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POTENTIAL OF SORGHUM AND FINGER MILLET TO ENHANCE HOUSEHOLD FOOD SECURITY IN ZIMBABWE'S SEMI-ARID REGIONS:

A CASE STUDY OF COMMUNAL AREAS IN MASVINGO PROVINCE

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DECLARATION

I, Peter Mukarumbwa, hereby declare that the work contained in this thesis is my own and that other scholars' works referred to here have been duly acknowledged. I also declare that this thesis is original and has not been submitted elsewhere for a degree.

_____ _____

Peter Mukarumbwa Date

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ABSTRACT

Successive droughts, in Zimbabwe compounded by other economic shocks in recent years have resulted in decreased maize productivity amongst the communal farmers most of whom reside in regions IV and V which are considered semi-arid. This has given rise to the need to find alternative food crops, which may be suitable for these areas. Generally, research in the world indicates that sorghum and millet have the potential to end chronic food insecurity in semi-arid areas because of their drought tolerance. Whilst this might be the case, research, government policy and assistance from non-governmental organizations on food crop production in Zimbabwe have shown a continual inclination to maize production in semi-arid areas. However, maize is regarded as a high risk crop in these regions.

The main objective of the study was to investigate major factors affecting smallholder farmers in semi-arid areas, from increased production of small grains, specifically sorghum and finger millet. The study was conducted in two rural districts of Masvingo and Gutu, which lie in natural region IV in Masvingo Province.

The questionnaire was used as the main tool of inquiry to gather data from households in selected villages within these districts. Questionnaires were administered through face-to-face interviews. The total sample size was 120. The logistic regression model was used to analyze data.

The results revealed that, at the 5% level, labour, cattle ownership, farm size, age, extension, yields and access to credit significantly influence sorghum and finger millet production. These findings suggest that an adjustment in each one of the significant variables can significantly influence the probability of participation in small grain production. In view of these research findings, a policy shift that encourages increased production of finger millet and sorghum in Zimbabwe's semi-arid regions is proposed. It is suggested that this may increase household food security in these regions.

Key words: semi-arid, sorghum, finger millet, small grains, food security

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LIST OF ABBREVIATIONS

AREX	Agricultural Research and Extension
CRS	Catholic Relief Services
C-SAFE	Consortium for Southern Africa Food Security Emergency
CSO	Central Statistics Office
FAO	Food and Agriculture Organization
FEWSNET	Famine Early Warning Systems Network
FIVIMS	Food Insecurity and Vulnerability Information and Mapping Systems
GASGA	Group for Assistance on Systems relating to Grain After harvest
GMB	Grain Marketing Board
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
NGOs	Non-Governmental Organizations
NRs	Natural Regions
SADC	Southern African Development Community
SPSS	Statistical Package for Social Sciences
WFP	World Food Program

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

Agriculture plays an important role in the development of the Zimbabwean economy through its impact on the overall economic growth, households' income generation and food security (Mlambo and Zitsanza, 2001). According to Juana and Mabugu (2005), it offers income and employment to about 70% of the population, 60% of the raw materials required by the industrial sector and is the largest export earning sector contributing about 45% of total exports in most years. As such, the sector creates employment opportunities for about 25% of the total work force in formal employment and contributes an estimated 17% of Gross Domestic Product (GDP) (Tekere and Hurungo, 2003). In comparison other sectors such as mining, manufacturing, electricity, construction and services contribute five percent, twenty seven percent, three percent, three percent and 47 percent respectively to the GDP (Juana and Mabugu, 2005).

Therefore, the pivotal role that agriculture plays in the Zimbabwean economy warrants that policies designed regarding household food security and the type of crop to be produced should be guided appropriately. Focus should be directed to communal farmers who reside in semi-arid regions (regions IV and V). This is because most of Zimbabwe's communal lands lie in the marginal agro-ecological region IV and V. FAO (2006) estimates that about 70% of Zimbabwe's communal lands lie in regions IV and V.

According to FAO (2008), findings large parts of the SADC are semi-arid, with erratic rainfall and nutrient poor soils. While maize is the major staple that is grown in this region as a whole, sorghum and millet were found to be important crops in these driest regions where rural farm households have limited production capacity and lowest incomes (FAO, 2008). Sorghum and millet being drought tolerant have a strong adaptive advantage and lower risk of failure than other cereals in such environments. In Zimbabwe, like other countries in the SADC region, production of the main staple maize continues to dominate in its semi-arid areas.

Zimbabwe is divided into five agro-ecological regions known as natural regions based on the rainfall regime, soil quality and vegetation among other factors (FAO, 2006). The quality of the land resource declines from Natural Region (NR) 1 through to NR V (Rukuni *et al.*, 2006). Table 1.1 below summarizes the rainfall patterns in Zimbabwe's natural regions and the type of farming systems that are practiced in each region.

Table 1.1: Zimbabwe's Natural Regions and Types of Farming Systems in each region

Natural Region	**Area (000 ha)**	**% of total land area**	**Annual rainfall (mm)**	**Farming Systems**
I	613	1.56	> 1 000. Rain in all months of the year, relatively low temperatures	Suitable for dairy farming, forestry, tea, coffee, fruit, beef and maize production
II	7 343	18.68	700-1 050. Rainfall confined to summer	Suitable for intensive farming, based on maize, tobacco, cotton and livestock
III	6 855	17.43	500-800. Relatively high temperatures and infrequent, heavy falls of rain, and subject to seasonal droughts and severe mid-season dry spells	Semi-intensive farming region. Suitable for livestock production, together with production of fodder crops and cash crops under good farm management
IV	13 010	33.03	450-650. Rainfall subject to frequent seasonal droughts and severe dry spells during the rainy season	Semi-extensive region. Suitable for farm systems based on livestock and resistant fodder crops. Forestry, wildlife/tourism
V	10 288	26.2	< 450. Very erratic rainfall. Northern low veldt may have more rain but the topography and soils are poor	Extensive farming region. Suitable for extensive cattle ranching, forestry, wildlife and tourism. Zambezi Valley is infested with tsetse fly.

(Source: Adapted from FAO, 2006)

Natural regions IV and V where most communal farmers reside and derive a living are too dry for successful crop production without irrigation but they grow crops in these areas despite the low rainfall. Millet is a common crop but most communal farmers also grow maize which is the

preferred staple (Rukuni *et al*., 2006). The relative ratio of land allocation per crop and yield suggests that farmers in NRs II have a comparative advantage in the production of maize and cotton (FAO, 2006). FAO (2006) further explains that farmers in NR III have a comparative advantage in the production of cotton followed by maize. For farmers in NRs IV and V, their comparative advantage is in the production of small grains (FAO, 2006).

Leuschner and Manthe (1996) points out that sorghum and millet are some of the most important cereal crops for communal farmers in Natural Regions IV and V of Zimbabwe. The regions are characterized by low, erratic and poorly distributed rainfall of less than 650 mm/year as shown in Table 1.1. Research has shown that in these regions small grains have the potential of stabilizing household food security (Leuschner and Manthe, 1996). However, yields of sorghum and millet are still very low in these areas because communal farmers use low yielding varieties (Leuschner and Manthe, 1996). This has also been attributed to inadequate government support to promote these small grains.

The above scenario has been compounded by the fact that in recent years, Zimbabwe's economy has been experiencing multiple shocks. For the past ten years since 1999, the economy has been ravaged by widespread rainfall deficits, the impact of HIV/AIDS and an acute foreign currency shortage which has resulted in a livelihoods crisis for the majority of the country's rural and urban poor (FAO, 2008).

A Consortium for Southern Africa Food Security Emergency (C-SAFE) has been trying to address acute food security problems in Zimbabwe (Devidze, 2006). It successfully piloted a scheme called Market Assistance Programme, which was being administered by Catholic Relief Services (CRS) in 2003 (Devidze, 2006). Under this programme, sorghum is imported into Zimbabwe from America, transported into the country, milled and packaged into 5kg bags. These bags are then delivered to vendors who in turn sell the product at a subsidized price to the targeted urban poor in high density areas in particular towns. This has been happening in Mutare, Bulawayo and Hwange (Devidze, 2006).

However, aid has been coming into Zimbabwe in this form of small grains such as sorghum, despite the Zimbabwe government's efforts to revive agriculture after the fast track land reform programme. The government has been offering subsidized inputs in the form of mainly maize seed and fertilizer to resettled farmers and communal farmers. Nonetheless, Foti *et al* (2007) suggests that not much benefit has been achieved from the government subsidized input scheme especially in these semi-arid regions because input packages and the variety that was being issued did not tally with the agro-ecological location of the farmer. These views are further supported by FAO (1996) that Zimbabwe government support measures for small grains have been shown to be relatively minimal compared to maize, and the latter has encroached into sorghum and millet land. This is despite previous studies that have shown that small grains have a comparative advantage in these semi-arid regions over maize.

1.2 Problem Statement

In Zimbabwe, rural farmers in the semi-arid regions are usually chronically food insecure (Rukuni *et al*., 2006). This situation has also been worsened in recent years with successive droughts that Zimbabwe has been experiencing since 2000/2001 agricultural season and a host of other economic shocks. These factors have resulted in complete maize failure especially in regions IV and V of the country, which are semi-arid. In order to alleviate the humanitarian crisis food aid has been distributed to communal farmers in these vulnerable regions. This aid has been in the form of small grains mainly sorghum and other food stuffs. On the contrary, government and other donor organizations, offer communal farmers in these semi-arid regions inputs for production of maize. However, small grains, sorghum and millet are known to be adaptable to semi-arid conditions. Nevertheless, production of sorghum and millet has been shown to be on the decline in these regions. With these facts in mind, this study attempts to investigate the major factors that hinder farmers in semi-arid areas from increasing production of small grains. This is regardless of widespread documentation in literature, which provides evidence that these crops have a better potential of contributing to household food security than maize in these regions.

1.3 Research Objectives

The following specific objectives guided the study:

Specific objectives

1. To identify major determinant factors affecting small grain production in communal areas.
2. To compare household food security status of small grain producers and non producers.
3. To assess the contribution of small grains to household income.

1.4 Research Questions

The research seeks to answer the following questions:

1. What are the major factors that affect small grain production in communal areas?
2. Are small grains producing households more food secure than non producers?
3. Does production of small grains increase household income in communal areas?

1.5 Hypotheses

1. Household characteristics and some institutional factors affect smallholder farmers' decision on small grain production.
2. Small grain producing households are more food secure than non producers.
3. Production of small grains generates more household income than maize in semi-arid areas.

1.6 Justification of the study

Research has shown that maize growing dominate in many semi-arid cropping areas in Zimbabwe (FAO, 1996). Conversely, maize is regarded as a high risk crop because it is susceptible to drought and is not well adapted to climatic conditions of semi-arid regions (Rukuni and Eicher, 1994).

Sorghum and millet have been viewed as traditional food crops in Zimbabwe, but they have been marginalized with the increased sowing of maize (Leuschner and Manthe, 1996). In Zimbabwe, the expansion of maize at the expense of small grains has been shown to be because of vigorous

research efforts that started in the 1930s and the formulation of various policies favouring the production of maize (Kupfuma, 1993a). Rukini *et al* (2006) further supports the contention that traditional crops grown by smallholder farmers, which are more suitable for their marginal rainfall areas, are not well researched in Zimbabwe.

Therefore, this study attempts to fill in some of the gaps regarding research on the potential of small grains to improve household food security in Zimbabwe's semi-arid areas. The findings of the study would assist to inform policy makers regarding formulation of appropriate household food security policies in semi-arid regions. This is in view of the fact that for household food security to be attained research and assistance in terms of input provision from government, NGOs or private sector should be adaptable to farmers' agro-ecological region and socioeconomic conditions. Hence, the study will contribute towards the search for long lasting solutions to the chronic problem of household food insecurity in Zimbabwe's semi-arid areas.

1.7 Outline of the Study

The study will be comprised of seven chapters. The second chapter discusses the literature review regarding sorghum and finger millet and their potential to enhance household food security in semi-arid communal areas. The third chapter gives an overview of the study area including where it is situated and the main agricultural activities. In the fourth chapter, the methodology is presented. The chapter explains the sampling procedure, data collection procedure and the variables collected. It further clarifies on the method of data analysis, pointing out the reasons for choosing such analytical methods. Chapter five presents the descriptive results of the research. Chapter six presents model empirical results. Finally, chapter seven presents the conclusions, summary and recommendations that were drawn from the research. It is important to appreciate that the seven chapters cannot be seen as separate units.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter offers a review of literature, which highlights the potential of small grains, specifically sorghum and millet to enhance household food security in Africa's semi-arid areas. Particular emphasis is given to communal households in these regions. The chapter starts by discussing adaptability of sorghum and millet to semi-arid environments. An overview of the food security situation in Zimbabwe is then provided. Views of different authors regarding the role of small grains in Zimbabwe's semi-arid regions are given. Challenges that farmers in semi-arid areas face in small grain production are looked at. In conclusion, the chapter reviews the role of government policy in promoting sorghum and millet production.

2.2 Adaptability of sorghum and millet to semi-arid environments

Sorghum and millet have been noted as staple food grains in many semi-arid and tropic areas of the world, particularly in Sub-Saharan Africa because of their good adaptation to hard environments and their good yield of production (Dicko *et al.,* 2005). Taylor *et al* (2006) expands on Dicko *et al's* findings by describing sorghum and millet as generally the most drought-tolerant cereal grain crops that require little input during growth and with increasing world populations and decreasing water supplies, represent important crops for future human use.

The semi-arid tropics are characterized by unpredictable weather, limited and erratic rainfall and nutrient-poor soils and suffered from a host of agricultural constraints (Maqbool *et al.,* 2001; Sharma and Ortiz, 2000). Pursuing this further, Sharma *et al* (2002) highlighted that there is an urgent need to focus on improving crops relevant to the smallholder farmers and poor consumers in the developing countries of the semi-arid tropics. This can be through the development of crops that are adaptable to these environments.

That being the case Food and Agriculture Organization (FAO) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (1996) agree that sorghum and millet have got the potential to contribute towards the food security of many of the world's poorest and most food-insecure agro-ecological zones. This can be achieved through increasing production and productivity of these crops in such agro ecological zones. These conclusions concur with those of Taylor (2003) that sorghum and millets have the potential to improve household food security in semi-arid regions because of their adaptability to such environments. Despite this, research on these crops has been lagging behind in Africa because they suffer something of an image problem and there often tends to be a preference for maize as the premier crop (Taylor, 2003).

2.3 Definitions of Food Security

According to Kidane *et al* (2005), food security is defined in different ways by international organizations and researchers. On the same note Maxwell (1996) pointed out that there are close to 200 definitions of food security. The 1996 World Food Summit defines food security as situation in which '…….all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 1996).

Following this further, Maxwell (1996) echoed the views that the term food security is a flexible concept that should be given its explicit or implied definition whenever introduced. There are different definitions of food security and they have been refined over time: The World Bank report on "Poverty and Hunger in 1986 defined food security as "access of all people at all times to enough food for an active and healthy life". On the other hand FAO (2001) defined food security as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

However, earlier Maxwell and Frankenberger (1992) had commented that the many definitions of household food security, "all agree that the key defining characteristic of household food security is secure access at all times to sufficient food".

With most of Africa's economies being based on agriculture, Masomera (1998) observed that crop production forms the corner stone of household food security in Africa. In this regard, a household is considered food secured if it produces enough grain for its needs to last the whole year until the harvest of the next season.

Furthermore, FAO/ World Food Program (WFP) (2008) noted that food security of individual households in any given location would be influenced by an array of factors. These factors affect household access to food either through their own production or market purchases using cash income (or exchange) earned from agricultural or non-agricultural livelihoods. However, Kidane *et al* (2005) mention that, the current working definition of food security emphasize on availability, access, and utilization of food. In tandem with the literature, this study also investigates factors determining food security and this definition is adopted.

On the contrary, food insecurity is defined by FAO and Food Insecurity and Vulnerability Information and Mapping Systems (FAO/FIVIMS) (2008) as a situation that exists when people lack access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. It may be caused by the unavailability of food, insufficient purchasing power inappropriate distribution or inadequate production at household level.

2.4 Food Security situation in Zimbabwe

In Zimbabwe, production of the main staple foods has been declining since the early 1990s greatly compromising household food security (Jayne *et al.,* 2006). Whilst various reasons have contributed to this, Rukuni *et al* (2006) pointed out that institutional and policy factors have played a major role in this decline.

FAO/WFP (2008) reported that household food security in Zimbabwe has declined due to drastic reduction in food and agricultural production following erratic rainfall and the gross lack of key farming inputs. These erratic rainfall and shortages of affordable inputs meant that poor "net consuming" households in Zimbabwe's semi-arid regions had difficulty in ensuring household food security (Chipika *et al*., 1999).

The Famine Early Warning Systems Network (FEWSNET, 2008) testified that food security in Zimbabwe continues to decline in the face of drought, acute foreign currency shortage and hyperinflation. FAO /WFP (2008) Crop and Food Supply assessment mission to Zimbabwe supported the same remarks and established that production decline in agriculture has been the main cause of household food insecurity in communal areas.

The worst affected provinces were those that lie in agro-ecological regions, IV and V that traditionally have a grain deficit, which are provinces of Masvingo and Matebeleland. The production capacity of farmers in these regions continues to decline as at times they are forced to liquidate their productive assets such as livestock (major source of draught power) in order to make ends meet (FEWSNET, 2008).

Findings by FAO (2008) suggests that for the agricultural season 2007/2008 there was an increase in area covered under the main staple maize but this did not correspond to increased yield compared with the previous season. This was mainly because of the reasons outlined above. The situation meant that the number of people in need of food aid in Zimbabwe has increased as well as malnutrition amongst both children and adults (FAO, 2008). FAO (2008) further reveals that government, donor organizations such as Non Governmental Organizations (NGOs) and other charity organizations are expected to intensify their efforts to address the situation. The need is more urgent in those remote rural areas where farming is the only source of livelihood. The measures have to tackle the situation both in the short term and in the long run.

2.5 Dimensions in food security

According to Mudimu (2003), the problem of food insecurity in Zimbabwe's rural areas has two dimensions. One dimension is the inability of the household to produce all its food requirements because of lack of access and diminishing quality of productive resources combined with an unfavourable or highly variable production environment. The other problem relates to the inability to acquire food from the market because of inadequate household incomes and or unreliable markets that deliver food at very high prices. Both of the above conditions point to the situation of access and availability of food and can create situations of transitory or chronic household food insecurity.

2.6 Measures to mitigate Zimbabwe's Food Security

Despite the deterioration in the food security situation in Zimbabwe the government of Zimbabwe has been issuing agricultural input aid (seed and fertilizer) to communal and resettled farmers as an agricultural recovery strategy (Foti *et al.,* 2007). Nonetheless, Foti *et al* (2007) suggest that not much benefit has been achieved from the government's subsidized input scheme especially in the semi-arid regions because input type and variety that was being issued did not tally with the agro-ecological location of the farmer. Issuing inputs to boost production of smallholder farmers, equipping them with improved crop management practices can assist in improving Zimbabwe's food security situation (FAO, 2008). In addition, FAO (2008) further supports the same notion that inputs need to suit farmer agro ecological region for better returns to be realized if Zimbabwe is to address its food security situation through increased agricultural production. FAO (2008) goes on to suggest that inputs of sorghum and millets should be distributed to low rainfall areas while inputs of maize should be distributed to high rainfall areas.

2.6.1 Diversification to small grains

According to Rukuni *et al* (2006), in Zimbabwe food security is mainly based on maize and wheat (for bread). Small grains such as sorghum, *rapoko* (finger millet) and *mhunga* (pearl millet) play a minor role in household food security. In addition, Mudimu (2003) revealed that there has not been much diversification from maize as the dominant source of food in Zimbabwe. Even in drier areas where small grains can be produced economically and sustainably, maize is the mainstay of household food security (Rukuni *et al.*, 2006). Hence, production of sorghum and millets is seen as another crop diversification strategy that can alleviate food security in Zimbabwe's semi-arid regions (Rukuni *et al.,* 2006).

On the same note, lessons can be drawn from other countries on how sorghum and millet can enhance household food security in semi-arid areas.

2.7 Small grain production case studies

In two case studies that were drawn from India and Kenya it was shown that sorghum and millet can enhance household food security of marginalized rural farmers in semi-arid areas. In the Medak District of Andhra Pradesh in India, the poorest and most marginalized, members of the

communities manage not only to achieve food security but also to assert food sovereignty, with sorghum and millet as the cornerstones of their strategy (Grains, 2007). These communities are marginalized in the sense that they are women and they practice their subsistence farming on the Deccan Plateau, which has one of the poorest soils and driest areas of India (Grains, 2007). However, they achieve household food security by growing millet and sorghum, which are ecologically compatible with their semi-arid areas. Hence, they achieve household food security and independence from government handouts.

In a study that was conducted in semi-arid eastern Kenya by Sutherland *et al* (1999) it was found out that household food security was more stable for those households growing more adaptable crops such as millet and sorghum. However, because of unreliable rainfall, food insecurity was high for those households that grew crops, which were less adaptable to the environment such as maize and beans.

Therefore, in Zimbabwe overall research can draw lessons from such case studies to build on the inherent drought tolerance of small grains such as sorghum and millet to ensure food security in drought prone areas (Alumira and Rusike, 2005).

2.8 Grain Production Trends in Zimbabwe

In Zimbabwe grains such as maize, wheat and small grains (millets and sorghum) are most considered because they are the main staple food and contribute over 70 per cent of calorie requirements (Jayne *et al*., 2006). Fig 2.1 below shows grain production trends in Zimbabwe from the period 1970-2003.

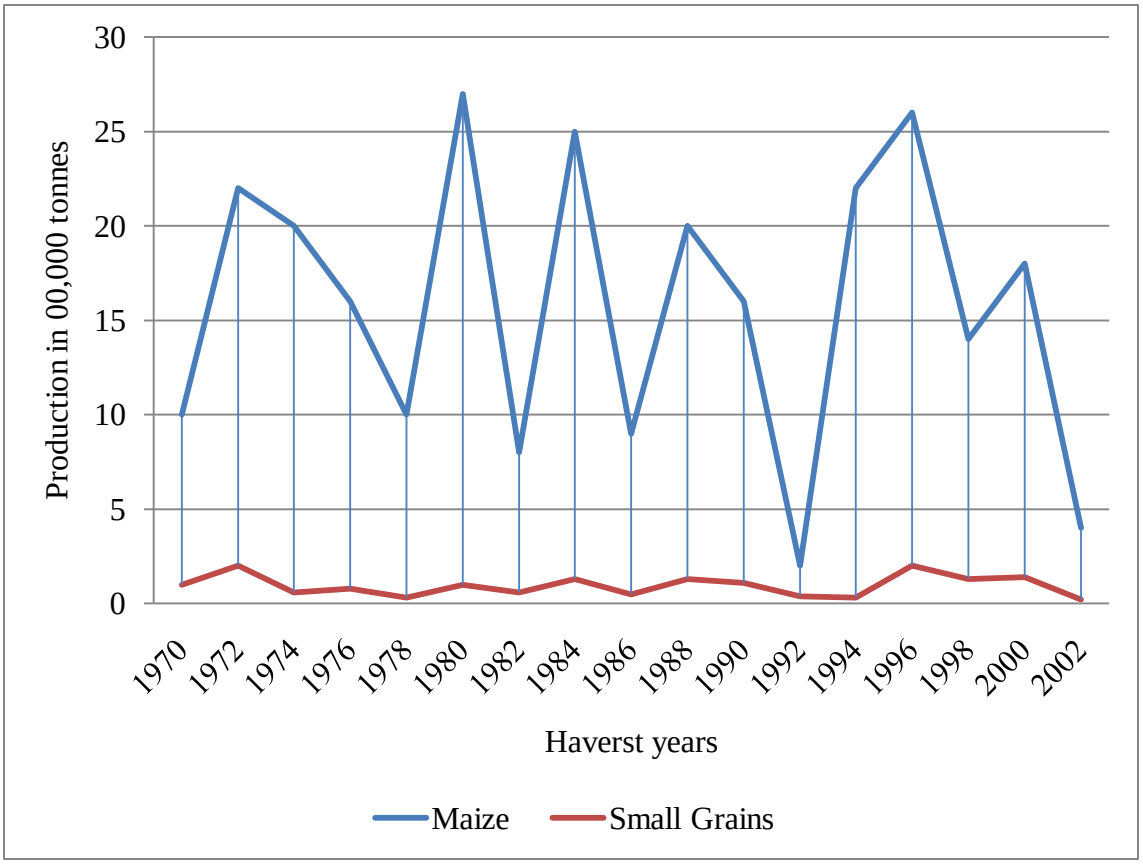

Figure 2.1: Grain Production Trends 1970-2003

Source: Jayne *et al* (2006)

Fig 2.1 shows that there have been major fluctuations in grain output in Zimbabwe from the period 1970 up to 2003. Seasons of high grain output coincide with years of optimal weather conditions whilst bad harvests are attributed to years of unfavourable weather conditions (Jayne *et al.*, 2006). From Fig 2.1 it can be shown that there were many more periods of bumper harvests in the 1980s as compared to the 1990s. There has been drastic decline in maize production especially in the late 1990s. Maize production declined from close to 2.0 million tonnes in 2000 to almost 500,000 tonnes in 2002 (Jayne *et al.*, 2006). Fig 2.1 also shows that there have been major fluctuations in small grain production since the early 1970s up to 2002. These fluctuations have been pointing towards a declining trend. This decline can be attributed to problems by farmers in accessing seed, fertilizer and the reforms that happened in Zimbabwe's agricultural sector (Jayne *et al.*, 2006).

2.9 Decline in small grain production

According to Rohrbach (1991), compared with maize, production of sorghum and millets has been declining in the Southern African Development Community (SADC) region. The situation in Zimbabwe has been such that for many years sorghum and millets have played a pivotal role in household food security (Leuschner and Manthe, 1996). Nevertheless, Eicher (1995) pointed out that Zimbabwe's Green revolution, which emerged in the early 1980's, saw maize outcompeting sorghum and millets as the major staples of rural communal farmers in semi-arid areas. This was because of the adoption of hybrid maize varieties that were suitable for these areas, access to credit, government support on maize prices and marketing subsidies.

However, this may be the case in Zimbabwe; three quarters of the communal households live in areas with less than 650 mm of rainfall per year (Rukuni *et al.*, 2006). This means that the larger part of the Zimbabwean population lives in natural regions IV and V. The need to review the competitiveness of sorghum and millets in Zimbabwe's semi-arid regions is now urgent. This is given the recurring droughts and the economic challenges that have left many rural households who rely mainly on maize production food insecure in these regions (Jayne *et al.*, 2006).

2.10 Importance of sorghum and millet to household food security

According to Taylor (2003), sorghum and millet are vitally important cereals for the maintenance of food security in Africa. The same notion is supported by FAO (2008) that small grains are the answer to chronic food shortages to rural communities who reside in semi-arid regions especially of the sub Saharan region. This is because of their high levels of adaptation to African conditions (Taylor, 2003). They represent about half the total cereal production on the continent and as such are a major source of protein for the population.

Same conclusions were made in a study that was conducted by Alumira and Rusike (2005) which revealed that new sorghum and millet varieties can reduce the probability of zero yields. Thus, they can make a significant contribution to household food security in drought years (Alumira and Rusike, 2005). However, Alumira and Rusike (2005) argued that changes in varieties alone could not guarantee increased yields from sorghum and millet. Rather they have

to be accompanied by improved crop management methods such as better soil fertility management.

Regardless of this, Taylor (2003) argues that sorghum and millets are still under researched compared to other cereals. In view of that, Taylor (2003) advocates that with proper research sorghum and millets could play a more important role and will offer better long-term food security than maize. This is because sorghum, pearl millet and finger millet are indigenous African cereals that, unlike maize and wheat, are well adapted to African semi-arid and sub-tropical agronomic conditions (Taylor 2003). Additional evidence is provided by Taylor (2003) that these grains represent the major source of dietary energy and protein for some one billion people in the semi-arid tropics. The same considerations were mentioned before by Rohrbach (1991) that sorghum and millet present potential food staples for many of the poorest farm households in semi-arid areas. Furthermore, their capacity to produce maize remains limited because of agronomic conditions. However, this is despite that in recent years these crops have been relegated to semi-subsistence status in favour of maize (FAO, 2008).

2.10.1 Potential of small grains

There is enough evidence from literature to suggest that small grains can outperform maize in semi-arid areas both in terms of yield and drought tolerance. FAO (2006) suggests that although Zimbabwe's Natural Regions (NR) IV and V are considered inappropriate for dry land cropping, drought tolerant crops such as sorghum, pearl millet *(mhunga*) and finger millet (*rapoko*) are suitable crops that can be grown by smallholder farmers in these regions. Moreover, in the event of drought, maize can be destroyed yet drought tolerant small grain cereals such as sorghum and millet can yield some food for subsistence (Maphosa, 1994; Rukuni *et al*., 2006). Hence, it has been highlighted that small grains (sorghum and millet) have the potential to outperform maize in marginal areas if appropriate policy and institutional support framework are designed to promote their production (Rukuni *et al*., 2006).

2.10.2 Advantages of small grains

Van Oosterhout (1995) pointed out some advantages of small grains (sorghum and millets) over maize as:

- A smaller amount of flour is needed to cook the main meal compared to maize;
- A meal cooked from the small grains satisfies hunger for a longer period and gives more energy (which is especially important for persons who do heavy manual labour like farmers);
- The small grains store better (usually 3-5 years but up to 20 years were reported by some farmers) than maize which cannot be stored beyond eight months. Local cost free storage technologies are available whereas maize needs poisonous organophosphate protectants, often unaffordable by farmers;
- Seeds of several varieties of small grains are available for planting from the farmers own granary when needed and can be exchanged with neighbours and relatives - they might not need to be purchased;
- In years of low rainfall, small grains will give some yield especially when grown in a multicropped system, whereas maize will be a complete failure.

2.11 Policy on small grain production in Zimbabwe

In spite of past measures to stimulate rural food production and incomes, food insecurity remains highly prevalent in the low rainfall communal areas of Zimbabwe (Rohrbach, 1988; Jayne *et al* 2006). Evidence suggests that past increases in food grain production and marketing has been both concentrated in high rainfall regions and within these regions, most of the marketed surplus was produced by a small proportion of the households (Rohrbach, 1988; Alumira and Rusike, 2005). Yet, strategies adopted had tended to treat the smallholder farmers as a homogenous group especially in terms of input supply (FAO, 2008). According to Mudimu (2003), the government's approaches of incentives did not deal with the unique technological, socio-economic and agro ecological regions of the farmers of different resource endowment. Mudimu (2003) adds that there has been no clear policy promoting small grain production amongst smallholder farmers in Zimbabwe’s semi-arid areas where they are thought to have a comparative advantage over maize particularly regarding their research. The same views were

upheld before by Leushner and Manthe (1996) that production of small grains has been on the decline in Zimbabwe due to policies that favor production of maize.

In contrast, Sukume *et al* (2000) is of a different opinion that for decades policy makers have encouraged the production of sorghum and millets in Zimbabwe. This was in the belief that they will reduce food shortages in communal areas, which lie in natural regions IV and V. Furthermore Sukume *et al* (2000) adds that policy makers thought that these crops would subsequently out compete maize in these semi-arid regions. Nevertheless, it has been shown that maize, particularly the short season varieties, has out yielded small grains in these regions (Sukume *et al.,* 2000). Mazvimavi (1997) attributes this higher yield to more research efforts being channeled into maize than to small grains.

2.12 Challenges in production of sorghum and millets

According to Sukume *et al* (2000), production of maize continues to dominate in Zimbabwe's semi-arid regions compared to small grains sorghum and millet because it offers higher yields. Sukume *et al* (2000) further noted that low yields of small grains have acted as a major obstacle and challenge for communal farmers in Zimbabwe's semi-arid regions to expand and adopt production of small grains on a large scale compared to maize. This lower productivity causes small grains to be very unattractive to communal farmers in the semi-arid regions was also cited by FAO (1995).

In the same way, Macgarry (1990) pointed out some of the challenges that communal farmers' face in sorghum and millet production and why they end up preferring maize. One of these major challenges is:

- Depredations of the quelea birds on sorghum and millet than does maize

Following this further, research has shown that rising labour costs in small grain production have affected most farm operations, from land preparation, weeding, bird scaring to harvesting and grain processing (FAO, 1996). In addition, the ease with which maize can be processed compared to the traditional staples of sorghum and millet is the other main reason why maize became widely accepted even in Zimbabwe's semi-arid regions during the green revolution (Alumira and Rusike, 2005).

Sukume *et al* (2000) have explained lack of processing technologies as yet another factor that has hindered the development of alternative formal markets for sorghum and millet. By using traditional processing technologies, sorghum takes longer to process than maize especially during harvesting (Sukume *et al.*, 2000). This factor has reduced its demand by even the poorest of the poor communal households (Mazvimavi, 1997).

Alumira and Rusike (2005) expand more on the challenges that even under semi-arid conditions it might be very difficult for small grains to compete with maize. This is because sorghum and millet do not yield much crop residue, which plays a very important role to communal farmers in terms of animal feed and crop manure. Similar observations were noted by Mapfumo *et al* (2005) that livestock depend upon crop residues for survival during winter, mainly from maize stoves.

Another very important factor, which has been acting as a production constraint towards sorghum and millet production, is changing food preferences. FAO (1996) explains that as incomes rise, consumers tend to purchase wheat, rice and in some cases maize, rather than traditional coarse grains. As a result, communal farmers tend to view sorghum and millet production as having lower returns than other enterprises. Real producer prices for sorghum, millets and edible legumes dropped considerably, since the trade liberalization program, compared to that of cash crops and maize (Macgarry, 1994). This also has acted as a major reason why rural farmers have shunned small grain production in favour of maize.

2.13 Role of the government in promoting sorghum and millet production

Evidence of the role of government in promoting production of sorghum and millet can be drawn from West African countries. Mallet and Plessis (2001) noted that there had been an increased production of sorghum and millet in this part of the continent by communal farmers since the last great drought in that region of 1982-85. This was because of cereal market liberalization jointly initiated in 1986 by Sahalian countries and the support measures given by the government and donor countries (Mallet and Plessis, 2001).

Consequently, similar policies were observed in Zimbabwe during the green revolution on maize in the 1980s. The Green Revolution came about because of government policies that supported

development and dissemination of improved varieties, efforts to promote fertilizer use, and greater extension designed to improve crop management (Eicher, 1995). In the same way, Alumira and Rusike (2005) suggest that if government policies are crafted in Zimbabwe that support the production of sorghum and millet at the same level as maize then an increased production in these crops can be achieved in semi-arid areas.

Similar findings were highlighted by Rukuni *et al* (2006) that lack of government support in Zimbabwe for production, processing and use of crops that are tolerant to drought has resulted in people in the drier areas changing their tastes from millet and sorghum to maize.

However, FAO (1995) argued that for sorghum and millet to vie with maize in the limited resources of the communal farmers, there is need for them to outperform maize in terms of yields. This entails massive investment by government and the private sector in the development of hybrid sorghum and millet varieties that have higher yields and better taste than maize (FAO, 1995).

2.13.1 Market Development for sorghum and millet

In Zimbabwe, the need for cash by rural farming families has been such that crops that are suitable for agro-ecological regions have often been overridden for maize production (van Oosterhout, 1995). In these regions, maize has a ready market and can be easily traded to meet other financial obligations.

In that regard, Rohrbach (1991) pointed out that government needs to come up with policies that favour the development of competitive intra rural markets if smallholder farmers are to be encouraged to grow sorghum and millet. Development of rural markets for sorghum and millet would act as a great incentive for rural farmers in these semi-arid regions to grow these crops. This is because they will now be growing them for both subsistence household food security as well as cash crops to meet other financial demands.

Following this further FAO (1995) reported that Zimbabwe's formal market handle less than 10 per cent of total sorghum and millet production. In addition, FAO (1995) also noted that most of

the sorghum and millets produced in Zimbabwe is consumed by the producing households, or sold in the informal markets, mainly for traditional beer brewing.

However, in Zimbabwe the price of maize in the informal markets is cheaper than that of sorghum and millets (FAO, 1995). Hence, in terms of market potential there is good reason to expand production of sorghum and millets in Zimbabwe's rural areas in view of the price differences.

2.13.2 Economic Growth

Taylor *et al* (2006) explain that commercial processing of sorghum and millet into value-added products in developing countries has the potential to stimulate economic development in these countries. Therefore, policies that support increased production of sorghum and millet should be viewed in a holistic approach regarding contributions they can make to the macro economy and not only as a means of increasing food security to those in semi-arid areas.

In Zimbabwe, it has been deduced that the industrial and commercial use of sorghum and all small grains in general are very limited (Sukume *et al.*, 2000). That being the case, Rohrbach (1991) mentions that gains to the economy from increased industrial use of small grains will have ripple effects besides just improving rural food security. These include but are not limited to reducing the need for drought relief, lowering the level of subsidies underlying grain markets, and, at least in the short run, stemming migration from rural to urban areas.

2.14 Insights from literature review

From the literature review, it has been shown that sorghum and millet have the potential to enhance household food security in semi-arid areas. This is because they are better adapted to these environments compared to maize. However, this is regardless of the challenges that they offer to farmers in producing them. Nevertheless, many authorities seem to reach a consensus that not much is being done to tap into the potential of these crops. This is in terms of government support to promote research on sorghum and millet in Africa. In Zimbabwe, it has been noted that small grains have received little government support to promote their production in semi-arid regions compared to maize. Though this may be, lessons of improving household

food security through increased small grain production can be drawn from the Sahalian region. Finally, it has been revealed that policies promoting small grain production should be viewed beyond just enhancing household food security. Rather other benefits that accrue to the macro economy at large should also be incorporated.

CHAPTER 3

DESCRIPTION OF THE STUDY AREA

3.1 Introduction

This chapter offers a description of the areas of study where the research was conducted. The areas' location (including a map), rainfall, temperature, landholdings, farming system, soil types, infrastructure and vegetation are fully explained. Description of the study area is important as it familiarizes one with the locality in which the study was carried out.

3.2 Location of Study Area

Figure 3.1 below shows location of Masvingo and Gutu Districts in Zimbabwe where the study was conducted. The study sites were selected in Natural Region IV where most of the communal areas in Masvingo Province lie.

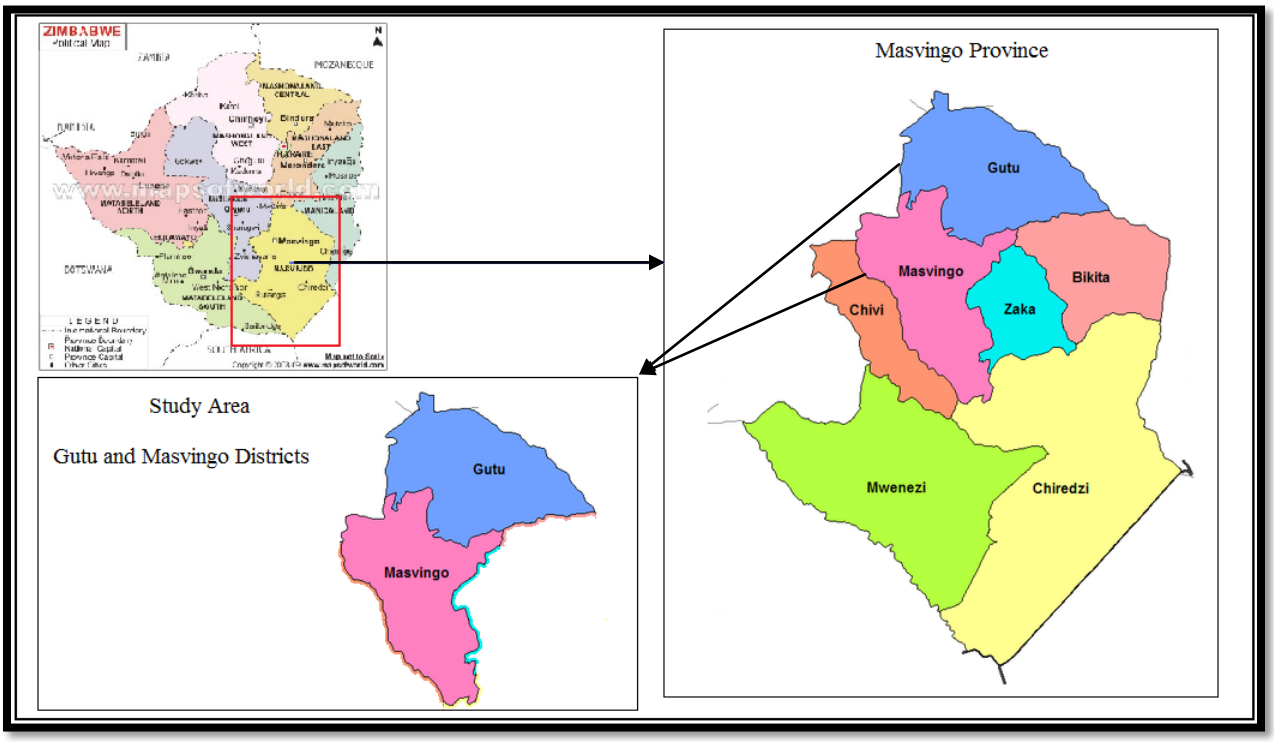

Figure 3.1: Location of the study districts

Source: FAO (2006)

Masvingo and Gutu Districts are two of the seven rural districts situated in Masvingo Province. Both Masvingo and Gutu districts are dry areas, which are found in south-central Zimbabwe (Kamanga *et al*., 2003). The districts are located northeast of Masvingo town. They fall under Natural region IV that is characterized by frequent seasonal droughts and severe dry spells during the summer season (Table 1.1). This makes the districts unsuitable for maize production especially through dry land farming.

3.3 Population and population density

According to the Central Statistics Office (CSO) (2002b), the population of Zimbabwe was estimated at 11 634 663 as of 2002. Out of these 5 631 426 were males and 6 003 237 were females. The population constituted 2 653 082 households, leading to an average of 4.4 persons per household (CSO, 2002b). With an area of 390.580 square kilometres, Zimbabwe has a population density of 30 persons per square kilometre.

Masvingo Province which is the study area has a total population of 1 320 438 which is 11.34% of Zimbabwe's total population. Furthermore, 99.86% of the Zimbabwean population is of an African ethnic origin (CSO, 2002a). Hence, a negligible percent accounted for persons of other origin. Masvingo and Gutu districts have total populations of 194 467 and 198 536 respectively. Masvingo district has an average household size of 4.65 while Gutu district has an average household size of 4.45 (CSO, 2002a). In addition, Masvingo district is subdivided into 30 wards while Gutu has 36.

3.4 Economic Activities

According to the CSO data (2002a), the agricultural sector constitutes a greater proportion of most of the economic activities in Masvingo Province with 77% of persons having their occupations in agriculture. The CSO (2002a) revealed that around 42% of the total population in Masvingo Province was economically active. The greater part of this percentage had their occupations in the agricultural sector.

In the districts under study, 76.62% of the people in Masvingo district have their occupations in agriculture (CSO, 2002a). This is followed by 6% employed in the services occupations. In Gutu

district, 82.55% of the population earns their livelihoods through occupations in agriculture and the second largest employer is the services sector with 5% of persons employed in this occupation (CSO, 2002a). This means that the remaining small percentage of the economically active population is fragmented in other occupations such as manufacturing, education, business and finance amongst others. Therefore, agriculture is the backbone of Masvingo Province**.**

However to supplement their income from agriculture households engage themselves in various off farm activities such as petty trading, knitting and casual labour (Bird and Shepherd, 2005). The degree of involvement in these activities varies with the wealth status of the household. Usually those households with lower incomes are the ones, which are involved, in casual labour such as brick moulding and thatching of huts for richer households (Bird and Shepherd, 2005). These poor households can also engage themselves in hunting and fishing, exchanging the produce for grain such as maize, sorghum or finger millet from wealthy households. Nonetheless, fishing is more prevalent in Masvingo district while hunting and gathering is practiced more in Gutu district (Bird and Shepherd, 2005). On the other hand, rich households take on higher income earning off farm activities. These include activities such as cross border trading where they sell goods mostly from South Africa and beer brewing.

3.5 Rainfall and Temperature

Both areas receive annual rainfall of between 450-650mm; experiences dryness during the summer season and recurrent droughts (Kamanga *et al.*, 2003). The rainfall season is usually from October to March. Kamanga *et al* (2003) further describes the rainfall pattern in these areas as unimodal. This means that there is only one rainfall season in the area. The rainfall season is characterized by sporadic, heavy rainstorms, with periodic dry spells. Rainfall comes in sporadic convectional storms with a 30% chance of a mid season drought in January or February (Hagmann, 1995). The rainfall pattern in the districts exhibit that of a semi-arid area. Haquel *et al* (1986) defines a semi-arid region as an area, which is characterized by annual rainfall of between 400-600mm and experiences long and severe dry season. The rainfall season is followed by a winter season, which stretches, from May to July/August. During the summer season, the annual average air temperature is about 22^{o}C (FAO, 1991). On the other hand, winter temperatures can be as low as 10^{o}C. According to FAO (1995), sorghum and millets are suitable

crops that can be produced in such environments. On the contrary, maize production is more suitable to Zimbabwe's high rainfall Natural Regions I and II (FAO, 2006). Previous studies by Makadho (1996) had shown that climatic changes especially rainfall and temperature had an effect on maize production in Zimbabwe's semi-arid areas. The findings hinted to the likelihood that communal areas in Masvingo might be turned into a non-maize producing region. This is because of continued climatic changes in the area that are not favourable to maize production especially with no irrigation facilities.

3.6 Land tenure

The communal areas under study in both districts are like any other communal area in Zimbabwe, where land ownership is under customary tenure system. Authority over land is exercised by chiefs with the help of council elders as enshrined in the Traditional Leaders Act of 1998 (Mohamed-Katerere, 2001). Individuals have land rights to small arable and residential plots and enjoy rights to common resources such as grazing lands, mountains and any other land not assigned to individuals.

There is a continued shortage of land in both districts, which is a characteristic of most communal areas in Zimbabwe's Natural Regions IV and V. According to Mehretu and Mutambirwa (2006), Zimbabwe's communal areas in Natural Regions IV and V have population densities exceeding 20 people per square kilometre. Mehretu and Mutambirwa (2006) further noted that there is continued land hunger in Zimbabwe's communal areas especially in Natural Region IV and V. This is however, despite the post-2000 land acquisition and fast track land redistribution and resettlement exercises.

The continued shortage of land in communal areas of these districts has led to the best fields especially those around homesteads being allocated to maize production (Kamanga *et al*., 2003). This has left production of small grains such as finger millet to be assigned to the poorest soils (van Oosterhout, 1995).

3.7 Farming systems

Crop production in the areas under study in both Masvingo and Gutu districts is rain fed with no irrigation facilities (Kamanga *et al*., 2003). The major crop grown in these areas is maize. Kamanga *et al* (2003) further explains that groundnuts, round nuts and finger millet are amongst some of the crops widely grown in these localities after maize. However, for dry land cropping the region is suitable for drought tolerant crops such as sorghum and millets (FAO, 2006). FAO (2006) expounded that farming activities in these districts are considered risky because of sporadic rainfall, irregular farm output marketing prices and unreliable yields.

The communities also practice animal husbandry to supplement their diets. Cattle are the most prized possession as they are used to pay the bride prize (*lobola*) and they are very important as a source of draught power (FAO, 1991). Cattle also provide manure to improve soil fertility. Goats and donkeys are relatively more important in these areas as well. In addition, poultry rearing is also very rampant (FAO, 1991).

Winter cropping is practiced in fields that are located near vleis, known as *matoro* in the local language. In these same fields, early summer maize is also planted around August/September. This is done in order to make sure that ploughing is timely to exploit the early rains; otherwise, maize yields could be reduced by as much as 70% (Haquel *et al*., 1986).

According to Mapfumo *et al* (2005), within these farming systems there is a high degree of interdependence and interaction among crop and livestock activities. Due to the very low productivity of the communal grazing areas in the districts, farmers supplement their livestock feed during winter. The livestock depend upon crop residues for survival during winter, mainly from maize stoves (Mapfumo *et al*., 2005). The activity of collecting maize stoves is done soon after harvesting of the last crop the period between April and June. Livestock are herded during the rainy season but graze freely in croplands during the dry months of May–October, feeding mainly on crop residues. Therefore, crop residues compete between livestock feed and soil fertility management (Mapfumo *et al*., 2005).

Besides field crops, mostly woman and children engage in vegetable growing from individual, group and community cooperative gardens. The outputs from these gardens usually meet both demands of home consumption and the market (FAO, 1991).

3.8 Soil types

The soils in the study areas of both districts are predominantly sandy and they have a low moisture holding capacity, a low pH, and little organic matter or nitrogen (Kamanga *et al.*, 2003). The soils are predominantly sandy, derived from granite with a pH of between 4.0 and 5.0 (Haquel *et al.*, 1986). The soils are inherently infertile and have low potential to support crop production under continuous cultivation (Mapfumo and Giller, 2001). The soils are specifically deficient in nitrogen, phosphorous and sulphur and the soil fertility continues to decline (Hikwa *et al.*, 2001). This amongst other factors has resulted in maize yields declining and food security in these areas worsening. The continued decline in the soil fertility has been attributed to several reasons. Nonetheless, chief amongst them has been inappropriate crop recommendations that fail to consider rainfall risks and investment capacity of the farmers in these areas (Dimes *et al*., 2004). On the other hand soils on the homestead fields are moderately shallow, well drained and consists of brown sands and sandy loams (Kamanga *et al*., 2003). This is because of their proximity to the homestead labour, wood ash, composite and kraal manure.

The nature of the soils causes farming to be very difficult without the aid of manure (Mapfumo *et al*., 2005). The soils are shallow, such that for farmers to get a good yield they have to buy expensive inorganic fertilizers usually Ammonium Nitrate (AN) and Compound D. Alternatively farmers have to apply cattle manure (Mapfumo *et al*., 2005). In order for farmers to have adequate amounts of cattle manure to use in their fields they have to collect and deposit large amounts of leaf litter in their kraals (Mapfumo *et al*., 2005). This activity is normally done in summer the period between August and October. The activity is completed just before the first rains. It is usually done by women and children. The soil types in both districts favour small grains, which can be produced with little input usage (van Oosterhout, 1995).

3.9 Vegetation

The vegetation type in the study areas is characterised by natural canopy forests with trees like *Musasa (Brachystegia spiciformis)* and *Mutondo (Julbernadia globiflora)* (Cousins, 1992). The trees are covered by an extremely sparse, but yet resilient grass species. The forests have now been reduced drastically from their former size because of deforestation. The trees are being cut in order to open up land for cultivation, firewood and construction poles.

Despite the rural electrification programme, firewood is still the most important source of domestic fuel in most communal areas of Gutu and Masvingo districts (Mehretu and Mutambirwa, 2006). This has led to rampant deforestation in the villages.

3.10 Socio-Economic Problems

The major problem in both districts is that of frequent droughts, which cause crop failure (Mapfumo and Giller, 2001). Further to that, droughts have caused livestock herds to decline and have depleted ground water. Deforestation is going on unabated together with uncontrolled grazing and monocropping. These have led to wide spread soil erosion and destruction of wetlands. In addition, this has led to siltation of major rivers Munyambe and Pokoteke in Masvingo and Gutu districts respectively due to soil erosion.

3.11 Conclusion

From the discussion presented in this chapter, it can be concluded that Masvingo and Gutu districts are located in Zimbabwe's Natural Region IV. The region is considered as a semi-arid region and has low agricultural potential. The area receives unreliable rainfall of between 450-650 mm per year. Although maize growing dominates in these areas, declining soil fertility and drought has resulted in lower yields. The worsening food security situation might need a review of the current crop production patterns. This is to come up with appropriate farming systems, which consider the rainfall risks and productive capacity of the farmers.

CHAPTER 4

METHODOLOGY

4.1 Introduction

This chapter gives an overview of the methods used for data collection and analysis. The chapter commences by explaining the sampling technique and the sample size from which data was collected. The following sub-sections outline the data collection methods and the variables that were collected. The section on data analysis explains the model that was used for data processing and justification of use of the model. The chapter concludes by explaining the independent variables that were considered in the study.

4.2 Sampling Procedure

Data was gathered in the Zimbabwean Province of Masvingo's rural districts of Gutu and Masvingo. A total sample size of 120 farmers was selected from a population of smallholder farmers in Masvingo and Gutu Districts with the assistance of agricultural extension officers and local leadership. Two administrative wards were randomly chosen in each district. Within each ward, one village was then randomly selected for interviews to be conducted. Table 4.1 below summarizes the distribution of respondents with respect to their farming type.

Table 4.1: Interviewed farmers in Gutu and Masvingo Districts

PROVINCE	***DISTRICT***	***SELECTED VILLAGES***	***Small grain producers***	***Non small grain producers***	***Total***
Masvingo	Masvingo	Mangwaya	15	15	30
		Ndava	15	15	30
	Gutu	Tonhomha	15	15	30
		Gorondondo	15	15	30
TOTAL			**60**	**60**	**N = 120**

Stratified sampling was then used to categorize farmers into two homogeneous mutually exclusive strata of small grain producers and non small grain producers. This was based on the sampling frame provided by the headman of each village with the assistance of extension officers. Random sampling was then used to select fifteen farmers (15) within each stratum in each village. Therefore, 30 farmers were interviewed in each village.

4.3 Data Collection

4.3.1 Questionnaire

A questionnaire was designed as a tool for primary data collection. Prior to the main survey, a pre-test of the questionnaire was done in one of the selected villages in each district. From the pre-survey the structure and wording of some questions was improved. The questionnaire was designed to capture information on a range of potential indicators related to household agricultural production of maize and small grains and other livelihoods strategies. Further to that, it also incorporated any relevant qualitative and quantitative data.

The heads of the households were interviewed. In the absence of the head, the spouse or any family member who is directly involved in the farming activities and management was interviewed. The main respondent provided most of the information, but allowed to consult other household members where necessary. The interviews were carried out in *Shona* (the local language of the people) in order to minimize misunderstandings and gain farmer confidence.

Secondary data regarding production of maize and small grains in the area was obtained from Agricultural Research and Extension (AREX) and Central Statistics Office (CSO).

4.3.2 Interviewing Procedure

In-person interviews were conducted by the researcher with two assistances. The major objective of the research was explained to the enumerators. Respondents were trained on how to collect data. Two local teachers were approached to assist as enumerators since the questionnaire required some numerical data. Extension officers were excluded as enumerators. This is because farmers were going to give biased answers to some of the questions since at times they get advice on agricultural activities from them.

During the data collection process, enumerators were expected to first introduce themselves and explain the purpose of the study to the respondents (farmers). This was done to establish rapport and encourage respondents to cooperate and give honest and unbiased answers.

4.3.3 Variables collected

The questionnaire was designed to capture data on a number of factors that might influence farmers' decisions on whether to grow small grains or maize and any other factors that affect household food security. Some of the variables that were collected are summarized in Table 4.2 below[1].

Table 4.2: Summary of variables analysed

Variable	Description
Family size	Measured by the total number of people who live in the household
Sex of household head	Whether a household is male headed, female headed or child headed. To ascertain whether it has any bearing towards farmer's crop choice.
Draught power	To determine whether the farmer has own draught power or uses hired draught power. Find out the effect it has on crop production.
Educational level of household head	Measured by total number of years that the household head has been into formal education
Production constraints	Determined by availability of seed, fertilizer and labour. Marketing constraints were also captured.
Land quality	Measures farmers' perceptions of the fertility of their farm land. Whether they consider their land as very fertile, medium or not fertile.
Age of household head	Measured by years of household head
Wealth status	Measured by the number of livestock a household owns.
Access to markets	Determined by where farmers sell their small grains or maize outputs.
Off farm work	Ascertain whether household has other off farm and non-farm activities that generate income
Crop yields	Measured by average yields for maize, finger millet and sorghum
Crop income	Measured by the amount of income realised by the farmer from the sale of maize, sorghum and finger millet.

[1] The table is not exhaustive see attached questionnaire in appendix for detailed explanation of all the variables that were collected

4.4 Data Analysis

Data was coded and was processed using the Statistical Package for Social Scientists (SPSS). Descriptive statistics were used together with the logistic regression model to analyze the relevant data. The main descriptive indicators that were employed are frequency and mean values for all the variables. These are useful in analyzing household characteristics as well as analyzing the relationship between variables. In that regard, the following specific analytical tools were used to test each hypothesis:

Factors that influence farmer's participation in small grain production

- Logistic regression Model
- Descriptive statistics

Small grain producing households are more food secure than non producers

- Net and Gross Food Security Index

Production of small grains generate more income than maize in semi-arid areas

- Descriptive statistics and Gross Margins

4.4.1 The Logistic regression Model

The logistic regression model was used to estimate factors that influence farmer's participation in small grain production. This was among small grain producers and non producers to which small grain production status of households was taken as the dependent variable. Thirteen predictor independent variables where regressed against the binary dependent variable of small grain production status of households. The binary logistic regression model as specified below according to Hosmer and Lemeshow (2000) was used to determine factors affecting households` participation in small grain production.

The specific form of the logistic regression model that was used in this study is of the form:

$$\pi(x) = \frac{e^{\alpha+\beta 0+\beta 1x1+\beta 2x2+\cdots\ldots\ldots\beta ixi}}{1+e^{\alpha+\beta 0+\beta 1x1+\beta 2x2\ldots\ldots\ldots\beta ixi}}$$

Where $\pi(x)$ = represents the logit $g(x)$ which is linear in its parameters

α = the constant of the equation

β = the coefficient of the predictor variable

x = are the explanatory variables and log is the natural logarithm

A transformation of π(x) leads to a logit transformation, which is defined as:

$$g(x) = \ln\left[\frac{\pi(x)}{1-\pi(x)}\right] = \alpha + \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \ldots \ldots \ldots \ldots \ldots \beta_i x_i$$

Source: Hosmer and Lemeshow (2000)

The logit g(x) is linear in its parameters, may be continuous, and may range from $-\infty \; to + \infty$, depending on the range of x (Hosmer and Lemeshow, 2000).

Now a sample of n independent observations of the pair (x_i, y_i), i = 1, 2……n was fitted into the logistic regression model.

In the above equation, y_i denotes the value of the dichotomous outcome variable and x_i is the value of the independent variable for the i^{th} subject (Hosmer and Lemeshow, 2000). In this study the outcome variable, participation in small grain production was coded one and non participation in small grain production was coded zero respectively. (Household producing small grains = 1; Non small grain producing household = 0).

Hosmer and Lemeshow (2000) highlighted that the logistic regression model is the best fitting model to describe the relationship between an outcome (dependent or response) variable and a set of independent (predictor or explanatory) variables where the dependent variable is dichotomous. The independent variables are also called covariates. The logistic regression can be used to predict a dependent variable based on continuous and/or categorical independent variables. It is also used to determine the percentage of variance in the dependent variable explained by the independent variables, to rank the relative importance of the independents, to assess interaction effects and to understand the impact of covariate control variables (Hesketh and Everitt, 2000).

Logistic regression is a variation of ordinary regression, useful when the observed outcome is restricted to two values, which usually represent the occurrence, or non-occurrence of some outcome event (usually coded 1 or 0 respectively). It produces a formula that predicts the probability of the occurrence as a function of the independent variables (Agresti, 1996). A logit link was used because it provides an estimate of the odds ratios. According to Agresti (1996) the odds of an event is defined as the probability of the outcome event occurring divided by the probability of the event not occurring. The conditional mean of the logistic regression must be formulated to bound between zero and one (Hosmer and Lemeshow, 2000). Therefore the conditional mean must be greater than or equal to zero and less than or equal to one [$0 \leq E(Y/x) \geq 1$)].

Logistic regression was used since the responses were binary and the independent variables consisted of both continuous and / or categorical variables. Binary logistic regression is used to classify observations into two categories. In this study, the two dependent categories are that either a farmer is a small grain producer or not.

4.4.2 Justification of the econometric model

The use of the logistic regression model was chosen because of the nature of the dependent variables, which is dichotomous Using data from relevant independent variables, logistic regression was used to identify significant factors that affect farmer participation to either produce small grains or not. Hence, as explained by Hosmer and Lemeshow (2000) the logistic regression model is the best fitting model to describe the relationship between an outcome (dependent or response) variable and a set of independent (predictor or explanatory) variables where the dependent variable is dichotomous.

According to Hosmer and Lemeshow (2000), there are many different methods that have been proposed for use in the analysis of dichotomous outcome variable. Regardless of that, Hosmer and Lemeshow (2000) pointed out two major reasons for using the logistic regression model in analyzing dichotomous dependent variable. The first is that mathematically it is an extremely flexible model and easy to use. Secondly, it lends itself to a clinically meaningful interpretation.

Regardless of the above, findings by Montshwe (2006) have shown that the linear regression model (also known as Ordinary least squares regression (OLS)) is the most widely used modelling method for data analysis and successfully applied in most studies. However, Gujarati (1992) pointed out that the method is useful in analyzing data with a quantitative (numerical) dependent variable but has a tendency of creating problems if the dependent variable is qualitative (categorical), as in this study. Amongst other problems, the OLS cannot be used in this study because it can violate the fact that the probability has to lie between 0 and 1, if there are no restrictions on the values of the independent variables. On the other hand, logistic regression guarantees that probabilities estimated from the logit model will always lie within the logical bounds of 0 and 1 (Gujarati, 1992). In addition, OLS is not practical because it assumes that the rate of change of probability per unit change in the value of the explanatory variable is constant.

The logit model was chosen because of its mathematical simplicity compared with other models and because it gives fewer classification errors (Gujarati, 1992). When compared to log-linear regression and discriminant analysis, logistic regression proves to be more useful. Log-linear regression requires that all independent variables be categorical and discriminant analysis requires them all to be numerical, but logistic regression can be used when there is a mixture of numerical and categorical independent variables (Dougherty, 1992).

The multinomial logistic regression is an extension of the binary logistic regression model. However, the multinomial or polytomous logistic regression is used where the outcome variable has three categories (Hosmer and Lemeshow, 2000). So in this study, the multinomial model is not the appropriate method since the dependent variables has two categories which are either participation in small grain production or not.

4.4.3 Net and Gross Food Security Index

Gross Food Security Index (GFSI) and the Net Food Security Index (NFSI) are partial indicators of food security status of households (Guveya, 2000), calculated as follows;

Gross Food Security Index (GFSI) is an indicator of whether the household will have enough food to last until the next harvest season, had the household not sold any of its grain.

$$GFSI = \left[\left(\left(\frac{TP}{R} \right) . 100 \right) \right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .. 1$$

Where;

GFSI = Gross Food Security Index

TP = Total Production defined by total grain production (maize and small grains)

R = Requirement given by multiplying total adult equivalents (TAE) by minimum annual grain requirement of an average adult, (155kg)

If GFSI is 100%, production will be equal to requirement and the household is food self-sufficient but has no surplus to sell.

If GFSI > 100%, the household is food self-sufficient and food secure.

If GFSI < 100%, this does not mean that the household is food insecure because the household might be earning enough from off-farm activities to buy supplements.

Net Food Security Index (NFSI) is an indicator of whether, after selling, the household will have enough food for consumption to last until the next harvest (Guveya 2000).

$$NFSI = \left[\left(\left(\frac{S}{R} \right) . 100 \right) \right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where;

NFSI = Net Food Security Index

S = Surplus given by production minus sales

R = Requirement given by multiplying total adult equivalents (TAE) by minimum annual grain requirement of an average adult, (155kg)

If NFSI, > 100%, this means that the household retains more than enough to meet household requirements till the next harvest.

If NFSI, < 100%, this means that the household does not retain enough grain to last until the beginning of the next season.

In this study, food security indices were used to compare the food security status of small grain and non small grain producing households. The NFSI was used to ascertain whether those households who had sold some of their output remain food secure. The two indices were used as dummy variables to assess whether there is any significant relationship between small grain production and food security status.

4.4.4 Gross Margins

Gross margin, (GM) is the difference between total sales commonly known as gross income, (GI) or gross output, (GO) and total variable costs, Johnson (1992). Johnson, (1992) further defines gross income as a product of output and price. Variable costs are mainly operational costs that vary with changes in scale of operation, to include most of the inputs like, fertilizers, seed, chemicals, transport, hired labour and land preparation.

Gross Margin= Total Sales (Gross Income) – Total Variable Costs

In other words, the gross margin value is the amount that a farmer is left with after paying off all the operational cost incurred during the production phase. Enterprises with higher or positive GMs are deemed viable by rule of thumb.

In this study, gross margins were used for comparative analysis amongst the crops under study that is sorghum, finger millet and maize. The gross margins were used to test hypothesis 3. This was done through comparing the total amount of income that each crop yields to the farmer. The gross margin enterprise budgets for the crops are presented in the next chapter and discussed to analyze the potential profitability of each crop.

4.5 Explanation of independent variables

Thirteen explanatory variables were investigated to determine how they affect farmers' decision to produce small grains and ultimately household food security. These include, labour, cattle ownership, educational level of household head, farm size, age of household head, gender of household head, market access, access to extension services, access to credit, crop yields, crop

incomes, marital status and asset ownership. Table 4.3, summarizes variables specified in the binary logistic model with small grain production as the dependent variable and their expected signs.

Table 4.3: Summary of variables specified in the model

Variable	***Variable measure***	***Expected sign***
Labour	Adult members who assist with farm labour	-/+
Cattle ownership	Number of cattle owned by a household	+
Educational level of household head	1= educated, 0 = uneducated	+
Farm size	Total land owned in hectares	-/+
Age of household head	Actual number of years	+
Gender of household head	0 = male, 1 = female	-/+
Market access	0 = no access, 1 = access	+
Access to extension services	0 = no access, 1= access	+
Access to credit	0 = no access, 1 = access	+
Marital status	1= married, 2= single, 3= divorced, 4= widowed	-/+
Asset ownership	Number of farm assets owned	+
Crop yields	Amount of crop output (sorghum, finger millet and maize)	-/+
Crop income	Amount of income realised from sale of crop (sorghum, finger millet and maize)	-/+

4.5.1 Labour

According to Hofferth (2003), subsistence farming generally relies on labour to a greater extent than commercial agriculture. Therefore, in subsistence farming, households with larger labour supplies are better positioned to increase their crop diversity. Availability of a relatively larger labour force, regardless of farm size, can be an advantage to those households who strive to produce a number of crops and ultimately achieve food security. However this is provided that the excess labour force is engaged in other income generating activities (Kidane *et al*., 2005).

Chen (1991) reported that labour availability is an important determinant of farmer crop choice and food security, especially in subsistence-oriented households given the necessary landholding and rainfall. It was thus expected that labour supplies would affect production of small grains positively. This is based on the understanding that production of these crops is labour intensive. Labour is a continuous variable, which was measured by total number of family members who assisted with farm labour.

4.5.2 Cattle ownership

Cattle ownership, a continuous variable, was another determinant factor that was considered in influencing farmer crop choice. Cattle serve as a source of draught power in Zimbabwe's communal areas, thereby significantly affecting households' crop production (Govereh and Jayne, 1999). According to Govereh and Jayne (1999), animal traction power enables households to cultivate greater areas of land and to execute agricultural operations timely. Therefore, a positive relationship between cattle ownership and small grain production was expected in this study.

4.5.3 Educational level of household head

According to Najafi (2003), educational attainment by the household head could lead to awareness of the possible advantages of crop diversification. Najafi (2003) adds further that education enables farmers to modernize agriculture by means of technological inputs and enable them to read instructions on fertilizer packs. As such educational level was expected to have a positive influence on farmer's decision to produce small grains. Educational attainment of a household head is considered a qualitative variable. Educational level of household head was obtained by assuming that any person who had completed at least level one at grade three was literate.

4.5.4 Farm size

Farm size is the total size of fragmented plots with different sizes and fertility levels that farmers' in Gutu and Masvingo district plough. It was determined by summing the fragmented plots, and converting them to hectares. Farmland size is a continuous variable. This study expected farmland size to affect both positively and negatively farmer's decision to produce

small grains. The rationale is that those farmers with large farm sizes are expected not constrained by land shortages on the number of crops they can produce.

4.5.5 Age of household head

Hofferth (2003) argues that the higher the age of the household head, the more stable the economy of the farm household, because older people have also relatively richer experiences of the social and physical environments as well as greater experience of farming activities. Moreover, older household heads are expected to have better access to land than younger heads, because younger men either have to wait for a land distribution, or have to share land with their families. In that regard it was hypothesized that, an older person heads a greater number of households who produce small grains. As such, it was expected that there is a positive relationship between age of household and small grain production. Age of household head is a continuous variable and is measured in years.

4.5.6 Gender of household head

Agriculture in communal areas usually revolves around women as men often migrate to urban areas to seek employment. Women are left in charge of the fields and livestock (FAO, 1995). It was expected that small grain production would be more prevalent in female headed households than male headed households. This is because according to earlier studies by van Oosterhout (1995) small grains are more preferred by women. Whilst on the other hand men are bound to be involved in production of other crops and different non-farm activities. These non-farm activities such as thatching of huts would be meant to diversify sources of household income. A dummy variable was introduced as follows; (0 if male headed: 1 if female headed) to represent this predictor variable.

4.5.7 Market access

Market accessibility was determined by the total time and distance that is required to reach the nearest available market. On the other hand, market availability was measured by whether there is a ready market for a particular crop output. Market access and availability for a particular crop output are expected to influence farmer's crop choice decision positively. This is because of the need for cash by communal households to meet other financial obligations. In line with the FAO (1995) report that finger millet fetches higher prices in Zimbabwe's informal markets compared

to maize. This is mainly because of traditional beer brewing. In view of this, it was expected that there was a positive relationship between market and small grain production.

4.5.8 Access to extension services

According to Kaliba *et al* (2000), extension service is a good indicator of a farmer's knowledge of agricultural information. This suggests that farmers tend to produce a particular crop based on the knowledge that they have on that specific crop. Therefore, it was expected that availability of extension services would influence farmer crop choice decision. In that view, the decision to produce small grains was expected to be positively influenced by availability of extension services. Access to extension service was measured as a dummy variable, equal to 1 if household had access to extension, 0 otherwise.

4.5.9 Access to credit

This implies access to input credit (seed and fertilizer) by farmers for production of either maize or small grains. According to Diagne *et al* (2000), access to credit can significantly increase the ability of poor household with no or little savings to acquire needed agricultural inputs. Hence this affects the type of crop a household is able to produce. In that regard it was expected that there will be a positive relationship between small grain production and access to credit. Households were therefore asked to respond to qualitative questions concerning their access to credit for small grain production. A dummy variable was introduced as follows; (0 if no access to credit: 1 access to credit) to represent this predictor variable.

4.5.10 Marital Status

According to Randela (2005), in the African context, the marital status of households is usually used to determine the stability of a household in terms of food security. It is generally believed that married household heads tend to be more stable in farming activities than unmarried heads (Randela, 2005). Hence, if this holds true, the marital status of household heads was expected to affect agricultural production either positively or negatively. This is in terms of the type of crops grown and hence household food security.

4.5.11 Asset ownership

Availability of implements is critical to the farmer as they determine timing and the rate of land preparation (Govereh and Jayne, 1999). Therefore, it was expected that ownership of farm implements such as the hoe, wheelbarrow, axe and scorch cart by the farmer would affect positively small grain production.

4.5.12 Crop yields

According to Kurukulasuriya and Mendelsohn (2007), expected crop yield is a very important factor to farmers when deciding on which crops to produce. Hence, it was expected that crop yields would have a positive or negative effect towards small grain production. Crop yields were measured in tonnes for the total output produced from finger millet, sorghum and maize.

4.5.13 Crop income

Expected income is also another very important factor, which farmers consider when deciding on which crops to produce (Kurukulasuriya and Mendelsohn, 2007). Crop income was measured by the total amount of income that a farmer realises after selling their output. Therefore, it was expected that projected income from small grain production would have a positive or a negative effect.

4.6 Conclusion

The study was conducted in the two districts of Masvingo and Gutu in Masvingo Province. Data was collected from 120 farmers in the study areas using a structured questionnaire. Face to face interviews were used to collect data from the respondents. Descriptive statistics were employed to access the household characteristics of sampled households. A logistic regression model was used to analyze the factors that influence farmer participation in small grain production. The Gross and Net food security indices were used to compare the household food security status of small grain producing and non small grain producing households. Finally, the gross margins were used to test hypothesis 3.

CHAPTER 5
CHARACTERISTICS OF THE STUDY POPULATION

5.1 Introduction

This chapter is a presentation of research results emanating from the field survey that was carried out. Findings of the research regarding factors that affect small grain production are highlighted. The chapter begins by explaining the demographic characteristics of the sampled households. An overview of household farm characteristics then follows. Gross margins for the three crops maize, finger millet and sorghum were computed. Finally, a comparison of income sources between small grain producing and non small grain producing households is undertaken.

5.2 Demographic characteristics of sampled households

This section discusses household head's aspects such as gender, age, marital status and highest educational levels. These aspects are important because according to Makhura (2001), the household head coordinate the main household activities and the head's decisions are most likely to be influenced by such demographic aspects. The section further presents and analyses results of the household sizes. According to Randela (2005), demographic characteristics of households are essential when analyzing economic data because such factors influence the households' economic behaviour. As such, it is important to consider household demographic characteristics in analyzing the potential contribution of small grains to household food security in Masvingo Province.

As previously stated this study was conducted in two administrative districts namely Masvingo and Gutu in Masvingo Province. Four villages were investigated by way of two villages being drawn from each district. The study sample consisted of 120 households. Of these 51.37% were male headed and 48.3% were female headed. Household size represents the total number of family members who permanently reside in the household. The average household size for Masvingo district was 4.6 and that for Gutu district was 5.2.

5.2.1 Gender of household head

Table 5.1 below summarizes the gender distribution of all sampled farmers in Masvingo and Gutu districts. In Masvingo out of 60 households that were interviewed 43% were female headed and 57% were male headed. In Gutu, from 60 households interviewed, 45% were female headed and 55% were male headed. This shows that on average both areas had males dominating as household heads. Farmers were further divided into their different farming types in order to investigate whether gender influences the choice of farming type and the results are summarized in Table 5.2 below.

Table 5.1: Gender distribution of respondents by districts

District	***Masvingo (N=60)***		***Gutu (N=60)***	
Gender of household head	Number	Percentage (%)	Number	Percentage (%)
Female	26	43	27	45
Male	34	57	33	55
TOTAL	**60**	**100**	**60**	**100**

Table 5.2: Gender distribution by farming type for both districts

	Male Number	Percentage (%)	Female Number	Percentage (%)
Small grain producers	28	47	32	53
Non small grain producers	35	58	25	42

Table 5.2 shows gender distribution of respondents by type of farming for both districts. The results show that there were almost a similar proportion of female farmers (53%) involved in small grain production compared to males (47%). However, in non small grain production there were greater proportions' of males (58%) than females.

5.2.2 Age of household head

According to Hofferth (2003), age of a household head is very important aspect in agricultural productivity as it determines farming experience. Further to that, age of a household head determines the knowledge of the social and physical environments. Table 5.3 below summarizes the age distribution of respondents in both districts.

Table 5.3: Age distribution of household heads

Characteristic	***Mean***	***Mode***	***Std. Deviation***	***Minimum***	***Maximum***
Age	41.83	53	14.641	15	83

Age range	***Non small grain producers***		***Small grain producers***		***Total Percentage***
	Number	Percentage %	Number	Percentage %	
<30	9	8	4	3	11
30-39	16	13	5	4	17
40-49	16	13	11	10	23
50-59	15	13	30	25	38
>60	4	3	10	8	11
TOTAL	60	50	60	50	100

Source survey results 2009

Overall, the dominant age range of the interviewed farmers was between 50-60 years, which constituted about 38% of the total respondents in both districts. The age range, which had the least number of respondents in both districts, was that below the age of 30 years, which had 11% of total respondents. This affirms the notion that farming in the rural areas is usually done by older people. This is probably because younger people migrate to urban areas to find other forms of employment, which offer better income compared to farming. The results from Table 5.3 also show that the average age of the household heads in the study area was 41.8 years.

The age range in the study areas were between 15 to 83 years. This shows that there were some child headed households[2]. However, the number of child headed households was very few with most of them found in Gutu district. Of the child headed households, none reported that they were involved in small grain production. The results of the survey further reveal that about 25% of small grains producing households were in the age range of between 50-59 years. This might be because of older households heads' having a variety of family labour at their disposal compared to young heads. The other reason was that generally older household heads in the study area had bigger farm sizes than younger heads. On the other hand, younger heads were constrained in land access as they either have to wait for land distribution or have to share land with their families (Kidane *et al*., 2005). This affects their capacity to produce small grains as the limited land that they own compete with maize production.

5.2.3 Household size

The mean household sizes for Gutu and Masvingo were 4.6 and 5.2 respectively. The study also revealed that household sizes were in the range of 1 to 6 for Masvingo farmers and 1 to 9 for Gutu farmers per household. Table 5.4 below summarizes the household sizes in the study areas.

Table 5.4: Household sizes

District	***Variable***	***Minimum***	***Maximum***	***Mean***	***Std. Deviation***
Masvingo	Household size	1	6	5.23	1.439
Gutu	Household size	1	9	4.61	1.552

As a proxy for labour availability, it can be inferred that both small grain and non small grain producing households would not have serious problems with farm labour. This is because the average household size was about five people per household. These findings are supported with earlier conclusions by Hages *et al* (1997) that a larger family size means that a variety of labour capacity is available in the form of young, middle aged and elderly members. However, this also depends on other factors such as household resource endowments like amount of draught power

[2] A child headed household was described as a household whose head is below the age of 18 years

and assets. On the other hand Paddy (2003) pointed out that while increasing family size tends to provide households with the required labour for agricultural production, larger families tend to put pressure on consumption than the labour it contributes to production.

5.2.4 Educational level of household head

Figure 5.1 below shows results of educational level of household heads in the two districts under study.

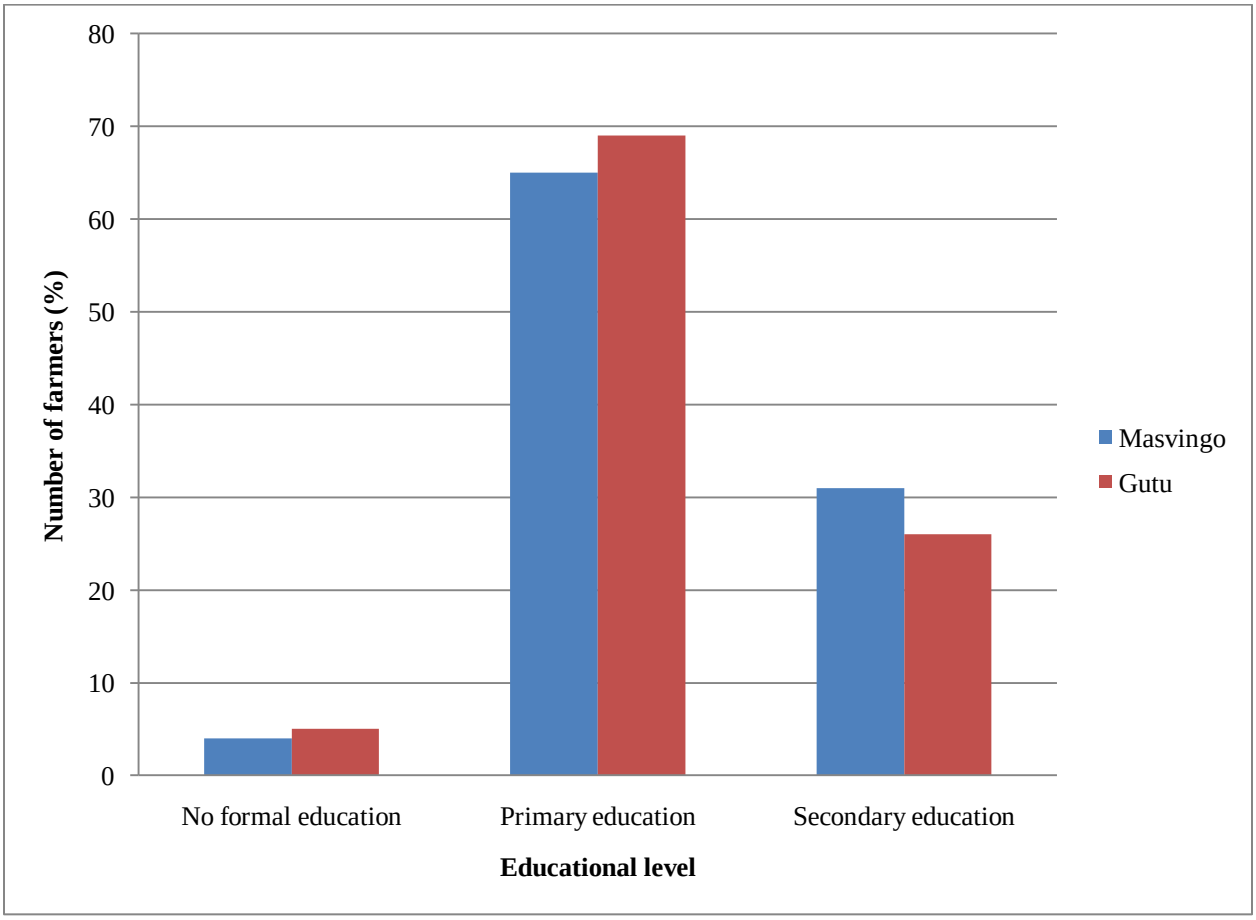

Figure 5.1: Educational levels of household head

About 96% of household heads in Masvingo district had attained some formal education. Nevertheless, of these the majority (about 65%) had attained primary education. Furthermore, for Gutu district about 95% of household heads reported that they had attained formal education. Like in Masvingo, the majority of them, 69%, had attained it at primary level. A smaller proportion of about 26% had attained secondary education. No household heads had attained

tertiary education from those that were interviewed. The literacy rate of the two districts is almost similar to that of the nation, which was estimated to be about 96% (CSO, 2002a).

The educational levels of household heads in the two districts were almost similar. Therefore, there were no major differences in the literacy rates between the two districts. Those who reported that they had not attained any formal education were 4% and 5% for Masvingo and Gutu respectively. Therefore, it can be concluded that most farmers had some basic literacy especially in *Shon*a their local language concerning their farming activities.

An investigation on the highest educational levels between the different farming types was done and the results are shown on Figure 5.2 below.

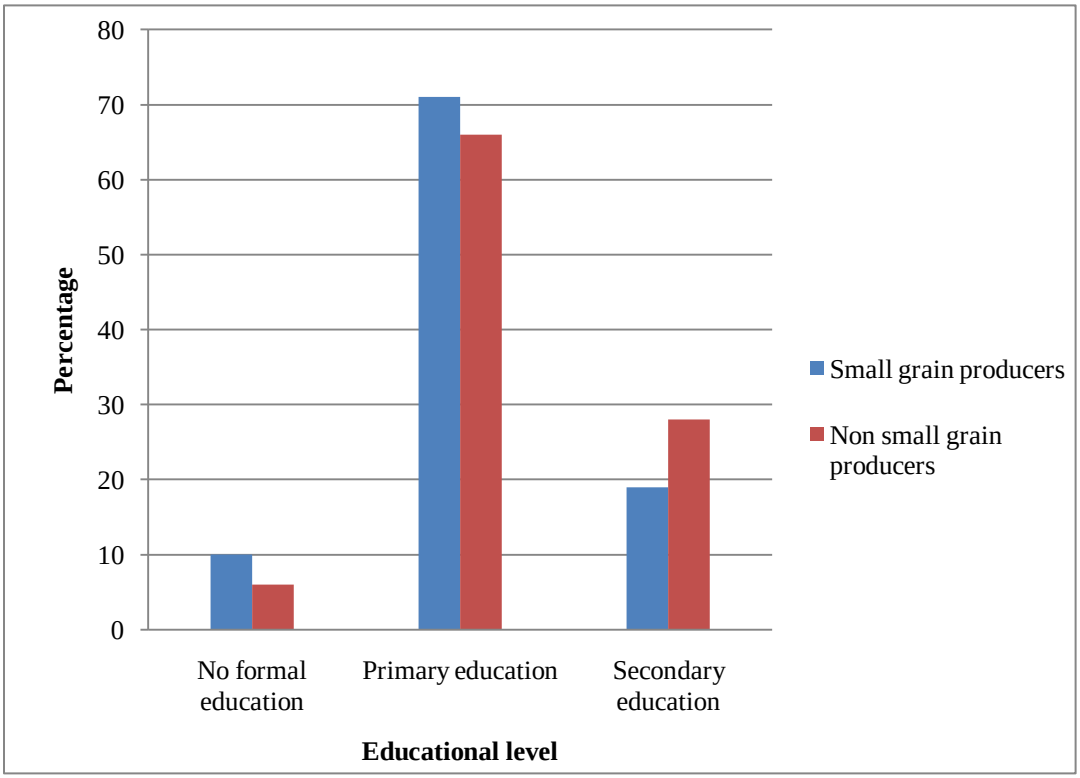

Figure 5.2: Education distributions between farming types

When the farmers were divided according to their farming types, it was observed that 10 percent of the small grain producers had no formal education. Most of these households were those that were being led by older household heads usually above 60 years. On the other hand, a lower

proportion of non small grain producers (6%) had no formal education. Nonetheless, distribution of respondents with regard to their educational level tends to point out that there were more non small grain producers who had attained both primary and secondary education. The results of the analysis tend to suggest that as the farmers become more educated they move away from small grain production. This might be because of changing food preferences as stated earlier by FAO (1996) that as incomes rise, consumers tend to purchase wheat, rice and in some cases maize, rather than traditional coarse grains.

5.2.5 Employment status of household head

Figure 5.3 below shows the employment distribution of household heads in the two districts.

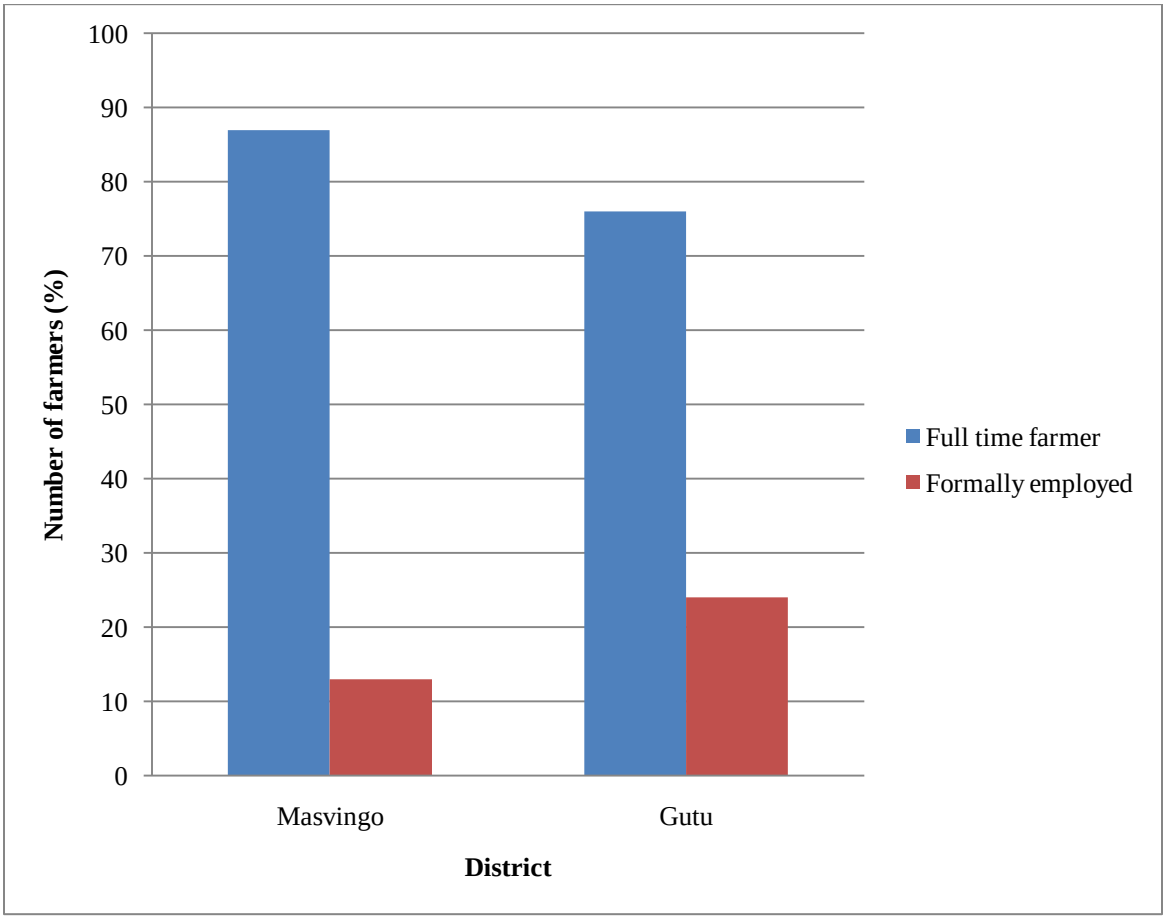

Figure 5.3: Employment status of household head

Most of the household heads in the study areas were full time farmers who entirely depend on subsistence farming and not formally employed. In Masvingo and Gutu, the percentages were

87% and 76% respectively of household heads who were full time farmers. Therefore, for Masvingo 13% of sampled farmers were formally employed and 24% was formally employed for Gutu. Of the interviewed farmers in both districts, no one was employed in the informal sector.

Gutu had the highest number of people who were formally employed because the area is near both Masvingo town and Mupandawana Growth point. The majority of household heads who reported that they were formally employed were men. Some were employed as local school teachers or were engaged in formal employment in the nearby Masvingo town.

5.2.6 Marital Status

The marital status of the respondents was divided into four main groups namely married, single, divorced and widowed. The results of the marital status of the household heads are presented in Figure 5.4 below.

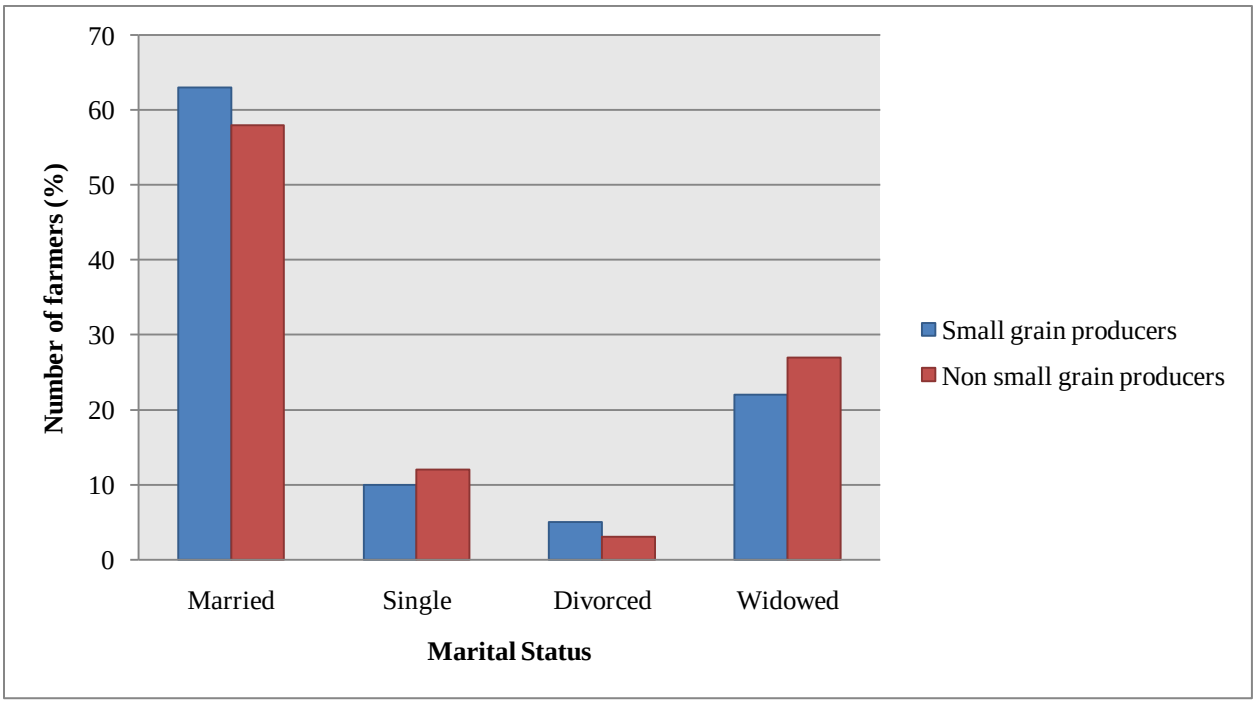

Figure 5.4: Marital status of respondents

Between the two farming types, most of the households constituted of married couples followed by widowed families, then single and divorced headed households. Sixty three percent of small grains producing households were married people, 22% were widowed, 10% were single and 5%

were divorced headed households. For non small grain producing , 58% of household heads were married, followed by 27%, who were widowed, then 12% who were single and then 3% who were divorced. Production of small grains was more prevalent in married households. This might be attributed to the ability of these households being able to coordinate their farming activities to meet the labour requirements of small grains compared to unmarried heads (Randela, 2005).

5.3 Farm characteristics of households

Table 5.5 shows that households who produced small grains had an average farm size of 3.33 hectares while those who were non small grain producers had an average farm size of 2.90 hectares.

Table 5.5: Farm characteristics of households

	Small grain producers		***Non small grain producers***	
Farm characteristic	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Land size	3.33	0.69	2.90	0.74
Family labour[3]	4.87	1.47	3.68	1.08
Cattle	5.05	2.14	4.35	2.46

On the other, hand farm sizes for those who reported that they were involved in small grain production ranged from 0.1 hectares to 5.5 hectares. While farm sizes for non small grain producers ranged from 0.1 hectares to 4 hectares. Table 5.5 further shows that the average family labour for small grain producing households was 4.87 and for non small grain producing households it was 3.68. Family labour for small grain producers was higher per hectare cultivated when compared to non small grain producers, maybe because small grains require a

[3] Family labour refers to household members who assisted in all farming activities during the farming season.

lot of labour. Hence, family sizes for small grain producing households were generally higher than non small grain producing households.

Those farmers who were engaged in small grain production generally had slightly more cattle on average than non small grain producers. The mean number of cattle was 5.05 and 4.35 for small grain producers and non small grain producers respectively. Availability of cattle for draught power determines timing of land preparation and amount that can be tilled following the onset of the rain season. Farmers reported that production of small grains exerted pressure on draught power. This is because land were small grains are broadcasted in summer should usually be prepared in winter. Therefore, this might be the reason why those households with more cattle could be engaged in small grain production.

5.3.1 Asset ownership

Availability of implements is critical to the farmer as they determine timing and the rate of land preparation. Table 5.6 below shows the percentage of agricultural implements owned by farmers according to the nature of their farming type that is whether a farmer is a small grain producer or a non-small grain producer. Results from Table 5.6 shows that the majority of households owned agricultural implements, which are commonly used for smallholder production.

Table 5.6: Asset ownership

	Percentage of farmers who own	
Asset	**Small grain producers**	**Non small grain producers**
Hoe	92% (56)	97% (58)
Axe	93%(56)	90%(54)
Plough	81%(49)	72%(43)
Scotch cart	67%(40)	63%(38)
Wheel barrow	62%(37)	68%(41)
Shovels	77%(46)	80%(48)

NB: Figures in parenthesis are actual number of farmers.

Source survey results 2009

The most common implement between the two categories of farmers was the hoe and an axe. Table 5.6 shows that 92% of small grain producers owned a hoe whilst 97% of non small grain producers also possessed a hoe. Furthermore, 93% and 90% of small grain producers and non small grain producers respectively owned an axe. The plough was also amongst the most prevalent implements. Table 5.6 shows that 74% and 81% of non small grain producing and small grain producing households respectively owned a plough. The scotch cart was owned by 67% and 63% of small grain producers and non small grain producers respectively. There was a slight difference in terms of percentage ownership of agricultural implements between the two categories of farmers. Nonetheless, results depicted in Table 5.6 show that small grain producing households had slightly more implements than non small grain producing.

5.3.2 Livestock ownership

Table 5.7 shows that 82% of non small grain producing households interviewed owned cattle while 78% of small grain producing households also owned cattle.

Table 5.7: Livestock ownership

Livestock	***Percentage of farmers who own***	
	Small grain producers	**Non small grain producers**
Cattle	78%	82%
Goats	65%	62%
Chickens	95%	92%
Donkeys	10%	7%
Sheep	5%	8%

Source survey results 2009

Nonetheless, a small percentage of both non small grain producing households and small grain producing households kept donkeys for draught power that is 7% and 10% respectively. These findings are supported by Mushunje (2005) that communal farmers prefer to keep cattle than donkeys because of the multi-purpose cattle have in communal areas.

Table 5.7 also shows that most households both small grain producing and non small grain producing owned goats and chickens. The high percentages of households who owned chickens may be attributed to the low cost at which they can be reared under free range systems in communal areas. However, results from Table 5.7 show that a very small percentage of households owned sheep. It can be inferred that those households who own livestock have better coping strategies in as far as purchasing supplement grain is concerned if need arises. This is compared with those households who do not own livestock hence they tend to be food insecure.

5.4 Crop production

The major crops that were grown in the two districts were maize, groundnuts, round nuts and finger millet. Figure 5.5 below summarizes the major crops grown in the two districts. Almost all households amongst the sampled farmers in both Gutu and Masvingo were engaged in maize production. Small grain production (sorghum and finger millet) were being done in conjunction with maize. To this end, no households were exclusively involved in small grain production but rather small portions of land were reserved for production of small grains.

Meanwhile sorghum production was found not to be very popular with most farmers in both districts. Nonetheless, there were more farmers engaged in sorghum production in Gutu district compared to Masvingo. By the same note, finger millet was more prevalent amongst households in Masvingo district than in Gutu. For the proportions of land that were devoted to each of the crops, see Figure 5.6 and Table 5.8 below. The majority of sampled farmers preferred finger millet production to sorghum. This is because they said finger millet was better adaptable to their climatic conditions than to sorghum. This was in terms of amount of rainfall received in the area and soil types. In addition, the role that finger millet played in beer brewing made it more profitable than sorghum.

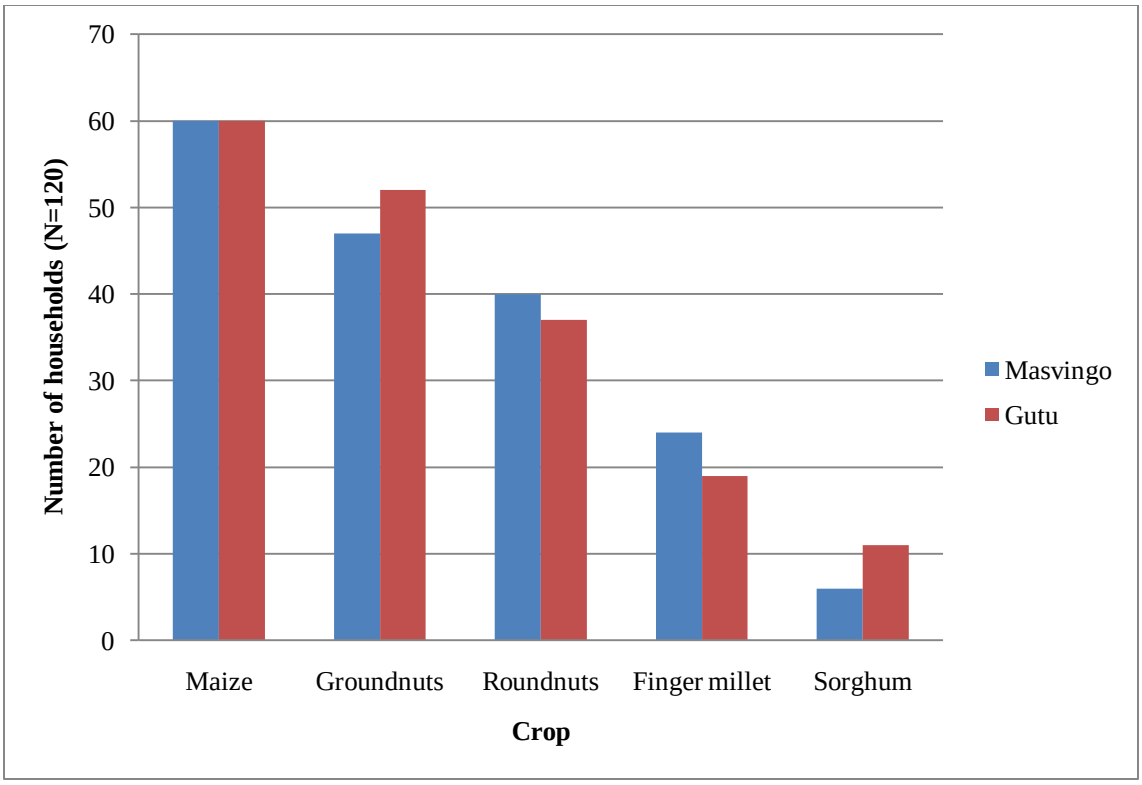

Figure 5.5: Crops grown by district

Moreover, farmers in both districts cited that production of round nuts was on the decline because virgin lands (*makombo*) where round nuts are claimed to thrive well were no longer available. Farmers were also asked to provide the average area that they devoted to each crop. Figure 5.6 below shows the percentage of land that was devoted to production of each crop in the study areas for the 2008/2009 cropping season. Maize had the highest mean area, in both districts. More land was devoted to the production of maize (72%) followed by groundnuts, round nuts, finger millet and sorghum respectively in both districts. Relatively small portions of land were devoted to finger millet and sorghum production 6% and 3% respectively.

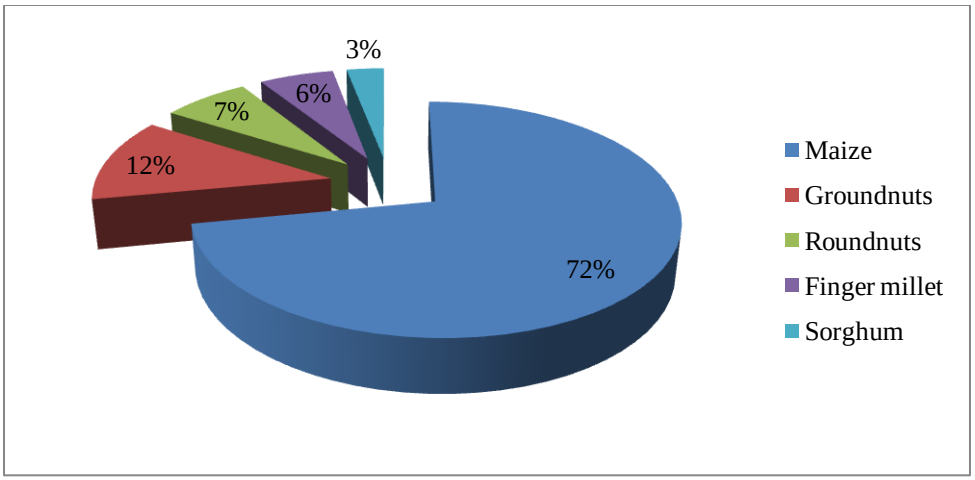

Figure 5.6: Percentage of land area devoted to major crops in the two districts

Source Survey Results 2009

Furthermore, yields estimates and average area devoted to each crop between the two categories of farmers were calculated based on the farm interviews and the results are summarised in Table 5.8 below.

Table 5.8: Average area and crop yields for 2008/9 season

	Small grain producers		***Non small grain producers***	
Crop	***Average area (ha)***	***Average yield tonnes/ hectare***	***Average area (ha)***	***Average yield tonnes/ha***
Maize	1.8	0.39	1.6	0.38
Sorghum	0.21	0.19	-	-
Finger millet	0.35	0.25	-	-
Groundnuts (unshelled)	0.53	0.35	0.54	0.37
Roundnuts	0.38	0.29	0.32	0.31

Source Survey Results 2009

Crop yield is a function of a number of factors which include soil fertility, amount of rainfall received in that particular season and land area devoted to the crop amongst others. Table 5.8 above shows that for both categories of farmers the highest average area was devoted to maize production. In addition, the highest yield was that of maize. This was followed by groundnuts 0.35 t/ha and 0.37 t/ha for small grain producers and non small grain producers respectively. Roundnuts was third with 0.29 t/ha for small grain producers and 0.31 t/ha for non small grain producers. The results show that there was a direct relationship between land area devoted to each crop and yield. Yields of finger millet and sorghum were the lowest corresponding to the small pieces of land that were devoted to these crops.

These findings are consistent with literature that maize is preferred to small grains, though production levels are low for all the crops. Several constraints to sorghum and finger millet production push farmers to shift to maize production. The major constraints that were highlighted by farmers during the survey are outlined in the following section.

5.5 Constraints farmers face in small grain production

Farmers were asked to rank constraints that they face in sorghum and finger millet production on a scale of 1 to 5. The ranking was in such a way that one was regarded as least important and 5 as most important. The most frequently mentioned constraints ranked according to number of times they were mentioned are shown in Table 5.9 below.

Table 5.9: Constraints faced by farmers in sorghum and finger millet production

	Percentage of farmers		
Constraint	***Masvingo***	***Gutu***	***Total %***
Low yields	46 (55)	44 (53)	90
Seed unavailability	43 (51)	40 (49)	83
Shortage of fertilizer	35 (42)	38 (46)	73
Quelea birds	33 (39)	29 (35)	62
Drought	28 (33)	25 (31)	53
Poor soils	20 (24)	22 (26)	42
Inadequate land	15 (18)	18 (21)	33
Limited Extension	11 (13)	8 (10)	19
Shortage of labour	9 (11)	8 (9)	17
Other*	7 (8)	4 (5)	11

*Other include pests, grain sprouting and itchy skin due to dust produced during threshing
Figures in parenthesis are actual number of farmers.
Source Survey Results 2009

As shown on Table 5.9 the most important and specific challenge, which was highlighted by most farmers, was low yields from small grains. Forty six per cent of farmers in Masvingo and 44% in Gutu district cited that small grains did not generate an adequate amount of food to satisfy family requirements compared to maize. They complained that this was the major reason why they end up shunning small grains for maize production. These findings were noted earlier by Sukume *et al* (2000) that low yields of small grains have acted as a major obstacle for farmers not to uptake production of these crops on a large scale.

Input shortage in terms of seed and fertilizer followed next in the rankings reported by farmers. A total of 43% of farmers and 40% of farmers in Masvingo and Gutu respectively cited problem

of seed unavailability. In the same way, 35% of farmers and 38% of farmers in Masvingo and Gutu respectively mentioned fertilizer shortage as their other major constraint in the production of small grains. This is because at times farmers reported that they received maize inputs especially seed from the government input scheme such as *maguta* programme. However, such facility did not exist for small grains. As a result, farmers highlighted that this made it difficult for them to access vital inputs of seed and fertilizer for small grain production without credit support from either government or NGOs. This was a very different case with maize as some farmers conceded that they had received maize seed from CARE Zimbabwe. Because farmers are getting input support from government and other donor organisations for maize production it would be logical to expect farmers to produce maize instead of small grains were inputs are not available. However, the potential viability of these crops under these agro-ecological conditions would be critically analysed further using gross margins, which shall be captured in section 5.6 below.

Attacks by quelea birds during the sprouting stage were mentioned by 62% of farmers in both districts. Consequently, this offered labour constraints to farming households as they had to engage a family member to scare away birds during this stage. Furthermore, farmers indicated that the birds drastically reduced yields. In contrast, there were no birds attacking maize crop and this made production of small grains laborious and unattractive to farmers.

Drought risk in terms of low rainfall and poor soils were reported by a total of 53% and 42% of farmers respectively. In the same way, inadequate land where the limited available land competes for the major preferred staple maize for the production of finger millet and sorghum was cited by 33% of farmers. Farmers who mentioned limited extension as an obstacle towards small grain production were 19%. Results of the survey revealed that most of the extension advice that farmers receive was geared towards the production of maize. There were also other constraints such as pests and itchy skin during harvesting that farmers encounter in small grain production.

5.6 Gross margins

Detailed crop budgets for the three crops from the study area were captured, based on variable costs and yields provided by farmers as shown in Table 5.10 to Table 5.12.

Table 5.10: Gross margin budget for maize

GROSS MARGIN BUDGET FOR MAIZE			
	Requirement/ha	**Units**	**1ha**
Yield		t/ha	0,39
Selling Price[4]		US$/t	265
Gross income		US$/ha	103,35
TOTAL VARIABLE COSTS (TVC)		US$/ha	98,94
Gross Margin		US$/ha	**4,41**
VARIABLE COSTS			**Cost (US$/ha)**
A. PRIOR TO HARVESTING			
1. Seed	25	kg/ha@$ 1.4/kg	35
2. Land Preparation[5]			5
3. Labour	5	ld/ha@$1.5	7,5
4. Fertiliser (ex factory)			
a. Ammonium Nitrate	50	kg/ha@$0.8/kg	40
5. Miscellaneous	2%		1,75
SUBTOTAL			**89,25**
B. HARVESTING & MARKETING			
1. Packaging material			
a. Bags	8	$0.5@ empty bag	4
b. Twine	1	kg/ha@U$1	1
2. Labour	3	Lab days/ha@$1.5	4,5
3. Miscellaneous	2%		0,19
SUBTOTAL			**9,69**

Table 5.10 shows that the average yield for maize was 0,39 t/ha. Farmers realized a gross margin of US$4,41/ha. The total variable costs of US$98,94 were incurred in maize production. The bulk of these costs were mainly production costs prior to harvesting. Ammonium nitrate had the

[4] The gazetted selling price of maize/tone was US$265

[5] The cost of land preparation was calculated from the cost of hiring ox drawn draught power/hectare which was $5/ha

highest cost of US$40. The majority of farmers in the study areas substituted Compound D with cattle manure and anthill soil; hence, it was not included in the costing. The other major variable costs were seed and labour.

Table 5.11: Gross margin budget for finger millet

GROSS MARGIN BUDGET FOR FINGER MILLET			
	Requirement/ha	**Units**	**1ha**
Yield		t/ha	0,25
Selling Price[6]		US$/t	240
Gross income		US$/ha	60
TOTAL VARIABLE COSTS (TVC)		US$/ha	38,76
Gross Margin ($/ha)		US$/ha	**21,24**
VARIABLE COSTS			**Cost (US$/ha)**
C. PRIOR TO HARVESTING			
1. Seed	8	kg/ha@$2/kg	16
2. Land Preparation			2
3. Labour	5	ld/ha@$1.5	7,5
4. Fertiliser (ex factory)			
a. Ammonium Nitrate	-		-
5. Miscellaneous	2%		0,51
SUBTOTAL			**26,01**
B. HARVESTING & MARKETING			
1. Packaging material			
a. Bags	5	$0.5@ empty bag	2,5
b. Twine	1	kg/ha@U$1	1
2. Labour	6	ld/ha@$1.5	9
3. Miscellaneous	2%		0,25
SUBTOTAL			**12,75**

Table 5.11 shows that the average yield for finger millet was 0,25t/ha and accrued a gross margin of US$21,24/ha. The variable costs for finger millet (US$38,76/ha) were lower than those of maize (US$98,94/ha). This variation is because for maize production farmers had applied fertiliser whilst for finger millet farmers had not applied any fertilisers. Similarly, the cost of maize seed was higher than that of finger millet. Seed that was used for finger millet production

[6] The gazetted selling price of finger millet/tone was US$ 240

was mainly seed retained from the previous cropping season. The total cost of buying finger millet seed locally from neighbours adequate for a hectare was US$16. In addition, land tillage costs for finger millet in summer were minimal compared to those of maize. Farmers mentioned that they usually broadcast finger millet seed on land that would have been prepared during winter. Then afterwards they harrow the land. This was a different case with maize, as it required thorough land preparation.

However, the other difference in the variable costs was in labour incurred in finger millet during harvesting. The average labour costs at harvesting for finger millet was US$9, while that for maize was US$4,5.

Despite that, the yields of finger millet and the selling price were lower than those of maize, overall its gross margin was high. Finger millet had the highest gross margin of US$21,24 compared with that of maize which was US$ 4,41. The higher gross margin of finger millet was because of lower operational costs compared to maize.

The higher gross margin of finger millet with minimal input usage under the current conditions is an indication that finger millet is capable of bringing more net income than maize to farming households.

Table 5.12: Gross margin budget for sorghum

GROSS MARGIN BUDGET FOR SORGHUM			
	Requirement/ha	**Units**	**1ha**
Yield (t/ha)			0.19
Selling Price (US$/t)			240
Gross income (US$/ha)			45.6
TOTAL VARIABLE COSTS (TVC)			38,25
Gross Margin ($/ha)			**7,35**
VARIABLE COSTS			Cost ($/ha)
A. PRIOR TO HARVESTING			
1. Seed	8	kg/ha@$2/kg	16
2. Land Preparation			2
3. Labour	5	ld/ha@$1.5	7,5
4. Fertiliser (ex factory)			
a. Ammonium Nitrate	-		-
5. Miscellaneous	2 %		0,51
SUBTOTAL			**26,01**
B. HARVESTING & MARKETING			
1. Packaging material			
a. Bags	4	$0.5@ empty bag	2
b. Twine	1	kg/ha@U$1	1
2. Labour	6	ld/ha@$1.5	9
3. Miscellaneous	2%		0,24
SUBTOTAL			**12,24**

Table 5.12 shows the gross margin for sorghum which was US$7,35. The variable costs for sorghum production were almost similar to those of finger millet. However, the only major difference was in the yields. Farmers in the study area reported low yields of sorghum of about 0,19 tonnes per hectare. As a result, the gross margin for sorghum was low compared to that of finger millet. This also confirms the reason why most farmers in the study area were not engaged in sorghum production. Similar to finger millet farmers reported that most of the variable costs that were incurred in sorghum production were on labour during harvesting. Despite that, the gross margin of sorghum was higher than that of maize. This shows that sorghum is a crop, which can yield higher returns in these areas.

5.7 Income sources for households

Other income generating activities were investigated between the two categories of farmers under study. This was important as it gave further insight into household food security status. Respondents were asked to recall certain activities and approximate amount of income that they brought home. Total household income was then calculated as an addition of off farm income and on farm income. On farm income emerged mainly from two sources that is the sale of crops produced and the sale of livestock. On the other hand, off farm income included income from sources such as casual labour (*maricho*), remittances and beer brewing. Table 5.13 classifies the income sources according to their various categories. This was done so that a comparison can be made between small grain producing households and non small grain producing households.

Table 5.13: Distribution of income sources

Category	***Small grain producers (N=60)***		***Non small grain producers (N=60)***	
	Amount ZAR	(%)	Amount ZAR	(%)
Grain	9565	30	8341	29
Livestock	16725	52	14021	50
Casual labour	1034	3	1986	7
Beer brewing	3456	11	1910	7
Remittances	1346	4	1954	7
Total	32126	100	28212	100

5.7.1 Income from grain crops

The major grain crops that were produced in both districts are maize, finger millet and sorghum. Table 5.13 shows that there were no major differences in the amount of grain sales realised by small grain producers and non small grain producers. However, Table 5.13 shows that 30% of small grain producing households received their income from grain sales this was almost an equal percentage with non small grain producers with 29% of households. This might be because of the sale of all three crops by small grain producing households (maize, sorghum and finger millet).

5.7.2 Livestock income

Income from the sale of livestock was also recorded. The higher percentages of livestock sales for both small grain producing and non small grain producing households can be attributed to the drought that affected the province during part of the 2008-2009 seasons. Small grain producing households received 52% of their income from livestock sales, while on the other hand non small grain producing households received 50% of their income from livestock sales.

Insight from the analysis shows that most of the income from livestock sales was from small grain producing households. This might be because they have more livestock at their disposal compared to non small grain producers. Further to that, the general trend is that both categories of farmers did not produce enough to meet their food requirements. Hence, because of trying to meet household food requirements and other financial obligations they were forced to liquate their livestock. Results of the survey revealed that small livestock like goats and chickens were the ones that were easily disposed of if the household wanted to buy grain and other household expenses. On the contrary, cattle were sold in extreme cases when a household seriously needs income. Usually this was because of medical expenses or school fees.

5.7.3 Casual labour

Casual labour (*maricho*) is another source of income for farm households in communal areas. The poor farmers received some of their income from working in the fields or homesteads of the better off farmers. Table 5.13 shows that there were no major differences in terms of percentage of farmers and total amount of income generated between the two categories of farmers. Small grain producing households had 3% of farmers involved in casual labour while non small grain had 7%. This slight difference might be attributed to minimal variations in wealth indicators between the two categories of farmers. This included things like availability of draught power. Other off farm casual labour that farmers were engaged in includes brick moulding and thatching huts.

5.7.4 Beer brewing

A portion of the millet and sorghum harvested by small grain producing households was used for beer brewing and the beer sold for income. Table 5.13 shows that 11% of small grains producing households were involved in beer brewing and they fetched a higher amount of R3 456. This is however compared to 7% of non small grain producing households and the amount they got was lower R1 910. This is because they would have acquired the millet or sorghum through other means from small grain producing households. They might have bought it or acquired it through bartering. This had an effect on total amount of profit that they realized. Farmers in both districts indicated that beer brewing was quite a lucrative venture because the profits that were realized were very high. This enabled farmers to raise money for household expenses as well as meeting costs of school fees. Those households who would have produced more small grains could brew beer more often and hence they realized more income. Results of the survey revealed that profits as high as R200 could be realized from brewing beer per week. However beer for traditional ceremonies and get together parties was not sold, people were just given to drink.

5.7.5 Remittances

Remittances for non small grain producing households were slightly higher than those of small grain producing households. Non small grain producing households had 5% of income coming from remittances while small grain producing households had 4%. In both districts, some families had a household member employed in the nearby Masvingo town. However, others were employed as far away as South Africa or Mozambique. However, the percentage remittances for both categories of farmers were too small as they were less than 10 percent. This may indicate a level of poverty in urban areas such that people in urban areas contribute very little to the income of households in the communal areas (Mushunje, 2005).

5.8 Marketing

According to Zenda (2002) efficient marketing systems are an important stimulus of high production. Further to that, it was noted that market availability for a particular yield output influences farmer's crop choice decisions positively. As such, farmers were asked to reveal the marketing channels that they use when selling their crop output. The results of the survey on

marketing channels used by farmers in both Gutu and Masvingo districts are illustrated in Table 5.14.

Table 5.14: Marketing channels used by farmers

Marketing Channel	***% of respondents non small grain producers***	***% of respondents small grain producers***
Local people	9	27
Shops/Schools	8	8
GMB	5	____
Did not sell	78	65

Table 5.14 above shows the different marketing channels that the farmers used for their crop output. The most used marketing channel for both maize and small grains was local people. About 9% of farmers reported that they had sold their maize to local people. While on the other hand, 27% of small grain producers had used this channel to market sorghum and finger millet. This was the most preferred marketing channel because there were no additional transaction costs and it was easy to deliver the produce to the buyer. The second most used marketing channel was that of shops/schools where 8% of farmers had used for both maize and small grains. However, a very small proportion of farmers (5%) had managed to produce surplus maize grain to sell to the Grain Marketing Board (GMB). Nonetheless, of all interviewed farmers none had managed to produce enough surplus small grains (sorghum and finger millet) to market through the GMB. On the other hand, 78% of farmers had not managed to produce any surplus maize to sell. In the same way, about 65% of farmers did not sell their small grain output. This shows that most of the farmers had managed to produce only enough to meet household subsistence requirements.

5.8.1 Marketing problems faced by farmers

Table 5.15 below illustrates some of the marketing problems that farmers highlighted. Fourteen percent of farmers stated that they faced transport problems in marketing of their produce. This was especially true for those farmers who would have produced a maize surplus that they wanted to market to the GMB. Farmers cited that there were problems in terms of availability of transport. In addition, they reported that if they find the transport, the transportation costs were too high. As a result, they end up eroding greatly on their profit margins.

Table 5.15: Marketing Problems

Category	***Percentage of respondents (%)***
Transport problems	14
Market information	25
Sourcing inputs	83

Market information was another major problem that farmers encountered when selling their output. Because of this lack of market information, 25% of farmers reported that they end up selling their output at very low prices. Eighty three percent of the farmers revealed that they faced problems in sourcing inputs. They stated that seed inputs for crops such as sorghum and finger millet were usually not readily available on the market. On the other hand, supply of inputs of maize seed and fertilizer were quite sporadic on the market. Further to that even if they were available farmers complained that their prices were too high, which they could not afford. Hence, as a result this influenced negatively on their planting time after the onset of the first rains. Consequently, this affected yields.

5.9 Conclusion

The chapter has discussed the different household demographic as well as farm characteristics of the study population. Results of the survey tend to suggest that household characteristics such as gender and age have an influence on small grain production. This is because small grain production was found to be more prevalent in female headed households and amongst older household heads. The results of the survey have revealed that the major constraint farmers' encounter in small grain production was low yields compared to maize. Consequently, these low

yields coupled with lack of credit in terms of seed and fertilizer made small grain production unattractive to farmers. Further to that, the results of the analysis have shown that finger millet and sorghum have higher gross margins than maize.

CHAPTER 6

EMPIRICAL RESULTS

6.1 Introduction

This chapter presents research findings in an attempt to address set objectives and operational research questions of the study. The chapter commences by explaining the results of the Gross and Net Food Security indices. This was in an effort to try to establish any possible link between small grain production and household food security. Furthermore, results of the logistic regression model are explained in trying to identify significant factors that affect small grain production in Zimbabwe's communal areas. Significant variables are explained and this is followed by the conclusion of the chapter.

6.2 Household food security status

This section presents empirical findings on the comparison of household food security status between small grain producing households and non producers. The implied objective was to compare and establish households, which are more food secure between small grain producing and non small grain producing. The underlying hypothesis was that small grain producing households are more food secure than non producers. The formula of Gross Food Security Index (GFSI) and Net Food Security Index (NFSI) that was discussed in Chapter 4 was used. Partial inferences were made based on the descriptive statistics results. Table 6.1 below gives a cross tabulation summary of food security of a household with respect to their farming type at gross food security level.

Table 6.1 shows that 60.8% of all the interviewed households were food secure at gross level, while 39.2% were food insecure. Therefore, as a partial indicator of food security status of households it can be inferred that most households both small grain producers and non small grain producers were food secure. Furthermore, a significant relationship (*p-value:* 0.000) was confirmed between food security and small grain production at Gross food security index according to the *Pearson Chi-Square*, although at this level results could not ascertain the strength and direction of the association.

Table 6.1: Gross Food Security Index Cross Tabs7

Household Characteristic		Gross food security index		Total
		secure	insecure	
non small grain producer	Count	27	33	60
	% of Total	22.5%	27.5%	50.0%
small grain producer	Count	46	14	60
	% of Total	38.3%	11.7%	50.0%
Total	Count	73	47	120
	% of Total	60.8%	39.2%	100.0%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.626	0.000*
N of Valid Cases	120	

*Significant at 99 %

Table 6.2 presents a summary of association between small grain production and food security at net level. A significant relationship (*p-value*: 0.027) was confirmed between food security and small grain production according to the *Pearson Chi-Square*. The results at Net gross food security index were most households were rendered food insecure concurs with farmers' responses during the survey. About 63 % of farmers had reported that they had not managed to produce enough grain to last until the next season. However, most of them reported that they end up selling some of their output to meet other financial obligations. Farmers reported that this was prevalent especially just at the end of the harvesting season to pay school fees. Furthermore, such sells were also common throughout the year. This was as a way of meeting other financial demands such as medication or buying household foodstuffs.

Table 6. 2: Net Food Security Index Cross Tab

Household Characteristic		Net food security index		Total
		secure	insecure	
non small grain producer	Count	20	40	60
	% of Total	16.7%	33.3%	50.0%
small grain producer	Count	32	28	60
	% of Total	26.7%	23.3%	50.0%
Total	Count	52	68	120
	% of Total	43.3%	56.7%	100.0%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.887	0.027*
N of Valid Cases	120	

*Significant at 99 %

Since at this level the results could not ascertain the strength and direction of the association between small grain production and household food security a further analysis was undertaken. Using a non-parametric correlation model the association between food security estimated through gross and net food security index of households and small grain production was investigated. Table 6.3 summaries the *Kendall`s tau_b* and *Spearman`s rho* correlation matrix between small grain production and food security.

Table 6.3: Summary of *Kendall`s tau_b* and *Spearman`s rho* results

			Small grain production	Gross food security index	Net food security index
Kendall's tau_b	Small grain production	Correlation Coefficient	1.000	0.067	0.438**
		Sig. (2-tailed)	.	0.464	0.000
		N	120	120	120
	Gross food security index	Correlation Coefficient	0.067	1.000	0.368**
		Sig. (2-tailed)	0.464	.	0.000
		N	120	120	120
	Net food security index	Correlation Coefficient	0.438**	0.368**	1.000
		Sig. (2-tailed)	0.000	0.000	.
		N	120	120	120
Spearman's rho	Small grain production	Correlation Coefficient	1.000	0.067	0.438**
		Sig. (2-tailed)	.	0.466	0.000
		N	120	120	120
	Gross food security index	Correlation Coefficient	0.067	1.000	0.368**
		Sig. (2-tailed)	0.466	.	0.000
		N	120	120	120
	Net food security index	Correlation Coefficient	0.438**	0.368**	1.000
		Sig. (2-tailed)	0.000	0.000	.
		N	120	120	120

**. Correlation is significant at the 0.01 level (2-tailed).

The results show that no significant correlation was confirmed between small grain production and food security status of households at gross food security level. The possible reason may be on the lack of specificity of gross food security index to distinguish the relative food insecurity status of small grain producers and non producers. Hence, as a result the net food security was used to investigate the relationship further.

At net food security level of households a weak positive linear correlation between small grain production and food security was confirmed. At 99% both *Kendall`s tau_b p-value* of (0.000) and *Spearman`s rho p-value* of (0.000) were obtained indicating linear correlation between the two variables. The absolute value of the coefficient (0.438) was obtained indicating a weak relationship between small grain production and food security at net food security level. Based on the results from non-parametric correlation models used, the study can infer a weak positive correlation between small grain production and food security at household level.

This association might be attributed to small grain producing households being able to produce more grain for household consumption than non small grain producing households. This is because even though small grains are assigned smaller pieces of land (3% and 6% for sorghum and millet respectively) they are produced in conjunction with maize. Overall, small grain producing households would end up having more grain at their disposal than non small grain producers.

The other reason small grain producing households have a slight advantage in their food security status compared to their non small grain producer counterparts might be inferred from the previous Chapter. It was shown that small grain producing households have a slight advantage in their off farm income sources mainly through beer brewing. This might result in their being more food secure than their non small grain producers' counterparts. The results from the same chapter also showed that small grain producing households have a slight advantage in livestock ownership compared to non small grain producers. All these might be reasons why small grain producing households have a slight advantage in their food security status compared to non producers.

6.3 Estimated Parameters of factors that affect household small grain production

The logistic regression model with thirteen predictor variables was regressed against a dependent dichotomous variable of household small grain production status. This was to identify significant factors likely to influence farmer participation in small grain production. This section presents the results of the logistic regression model and discusses results of the significant variables. All

the variables that were discussed in Chapter 4 were considered for the model and tested for their significance. Table 6.4 below summarizes the results of the logistic regression model.

Table 6.4: Estimated Parameters of factors that affect household small grain production

Variable	**B**	**Std error**	**Wald Statistics**	**Significance level**
Labour	0.547	0.321	3.964	0.032*
Cattle ownership	0.725	0.498	4.325	0.029*
Educational level	-0.426	0.714	0.197	0.5610
Farm size	0.608	0.352	5.980	0.011*
Age	0.153	0.017	12.982	0.000**
Gender	-0.734	0.733	1.246	0.3650
Extension	1.788	0.620	4.314	0.025*
Access to credit	2.018	1.063	9.029	0.006**
Market access	-0.004	0.618	0.000	0.8950
Marital status	3.485	1.409	5.670	0.224
Asset ownership	-0.227	0.387	3.481	0.971
Crop yields	2.341	1.732	6.954	0.019*
Crop income	-0.581	0.81	4.794	0.680
Constant	-7.365	3.107	3.924	0.058

Chi-square (df =9) = 64.214

(-2) Log likelihood = 103.426

Nagelkerke R^2 = 0.765

Number of observations N = 120

Note ** and * indicate significance at 0.01 and 0.05 probability level respectively

As shown in Table 6.4, some predictor variables influence farmer participation choices in small grain significantly. Out of the thirteen predictor variables seven were statistically significant ($p < 0.05$) and these are labour, cattle ownership, farm size, age, extension, access to credit and crop yields. In some cases, the signs of the estimated coefficients were consistent with the *a priori* expectations whereas in some they were contrary to expectations. The results are discussed in detail in the following section.

6.3.1 Labour

The positive significant coefficient of labour indicates its positive influence on farmer's decision to produce small grains, which was as presumed. The significance value of 0.032 implies that there is enough evidence to support that household labour availability affect small grain production. Per every unit increase in labour a 0.547 increase in the log odds of participation in small grain production is expected holding other independent variables constant. This means that the amount of family labour available has an influence on farmer's decision on crop production. Those households with more family labour are more likely to engage in small grain production compared to those households without adequate family labour.

This result is consistent with the findings of Phororo (2001) that the larger the number of people in the farming households, the greater the crop production diversity and the possibilities to cultivate larger areas. This is because communal areas are characterized by a heavy reliance on labour intensive methods of cultivation. These findings are further supported by Food Studies Group (1990); Mallet and Plessis (2001) that processing of small grains especially during threshing and harvesting imposes labour constraints on farmers as it competes with other on-farm and off farm activities. Hence, availability of family labour is a determinant of production for small grains as noted by Govereh and Jayne (1999).

6.3.2 Cattle ownership

Households who own livestock would be expected to have greater flexibility on crop production choices. This is because in communal areas livestock ownership determines availability of draft power. In this study a positive and significant (0.029) relationship was found between livestock ownership and small grain production. The significance value is consistent with the *a priori*

expectations. Furthermore, the results indicate that for every unit increase in livestock ownership there is a 0.725 increase in the log odds of a farmer participating in small grain production. Therefore, it can be implied that farmers with draft power are more likely to engage in small grain production compared to their counterparts who do not have draft power. This is given the fact that draft power facilitates land preparation, weeding and application of manure on crops. These findings concur with earlier studies by Govereh and Jayne (1999) that cattle ownership enables households to cultivate greater areas of land as well as to grow more crops and to execute agricultural operations timely. Whilst on the other hand those without draft power would have problems in land preparation as they had to wait and hire it at a cost or use hand hoes. Results of the survey also revealed that preference for land preparation was given to maize. Hence, as a result those households who wait to hire draft power could end up failing to produce small grains as the season could have progressed.

6.3.3 Farm size

A positive and significant (0.011) relationship was found between farm size and participation in small grain production. The results are consistent with *a priori* expectations. The results imply that those households who own large area of land are more likely to engage in small grain production, as they would not be facing land constraints. Similar findings were observed by Najafi (2003) that total size of fragmented plots that communal farmers own affect the number of crops they can produce and consequently food production.

With the persistent land shortages in communal areas of Gutu and Masvingo districts, despite the fast track land distribution, such a trend would be expected. Therefore small grain production would be competing for the limited available land with maize production. However, maize production is given preference in crop production therefore those farmers who would be having land constraints are more likely not to produce small grains.

6.3.4 Age

The positive significant coefficient (0.000) of household head age indicates its positive influence on participation in small grain production, which was as presumed. Per every unit increase in household head age a 0.153 increase in the log odds of participation in small grain production by

households holding all other independent variables constant was confirmed. This relationship may be explained by the fact that older household heads either have better access to land than younger heads, because younger men have to wait for a land distribution, or have to share land with their families. In the same way, older heads got land from traditional leaders long ago when land was not as scarce as it is these days. Moreover, this relationship might be attributed to the fact that generally farming in these districts was practiced by older people as the youngsters would have moved to seek employment in urban areas.

6.3.5 Access to extension services

It was expected that availability of extension services would influence farmer small grain production positively *ceteris paribus*. The results shown in Table 6.4, for this variable are consistent with the *a priori* expectations. This implies that regular contact with an extension worker is necessary to enhance small grain production. Extension service provides the necessary information, knowledge and skills in order to enable farmers to produce small grains. This finding is in conformity with studies by Kaliba *et al* (2000) that extension service is a good indicator of a farmer's knowledge of agricultural information. This suggests that farmers tend to produce a particular crop based on the knowledge that they have on that specific crop.

However, the majority of farmers in Gutu and Masvingo have not been able to obtain extension information regarding small grain production. This was because most farmers reported that in their fortnightly meetings with the extension worker they received information geared towards the production of maize. This is due to government policies, which mandate extension workers to disseminate such kind of information in these districts. Therefore, this has created the conventional belief that maize is the major crop that should be promoted in these areas.

6.3.6 Access to credit

Access to credit was a positive and statistically significant factor (0.006) in influencing farmer small grain production choice. Therefore, there is sufficient evidence to support that availing of credit in terms of seed and fertilizer is likely to encourage households to produce small grains. The results tally with findings by Kurukulasuriya and Mendelsohn (2007) that credit availability

in terms of seed and fertilizer is one of the most important factors in influencing crop production choice.

The result is also in conformity with earlier studies by Kidane *et al*., (2005) that, subsistence farming, by its nature, is production for direct consumption. Therefore, access by farmers to any farm input (seed or fertilizer) is expected to boost the overall production of that particular crop.

This result tends to suggest the probability that if credit in terms of seed and fertilizer is availed to farmers for small grain production most farmers might tend to produce these crops. This is because most farmers who were interviewed had not received credit for small grain production. Rather most credit that was being availed from companies, NGOs, and government was for maize production. Currently input credit is not availed for small grain production because these crops are still viewed as minor crops contributing very little to household food security of smallholder farmers.

6.3.7 Crop yields

A positive significant (0.019) relationship was found between crop yield and participation in small grain production. The results were consistent with *a priori* expectations. The results tend to suggest that if small grains can offer higher yields, farmers might be attracted to uptake their production. This result point out to the importance that farmers attach to crop yield as a major factor when deciding on crop production as noted earlier by Kurukulasuriya and Mendelsohn (2007).

6.4 Evaluation of performance of the model

The Hosmer and Lemeshow Goodness of Fit test was 0.4734. This indicates that the model is a good fit as it predicts values significantly similar to what they ought to be (observed values). This is because if the Hosmer and Lemeshow Goodness-of-Fit test statistic is 0.05 or less, we reject the null hypothesis that there is no difference between the observed and the predicted values of the dependent. Nonetheless, this does not mean that the model necessarily explains much of the variance in the dependent variable, only that it does so to a certain degree.

6.5 Conclusion

This chapter provided results of the Gross and Net food security index as well as those of the logistic regression model. The results of the GFSI and NFSI indicate that there is a relationship between small grain production and household food security. A further analysis was undertaken using the non parametric correlation matrix of *Kendall`s tau_b* and *Spearman`s rho* to ascertain this relationship. At net level a weak relationship was confirmed. Based on these results at this level it was inferred that small grain production enhances household food security.

Results of the logistic regression model revealed that factors such as labour, cattle ownership, farm size, age, extension, availability of credit and crop yields significantly affect small grain production at household level. Generally, the results tend to suggest that an adjustment in one of the significant variables can lead to increased production of small grains at household level. Therefore, this tends to suggest that measures such as availing of credit for small grains can lead to increased production of small grains in Zimbabwe's semi-arid areas. This leads to the next chapter where policy recommendations for improved production of small grains are highlighted given their potential to enhance household food security. The chapter also summarizes the research and suggests areas of further study.

CHAPTER 7

CONCLUSIONS AND POLICY RECOMMENDATIONS

7.1 Introduction

This chapter summarizes and concludes the study. The major findings of the study are briefly mentioned. These were guided by the specific objectives that were stated in chapter one. The chapter then provides possible policy recommendations based on the results from the analyzed data. Finally, the chapter concludes by exploring areas of further study.

7.2 Research Summary

The main purpose of this study was to investigate the major factors that affect small grain production in Zimbabwe's semi-arid areas. A comparison of the household food security status was undertaken between small grain producers and non producers.

Results obtained from the research indicated that household demographic characteristics such as gender and age of household head influence small grain production. This is because it was revealed that small grain production was more prevalent in female headed than in male headed households. Further to that, about 38% of small grain producers' were in the age range of between 50-59 years. This is probably because younger people migrate to urban areas to find other forms of employment, which offer better incomes leaving farming to be done by the older generation. Moreover, the study revealed that this older heads had better access to labour and land compared to younger heads.

In addition, other farm characteristics such as family labour and cattle ownership were found to have an influence on small grain production in the study areas. Generally, families that were engaged in small grain production on average had more family labour compared to those who were not engaged in small grain production. Similarly, those households who were engaged in small grain production on average had more cattle than non producers. This was because cattle ownership enables timely land preparation and gives flexibility in the number of crops that can be grown by the household.

The major crops that were grown in the two districts were maize, groundnuts, roundnuts and finger millet. However, in terms of average area devoted to each crop, maize was allocated the biggest portion 72%. In the same way, relatively small portions of land were devoted to finger millet and sorghum production, 6% and 3% respectively. This shows that production of small grains is not prioritized in semi-arid communal areas of Zimbabwe.

Farmers were asked to rank the major constraints that they encounter in small grain production. This was a way of getting further insight in the factors that affect small grain production in semi-arid areas. The major constraint that they mentioned was low yields from small grains compared to maize. This was followed by lack of credit in terms of seed for small grain production. They mentioned that these constraints caused production of small grains to be unattractive.

The gross margin budgets for each of the three crops were also computed. Finger millet and sorghum were found to have higher gross margins than maize. The higher gross margin of small grains emerged from their lower variable costs compared to maize.

In terms of income, sources there were no major differences between the two categories of farmers. However, small grain producers generated slightly more income mainly as a result of beer brewing.

A comparison of household food security between small grain producers and non small grain producers was undertaken using Gross and Net food security indices. Partial inferences that were made both at Gross and Net Food Security index indicated that there were more small grain producing households who were food secure than non small grain producers. However the *Kendall`s tau_b* and *Spearman`s rho* correlation matrix indicated a weak positive linear correlation between small grain production and food security at net level.

The logistic regression model was used to estimate factors that influence farmer participation in small grain production. Thirteen predictor independent variables were regressed against the binary dependent variable of small grain production status of households. The significant variables were labour, cattle ownership, farm size, age, extension, yield and access to credit ($p<0.05$).

7.3 Conclusions

A number of factors affected small grain production in Zimbabwe's semi-arid areas. These vary with household characteristics, farm characteristics and institutional factors. The major factors identified were age, labour, access to credit, extension, farm size and cattle ownership. However, the major constraint that farmers complained about was lower yields of small grains compared to maize. The lower yields were caused by the fact that farmers resorted to the use of retained seed from the previous cropping season. The lower yields make it difficult for small grains to compete with maize for the communal farmer's limited resources.

The computed gross margins for the three crops showed finger millet and sorghum had higher returns than maize. This was despite the fact that yields and selling price for small grains were lower than maize. The higher gross margins of small grains with minimal input usage under the current conditions was an indication that small grain production is a more viable enterprise, which is capable of bringing higher net income to farming households. This was a different case with maize were farmers get subsidised inputs (seed and fertiliser) from government and non-governmental organizations (NGOs) for its production.

Nevertheless, the potential of these crops to alleviate household food security in Zimbabwe's semi-arid areas can be unlocked. This entails a joint effort from government, the private sector and NGOs to address the major challenge of low yields from small grains. This is because improved production of these crops in semi-arid areas has the potential of improving household food security as was highlighted by their higher gross margins compared to maize. However, to achieve this, there is need to promote extension services and strengthening of input and product markets for small grain production.

7.4 Policy Implications and recommendations

Based on the results drawn from the study it has been shown that small grains have the potential to improve household food security if the necessary support for their production is given. However, the study highlighted that the major hindering factor affecting small grain production are their low yields compared to maize. It is suggested that policies be crafted that encourage

research of high yielding varieties of finger millet and sorghum suitable for natural region IV and V.

The other major important factor, which was shown to constrain production of small grains in semi-arid areas, was lack of credit in terms of seed and fertilizer for small grains. These findings are supported by literature that the trend in Zimbabwe has been that the government has been treating farmers as a homogenous group by issuing maize inputs throughout all the agro-ecological farming zones. Rather it is recommended that farmers in areas such as Gutu and Masvingo, which are considered semi-arid, be assisted with subsidized hybrid seeds and fertilizer for finger millet and sorghum production. According to Taylor (2003), these crops are known to have better adaptability to such agro-ecological environments over the main staple maize. Therefore, concerted efforts are required from government, non-governmental organizations (NGOs) and the private sector to extend credit to farmers for the production of small grains.

Pursuing this further, the green revolution in the 1980s emerged because of strong government policies that supported maize production. Therefore, it is suggested that if similar policies are replicated for sorghum and finger millet there might be an increase in production of these crops in semi-arid areas where they have a comparative advantage over maize.

Policies that strengthen input and product markets for sorghum and finger millet in Zimbabwe's semi-arid communal areas are also recommended. This might act as a great incentive for farmers to adopt production of these crops on a large scale. This is in view of price differences between small grains and maize on the market. Hence, in terms of market potential there is a good reason to expand production of sorghum and millets in Zimbabwe's semi arid communal areas.

The government also needs to promote extension services so that farmer's knowledge about finger millet and sorghum production can be improved. This will hasten the process of reviewing the competitiveness of sorghum and millet in Zimbabwe's semi-arid regions and boost household food security. This is in view of the changing climatic conditions and a host of other factors that have been affecting household food security in Zimbabwe.

There is need to reduce the labour burden involved in production of small grains if farmers are to be attracted towards their production. In that regard it is suggested that policies be crafted that encourage technological innovation from planting to harvesting of small grains.

Non Governmental Organizations (NGOs), government and the private sector need also to revisit the issue of handouts. In some areas of Zimbabwe, handouts have been given to communities in the form of milled sorghum. Rather resources should be channelled towards increased production of finger millet and sorghum in these semi-arid areas where they are better adapted to the climatic conditions than maize. These initiatives include the following but are limited to:

- Better varieties for sorghum and millet
- Input packages for small grains
- Improved pest management methods with the focus on quelea birds.

Development of policies that encourage sorghum and finger millet production should also be viewed beyond the objective of achieving household food security. Other holistic economic benefits that can be reaped for the macro economy, as a whole, need to be considered. These include ripple effects favourable to the agro processing sectors. That is the other long term goal will be to encourage production of small grains for commercial use in various sections of the economy. Such sectors include the animal feed industry, cereal production and commercial use to produce opaque and lager beer as well as other sectors of the economy.

7.5 Areas of further Study

The study was conducted only in two districts in Masvingo Province with 120 respondents being interviewed. However, the study can be expanded to incorporate a bigger sample size and draw better conclusions. Moreover, the study was also mainly focusing on factors that affect finger millet and sorghum production in semi-arid areas of Zimbabwe. In addition, their potential contribution to household food security was investigated. From an economic point of view, there is need to broaden the research to incorporate other economic benefits of small grains at macro level. Such studies might investigate the possible benefits that can accrue as a result of increased commercial use of small grains. There is also a need for agricultural economists to work closely

with crop scientists to research finger millet and sorghum varieties that offer higher yields and better taste than maize. This can cause increased adaptation and shift in crop production patterns from the main staple maize to small grains in semiarid areas. The study was also focusing on only two small grains that are sorghum and finger millet. The study can be expanded to look also at other small grains such as pearl millet.

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APPENDIX: Questionnaire

Household Survey Questionnaire

BACK GROUND INFORMATION

Date…….

Enumerator name……..

Name of village…….

Name of respondent (Optional) ……

Relation to household head …….

A.DEMOGRAPHIC DETAILS

Fill in the relevant information and where possible mark with an X

A.1. GENDER		**A.2.** AGE (Years)	**A.3.** MARITAL STATUS				**A.4.** HOUSEHOLD SIZE
M	F		Single	Married	Widowed	Divorced	Total

A.5. How many household members assist with farm labour……?

A. 6. What is the highest educational level the head of household has completed? (Mark with an X)

No formal education	Primary school only	Secondary/High school	Tertiary education	Other (specify)

A.7. What is your employment status?

EMPLOYMENT STATUS		
	Tick	Average Income (Rand per month)
Full time farmer		
Part time farmer		
Formally employed		
Pensioner		
Unemployed		
Other (Specify)		

B. LAND OWNERSHIP AND TYPES OF CROPS GROWN

B1. How much land do you own in hectares……..

B2. Are you satisfied with the size of the land [1] Yes [2] No

B3. If no how big would you want it to be…….

B3 a) Do you consider your land to be [1] fertile [2] average [3] not fertile

B4. Which crops do you grow?

Crop	**Area devoted to crop**	**Yield (tonnes)**	**Amount consumed(t)**	**Amount sold**	**Amount of income (Rands)**
Maize					
Sorghum					
Finger millet					
Ground nuts					
Round nuts					
Beans					
Wheat					
Sunflower					
Other (specify)					

B5. Where did you get inputs to grow each of the above crops?

Crops	**Seed**				**Fertilizer**		
	1.Purchased 2.Government Input Scheme 3.Stored from last season 4.Borrowed 5.Other				1.Purchased 2.Government Scheme 3.Did not apply 4.Other		
Maize							
Sorghum							

Finger millet							
Ground nuts							
Round nuts							
Beans							
Sunflower							
Other Specify							

B6 Do you get some extension services from AREX officers pertaining the crops that you produce?

[1] Yes [2]

B6 a) If yes how often?

……

B6b) What type of information do you get from extension officers?

……..

B7. Which crop do you prioritize to plant first during the beginning of the season?

…….

B8 Why prioritize the crop? .....

B9. Which factors do you consider when deciding which crops to grow (list according to order of importance)? Rank 1 least important and 5 as most important.

Factor	**Crop**	**Rating**
a)Seed availability		
b)Fertiliser availability		
c)Labour intensity		
d) Land Area crop use		

e) Drought tolerance		
f) Market availability		
g)Expected incomes		
h)Extension availability		
i) Amount of food generated		
j) Quelea birds		
k) Poor soils		
l) Other Specify		

B10. Do you sometimes fail to grow your required area of maize because of input unavailability? 1) Yes 2) No

B11. Do you sometimes fail to grow small grains sorghum and finger millet because of unavailability of inputs? 1) Yes 2) No

B12. If yes what kind of assistance do you want? Explain……..

B13. What other constraints do you face in production of sorghum, maize and millet?

Key: rank 1 least important 5 most important

Crop			**Constraint**	**Rank**
Maize	Sorghum	Millet		

B14. How do you store the crop and how long does it last you after harvest?

Crop	**Storage method** **1) Apply chemicals** **2) Dry the crop and store in granaries** **3) Other specify**	**Period after harvest with the crop (months)** **1) 1-4** **2) 5-8** **3) 9-12**
Maize		
Sorghum		
Finger millet		
Ground nuts		
Round nuts		
Beans		
Wheat		
Sunflower		
Other specify		

C. INCOME

C1. Which crops did you realize a lot of income and what did you use it for?

Crop	**Income**	**Use**

C2. What other income generating activities do you do?

……..

C3. How much money did you realize from the activity (Rands)?

…….

D. MARKETING

D1a) Where did you sell the crops you grow?

Crop	**Market**
Maize	
Sorghum	
Finger millet	
Ground nuts	
Round nuts	
Beans	
Wheat	
Sunflower	
Other specify	

[1] Locally to neighbours [2] Hawkers [3] School teachers [4] Local shops [5] other specify

D1 b) Do you have problems in selling some of your crops? [1] Yes [2] No

D2a) If the answer is Yes specify crop……

D2b) Specify nature of the marketing problem

1) no readily available market 2) did not produce enough to market 3) market too far

4) price offered on the market too low 5) other specify

E. LIVESTOCK AND HOUSEHOLD ASSET ENDOWMENTS

E1a). Livestock Type

Livestock	Cattle	Goats	Sheep	Chickens	Donkeys	Pigs	Other (Specify)
Numbers							

E1b) Did you sale any of your livestock for the 2008/2009 season? [1] Yes [2] No

E1c) If 'yes' specify livestock and amount……

E2. Assets

Type of assets & implements	**Numbers**	**Value of assets**
Plough		
Hoe		
Shovels		
Scotch cart		
Harrow		
Car		
Seed planter		
Car		
Tractor		
Brick house		
Cultivator		
Other		
1)		
2)		
3)		

F. FARM OPERATIONS AND HOUSEHOLD COPING STRATEGIES

F1. What type of draught power do you use?

a) own draught power b) hired c) hand digging d) zero tillage f) other specify…….

F2. Which crops are given preference in land preparation and why?

……

F3 a) For the farming season 2008/2009 did you produce enough grain to last until next harvest?

1. Yes 2.No

F 3b) If the answer to question a) is 'no', are you able to purchase supplement grain?

1. Yes 2.No 3.N/A

c) If the answer to b) is 'no' what consumption coping strategies do you use?

1) Reduce number of meals

2) Borrow from relatives and friends

3) Switch to substitutes (specify)

4).N/A

5) Other specify

F4. What kind of assistance do you want to increase crop output and household food security?

……

END THANK YOU