soil fertility and rapidly declining production levels that occur in large parts of the world needing the basic principles of good farming practice. Reicosky (2008), identifies crop residue management as one of the key practices in CF. He observes that crop residue mulches increase infiltration by reducing surface sealing and decreasing runoff velocity. The crop residues on soil surface are known to reduce both wind and water erosion either directly by affecting the physical force involved in erosion or indirectly by modifying the soil structure through the addition of soil organic matter. Reicosky (2008), further notes that adopting crop residue management practice could significantly improve soil quality, reduce soil erosion and runoff, enhance moisture retention, lower summer temperatures, reduce the trips across the field, reduce machinery costs and at the same time may increase the net return to the farmer.

CFU (2009), also enumerates a number of benefits for CF: Farmers can plant a larger area because they are not moving or turning over the soil before they plant. This saves money and time. For example, conventional ploughing or ridging 1 hectare of land 10cm depth involves turning 1000 tons of soil; Farmers can begin to prepare their land as soon as they have harvested. This allows for early planting at the onset of the rains, which is critical for success. Early land preparation and rapid planting also permits early weeding; Planting holes or basins concentrate early rainfall around the seeds, accelerating emergence and improving crop stands; Rotations with legumes reduce the requirement for artificial fertilizers. Pigeon peas and other legumes also have strong roots that break up plough pans and aerate the soil. Pigeon peas also recycle phosphorous from deeper layers and make it available to shallower rooted crops that follow in rotation. Early maturing varieties of cowpeas and gram provide a high protein source in February when food is generally scarce; Hand hoe CF does not entail the need for purchasing any additional capital equipment by the smallholder. It is also easy to understand and apply; because the inter-

row is never ploughed, weed populations will decline over time as long as weeds are not allowed to seed; fertilizers and seeds are increasingly costly. Accurate placement of fertilizers and seeds reduces wastage and allows optimal use by the crop.

Additionally as a result of massive deforestation, climate change is already taking a heavy toll, with shifts in the onset and cessation of rainy seasons. The erratic weather pattern has threatened crops and increased food insecurity but a switch to CF is paying off (Tembo 2008).

Mwila (2008), lists the other benefits to the adoption of CF as follows;

i. Government would in time be able to reduce and gradually withdraw from the costly provision for fertilizer subsidies for maize production.
ii. Farmers will be liberated from excessive dependency on chemical fertilizers, production cost would decline, yields per unit area would increase and Zambia would become a highly competitive player in the regional maize market
iii. Household food security and dietary intake would improve and the need for food relief for all but the most disadvantaged families would become unnecessary.
iv. The adoption of reduced tillage (ripping) as opposed to ploughing would enable ox owners to provide a timely and less expensive land preparation service to their neighbours.
v. Resilience to future challenges imposed by climate variability would be enhanced.
vi. With a more robust and diversified production base the regeneration of soil fertility, farmers would be in a much stronger position to grasp the future economic opportunities.

### 2.6.2 The Negative Impact of CF

Even if CF has presented itself with a lot of positive impacts or advantages, there are also some negative impacts or disadvantages that farmers experience.

According to CFU (2009), before the fourth growing season a farmer faces a lot of disadvantages after adopting CF. The major noted disadvantages are: Intensive labour for digging basins for the basin adopters, a lot of weeds, pests such as ants that accumulate due to the non-clearing of the previous crop residue and the pests require financial resources

that a small-scale farmer may not afford. However, from the literature reviewed, there are a lot of advantages of CF than disadvantages.

### 2.7 Spatial Diffusion of CF in Zambia

A pilot project of the hoe and ox farmers began in Monze district of Southern Province in 1996 by ZNFU through CFU and GART. Hagghblade and Tembo (2003), noted that, since then many institutions such as MACO and a variety of NGO's helped in adapting and disseminating these CF practices with support from bilateral and multilateral partners. The programme of LMCF under Swedish International Development Cooperation Agency (SIDA), CF technologies component was supported by United Nations Development Programme (UNDP). These supported government efforts to promote farming related activities from 1991 until 2002 and were implemented in seven provinces except North-Western and Western Provinces.

The diffusion process for field activities was on farm. Trials were conducted on farmers' fields and learning, modification and promotion were all done there. CFU gathered more than 3200 observations from farmers' trials and demonstrations, (Hagghblade and Tembo, 2003). However, adoption rates of CF basins and ripping vary dramatically across agro-ecological zones and individual Districts. Hagghblade and Tembo (2003), observe that, among Dunavant cotton farmers' use of basins varied from 15% in Lusaka to 0% on the Copper-belt and that ripping technology proved most popular in Lusaka and least popular in Eastern Province. They went on to note that, across agro-ecological zones, adoption of CF basins proves highest in region IIa (at 10%) and region I (3%) while none of the cotton farmers in higher rainfall region III apply CF basins in their cotton plots. Nonetheless Hagghblade and Tembo (2003), argue that even within a given high potential CF zone, adoption rates differ considerably; in Mumbwa the heart of Zambia's cotton zone, adoption of CF basins ranges from 27 % at their Nangoma depot to 8% at Shinuma. Thus although an agro-ecological zone clearly affects the feasibility of CF adoption Hagghblade and Tembo (2003), are of the view that other factors are also at play. These include; ownership of cattle, extension support and personal characteristics which likewise affect adoption decisions as CF requires careful advance planning and meticulous timely execution of key tasks.

Hagghblade and Tembo (2003), also argued that some of the farmers who adopted CF practices did not apply them to all their plots and on average 125 farmers in Central and Southern Provinces applied CF basins on about a quarter of their cotton plots and about a half of their maize plots. On the other hand it was noted that adoption rates likewise varied by group, gender and length of experience with CF but also that adoption rates rarely reached 100% because farmers focused a portion of their labour resources on CF plots as insurance against drought and famine.

The preliminary analysis of Crop Focus Surveys (CFS) data according to Agriculture Consultative Forum (ACF) (2008), suggested that adoption rates of CF technologies (basins, zero tillage, ripping) in maize production among small-scale farmers ranged from 4.1 to 7% and among medium scale farmers from 1.5 to 3.4% indicating a higher popularity of CF among small-scale farmers. Among the vulnerable but viable households covered under Food Security Pack- Programme Against Malnutrition (FSP-PAM), the adoption rate of CF had reached 90% since CF was a prerequisite to accessing FSP-PAM inputs. However, maize was still the dominant staple food crop under CF constituting 72% of the planted area in small-scale farmers households in Zambia (ACF, 2008).

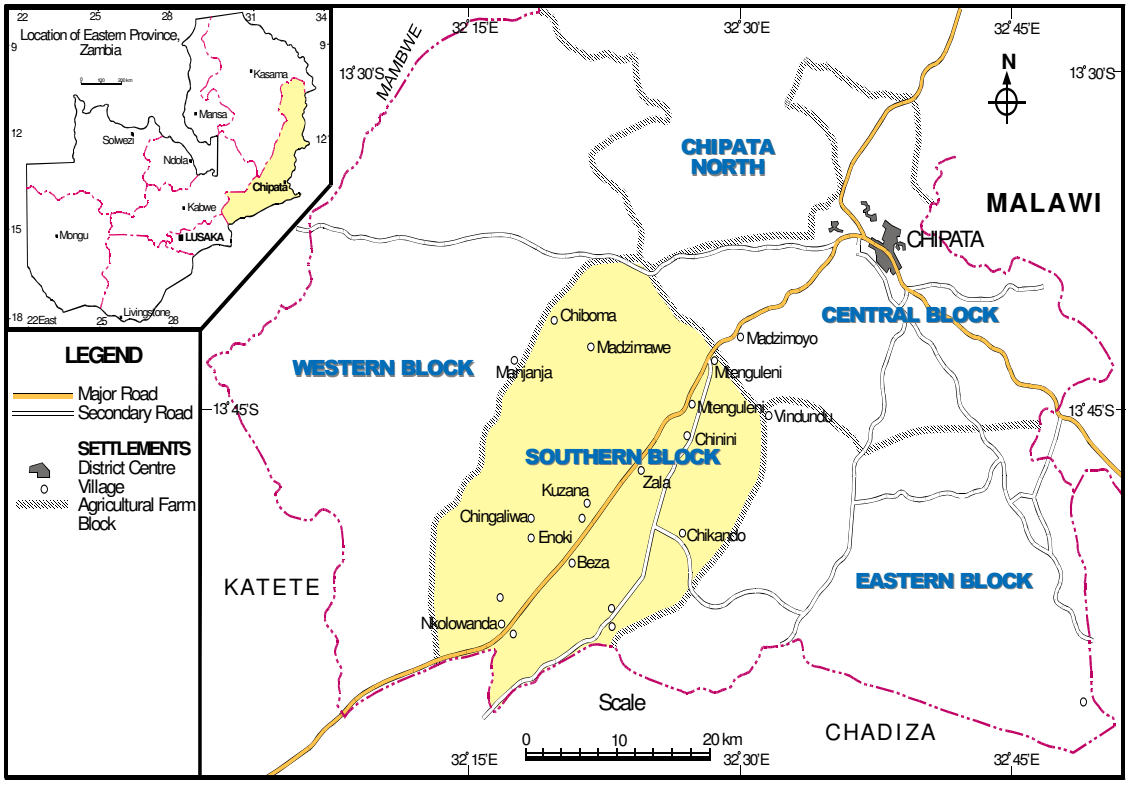
## CHAPTER 3: DESCRIPTION OF THE STUDY AREA

This chapter describes the study area in terms of location and size, physical characteristics, social and economic characteristics of the people.

### 3.1 Location and Size.

In the 2nd Republic of Zambia, under the UNIP government, Chipata district of Eastern Province was divided into two parts for the purpose of easy agricultural supervision; Chipata North and South Agriculture zones. Chipata South borders Malawi to the east and Chadiza to the south. To the west it borders Katete district and to the north Chipata North Agriculture zone. To the north-west it borders Mambwe district.

**Figure 3.1 Location of Southern Agricultural Farming Block in Chipata District.**




Source: Ministry of Agriculture. (2000)

The Southern Agricultural Farming Block is one of the 4 farming blocks within Chipata South Agriculture zone. It lies approximately between latitudes 13° 38′ and 14°.0′ south and longitudes 32° 13′ and 32° 32′ east. The Great East Road passes through almost at the middle of the Southern Agricultural Farming Block in the South West to North-East direction. The area of the farming block is approximately 575km$^2$.

### 3.2 Physical Characteristics

#### 3.2.1 Relief and Drainage

There are no major rivers in the study area other than Lutembwe which borders the area to the North-East with the Central Agriculture Farming Block. Makungwa and Mtenguleni streams in the middle and a few other streams form the drainage system for the area. The Farming Block is also characterized by some dambos where vegetable gardening takes place.

#### 3.2.2 Soils

Since the study area falls within a radius of 50km from the CBD of Chipata, it can be extrapolated that it has red clays and red brown loams. This is justified due the fact that Simute *et al*., (1998), observed that within a radius of 50km of Chipata there are red clays and red brown loam soils. Other types of soil in the study area are yellowish sands. These are light and easy to till but are low in nutrients and water holding capacity. In these soils nitrogen is deficient. Thus on these poorer sandy soils good yields of maize cannot be obtained without nitrogenous fertilizers.

#### 3.2.3 Vegetation

The common vegetation found in the study area is woodland (*Simute et al.,* 1998). These trees lose their leaves during the period of very little moisture. However, along streams the vegetation is riparian woodland and in few scattered areas of rich clay soils with munga woodland. Since the Southern Agricultural Farming Block is an agricultural area it can be argued that many areas were cleared of trees to pave way for farming activities. In addition more vegetation has been cleared because wood is the people's main source of energy. Therefore tall trees are rarely found except around a few hills in the area because many have been cleared for charcoal and fire wood.

#### 3.2.4 Climate

The study area is in Chipata district which has three distinct seasons: the warm rainy season from November to April, the cool dry season from May to August and the hot dry season from September to October. It can also be extrapolated that the study area experiences these three distinct seasons. Annual rain fall ranges from 800 to 1000mm and

approximately 85% of this rainfall falls during the four wettest months; from December to March (Simute *et al*., 1998).

### 3.3 Socio-Economic Characteristics

#### 3.3.1 Demography

According to census of population (2000) the population of Chipata district was 367,539. Of these 183,352 were male and 184,187 were female. The population of Chipata was then 3.5% of Zambia's total population of 10.1million people (CSO, 2000). In terms of households, there are 70,347 of them in the district. Southern Agricultural Farmimg Block has approximately 20,000 small-scale farmers.

#### 3.3.2 Land Tenure

Most of the land in the district is classified as traditional land. Simute *et al*., (1998) observe that this land may be used according to customary law without leasing or having any formal right assigned and it is controlled by Chiefs with their Headmen in charge of villages. Thus utilization depends on both right and ownership of the community. An individual can, however, acquire a certificate of title depending on how the Chief perceives the request, though normally Chiefs do not accept such requests because they fear it might lead to a loss of popularity among their subjects. There are two Chiefs namely Nzamane and Mazimawi who share the traditional ownership of land in the Agricultural Farming Block. However, this type of tenurial arrangement has a bearing on the farming system in the district. In many areas tree felling, grazing and overall management of natural resources are regarded as free for all, resulting in over-use and degradation of the land (Simute *et al*., 1998).

#### 3.3.3 The People of Southern Agricultural Farming Block

The majority of the people are those called Ngoni who came from South Africa after 1835. These people are under the traditional leadership of the two Ngoni Chiefs; Nzamane and Mazimawi. However, some of the villages in the farming block are those of the Chewa tribe such as Mkuzi and Katsekula just to mention but two. There are also a few civil servants in the farming block such as teachers, nurses and agriculture extension officers.

### 3.3.4 Agriculture

The people of the Southern Agricultural Farming Block are sedentary agriculturalists whose subsistence economy is based on the cultivation of maize, groundnuts, cotton, tobacco, sunflower, soya beans, and sorghum. Some of them are mixed farmers combining both pastoral and arable activities. Domesticated animals kept include; cattle, sheep, goats, pigs and some domesticated birds such as chicken and pigeons. The area has only one commercial farmer.

The two major farming systems in the farming block are conventional; hand-hoe cultivation and ox-cultivation. In hand-hoe cultivation the area under cultivation is usually small (1-2ha). Some hoe cultivators are able to hire oxen for cultivation from their relatives or friends when resources permit. Under ox-cultivation some families have cleared fairly large tracks of land for crop cultivation. Oxen are used to cultivate the land and the crops generally grown under this system are maize, groundnuts, cotton, sun flower, tobacco and soya beans (Simute *et al*., 1998). However, there is pressure on the land from both livestock and people and as such most people practise monocropping of maize and this crop takes up much of the cultivated land. The hand-hoe farmers have their main constraints such as lack of labour early in the farming season, limited cash to purchase inputs, seasonal food shortages in the period beginning from January to March and declining soil fertility (Simute *et al*., 1998).

### 3.3.5 Social Services

There are several basic schools in the farming block. However, there is only one high school (Chikando) that services the area, though some of the villages which are relatively closer to Madzimoyo where there is a high school are able to send their children there for higher education. There are also health centres in the farming area, namely; Chikando clinic, Mazimawi clinic, Kamulaza clinic and Chipungo clinic. There are also some agriculture camps in the farming block; Shamombo, Nkholowondo, Kamulaza, Mtenguleni, Chiteu, Chikando and Chankhanga. The Agriculture Extension Officers in these camps offer technical advice and knowledge on agriculture to the farmers within their respective catchment areas.

# CHAPTER 4: METHODOLOGY

This chapter describes types and sources of data, sampling methods, methods of data collection and analysis.

## 4.1 Types and Sources of Data

Both secondary and primary data were collected. A combination of techniques which included administration of questionnaires and interview schedules were used.

### 4.1.1 Secondary Data

A review of published literature from text books, journal articles and farm magazines was done to obtain secondary data. Some maps were also used which were obtained from the Provincial Agriculture Office. Review of published data provided information on background of CF in Zambia, factors that influence small-scale farmers to adopt CF practices, government's contribution to the promotion of CF in Zambia and percentage distribution of adoption of CF practices by region/province. The review also highlights some of the barriers to diffusion of CF among the small-scale farmers in the country reported in chapter two.

### 4.1.2 Primary Data

Primary data were obtained through the administration of a questionnaire and interview schedule. The interviews provided information on hectarage under cultivation, types of crops grown using CF practices, adoption of CF, means through which farmers received CF messages, and on difficulties which the small-scale farmers face in practising CF. Interviews were also held with the key informants such as the CFU Supervisors, Agriculture Extension Officers, Farmer Coordinators, Contact Farmers and some Agriculture Experts from the District Agriculture Office. The key Informants provided information on number of small-scale farmers who are practising CF, measures which are put in place by the promoters to spread CF among the small-scale farmers, challenges faced by the Promoters to enhance the diffusion of CF and on barriers to diffusion of CF among the small-scale farmers.

### 4.2 Sampling Methods

The total population of small-scale farmers practising CF in the farming block was 3000.

This represents about 23% of CF adopters in Chipata district and formed the sampling frame for the study. In the farming block there are 10 Farmer Coordinators who are in different villages. The distribution of the 3000 farmers according to the sampling frame of each Farmer Coordinator and the number sampled is shown in Table 4.1.

**Table4. 1 Sampled Small-scale Farmers**

| Coordinator's Zone/Site | Sampling frame | Sampled |
|---|---|---|
| Mtenguleni | 600 | 20 |
| Chikando | 220 | 7 |
| Malume | 450 | 15 |
| Matowa | 200 | 6 |
| Mphamba | 230 | 8 |
| Mkanile | 250 | 9 |
| Mcaca | 500 | 16 |
| Mkuzi | 150 | 5 |
| Koma | 250 | 9 |
| Matambo | 150 | 5 |
| TOTAL | **3000** | **100** |

**Source: Field Data (March, 2010)**

A simple random sampling technique was applied to select the required number of small-scale farmers from each sampling frame of the Coordinators in order to arrive at 100 CF Adopters (Sample). The sample was drawn proportionary to avoid biasness since some Coordinators had more CF farmers than others. The three locations; Mtenguleni, Chikando and Malume contributed 51% to the sample whilst 49% came from the remaining seven locations. This was so because the three locations contributed in total 1550 CF Adopters. This figure constitutes more than half of the sampling frame of CF adopters in the farming block.

### 4.3 Data Collection

Reconnaissance surveys were made in the study area. This was necessary in order to check whether land preparation for cultivation was done by CF methods. The other reasons for these surveys were to get preliminary information from some of the key informants and also to test the research instruments. Questionnaires were administered to the household heads. If the sampled respondent was not found at home, his or her spouse or any member of the household who participates in farm work was interviewed. Interview guides were used to interview the identified key informants. These were the persons who were well versed with aspects of CF. The responses from these interviews were recorded in the research note book. The Officer from CFU provided data on the rates of adoption from 2001 to 2009 growing season.

A Global Positioning System (GPS) instrument was used to record some coordinates of the sites which were selected randomly where adoption of CF had taken place. The coordinates were recorded in actual degrees of latitudes and longitudes. The latitudes and longitudes were converted into coordinates of the Universal Transverse Mercator (UTM) system. However, plotting of these sites was done by the approximation of the latitudes and longitudes on the base map of the study area.

### 4.4 Methods of Data Analysis

The data was first coded. It was then reduced to frequency tables, charts and graphs by the use of SPSS 11. Product-Moment Correlation Co-efficient and t-test, parametric measures of the relationship between two variables were applied to test correlations between various variables such as age and adoption, size of land ownership and adoption, cattle ownership and adoption and the test in significance of the difference of maize production between basins and ridges respectively. To test the significance of the difference of maize production between basins (CF) and ridges (conventional farming), data of maize production for 10 small-scale farmers was used. The 10 small-scale farmers were the only ones who had credible records of maize production for the two different methods of farming. The use of data for only 10 small-scale farmers is also justified because they represented 10% of the sample.

Frequencies which were obtained on marital status of respondents, membership to Farmers Support Organizations of the respondents and level of educational attainment of the respondents were also examined to determine whether they influenced adoption of CF.

### 4.5 Limitations of the Study

The need to interview more than 100 respondents was quite probable. However, it was not possible to do so due to limitations of funds for transport as the area is quite large in terms of extent and also due to inadequate time. The other limitation was associated with the objective number two. Thus, even if the desire was to test the significance of the difference in maize production between two different farming methods for the entire sample, only 10 small-scale farmers had credible records of their maize production for the two different methods of cultivation.

## CHAPTER 5: FINDINGS AND DISCUSSION

### 5.1 Introduction

This chapter describes and discusses the basic characteristics of the sample population, adoption and rate of adoption, trends of adoption and adopted CF practices, factors which influenced adoption of CF, the impact of CF on small-scale farmers and an illustration of the patterns of adoption of CF. A map for some locations where small-scale farmers are practising CF and some barriers to diffusion of CF in the study area, have also been presented and discussed.

### 5.2 Sample characteristics

The sample comprised 100 Heads of households. Of these 81 were male and 19 were female giving a ratio of almost 4:1. The mean household size is 2.1 members per household. The age of the sample ranged from 20 to above 50, (Table 5.1)

**Table5. 1 Ages of the respondents**

| Age | Number | Percent |
|---|---|---|
| 20-24 | 3 | 3 |
| 25-29 | 7 | 7 |
| 30-34 | 18 | 18 |
| 35-39 | 12 | 12 |
| 40-44 | 25 | 25 |
| 45-49 | 20 | 20 |
| ≥50 | 15 | 15 |
| Total | 100 | 100 |

**Source: Field Data (March, 2010)**

From Table 5.1 it can be noted that more small-scale farmers were above the age of youths. Regardless of their marital status, the respondents were able to support their families. However, the majority of these respondents were married persons while some were divorced and others widowed (Table 5.2).

**Table5. 2 Marital Status of the Respondents**

| Marital Status | Number | Percent |
|---|---|---|
| Married | 88 | 88 |
| Single | 04 | 04 |
| Divorced | 02 | 02 |
| Widowed | 06 | 06 |
| Total | 100 | 100 |

**Source: Field Data (March, 2010)**

Looking at the frequency distribution (Table 5.2) 88% of adopters were married persons.

As regards education attainment, the sample composed of respondents from lower basic education and way through to tertiary education (Table 5.3).

**Table5. 3 Level of Education Attainment of the Respondents**

| **Level of Education** | **Number** | **Percent** |
|---|---|---|
| Lower basic | 34 | 34 |
| Middle basic | 29 | 29 |
| Upper basic | 20 | 20 |
| High school | 14 | 14 |
| Tertiary | 3 | 3 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

The small-scale farmers who attained lower, middle and upper basic education were more than those with high school and tertiary education in the adoption of CF. Small-scale farmers who attained basic education constituted 83% of the sample.

The frequency distribution of socio-economic status of the respondents was also investigated (Table 5.4).

**Table5. 4 Socio-Economic Status of the Respondents**

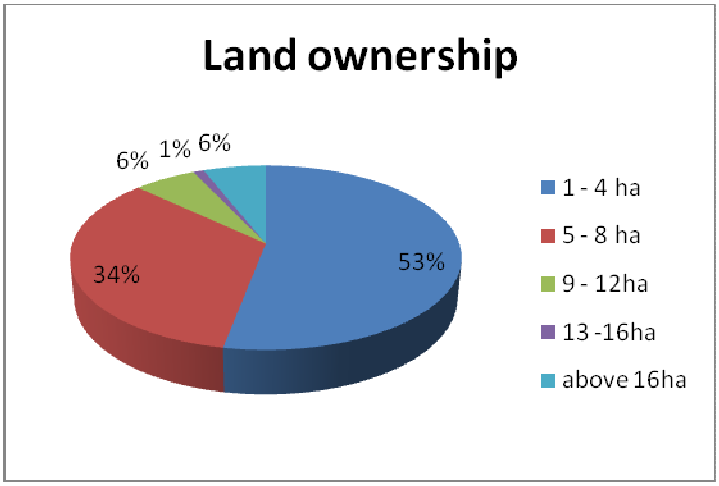
| Occupation | Number | Percent |
|---|---|---|
| Cultivation of crops only | 18 | 18 |
| Cultivation and gardening | 27 | 27 |
| Mixed farming | 48 | 48 |
| Cultivation of crops and teaching | 3 | 3 |
| Cultivation and small grocery shops | 4 | 4 |
| **Total** | 100 | 100 |

**Source: Field data (March, 2010)**

Going by the frequency distribution of the socio-economic status of the small-scale farmers in Table 5.4 it can be noted that 82% of the small-scale farmers combined cultivation of crops with other economic ventures. The farmers who depended on cultivation of crops only constituted 18%.

Land ownership by the small-scale farmers was categorized and its distribution is shown in Figure 5.1

**Figure 5.1Size of CF Adopters' Land Ownership Distribution**




**Source: Field Data (March, 2010)**

The size of land owned by each household is dependent on the previous size of land that was owned by its ancestral parents. Thus ownership has been passing on from one

generation to the other from the time in memorial. This kind of ownership is based on the customary law of the two Ngoni Chiefs; Nzamane and Mazimawi.

The number of years each small-scale farmer had been living in the Southern Agricultural Farming Block were also investigated. This was done in order to find out if the length of stay in the farming block had an influence on the adoption of CF practices (Table 5.5).

**Table5. 5 Period of Residence of the SsF in the Southern Agricultural Farming Block**

| Period of Residence (years) | Number of farmers | Percent |
|---|---|---|
| **1-3** | 12 | 12 |
| **4-6** | 27 | 27 |
| **7-9** | 61 | 61 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

From Table 5.5 it can be extrapolated that more than 60% of the small-scale farmers have lived in the Southern Agricultural Farming Block for more than five years..

The distribution of cattle ownership by the small-scale farmers was also investigated (Table 5.6)

**Table5. 6 Cattle Ownership**

| Number of Cattle | Number of Households | Percent |
|---|---|---|
| 1-10 | 7 | 28 |
| 11-20 | 8 | 32 |
| 21-30 | 3 | 12 |
| 31-40 | 3 | 12 |
| 41-50 | 2 | 8 |
| 51-60 | 2 | 8 |
| Total | 25 | 100 |

**Source: Field Data (March, 2010)**

There were only 25 households which owned cattle. Thus, there were more households which did not have cattle.

### 5.3 The Rate of Adoption of CF in the Southern Agricultural Farming Block

CF was first introduced by the Government in the Southern Agricultural Farming Block in 2001. The introduction of CF into the area was through the Agriculture Extension Officer who was based at Mtenguleni Agriculture camp. According to CFU officer (key informant) the rate of CF adoption in the Southern Agricultural Farming Block since 2001 growing season is illustrated in Table 5.7. The rates of adoption were calculated by determining the difference in the number of SsF between growing seasons and then multiplied by 100.

**Table5. 7 Rate of Adoption of CF between 2001 and 2009 growing seasons**

| Growing Season | Number of Adopters | Increase/Decrease | Rate of Adoption (%) |
|---|---|---|---|
| 2001-2002 | 350 | | |
| 2002-2003 | 280 | -70 | -20.00 |
| 2003-2004 | 240 | -40 | -14.29 |
| 2004-2005 | 400 | 160 | 66.67 |
| 2005-2006 | 500 | 100 | 25.00 |
| 2006-2007 | 1200 | 700 | 140.00 |
| 2007-2008 | 1800 | 600 | 50.00 |
| 2008-2009 | 2050 | 250 | 13.89 |
| 2009-2010 | 3000 | 950 | 46.34 |

**Source: Field Data- CFU Officer (March, 2010)**

The downward trend in adoption (Table 5.7) is observed in the initial growing seasons (between 2001 and 2003). This downward trend could be attributed to the fact that at this time the small-scale farmers had not much information about CF and probably had not even seen the benefits of adopting it. Thus, during this period the rate of adoption was negative because instead of new more farmers to adopting CF, some who had adopted it began to abandon it too. It could be noted therefore, that 110 small-scale farmers discontinued CF between 2002 and 2003 growing seasons. However, the impact of the drought of the 2003-2004 growing season was a wake up call for the small-scale farmers, as can be seen that in the 20004-2005 growing season, there was a tremendous increase in the rate of adoption of CF. The coming of CFU into the area in 2006, further increased the awareness of CF to the small-scale farmers. CFU even established a field demonstration centre at Mtenguleni for disseminating CF practices. Some of the established farming zones by CFU such as Mtenguleni, Mcaca and Malune are much nearer to the demonstration field centre (Mtenguleni) and as such a lot of CF farmers and would be CF adopters were able to attend field day demonstrations every growing season where they gathered more knowledge about CF. Therefore, the rate of adoption of CF by the small-

scale farmers increased quite tremendously. On average, there was about 38% rate of adoption of CF by the small-scale farmers for a period of eight growing seasons.

### 5.3.1: Trends of Adoption of CF in the Southern Agricultural Farming Block

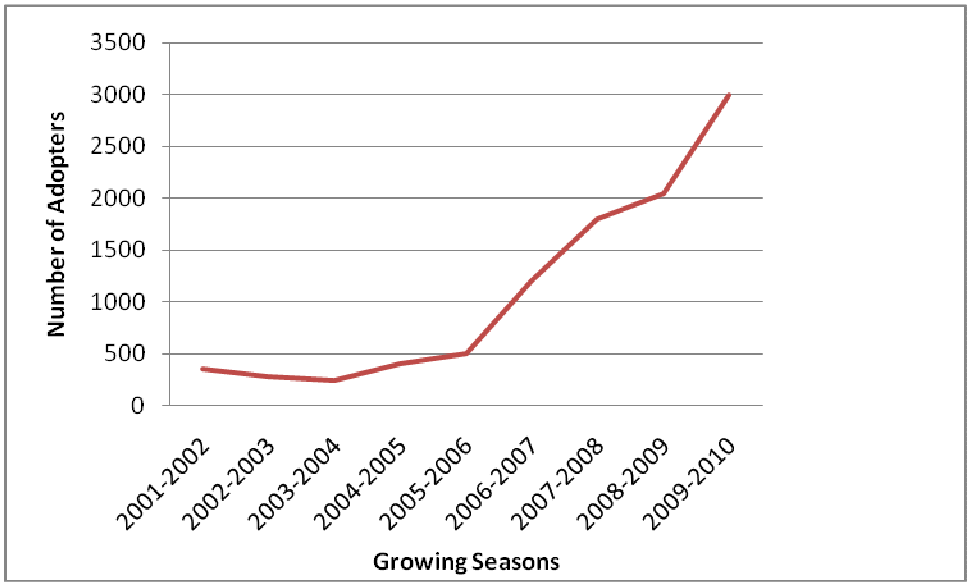
When the small-scale farmers began adopting CF as far back as 2001, there were not as many as there were in 2010. However, the decline of the number of CF farmers between 2001 and 2003 was because at this point the farmers only received CF messages from a few Agriculture Extension Officers. Some Agriculture camps had no such officers. For example Shamombo Agriculture camp had no Agriculture Extension officers at the time of this study to disseminate CF messages within their catchment area. At Chiteu Agriculture camp an Agriculture Extension officer was only a few months old at the time of this study. Thus the dissemination of CF practices was only through Contact farmers under CFU arrangement. This means therefore that if some farmers were not captured by CFU Contact farmers they lagged behind in receiving information about CF practices.

This also brings in an aspect of the ratio between farmers and Agriculture Extension officers. For example, the Agriculture Extension officer at Kamulaza had about 800 small-scale farmers to monitor in their agriculture activities in 2002-2003 growing season. Some of the small-scale farmers according to the Agriculture officer only applied CF practices just for one farming season and abandoned them in the subsequent farming season because the officer in question could not be every where at the right time in his extension services to the farmers. This actually confirms Nowak and Korsching's (1985) argument that adoption of a farming technology depends on regulating farmers. Thus any inconsistence in monitoring farmers' implementation of any new farming method taught, may lead to some farmers abandoning it. The Agriculture Extension officer based at Mtenguleni also noted that, hard labour and more weeds associated with CF discouraged some of the farmers and hence abandoning it. This was an interesting finding of the farmers' characteristic because whilst some did experience fewer weeds with CF practices others were abandoning CF due to weeds. However, CFU officers and Agriculture Extension officers did clarify that when a farmer observes all practices of CF for at least 4 growing seasons, weeds become fewer in his or her field. They further argued that, since the soil is never ploughed, the number of weed seeds in the sub soil declines. To qualify this point CFU (2009) also pointed out that at GART in Chisamba where CF began to be practised in

1997, the labour requirements for weeding had declined by 50% by 2001. Thus in the initial period of adoption, farmers are not likely to experience fewer weeds in their fields. So the farmers who had abandoned CF in 2002-2003 or 2003-2004 growing season in the Southern Agricultural Farming Block couldn't experience fewer weeds as the period was too short for them to do so. In terms of the reduction of labour requirements, the CF basin adopters who abandon it in less than four growing seasons for example, may not appreciate the reduction in labour required for digging the basins. This has also been demonstrated by CFU (2009) that by year four after adoption of basins, requirement for digging reduces by 35% to 40%. Therefore the small-scale farmers in the Southern Agricultural Farming Block who may have abandoned CF basins in less than four growing seasons were likely not to appreciate the reduced labour in digging. It could be argued therefore that all CF basin adopters who abandoned this practice of land preparation in less than four growing seasons did not appreciate or experience the reduction in labour for digging. No wonder some of them claimed that CF was labour intensive.

The effects of drought other than inadequate information about CF in the 2003 growing season also resulted in the number of CF farmers in the agricultural farming block to increase in the subsequent growing season. This was obviously to respond to the challenges of food shortages in the preceding farming season. This is what justifies the rising pattern in numbers of the farmers adopting CF after 2003 growing season. The drought effects of 2008-2009 growing season also impacted positively on the small-scale farmers in as far as adoption of CF was concerned. No wonder there was a sharp rise of the curve beginning of the 2009-2010 growing season because 950 more small-scale farmers adopted CF (Figure 5.2).

**Figure 5.2Trends of Adoption of CF in the Southern Agricultural Farming Block**




**Source: Field Data (March, 2010)**

Even if at the start of adoption of CF practices (between 2001 and 2003) there was a downward trend, overall there is an upward trend in adoption. CFU and the Government were both largely attributed to this upward trend in adoption. The incentives which were given by CFU and the Government continued to attract many small-scale farmers to adopting CF.

Figure 5.2 may not conform to the logistic curve in the immediate future because of CFU and the Government's continued stepping up of CF sensitization campaigns. Thus more and more small-scale farmers are likely to adopt CF in the subsequent growing seasons. However, when all the small-scale farmers including the laggards adopt CF, the rising trend in adoption is likely to begin to fall again because the number of small-scale farmers adopting CF would also be decreasing. This could be so as the number of small-scale farmers adopting CF would be becoming fewer and fewer in the subsequent growing seasons.

### 5.3.2 Major Factors Influencing the Rate of Adoption of CF.

There were several factors that had influenced the rate of adoption of CF by the small-scale farmers in the Southern Agricultural Farming Block (Table 5.8).

**Table5. 8 Major Factors Influencing the Rate of Adoption of CF**

| Factors Influencing Adoption of CF | No. of Adopters influenced | Percent |
|---|---|---|
| Incentives given by CFU | 26 | 26 |
| Membership to Support Organizations | 21 | 21 |
| Expectations of small-scale farmers | 16 | 16 |
| Period of residence in the area | 12 | 12 |
| Socio-economic characteristics | 10 | 10 |
| Marital status of respondents | 9 | 9 |
| Other | 6 | 6 |
| Total | 100 | 100 |

**Source: Field Data (March, 2010)**

From Table 5.8 incentives were a major influencing factor to small-scale farmers' adoption of CF. This justifies 26% of the adopters who noted that they were largely influenced by incentives to adopt CF. The incentives to small-scale farmers were given in the following way; Farmer Coordinators were given vouchers worth K600, 000.00, 20kg of groundnuts, 10kg of sun hemp, 2litres of herbicides and jacto sprayers. Contact farmers were given a voucher worth K200, 000.00 each, 20kg of groundnuts and 10kg of cowpeas. The Government also gave out bicycles to the Lead farmers. The Farmer Coordinators and Lead/Contact farmers were given these incentives in appreciation of the work they do. All the other small-scale farmers when they adopt CF, in the first growing season are given velvet beans, msangu seedlings and 5kg of groundnuts. However, the 5kg of groundnuts is given to the small-scale farmers as a loan which they are expected to pay back after harvest. Such incentives are likely to attract other small-scale farmers who have not yet adopted CF to do so in the subsequent farming seasons. However, this would only be possible if the Government and NGOs shall continue to provide these incentives. In addition it would not be possible for the NGOs and the Government to avail the incentives to all the small-scale farmers in the Southern agricultural farming block as a basis for adopting CF. Thus, the giving of incentives such as money, groundnuts, herbicides, sun hemp and jacto sprayers only to Farmer Coordinators and money, groundnuts and cowpeas

only to Contact farmers somehow suggests that CFU has no capacity to give such incentives to all the small-scale farmers. This could be confirmed by the fact that the other small-scale farmers are only given 5kg of groundnuts on a loan basis. Therefore, the giving of incentives to small-scale farmers to lure them into adopting CF is not sustainable and ultimately may also affect the adoption of CF if the small-scale farmers view and consider adopting CF on the basis of being given incentives.

Belonging to Farmers Support Organizations by small-scale farmers has also contributed to the adoption of CF practices. The farmers were asked to state the supporting organizations they belonged to (Table 5.9).

**Table5. 9 Membership to Support Organizations of SsF**

| Support Organizations | Number | Percent |
|---|---|---|
| CFU Only | 39 | 39 |
| Cooperative Only | 1 | 1 |
| Cooperative& CFU | 42 | 42 |
| Cooperative& Dunavant | 4 | 4 |
| Dunavant Only | 4 | 4 |
| Clark Cotton& CFU | 4 | 4 |
| Clark Cotton only | 1 | 1 |
| None | 5 | 5 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

As shown (Table 5.9) 39% of farmers belongs to CFU only, which is a higher percent when compared with other support organizations. This is so because of the incentives CFU offers in its deliberate campaigns to promoting CF. However, 42% of farmers have dual membership with CFU and the Cooperative movement and four percent of them have also dual membership with Cooperative and Dunavant. Another four percent of farmers have also dual membership with Clark Cotton and CFU. The farmers are attracted to dual membership because of the different support services they receive from each support organization. The Cooperatives for example, provide fertilizer subsidies that come from the Government through its Farmer Input Support Programme (FISP). Dunavant and Clark

Cotton offer market of cotton and loan of inputs such as seed cotton and chemicals for pest's control. The five percent represents farmers who did not belong to any Farmer Support Organization. These claimed that they were able to stand on their own. Clark Cotton and Dunavant have smaller membership percentages because not all small-scale farmers cultivate cotton. However, 21% (Table 5.8) when asked if belonging to any farmer support organization had assisted them in any way, they observed that belonging to these support organizations had really assisted them to easily practise CF as it was easy for them to acquire more knowledge about CF and other support services such as markets for their crops and loan inputs.

The small-scale farmers have certain expectations from Promoter NGO's and Government as they adopt CF practices. When asked what they expected from the NGO's and Government 16% (Table 5.8) of them expressed a lot of expectations which are broken down (Table 5.10).

**Table5. 10 Small-scale Farmers' Expectations**

| **Expectations** | **Number** | **Percent** |
|---|---|---|
| Free Inputs | 7 | 43.75 |
| Subsidized Inputs | 4 | 25.00 |
| Free Equipment | 3 | 18.75 |
| Other | 2 | 12.50 |
| **Total** | 16 | 100.00 |

**Source: Field Data (March, 2010)**

There are more small-scale farmers (Table 5.10) who expect some form of assistance as compared to those who could stand on their own if they were to continue with the adoption of CF. They represent 87.5%. This phenomenon presents a big challenge to the continuity of the adoption of CF by the small-scale farmers. Thus in a way some of the farmers have not taken CF methods as their concern but the concern of Government and farmer groups support organizations. However, it can be argued that the focus by these small-scale farmers should be at the advantages of using CF practices in their cultivation of crops and not what they may be given by the Government or the organizations promoting it. Expectations of the farmers should be on what they may achieve as households or

individuals by adopting CF. Therefore, on one hand these expectations influence some farmers to adopt CF, but when these expectations are not met on the other hand they are like barriers to adoption of CF.

The need to over come poverty was another reason for adopting CF. They (10% of Table 5.8) argued that the ever increasing prices of fertilizers every growing season makes the majority of them fail to buy. Some even noted that they could not afford to raise the 25% contribution to FISP. Thus they were left with no option but to employ farming techniques that enabled them produce more even in the absence of these fertilizers. The idea is to harvest something for their household consumption and meet some other demands for their households. So far the farming technique which in spite of the absence of fertilizers a farmer is able to harvest something is CF. Therefore a number of small-scale farmers are beginning to realise the importance of CF in these circumstances and hence its adoption, in order to fight poverty that cuts across all ages of the small-scale farmers in the Southern Agricultural Farming Block. However, going by the frequency distribution of the socio-economic status of the small-scale farmers (Table 5.4) it can be deduced that adoption of CF also depended on ones socio- economic status. Thus the small-scale farmers with other economic ventures were at an advantage of adopting CF because with the extra sources of income they could easily hire labour for land preparation for cultivation or would be able to buy their own inputs and their own farm equipment such as a Magoye Ripper.

The period at which each small-scale farmer had been living in the Southern Agricultural Farming Block had a much direct influence on the adoption of CF. (Appendix 3). 12% (Table 5.8) of the small-scale farmers revealed that their soils had been degraded due to repeated cultivation by conventional methods of farming for many years and the introduction of CF on their fields was beginning to regenerate the soils in the fields. This could be justified in the sense that the more years a small-scale farmer had stayed in this farming block the more years conventional methods of farming were likely to have been practised by such a farmer. For example, from Table 5.5 it can be extrapolated that more than 60% of small-scale farmers had lived in the Southern Agricultural Farming Block for more than five years. Thus many years of conventional farming may have led to the degradation of soils thereby leaving the small-scale farmers with no option but to adopt CF

practices which have proved to regenerate soil fertility and ultimately also enhance production of crops.

Marital status of the small-scale farmers has an influence on adoption of CF. When interviewed on the importance of marriage 9% (Table 5.8) of them argued that when a person gets married he or she assumes a lot of responsibilities of looking after his or her family. Responsibilities such as ensuring that there is food for the family all the times, sending children or other dependants to school, providing medical care to the children and clothing. All these demands require sustainable sources of income they argued. In addition they observed that it was easy to cultivate with family labour unlike when one is not married. Thus, there is an aspect of complimenting each other in as far as farming is concerned.

There are other factors which had little influence to the adoption of CF by the small-scale farmers. These were level of educational attainment, size of land ownership, cattle ownership and age of the respondents.

Using percentage frequency distribution of educational attainment 83% of the small-scale farmers had only attained basic education. Yet these small-scale farmers had adopted CF. The small-scale farmers with high school education only constituted 14% and 3% tertiary education. This therefore can be concluded that for the small-scale farmers of the Southern Agricultural Farming Block, the level of education attainment did not matter much in the adoption of CF. Yes farmers may need some kind of high education but in this case the adoption of CF by these farmers did not require much high qualification in education but just the basic one to enable them understand CF practices.

The size of land owned by each small-scale farmer only accounted for 23% of adoption of CF at the level of significance of 0.05 and degrees of freedom 15 (Appendix 4). Thus 77% was accounted for by other factors that influenced adoption of CF by the small-scale farmers. Therefore the size of land owned by each small-scale farmer was not a major factor influencing adoption of CF. Thus whether one had many hectares of land or not did

not matter. In fact some small-scale farmers' fields which were under CF practices were less than a Lima and others just about half a Lima.

There were only 25 households who owned cattle which also constituted 25% of the sample. This means that cattle ownership may only enable a farmer to use Rippers for land preparation. Thus, even other small-scale farmers that may not own cattle could still adopt CF basins. So cattle ownership only helps a farmer to adopt furrows. It simply shows that those who own cattle go for furrows and those without cattle go for basins. However, some small-scale farmers in spite of not having cattle still adopted furrows by hiring others with cattle to make furrows for them. Nonetheless some of the small-scale farmers argued that when one owns cattle, it becomes easy to obtain manure for improving the soil fertility.

Age of the small-scale farmers had very little influence on adoption of CF. At the level of significance of 0.05 with the degrees of freedom 21, age accounted for only 3.33% of the rate of adoption of CF among Small-scale Farmers, (Appendix 5). So 3.33% is quite insignificant to influence adoption of CF. There was only one farmer who appreciated that adoption of CF depended on one's age, when asked whether one's age had an influence in adopting CF. She argued that when one is too young, he/she cannot manage to dig basins just as when one is too old.

Looking at the factors that influenced the small-scale farmers to adopt CF, it could be argued therefore, that, only 10% (Table 5.8) and five percent (Table 5.9) may be genuine adopters of CF. The 10% were influenced by the need to overcome poverty while the five percent were able to stand on their own. These two categories of small-scale farmers most likely understand that CF is the engine through which their livelihoods would be improved. The rest other adopters, incentives from the promoter NGO and belonging to different support organizations mostly regulated them to adopting CF. This finding can be likened to the findings by Gukurume *etal*., (2010), on the smallholder farmers of Chivi South District of Zimbabwe's fears of the future not to receive aid if they did not embrace CF. Similarly the majority of the small-scale farmers of the Southern Agricultural Farming Block, are embracing CF due to fears to be left out on incentives. Such, is causing the low adoption rates of CF because the majority of these farmers are not adopting CF to address climate change challenges but due to the short term benefits of receiving incentives. Thus, it can

also be argued that, when they are sure that they may not benefit from the incentives, they are most likely to continue with their conventional methods of farming.

### 5.3.3 Adopted CF Practices in the Southern Agricultural Farming Block

Both hand hoe basins and ripped furrows have been adopted in the farming block. The distribution of CF practices is shown in Table 5.11.

**Table5. 11 Adopted CF Practices in the Southern Agricultural Farming Block**

| CF Practices | Number Adopted | Percent |
|---|---|---|
| Hand hoe basins | 70 | 70 |
| Ripped furrows | 22 | 22 |
| Both furrows ع basins | 08 | 08 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

It is evident from Table 5.11 that hand hoe basins have been widely adopted as they represent 70% of CF practices. This phenomenon is as a result of the majority of small-scale farmers who do not have cattle. However, even some of the farmers, who own cattle but do not own Magoye Rippers, are compelled to adopt hand hoe basins. Plates 5.1 and 5.2 illustrate the adopted CF practices.

**Plate5. 1 Farmer Ripping Furrows**

**Source: Field Data (September, 2009)**

A farmer (Plate 5.1) is ripping furrows with a Magoye Ripper. The recommended depth of the furrows is between 15cm and 20cm.

Digging furrows with a Magoye Ripper is faster than digging hand hoe basins with a Chaka hoe. However, it is also more advantageous to use a Ripper as it is less laborious. Ripping of planting furrows can be done simultaneously with the planting of crops. Thus as the furrow is being ripped some of the household members could be following behind planting the seed crop. This enables a farmer to plant a large area in a day.

However, Plate 5.1 shows that the land was partially cleared of some of its previous crop residue. This practice is common in the Southern Agricultural Farming Block where farmers do not entirely leave the crop residue in their fields but clear some of it. They claimed that it is easier to make planting furrows on cleared land than where the entire crop residue is left lying in the field. But this contradicts with one of the recommended CF practices of not clearing the field of its previous crop residue.

Plate 5.2 illustrates hand hoe basins for one of the small-scale farmers in the Southern Agricultural Farming Block.

**Plate5. 2 Hand Hoe Basins**

**Source: Field Data (September, 2009)**

The basins are usually 20cm deep and 30cm long. They are spaced at 70cm along the row and 90cm between the rows. This CF practice is usually adopted by small-scale farmers who do not own cattle. Sometimes farmers who do not own cattle are discouraged to adopt basins because preparation of planting basins using a Chaka hoe is quite laborious and at the same time some of them cannot afford to hire ox-farmers to do land preparation for them. As such they continue with conventional methods of farming. However, though the digging of basins is quite laborious, it enables a farmer who does not own cattle to plant early instead of waiting to hire an ox-farmer with a Magoye Ripper which may cause delays in planting.

During drought conditions, the basins are able to store moisture. This makes the crops to survive even if rains take some time to fall. Basins are also advantageous because manure or fertilizers when applied are not washed away; they simply dissolve within the basins. Thus they enhance the economic use of inputs. However, the owner of the field (Plate 5.2) also contradicted with one of the CF practices by clearing his field of the previous crop residue. In this way the field has less organic matter which also leads to less soil fertility restoration.

### 5.4. The Impact of CF among the small-scale farmers.

There were both positive and negative impacts among the small-scale farmers as a result of adopting CF practices.

#### 5.4.1 The positive impact of CF

The positive impacts are presented in Table 5.12 below.

**Table5. 12 Positive Impacts of CF among the small-scale farmers**

| Observed impacts | Number | Percent |
|---|---|---|
| Enhanced maize production | 10 | 10 |
| Less labour | 16 | 16 |
| Fewer weeds | 9 | 9 |
| Resistance of crops to drought | 10 | 10 |
| Soil fertility improved | 30 | 30 |
| Less fertilizers needed | 21 | 21 |
| Easy germination of seed crops | 4 | 4 |
| Total | 100 | 100 |

**Source: Field Data (March, 2010)**

Some ten small-scale farmers who used both CF and conventional farming methods on an experimental basis were identified. These CF adopters were trying to find out from which method of farming they would harvest more. So they grew maize in the 2008-2009 growing season on two plots each. Each plot was half a hectare in size (100mx50m). On one plot, ridges were made and on the other one hand hoe basins were dug. The results of production are given as numbers of 50kgs bags of maize (Table 5.13) and F stands for farmer.

**Table5. 13 Comparison of Maize Production between Ridges and Basins**

| Method | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | Total | Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges | 28 | 30 | 35 | 24 | 27 | 24 | 30 | 31 | 33 | 29 | 291 | 48.18 |
| Basins | 26 | 33 | 40 | 28 | 25 | 29 | 32 | 30 | 36 | 34 | 313 | 51.82 |
| **Total** | 54 | 63 | 75 | 52 | 52 | 53 | 62 | 61 | 69 | 63 | 604 | 100 |

**Source: Field Data (March, 2010)**

There were 22x50kgs bags of maize more from the basins than ridges. This is a confirmation that CF practices increase production of crops, in comparison with conventional methods of farming. Half a hectare for each farmer translates into 5hectares for the 10 farmers. Thus 5hectares of ridges produced 291x50kgs bags of maize whilst the 5hectares of basins produced 313x50kgs bags of maize. The difference of production between ridges and basins was not much. This is also confirmed by the student's t- test that at the level of significance 0.01 (two tailed test) with 9 degrees of freedom the research hypothesis can be rejected because the calculated value of t is less than the critical value (Appendix 6). However, the insignificant difference between the production of maize in ridges and production of maize in basins could be attributed to the revelation by the 10 small-scale farmers, that, they had not followed all CF practices. For example, they revealed that they had cleared the previous crop residue even in the fields where basins were dug.

Nevertheless it was also noted by the 10 farmers (Table 5.13) that indeed in the fields where they used basins the maize plants were somehow slightly greener and healthier than those from the ridges during the growing period. They also acknowledged that maize cobs from the basins were slightly bigger than those from the ridges. In fact even the other 90 small-scale farmers also had practised CF side by side with conventional practices of farming in the maize cultivation. However, even though they did not record what they had harvested in 2008-2009 growing season, they also revealed that maize harvests from the CF fields were slightly more than from conventional fields. They further confirmed that during the growing period, maize stalks appeared slightly healthier in CF fields than the stalks from fields which were under conventional practices. It can be deduced therefore,

that, a slight high production of maize from basins (Table 5.13) was a positive impact that farmers had experienced as a result of adopting CF.

In this case any farmer's aim is to improve productivity of crops if he or she is involved in arable cultivation of the land. Therefore any farming technology which enhances production of crops such as maize is likely to be adopted by a farmer. Thus CF has proved to be a type of farming technology that enhances production of crops, than conventional methods of farming, and its adoption by small-scale farmers though not much is encouraging.

Some CF adopters (16% of them) revealed that they had less labour in digging basins and others (9%) noted that they had little difficulties in weeding because their fields had fewer weeds. This means that both had been consistent with CF for more than 4 growing seasons. However, CF adopters who revealed that they had less labour in digging basins noted that for one to have less labour in digging, the same position of basins each year has to be returned to every growing season. Thus by the $4^{th}$ year (CFU, 2009) the requirement to dig reduces tremendously.

Resistance of crops to drought when CF practices are applied in this case was another impact which small-scale farmers had experienced. The small-scale farmers, 10% of them, (Table 5.12) acknowledged that crops do not wither or wilt in drought conditions. This is why they had continued to use CF practices in every growing season as a precautionary measure to the occurrence of drought. They believe that whenever CF practices are used, even if the farming season could be characterized by drought, they would still harvest enough food for their consumption. For example, during the 2009-2010 growing season there was no rain for about three weeks in Chipata district in the month of January. However, according to the CFU Officer (key informant) the small-scale farmers who used either basins or furrows, their crops did not wither but survived the drought conditions and ultimately gave farmers a high yield.

Food security is also a priority of every household in the farming block. This could be justified by the high number of small-scale farmers who are growing maize (staple food) using CF practices (Table 5.14).

**Table5. 14 Crops cultivated under CF Practices**

| Crop | Number | Percent |
|---|---|---|
| Maize Only | 50 | 50 |
| Maizeع Cotton | 30 | 30 |
| Maizeع Groundnuts | 8 | 8 |
| Soya beansع Maize | 2 | 2 |
| Sun Flowerع Maize | 3 | 3 |
| Maizeع Cowpeas | 4 | 4 |
| Velvet beansع Maize | 3 | 3 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

The small-scale farmers who cultivate only maize (Table 5.14) using CF practices constitute 50%. The other 50% is a combination of maize and other crops. This implies that small-scale farmers are conscious of the fact that food security is very important. This is why to ensure that they are food secure 50% of them grow maize using CF practices because they believe that no matter what the prevailing circumstances of rain in a particular growing season may be, the probability of harvesting adequate stocks is guaranteed. Such is a positive impact of CF among the small-scale farmers. They (small-scale farmers) indeed acknowledged that since they adopted CF on the cultivation of food crops particularly maize, they rarely experience food shortages in their respective households. On the cash crops such as cotton which are cultivated using CF practices, small-scale farmers also acknowledge that there is an increase in the harvests compared to previous harvests under conventional methods of farming.

Soil fertility is regenerated by not allowing the clearing and burning of the previous crop residue. The 30% of CF adopters (Table 5.12) who are not clearing previous crop residue from their fields also observe that the rotting of the previous crop residue returns nutrients into the soil. Such, they note that, it improves the growth of crops and ultimately their dependence on chemical fertilizers is also being reduced.

The four percent of the small-scale farmers (Table 5.12) observe that there is easy germination of seed crops once planted in basins or furrows. This confirms what CFU

(2007) observes that, once the hard soil pan has been broken, it is easier for the seed crops to germinate due the improvement of the soil structure.

### 5.4.2 The Negative impact of CF

The negative impacts on small-scale farmers as a result of adopting CF were few compared to the positive impacts. Some of them were: Timing for land preparation disadvantages the small-scale farmers as it is suppose to be done immediately after harvest. The small-scale farmers argued that after harvest they are expected to prepare for the markets, while at the same time they are also expected to dig basins or rip the furrows. Naturally small-scale farmers begin with making their harvest ready for market. Crops like maize have to be shelled and put into bags and then taken to the market. Cotton has to be picked from the fields and then bailed into bags and later taken to the market. Groundnuts have to be dug, put into bags and at times they require to be shelled before they are put into bags and later sold to the market. Therefore the small-scale farmers observed that by the time they are through with the marketing of their crops, their fields are quite dry. Thus instead of ripping furrows or digging basins immediately after harvesting (between April and June) when the soils are still wet, they do so when it is quite dry some times in August or September. It is argued by the small-scale farmers that the digging of basins and ripping of furrows, when the soils are quite dry is quite laborious.

In addition, some of the positive impacts take long to be realized by the farmers, as already alluded to by CFU (2009). Some of the farmers complained of intensive labour in the digging of planting basins and others complained about more weeds in their fields. Thus, such farmers would have to wait until in the fourth growing season for them to enjoy the benefits of reduced labour in digging planting basins and fewer weeds.

The farming technique also renders the farmers with no time to rest because by the time they are through with the marketing of their crops, it is almost the beginning of another growing season, claimed some of the farmers. The other disadvantage that some of the small-scale farmers complained about, was that, even if they may not clear their fields of the previous crop residue, the domesticated animals at times are left free in the dry season and as such feed on the crop residue. However, such are the challenges of the traditional land tenure system because there is communal ownership of the land. Domesticated

animals are left free, especially where a traditional leader such as a chief has not imposed strict regulation on looking after these animals in the dry season. This phenomenon is quite common in chief Nzamane chiefdom.

### 5.5 Patterns of Adoption of CF in the Southern Agricultural Farming Block

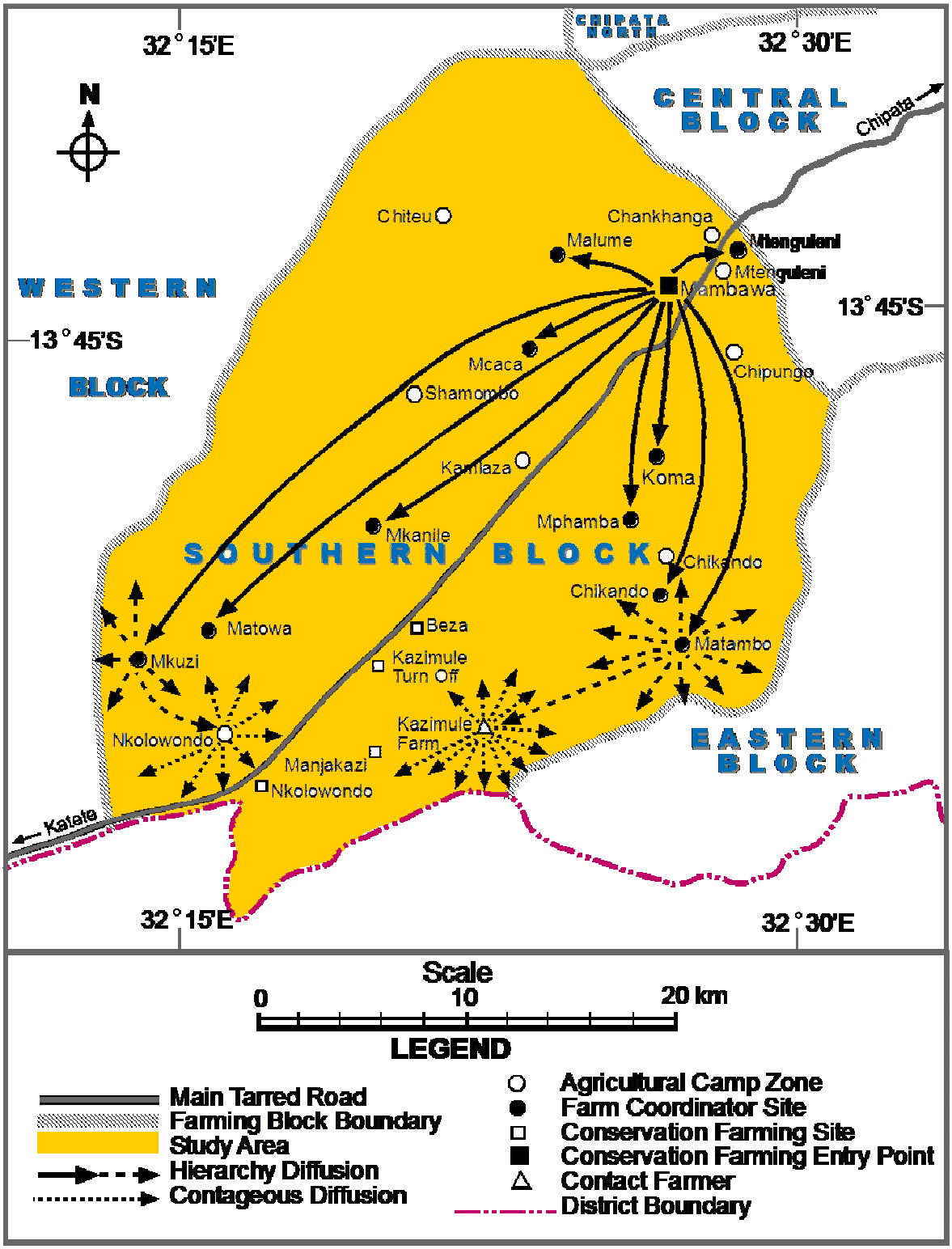
Mambawa village was the entry point through which CF entered into the study area. Actually it was way back in 2001 before CFU came into the area that MAFF then initiated CF through its Agricultural Extension officer of the area. By 2005 CF had spread just to villages surrounding Mtenguleni area such as Fisheni, Chipungo, Chigeni, Gone, Malume, Madzimawi and Muyuki and in few isolated far outlying areas such as Enock village.

Incidentally CFU also began from Mambawa as its entry point into the study area in its promotion of CF among the small-scale farmers. This was so because CFU wanted to begin from an area where the farmers had already got the idea of CF. This Organization found it easier to start teaching about CF practices to such farmers and with the understanding that in turn the taught farmers would easily teach other farmers too.

#### 5.5.1 Adoption of CF through Hierarchical and Contagious Diffusion

CF has been adopted in the Southern Agricultural Farming through both hierarchical and contagious diffusion. The movement of CF messages was from CFU to the Farmer Coordinators, to the Contact farmers and then finally to all other small-scale farmers or from MACO to Agriculture Extension officers to the Lead farmers and finally to the general populace of small-scale farmers. This movement is hierarchical in nature because the transmission of an idea of farming from CFU/MACO to the farmers followed a hierarchical order within the social structural framework of CFU/MACO (Figure 5.3).

**Figure 5.3 Hierarchical and Contagious Diffusion Patterns of CF Adoption.**




**Source: Field Surveys**

To elaborate on Figure 5.3, CFU has its offices in Chipata town which can be described as an urban area. The study area is approximately 20km away from town in a rural set up. CFU first of all divided the Southern Agricultural Farming Block into 10 zones and identified a small-scale farmer in each zone who knew how to read and write and appointed him or her as a Farmer Coordinator. The Farmer Coordinators were trained by CFU officers at Mambawa and after training, each one of them went back to his or her respective zone. Each Farmer Coordinator was asked to identify 10 small-scale farmers to be Contact farmers in his or her respective zone whom she or he also trained in CF practices. Then each Contact farmer was also asked to identify about 30 small-scale farmers within his or her surrounding area and recruit them into CF. A Farmer Coordinator at Matambo for example (Figure 5.3) has 10 Contact farmers of which one of them is at Kazimule farm who also trained 30 other small-scale farmers from his surrounding area. Thus from Mambawa to Matambo to Kazimule farm and to 30 surrounding farmers, the pattern of diffusion of CF followed a hierarchical order.

In as far as MACO was concerned the pattern of diffusion of CF was the same. There are 8 Agriculture camps in the Southern Agricultural Farming Block; Chikando, Chiteu, Kamulaza, Nkholowondo, Shamombo, Chankhanga, Chipungo and Mtenguleni. In 2008 the Government decided to step up the promotion of CF among the small-scale farmers by using Agriculture Extension officers in the recruitment exercise. At that time 3 of these Camps had no Agriculture Extension officers. The 3 Camps were Shamombo, Chiteu and Chikando. However, the Agriculture Extension officers just like the Farmer Coordinators also identified Lead farmers in their respective catchment areas and trained them into CF. (Contact farmers are referred to as Lead farmers by MACO). The Lead farmers also trained about 30 small-scale farmers into CF. Thus, once the knowledge of CF has reached the Farmer Coordinators or Agriculture Extension officers its downward spread to the Contact farmers/Lead farmers and finally to all other small-scale farmers is rapid.

Contagious diffusion starts at the Farmer Coordinator or Agriculture Extension officer's level as he or she recruits 10 Contact/Lead small-scale farmers respectively from his or her surrounding area. The Contact/Lead farmer recruits some farmers into CF from his or her own village and nearby villages too. The recruited farmers do not have formal ways of teaching other farmers but as they meet with other farmers at different fora such as

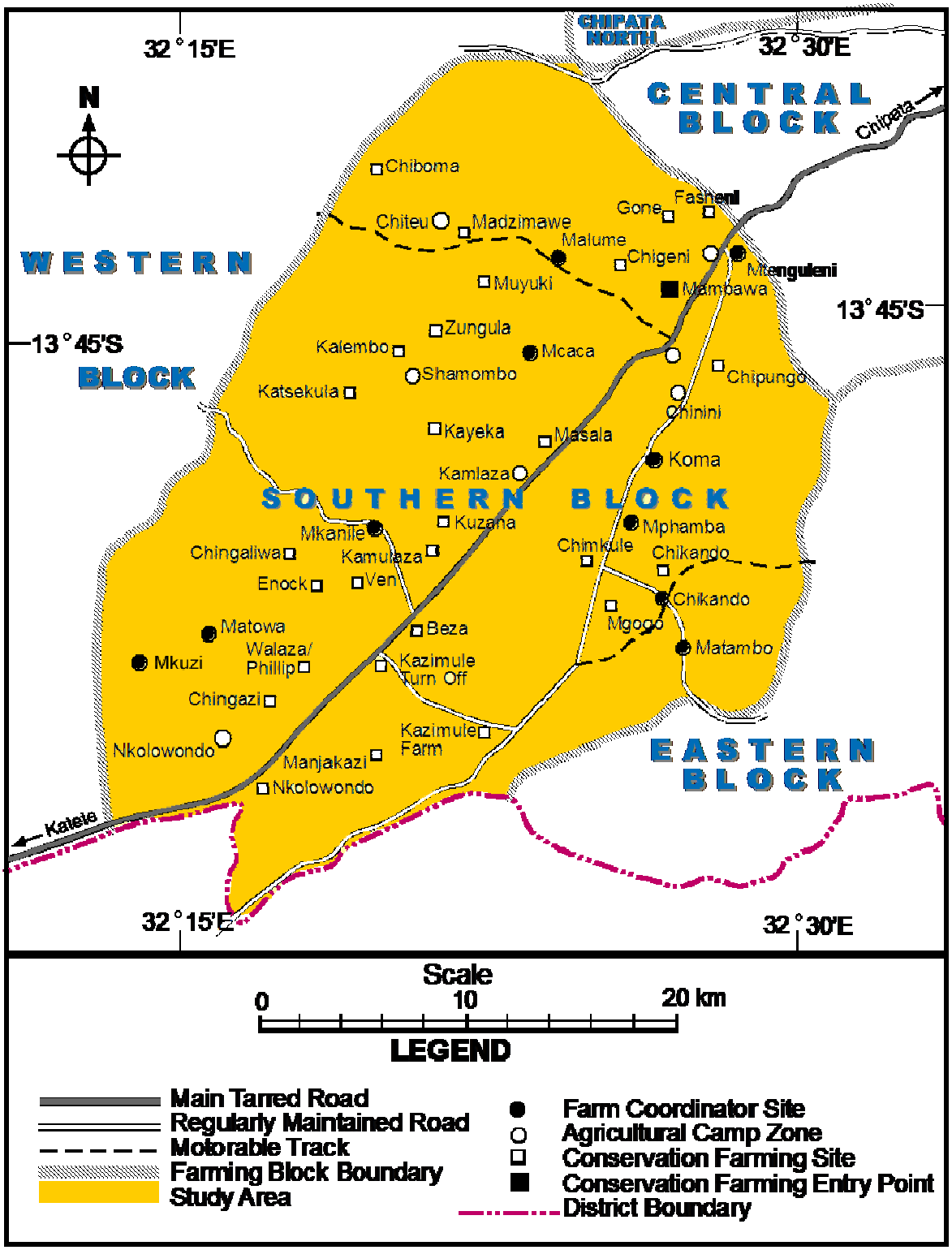
funerals, football matches, and traditional dances or at beer parties they share CF messages. In this way CF is spreading outwards to far areas.

This type of diffusion of CF involves direct contact of persons to share an idea or information. The process of diffusion to take place is largely influenced by distance that separates the two persons. This means that the nearer the persons or villages the much higher probability of contact to share information. When this trend continues with other subsequent near by villages the pattern of diffusion of CF spreads in a rather centrifugal manner in some cases like Chikando area, where villages are in a clustered pattern or linear from the source region such as along the Great East road from Beza village going to South-west up to Nkholowondo village. So distance in this case has been an influencing factor in the diffusion and adoption of CF.

### 5.5.2 The Extent of Adoption of CF in the Southern Agricultural Farming Block

In order to locate the sites where CF has been adopted, 25 sites (Figure 5.3) were selected randomly and their coordinates (Appendix 7) were approximately plotted on the base map of the study area. However, even some sites whose coordinates were not collected have been approximately plotted as long as CF has been adopted in such areas (Figure 5.4).

**Figure 5.4 Some CF sites in the Southern Agricultural Farming Block**




**Source: Field Surveys**

The extent of the adoption of CF has become wider and this success can mainly be attributed to CFU. The establishment of Farmer Coordinators in the Southern Agricultural Farming Block enhanced the down ward movement of CF to other small-scale farmers. As shown (Figure 5.4) there were 5 Farmer Coordinators on both sides of the Great East road. This arrangement has enhanced the transmission of CF messages.

The information about CF has actually spread out in the entire Southern Agricultural Farming Block. It is now up to the small-scale farmers who have not yet adopted it to make a decision to do so. However, this may take a long time for some of them to do so because of their attitudes and perceptions. Some believed that conventional ways of farming were better than CF practices. For example some even argued that they could not abandon their conventional ways of farming like making of ridges using a hoe- a system of making ridges which is commonly called*'galauza'*. They also expressed surprise that it was possible to cultivate the land without clearing the previous crop residue by burning it. In terms of attitudes some of them have the habit of wanting to get something before they can adopt CF, (for example, they could ask questions such as, 'what would the Government give us if we adopted CF?'). Such a question was asked in spite of the incentives that some NGO's and the Government were giving. It is such an attitude of expectation to receive something that hinders or delays adoption of CF by some of the small-scale farmers. This finding where the small-scale farmers of the Southern Agricultural Farming Block would like to adopt CF only when there are incentives given to them, is similar to the findings of Gukurume e*t al*., (2010), about the farmers of ward 21 of Chivi District in Zimbabwe. They (farmers in Chivi) pretended to embrace CF because of the need to access farm inputs. Similarly the small-scale farmers of the Southern Agricultural Farming Block embrace CF because of the need to receive incentives from the promoter NGO's and subsidized farm inputs through FISP. Therefore, these farmers also need education if their attitude is to change.

### 5.5.3 Channels of Diffusion of CF in the Southern Agricultural Farming Block

There are a number of channels through which diffusion of CF has taken place in the Southern Agricultural Farming Block. These include the following;

**Field Day Demonstrations**

Every year CFU conducts field day demonstrations for small-scale farmers with the help of some seed companies such as Pannar, SeedCo and ZamSeed. The seed companies provide seeds and fertilizers to CFU which identifies some small-scale farmer beneficiaries whose fields become demonstration plots. During the demonstrations small-scale farmers from the surrounding and far areas are invited regardless of whether they practise CF or not.

In the Southern Agricultural Farming Block demonstration plots are at Mtenguleni just along the Great East road. The owners of the plots and CFU field supervisors explain how CF is done from land preparation to harvesting. Thus field day demonstrations have become an important tool for disseminating CF practices. Plate 5.3 illustrates one of the Field Day Demonstration which was held at Mtenguleni on the 26th of February, 2010.

**Plate5.3 Field Day Demonstration at Mtenguleni.**

**Source: Field Data (March, 2010)**

A Zambia Seed Company (ZamSeed) Officer was explaining to farmers about Zambia Seed Company varieties. The owner of the field had also an opportunity to explain processes in CF from land preparation to harvesting. Other groups of farmers not shown in Plate 5.3 were with Pannar officials and some were with Seed Co officers at other plots.

From Figure 5.4, it could be observed that Mtenguleni is not at the minimum travel distance for all the farmers in the Southern Agricultural Farming Block. The villages such as Nkholowondo, Mkuzi, Chikando, Matambo, Manjakazi and Kazimule farms just to give an example, are some of the farming areas which are quite far from this Demonstration Centre. This is why the Farmer coordinator zones which are relatively near this centre had more small-scale farmers (Table 4.1) who were practising CF than those from far areas.

**Influence of the media**

A number of small-scale farmers indicated that they also received CF messages through audio, print and visual media (Table 5.15).

**Table5. 15 Types of Media in the Dissemination of CF practices**

| **Media** | **Number of CF Adopters** | **Percent** |
|---|---|---|
| Audio | 82 | 82 |
| Print | 15 | 15 |
| Electronic | 3 | 3 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

The influence of the media through audio represents 82%. The percentage for audio is higher because the number of community radio stations to which farmers can listen in the district has increased to two. However, radio stations one and two of Zambia National Broadcasting Corporation (ZNBC) also give farmers a wider choice to listen to agricultural messages. For example, ZNBC radio two presents a program called voice of the farmer and rural note book and radio one, '*Nkhani za Alimi*' every week. Radio Breeze airs Agriculture programmes every Sunday at 1630 hours and the same programme is repeated every Wednesday at 1130 hours. This provides greater opportunity to small-scale farmers to learn a lot about farming in general.

Dissemination of CF messages through radio is very important because it does not depend on ratios like Extension work by Agriculture experts. Thus all farmers can listen to Agriculture messages through radio at the same time and does not require formal

arrangement to listen to. Even a farmer without radio can easily listen from his or her neighbour who may own a radio.

Only three percent (Table 5.15) of farmers were able to receive CF messages from visual media such as television because the study area has power only at Mtenguleni. The other reason is that a number of small-scale farmers cannot afford to buy and let alone service the solar panels. Thus even if they could afford to buy television sets, accessibility to energy sources such as hydro electric power, solar panels and batteries still poses a big challenge to many of them.

The access of CF messages through print media only accounted for 15% of the CF adopters. It can be argued therefore that the percentage representing print media is small because the access to newspapers, farm magazines and other publications on farming is limited in the area. In addition the majority of CF adopters attained only basic education. It can be argued therefore that many of them cannot clearly comprehend most of these print media publications which are often written in English. Thus print media publications on agriculture vis-à-vis in the local language of the area are rarely found.

**Trainings and Meetings**

CFU conduct meetings and trainings first with Coordinators where CF practices are discussed and taught by the Field Officers. The 10 Coordinators in the zone then teach their respective Contact farmers. The Contact farmers teach about 30 to 35 farmers each at arranged meetings. Contact farmers report the progress to Coordinators monthly. Coordinators also report to CFU Field Officers or supervisors monthly. In this way CF has spread quickly to other areas in the farming block. Agriculture Extension officers also conduct trainings and meetings among the small-scale farmers within their respective catchment areas.

## 5.6 Barriers to Adoption of CF in the Southern Agricultural Farming Block

The CF adopters expressed a number of barriers when they were interviewed which they felt discourage other farmers to adopt CF (Table 5.16).

**Table5. 16 Barriers to Adoption of CF in the Southern Agricultural Farming Block**

| Barriers | No. of CF Adopters who expressed the barrier | Percent |
|---|---|---|
| Persistence of Conventional methods | 45 | 45 |
| Distance to Demonstration Centre | 22 | 22 |
| Non-attractive markets | 13 | 13 |
| Giving of incentives to farmers | 20 | 20 |
| **Total** | 100 | 100 |

**Source: Field Data (March, 2010)**

The most common barrier identified to adoption of CF in the farming block is the persistence of some Conventional practices of land preparation. These include; clearing of crop residues after harvest, making of ridges either with ploughs or hoes and ploughing of the land. However, 45% of CF adopters (Table 5.16) argued that many farmers in the farming block practice both CF and Conventional farming on their maize fields. Thus one maize field is usually under CF and the other Conventional farming. When asked as to why they do so they revealed that it was part of their risk management strategy. The essence is that when there is drought they are likely to harvest enough maize from fields under CF practices.

Plate 5.4 illustrates some ridges in a field which is one example of the Conventional practices of cultivation which has persisted.

**Plate5. 4 Ridges in a Field**

**Source: Field Data (November, 2009)**

With a closer look at Plate 5.4 it can be appreciated that the soil in the field had already created a hard pan. So it can be argued that for whatever crop was planted in this field the roots had difficulties to penetrate the soil hard pan.

These Conventional methods of farming have persisted because some of the small-scale farmers believed for example that it was practically impossible to do land preparation for cultivation without first of all clearing the previous crop residue. Others believed that crops cannot grow well without the preparation of ridges or without ploughing the land. Therefore the farmers' perceptions based on their cultural background of cultivation also act as barriers to the adoption CF practices. They develop inertia to new methods of farming probably because they become uncertain of the new methods.

Another barrier is the geographic distance of the Demonstration Centre to the periphery villages within the block. The farmers from these villages do not attend the Field Day Demonstrations which are held at Mtenguleni every year. When asked why other farmers do not attend the Field Day Demonstrations the 22% of CF adopters (Table 5.16) argued that some of the small-scale farmers lacked bicycles and for others it was just laziness on their part.

Non-attractive markets for the farmers' produce have also impacted negatively on the adoption of CF by the small-scale farmers. Some small-scale farmers have really realized that CF enhances production of crops but their adoption is hampered by the unfavourable markets. For example, 13% (Table 5.16) of CF adopters observed that many farmers in the Southern Agricultural Farming Block take their farm produce to Indian shops in Chipata town which is about 20km away from their residential villages. Therefore this makes the majority of them sell their crops like maize, groundnuts and sunflower, cheaply to mobile crop buyers. The idea of giving incentives to small-scale farmers who adopt CF practices though it encourages them to continue practising CF on one hand, has also posed a challenge to the continuity of practising CF by some of the small-scale farmers on the other hand. Some of the CF adopters (20%, Table 5.16) argued that when these incentives are discontinued other adopters also discontinue practising CF in the subsequent growing season. Therefore in a way giving incentives to small-scale farmers becomes a barrier to adopting CF because some of them when they are not given do not adopt CF. Thus, they can only adopt CF once they are given incentives. It is such attitude and perception by some of the small-scale farmers that hinder the adoption of CF in spite of the deliberate efforts which are being made by some NGO's and the Government in promoting CF among them. Such farmers do not have adequate knowledge about the importance of CF. The impression they create is that they do farming for the benefit of the Government and NGO's and not their own benefit.

# CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

This chapter presents both a conclusion of the findings and recommendations of the study.

## 6.1 Conclusion

CF is proving to be the most promising technique in the cultivation of crops by the small-scale farmers in the Southern Agricultural Farming Block. The number of small-scale farmers adopting CF is increasing every growing season. At the time of this study there were 3000 small-scale farmers practising CF. The rate of adoption of CF on average by the small-scale farmers since CFU began promoting it, is at 38%. However, this rate of adoption is still low considering the number of small-scale farmers who are about 20000 in the Southern Agricultural Farming Block.

The factors which so far are encouraging the current rate of adoption of CF by the small-scale farmers are; incentives given by CFU and the Government. Membership to Farmer Support Organizations, sensitization messages on CF through Radio Stations such as Radio Maria, Radio Breeze and ZNBC are also important factors in the promotion of CF. Others include the need by small-scale farmers to reduce poverty and hunger in their households through the realization that CF enhances crop production, enables restoration of soil fertility and that, when there is drought, crops do not to wither.

There have been both positive and negative impacts on the small-scale farmers that adopted CF in the Southern Agricultural Farming Block. The positive impacts include; enhanced crop production. This is an undeniable fact even if most of the small-scale farmers had no records apart from the 10 (Table 5.13) who had records of maize production for 2008-2009 growing season. The farmers acknowledged and confirmed that crops under CF methods were usually greener and healthier such that at the time of harvests they had high yields. Also for the farmers who pratcised CF (basins) for a period of four years continuously, saw that weeds had reduced from their fields and that labour for digging basins had also reduced. Most of the farmers confirmed that fertility in their fields had been restored due to the adoption of CF. In a growing season which was characterized by drought, for example 2008-2009 growing season some farmers were still able to harvest adequate food crops such as maize. Therefore it can be argued that CF has impacted

positively on the production of maize and other crops in the Southern Agricultural Farming Block.

The negative impacts of CF on the small-scale farmers were few compared to the positive impacts. The negative impacts include; the farmers complained that they had little time to rest because the timing for land preparation for cultivation comes immediately after harvest. However, they observed that this is the same time when they are supposed to prepare their crops for market. Thus, by the time they are through with the marketing of crops, it is almost another growing season, and by such a time the soils are so dry that the digging of basins and ripping of furrows is quite laborious. In some cases the small-scale farmers also complained about the domesticated animals which are left to feed on a free range system, thereby, feeding on the left crop residue of their fields. However, this is so because of the traditional land tenure system which encourages communal ownership of the land in the Southern Agricultural Farming Block.

The information about CF has reached all households in the farming block though its adoption is not commensurate with its diffusion. It is common to find that in one village one or two small-scale farmers practise CF and the rest do not. However, the small-scale farmers who have not yet adopted CF do not lack knowledge nor are they not aware of the existence of its presence in their area. Thus in terms of the extent of diffusion of CF the entire study area has been covered. The other thing to note is that the main diffusion channel of CF from the Promoters to the farmers has been hierarchical in nature though from Lead/Contact farmers to the general populace of small-scale farmers the trend of diffusion has been that of contagious diffusion.

There are also some barriers to adoption of CF in the Southern Agricultural Farming Block. The unreliability of markets for the farmers' crops such as maize is one of them. In the entire area of the farming block for example, FRA never established a maize market in the 2008-2009 growing season. This discouraged certain farmers to produce more maize through CF even after proof from other farmers that it does enhance production of maize. In addition, Mtenguleni which is being used as a Field Day Demonstration Centre by CFU is not at the mean Centre travel distance to all the small-scale farmers in the Southern Agricultural Farming Block. This also acts as a barrier because some farmers who are at

distant places from this centre do not attend these organized Field Day Demonstrations. The persistence of conventional methods of farming in the Agricultural Farming Block also suggests that some small-scale farmers have not fully appreciated the importance of CF because of the inertia to this new method of Farming. In addition, though Incentives promote the adoption of CF to some of the farmers, may act like barriers to others especially those who may want to wait to adopt it until they receive them. However, these direct given incentives alone will never achieve the scale of new CF adopters required in many areas unless an adopter himself or herself places a positive value on CF. It can be argued therefore, that such barriers above, are contributing to the low adoption rates of CF in the Southern Agricultural Framing Block.

## 6.2 Recommendations

### 6.2.1 Small-Scale Farmers

- should not base adoption of CF on the given incentives by the promoters but on the derived benefits from practising it (e.g. high production of maize).
- should trial CF practices to prove for themselves if they really enhance maize production and other crops.

### 6.2.2 The NGO's Promoting Adoption of CF among the Small-Scale Farmers

- should ensure that Field Day Demonstrations are held at two other Centres with minimum travel distances (unlike Mtenguleni) from all directions in the Southern Agricultural Farming Block. Masala village and Kamulaza agriculture camp (Appendix 8), have been identified as suitable centres for field Day Demonstrations.

### 6.2.3 The Government

- should ensure that all Agriculture camps in the Southern Agricultural Farming Block have Agriculture Extension officers or increase the number of Agriculture camps when resources permit to reduce on the ratio between Farmers and Agriculture Extension officers. This will enhance quality of Extension services to the farmers.

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# APPENDICES

## Appendix 1 Interview Schedule

1. Head of the household……Female/Male (tick)
2. Marital Status…….Single/Married/Divorced/Widowed (tick )
3. Age……
4. Size of the household……
5. Highest level of education……Lower basic, middle basic, upper basic, High School or Tertiary (tick) and indicate grade
6. How much land do you own in hectares?
7. Do you own cattle?.....Yes/No
8. If yes in 7 above how many of them do you have?
9. For how long have you been practicing conservation farming?.....(years)
10. What crops do you cultivate using conservation farming practices?

    ……

11. How many hectares of land do you cultivate of the crops in 9 above?
12. Which farmer support organization do you belong to?
13. Which conservation farming technology do you practise? Planting basins/Planting furrows or both? Specify

    ……

14. Do you also grow crops using conventional tillage system? Yes/No
15. If yes in 11 above, where do you produce more between conservation tillage and conventional tillage?
16. What is the hectarage under conventional methods?
17. What depth do you till your land under CF practices?
18. Where did you get the idea of conservation farming?

    From CFU Officer/Coordinator/Contact farmer/Agriculture Extension Officer/Fellow farmer/Co-operative/Radio/TV/Farm magazine (tick ) if other

    ……...

16. Did you teach any other small-scale farmer about conservation farming? Yes/No

17. If yes in 13, how many did you teach?

18. Do you attend field day demonstrations that are held at Mtenguleni every year?

.....

19. If yes what things do you learn? Specify

…….

20. If no give reasons for not attending

……

…….....

…….

21. Do you use fertilizers in your cultivation of crops? Yes/No

22. If yes in 21 how do you obtain this fertilizer? From CFU, Cooperative, Dunavant, Clark cotton, or from own resources. If other Specify

……

……

23. Do you think that conservation farming is improving the soil fertility of your field? Yes/No……

24. What benefits have you observed and experienced in conservation farming?

Less labour/Less weeds/High yields/ No withering of crops in drought/ If other Specify……

25. Are you given any incentives by CFU for practising CF? Yes/No

26. If yes in 25 above Specify incentives given……

……

27. If no in 25 above would you continue practising conservation farming?

Yes/No

……

28. If no in 27 above what are your expectations?

…….

29. What differences have you experienced between conservation and conventional Farming?

30. What could be the reason for those small-scale farmers who have not yet adopted conservation farming? Lack of knowledge for conservation farming/ they are just lazy/ they are used with conventional methods of farming/Lack of understanding. If other, specify……

……...

# Appendix 2 Interview guide

**District Agricultural Officer**

i. Origin of CF in Chipata district

i. Extent of diffusion of CF in the district

ii. Impact of CF on production of crops

iii. Problems that hinder adoption of CF by Small-scale farmers

**CFU Coordinator**

Number of Small-scale farmers taught CF methods

**(i)** CF methods

**(ii)** Barriers to the diffusion of CF

**(iii)** Promotion of CF

**Agricultural Extension Officer**

1. Number of Small-scale farmers adopting CF
2. Extent of diffusion of CF in the Farming block
3. Barriers to the diffusion of CF
4. Origin of CF in the block
5. Diffusion pattern of CF in the block
6. Measures put in place to overcome barriers to diffusion of CF
7. Continuation of conventional methods

**Contact or Lead Farmer**

i Period of practicing CF

ii Number of farmers being taught CF

iii Barriers to diffusion of CF

iv Problems encountered by CF farmers

v Sources of farming inputs

**Appendix 3 Period of Residence (Stay) and Adoption of CF by the small-scale farmers**

| Period( in years) (x) | Number of farmers (y) | $x^2$ | $y^2$ | Xy |
|---|---|---|---|---|
| 1 | 4 | 1 | 16 | 4 |
| 3 | 8 | 9 | 64 | 24 |
| 5 | 12 | 25 | 144 | 60 |
| 6 | 15 | 36 | 225 | 90 |
| 7 | 40 | 49 | 1600 | 280 |
| 9 | 21 | 81 | 441 | 189 |
| **Σx**=31 | **Σy**=100 | **Σx²**=201 | **Σy²**=2490 | **Σxy**=647 |

$\bar{x}$= 5.16

$\bar{y}$= 16.66

n= 6

$$r_{cal} = \frac{n\Sigma xy-(\Sigma x)(y)}{\sqrt{\left[n\Sigma x^2-(\Sigma x)^2\right]\left[n\Sigma y^2-(y)^2\right]}}$$

$$= \frac{6x647-31x100}{\sqrt{\left[6x201-961\right]\left[6x2490-10000\right]}}$$

$$= \frac{782}{1100.14}$$

= 0.710818623

$r_{cal}$ = 0.7108

$r^2_{cal} = 0.7108^2$

= 0.50523664

= 0.50523664x100

= 50.52%

= 51%.

$r_{crit}$ = 0.707 at level of significance 0.05 (two tailed)

## Appendix 4 Size of Land Ownership and Adoption of CF

| Hectares of Land (x) | Number of Farmers Owning (y) | $x^2$ | $y^2$ | xy |
|---|---|---|---|---|
| 1 | 5 | 1 | 25 | 5 |
| 2 | 2 | 4 | 4 | 4 |
| 3 | 18 | 9 | 324 | 54 |
| 4 | 28 | 16 | 784 | 112 |
| 5 | 16 | 25 | 256 | 80 |
| 6 | 8 | 36 | 64 | 48 |
| 7 | 6 | 49 | 36 | 42 |
| 8 | 4 | 64 | 16 | 32 |
| 9 | 2 | 81 | 4 | 18 |
| 10 | 1 | 100 | 1 | 10 |
| 11 | 2 | 121 | 4 | 22 |
| 12 | 1 | 144 | 1 | 12 |
| 14 | 1 | 196 | 1 | 14 |
| 17 | 2 | 289 | 4 | 34 |
| 20 | 4 | 400 | 16 | 80 |
| **$\Sigma x$** = 129 | **$\Sigma y$** = 100 | **$\Sigma x^2$**=1535 | **$\Sigma y^2$**=1540 | **$\Sigma xy$**=567 |

$$r_{cal} = \frac{n\Sigma xy-(\Sigma x)(\Sigma y)}{\sqrt{\left[n\Sigma x^2-(\Sigma x)^2\right]\left[n\Sigma y^2-(\Sigma y)^2\right]}}$$

$$= \frac{15x567-129x100}{\sqrt{\left[15x1535-16641\right]\left[15x1540-10000\right]}}$$

$$= \frac{8505-12900}{\sqrt{83630400}}$$

$$= \frac{-4395}{9144.965828}$$

$= -0.480592282$

$r_{cal} = -0.480$

$r^2 = -0.480^2$

$= 0.2304$

$= 0.2304 \times 100$

$= 23.04$

$= 23\%$

$r_{crit} = 0.482$ at level of significance 0.05 (two tailed)

## Appendix 5 Ages of the Small-scale farmers and Adoption of CF

| Age(x) | Number of Adopters(y) | $x^2$ | $y^2$ | xy |
|---|---|---|---|---|
| 20 | 1 | 400 | 1 | 20 |
| 23 | 2 | 529 | 4 | 46 |
| 25 | 3 | 625 | 9 | 75 |
| 27 | 2 | 729 | 4 | 54 |
| 29 | 2 | 841 | 4 | 58 |
| 30 | 3 | 900 | 9 | 90 |
| 32 | 6 | 1024 | 36 | 192 |
| 34 | 9 | 1156 | 81 | 306 |
| 35 | 3 | 1225 | 9 | 105 |
| 37 | 4 | 1369 | 16 | 148 |
| 39 | 5 | 1521 | 25 | 195 |
| 40 | 9 | 1600 | 81 | 360 |
| 42 | 8 | 1764 | 64 | 336 |
| 44 | 8 | 1936 | 64 | 352 |
| 45 | 7 | 2025 | 49 | 315 |
| 47 | 8 | 2209 | 64 | 376 |
| 49 | 7 | 2401 | 49 | 343 |
| 50 | 5 | 2500 | 25 | 250 |
| 53 | 4 | 2809 | 16 | 212 |
| 61 | 3 | 3721 | 9 | 183 |
| 70 | 1 | 4900 | 1 | 70 |
| **Σx=**832 | **Σy**=100 | **Σx²**=36184 | **Σy²**=620 | **Σxy**=4086 |

$$r_{cal} = \frac{n\Sigma xy-(\Sigma x)(\Sigma y)}{\sqrt{\left[n\Sigma x^2-(\Sigma x)^2\right]\left[n\Sigma y^2-(\Sigma y)^2\right]}}$$

n = 21

Σx = 832

Σy = 100

$\Sigma x^2$ = 36184

$\Sigma y^2$ = 620

Σxy = 4086

$$r = \frac{21x4086-832x100}{\sqrt{\left[21x36184-692224\right]\left[21x620-10000\right]}}$$

$$= \frac{85806-83200}{\sqrt{\left[67640\right]\left[3020\right]}}$$

$$= \frac{2606}{\sqrt{\quad}}$$

204272800

$$= \frac{2606}{14292.40358}$$

$r_{cal} = 0.182$

$r^2 = 0.182^2$

$= 0.033124$

$= 0.033124 \times 100$

$= 3.3124$

$= 3.3\%$

$r_{crit}$ at level of significance of 0.05 is 0.409 (two tailed)

**Appendix 6 Maize Production between two different farming methods (ridges and basins) by 10 small-scale farmers (Student's t test)**

| Farmer | Ridges | Basins | d | $d - \bar{d}$ | $(d - \bar{d})^2$ |
|---|---|---|---|---|---|
| **1** | 28 | 26 | -2 | 0.6 | 0.36 |
| **2** | 30 | 33 | 3 | 0.4 | 0.16 |
| **3** | 35 | 40 | 5 | 2.4 | 5.76 |
| **4** | 24 | 28 | 4 | 1.4 | 1.96 |
| **5** | 30 | 32 | 2 | -0.6 | -0.36 |
| **6** | 24 | 29 | 5 | 2.4 | 5.76 |
| **7** | 30 | 32 | 2 | -0.6 | -0.36 |
| **8** | 31 | 30 | -1 | -3.6 | -12.96 |
| **9** | 33 | 36 | 3 | 0.4 | 0.16 |
| **10** | 29 | 34 | 5 | 2.4 | 5.76 |
| $\sum$ | | | **26** | | **6.66** |

$$\bar{d} = \frac{\sum d}{n} \qquad SD = \sqrt{\frac{\sum (d - \bar{d})^2}{n-1}}$$

$$= \frac{26}{10} \qquad = \sqrt{\frac{6.66}{9}}$$

$$= 2.6 \qquad = \frac{2.58}{9} \qquad = 0.29$$

$$SD = 0.29$$

$$t = \frac{\bar{d}}{\frac{SD}{\sqrt{N}}} \qquad = \frac{2.6}{\frac{0.29}{3.16}} \qquad = \frac{8.96}{3.16} \qquad = 2.84$$

$$t = 2.84$$

df = n-1, 10-1= 9

Level of significance = 0.01

t, critical = 3.25

Two Tailed test

From the tables of the student's t sampling distribution (Appendix C4, Ebdon, 1985) the critical value of t with 9 degrees of freedom for a two-tailed test at the 0.01 significance level is 3.25. However, the calculated value of t (2.84) is less than the critical value, and therefore, the research hypothesis which states that there is difference in production of maize between CF basins and conventional ridges can be rejected.

## Appendix 7 Coordinates of some CF Sites

| Serial No. | Longitude | Northing | Latitude | Easting | Site |
|---|---|---|---|---|---|
| 1 | 032.30300 | 0424698 | 13.91417 | 8461956 | Nkholowondo |
| 2 | 032.33994 | 0428678 | 13.87489 | 8466312 | Chingazi |
| 3 | 032.35323 | 0430109 | 13.86319 | 8467610 | Kazimule Turn Off |
| 4 | 032.37797 | 0432791 | 13.88901 | 8464762 | Walaza village |
| 5 | 032.40308 | 0435507 | 13.89929 | 8463632 | Kazimule Farms |
| 6 | 032.44837 | 0440390 | 13.85930 | 8468060 | Mgogo village |
| 7 | 032.46444 | 0442123 | 13.84494 | 8469658 | Chikando school |
| 8 | 032.42122 | 0437449 | 13.83323 | 8470942 | Chimkule village |
| 9 | 032.41002 | 0436233 | 13.81026 | 8473480 | Masala village |
| 10 | 032.46110 | 0441737 | 13.74559 | 8480646 | Mambawa village |
| 11 | 032.48325 | 0444125 | 13.71647 | 8483870 | Fisheni village |
| 12 | 032.37684 | 0432653 | 13.83715 | 8470496 | Kamulaza Agric. camp |
| 13 | 032.35709 | 0430522 | 13.84508 | 8469614 | Veni village |
| 14 | 032.35045 | 0429804 | 13.84522 | 8469596 | Enock village |
| 15 | 032.38173 | 0433178 | 13.82240 | 8472130 | Khuzana village |
| 16 | 032.36982 | 0431887 | 13.80713 | 8473814 | Kayeka village |
| 17 | 032.34462 | 0429154 | 13.77938 | 8476876 | Katsekula village |
| 18 | 032.35485 | 0430258 | 13.77263 | 8477626 | Kalembo village |
| 19 | 032.37449 | 0432379 | 13.76526 | 8478446 | Zungula village |
| 20 | 032.40026 | 0435158 | 13.73974 | 8481276 | Muyuki village |
| 21 | 032.41118 | 0436332 | 13.71473 | 8484046 | Madzimawe village |
| 22 | 032.43685 | 0439111 | 13.73152 | 8482196 | Chigeni village |
| 23 | 032.48481 | 0444304 | 13.76080 | 8478968 | Chipungo village |
| 24 | 032.47354 | 0443081 | 13.74053 | 8481208 | Mtenguleni village |
| 25 | 032.46144 | 0441767 | 13.72041 | 8483430 | Gone village |

**Source: Field Data (March, 2010)**

## Appendix 8 Recommended Field Day Demonstration Centres

| Point/Coordinator's site | x coordinate (cm) | y coordinate (cm) | Weight (No. of farmers) | Weighted x (xw) | Weighted y (yw) |
|---|---|---|---|---|---|
| Chagumu | 0.4 | 4.0 | 150 | 60 | 600 |
| Matowa | 1.8 | 4.4 | 200 | 360 | 880 |
| Mkanile | 4.4 | 6.0 | 250 | 1100 | 1500 |
| Mcaca | 6.8 | 8.7 | 500 | 3400 | 4350 |
| Malume | 7.2 | 10.2 | 450 | 3240 | 4590 |
| Koma | 8.7 | 7.0 | 250 | 2175 | 1750 |
| Mphamba | 8.3 | 6.1 | 230 | 1909 | 1403 |
| Matambo | 9.0 | 4.1 | 150 | 1350 | 615 |
| Mtenguleni | 10.0 | 10.2 | 600 | 6000 | 6120 |
| Chikando | 8.7 | 4.9 | 220 | 1914 | 1078 |
| | **Σx**=65.3 | **Σy**=65.6 | **Σw**=3000 | **Σxw**=21410 | **Σyw**=21576 |

$\bar{x} = \Sigma x/10 = 65.3/10$

$x = 6.53$

**When only distance is considered**

$\bar{y} = \Sigma y/10 = 65.6/10$ (mean x and mean y intersect at Kamulaza agriculture camp)

$\bar{y} = 6.56$

$\bar{x}w = \Sigma xw/\Sigma w$ **When population and distance is considered**

$\bar{x}w = 21410/3000$ (wieghted mean x and weighted mean y intersect at Masala village)

$\bar{x}w = 7.14$

$\bar{y}w = \Sigma yw/\Sigma w$

$\bar{y}w = 21576/3000$

$\bar{y}w = 7.19$