EFFECT OF THE REDUCED FARMER INPUT SUPPORT PROGRAMME PACK SIZE ON SMALL SCALE FARMERS' MAIZE YIELD

A case of Katuba Constituency (Chibombo District-Zambia)

A Research Project submitted to Van Hall Larenstein University of Applied Sciences in Partial Fulfilment of the Requirements for the Degree of Master in Management of Development, specialisation Rural Development and Food Security (*MOD RDFS*)

By

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ABSTRACT

This report is on the findings of the effect of the reduction of the fertiliser and seed pack sizes under the government's Farmer Input Support programme (FISP) on maize yield for the small scale farmers. The programme gives inputs in the form of fertiliser and hybrid maize seed to the small scale farmers that are members of cooperatives or farmer associations at a subsidised rate of 75%. Following the reduction in the quantities of the inputs from 8 x 50 kg bags of fertiliser and a 20 kg bag of hybrid maize seed to 4 x 50 kg bags of fertiliser and a 10 kg bag of hybrid maize seed, the small scale farmers were expected to improve their maize yield from past figures of between 1.7- 2 tonnes per hectare to about 3-4 tonnes in a half hectare although no time frame was given in which to achieve this. The improvement in the yield was going to be as a result of good management practices and farming techniques arising from managing a smaller plot of hybrid maize. This reduction was effected in the 2009/10 and 2010/11 farming seasons and this research tried to establish whether small scale farmers were getting better yields and using good management practices in hybrid maize cultivation.

The study was undertaken in Katuba constituency in Chibombo district of Zambia which is about 20 km north of Lusaka city, the capital of Zambia with a population of around 56,628 with small scale farming being the main livelihood of many households. The study interviewed thirty (30) small scale farmers that have benefited from the adjusted inputs and a key informant who was the Camp Agricultural Extension Officer in the area. Farmers provided information on input accessibility, management practices, labour, access to extension services and the rainfall performance while the key informant mainly gave information on the management practices by the farmers.

The findings of the study showed that the farmers did not achieve higher yields following the reduction of the input pack size. A total of 17.4 hectares was cultivated by 26 farmers each with the average plot size of 0.7 hectares in the 2009/10 farming season and 18.7 hectares by 24 farmers with the average of 0.8 hectares per farmer for the 2010/11 season. From the total land cultivated a total of 30.3 tonnes of maize was harvested in 2009/10 season and 32.75 tonnes in the 2010/11 thus presenting average yields of 1.74 tonnes/ha for 2009/10 season and 1.76 tonnes/ha for the 2010/11 season. The yields are almost the same level to the previous yields which they used to get before the inputs were reduced. The results also show that women farmers performed poor in terms of the yields that averaged 1.5 tonnes/ha while the average for men was 2 tonnes/ha

The research revealed the possible reasons why the small scale farmers still were achieving low yields despite managing smaller portions. The late delivery of inputs by the government contributed to the low yields because this led to late planting. The majority of the farmers reported receiving inputs as late as January when they were supposed to plant around November. The other reason was due to poor management practices by the small scale farmers. It was discovered that some farmers were weeding their fields late and others only did it once claiming lack of adequate labour to weed. The poor fertiliser application methods that included broadcasting of fertiliser particularly compound D fertiliser, using hands in applying and measuring the quantities. The lack of pest control especially mice which the farmers said destroyed their planted seeds and seedlings meant that the yields were directly affected as a result of reduced plant population. Very few farmers practiced crop rotation which meant that they have been cultivating maize in the same fields for a number of years that would have led to the deterioration of the soil. The poor rainfall patterns for the 2010/11 season could have also contributed to the low yields and lack of extension services to the farmers. Over three quarters of the farmers never received any extension services from government or other organisations. The other important factor not considered by the study but led to the computation of lower yield figures were the post-harvest losses as these losses are always there when harvesting.

Arising from the poor yields from the small scale farmers the study recommended the government to ensure timely distribution of inputs so that farmers were able to plant early and also considering the revision of the pack so that farmers are able to get the inputs according to what they can manage to grow and not restricting the inputs to maize production only. Also enhancing agricultural extension services, promotion of farmer associations and small irrigation schemes.

DEDICATION

This work is dedicated to my beloved wife and friend, Muleme Harah Sitali for the love and moral support she has always given me.

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First I wish to express my sincere gratitude to Eddy Hesselink my supervisor and course coordinator for the good guidance throughout the course of my research without whom this work would have been difficult to accomplish.

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LIST OF ACRONYMS AND ABBREVIATIONS

cm ……	Centimetre
CSO ……	Central Statistical Office
FISP……	Farmer Input Support Programme
FSP……	Fertiliser Support Programme
Ha ……	Hectares
Kg ……	Kilograms
m ……	Metre
MACO ……	Ministry of Agriculture and Cooperatives
n.d ……	No date

1 INTRODUCTION

1.1 Overview of the research

This research was undertaken arising from the agricultural subsidies that the government of Zambia offers to the small scale farmers. The subsidies have been offered in form of hybrid maize seed and fertiliser to the small scale farmers that are members of agricultural cooperatives or associations. Following the downward adjustments to the quantities that each small scale farmer was entitled, this research tried to find out whether the smaller quantities the small scale farmers were now receiving had affected their maize yield. This was understood by the government in the context that if the small scale farmers received smaller quantities of inputs they were going to manage their smaller portions of hybrid maize more effectively by employing better management practices that would result in increased maize yield. It is for this reason that this research tried to determine the assertions made by the government by conducting a study in Katuba constituency which is in Chibombo district of Zambia. The study looked at the management practices that the small scale farmers were practicing and compared to literature and information gotten from the key informant about the best management practices in maize production as these were considered to affect the potential yield for maize. Some factors that would influence maize yield such as the rainfall performance, labour availability, availability of extension services, and the time the inputs were received by the farmers were taken into consideration. The yields were then determined by using a method called farmer estimation which considered the total quantity of maize harvested and dividing it by the total area cultivated. The yields were then compared with the yields that the government anticipated the small scale farmers to achieve and conclusions with recommendations drawn from the study.

1.2 Organisation of the report

This report has been organised into six (6) chapters with each containing subsections. The first chapter begins with an introduction giving the overview of the whole research work, how the research has been organised and a general description of agricultural subsidies. Information about the Farmer Input Support Programme in Zambia and the study area has been given which is followed by the problem statement, research objectives and questions for the study. Lastly the chapter gives the conceptual framework for the study. Chapter two (2) describes the various management practices in maize cultivation followed by Chapter three (3) which describes the methods of data collection. Chapter four (4) is a presentation of interview outcomes from the field which gives raw data from the small scale farmers and the key informant. Chapter five (5) gives the results and discussion of the research arising from the preceding chapter on interview outcomes. The chapter discusses the general information about the respondents, access to inputs by the small scale farmers, management practices, performance of the rain seasons, labour input and access to extension services. In the same chapter discussions about maize yields have been given. Finally, the last part of the report which is Chapter six (6) gives a conclusion and recommendations of the study.

1.3 Agricultural subsidies

Agricultural subsidies are said to be governmental subsidies paid to farmers and agribusinesses in order to supplement their income, manage the supply of agricultural commodities and influence the cost and supply of such commodities (Wikipedia, 2011). Agricultural subsidies have been given to a varying extent to both farmers in the developed and developing countries directly or indirectly. Vina *et al* (2007) emphasises that agricultural subsidies are amongst the factors that determine whether and how agriculture helps the poor in developing countries to make a sustainable livelihood. In the Sub-Saharan Africa fertiliser subsidies have re-emerged as a tool in the agricultural strategies even though there

performances have been disappointing (Banful, 2010). According to Tiba (n.d), the interest that has been shown in subsidies has been the result of several factors that include failures of liberalisation policies, stagnation of agriculture and declining soil fertility. Other factors that have been mentioned are deteriorating livelihoods of poor rural households, rapidly increasing food and fertiliser prices. Minot and Benson (2009) reports that "*proponents of subsidies believe that fertilizer subsidies are the only way to jump-start African agriculture and deliver concrete food security and income benefits to the rural poor*". The same thought is shared by Wiggins and Leturque (2011) who also highlights the importance of agricultural subsidies as in helping to overcome poor farmers' inability to obtain credit or take risks.

Agricultural input subsidies when implemented in an effective manner can have positive impacts to both the small scale farmers and to the food security of the country as a whole. Dorward (2009) notes that agricultural subsidies have the potential in contributing to wider growth when used in the production of staple grains which contribute to consumers' welfare and real incomes through lowering food prices. In Malawi the input subsides is said to have increased the production of maize from 26% to 60% (Dorward *et al*, 2010). While the Fertiliser Support Programme implemented in Zambia improved small scale farmers' access to agricultural inputs which had managed to distribute a total of 422,000 tonnes of fertiliser covering a total of 1,505,000 hectares of small scale maize (FSP Study Team Report, 2009).

Although there have been a few successes recorded in agricultural subsidies in Africa, these have been overshadowed by challenges that threaten the sustainability of these programmes. Yawson *et al* (2010) in a study in Ghana indicate that there are delays in the release of both coupons and fertiliser to farmers which has detrimental consequences for crop production, the subsidy program, and fertiliser market. Malawi and Zambia faces similar challenges in implementing the programmes that include cost control, timing of input deliveries, effective targeting of subsidised inputs, reducing diversion, fraud and sustainability (Dorward *et al*, 2010; FSP Study Team Report, 2009).

1.4 The Farmer Input Support Programme in Zambia

Maize is Zambia's staple crop that is widely grown by the small scale farmers in the country. Because of its importance to national and household food security the Zambian government through the Ministry of Agriculture and Cooperatives (MACO) reintroduced the policy of providing subsidised agricultural inputs to farmers under the programme called the **Fertiliser Support Programme (FSP)** and was launched in the year 2002 (World Bank, 2010). According to the World Bank report (2010), the main reasons for initiating the FSP was that only 30% of smallholder households were able to access improved maize seed and 20% of the total population of farmers had access to fertiliser. It is against this background that the government realised that small-scale farmers were economically weak to provide adequate demand for private inputs and that this was leading to problems with the erosion of Zambia's resources, low farmer productivity, and increased cases of food insecurity and poverty at the household and national levels (World Bank, 2010). The purpose of the FSP was to improve household and national food security, incomes, access to inputs by small-scale farmers through subsidy and building the capacity of the private sector to participate in the supply of agricultural inputs (FSP Study Team Report, 2009). Under this programme each farmer was expected to receive 8 x 50 kg bags of fertiliser and 20 kg of hybrid maize seed at 75% subsidy (MACO, 2009). However, during the implementation process of the programme a lot concerns were raised with regard to how the whole programme was being administered and had affected the small scale farmers. The FSP study report (2009) points out that there were poor targeting and selection of beneficiaries, delays in distributing inputs and poor fertiliser use efficiency among the targeted farmers. With particular emphasis on poor fertiliser use efficiency the report states that the 2004 crop forecast data estimated an average maize yield of two (2) tonnes per hectare among FSP beneficiaries which is 1 tonne below the expected FSP minimum of 3 tonnes per hectare and attributes the main reasons

for low maize yields as due to poor agronomic practices like delayed planting, poor and untimely fertiliser application, weed infestation among others.

Arising from the complaints and recommendations by various stakeholders in the FSP programme the government made some changes in the administration of the whole programme in the year 2009. The programme was renamed the **Farmer Input Support Programme** (FISP). Under the new FISP programme the input pack size was reduced by half, that is 4 x 50 kg bags of fertiliser and 10 kg hybrid maize seed and in the first year (2009/10) of the FISP a total of 534,000 small scale farmers benefited from 106,836 tonnes of fertiliser and 5,341.9 tonnes of hybrid maize seed (MACO, 2010). The reason given for the reduction was to facilitate the small scale farmers to produce at least three (3) to four (4) tonnes of maize per half hectare or 60 to 80 x 50 kg bags from the average of 1.7 tonnes or 30 to 35 x 50 kg bags per hectare due to improved management of a half hectare arising from early land preparation, use of hybrid seed, use of improved technologies and weed management and the other reason was to increase the amount of beneficiaries (MACO, 2009). However, there was no indication of the period in which the small scale farmers were required to achieve the desired yields.

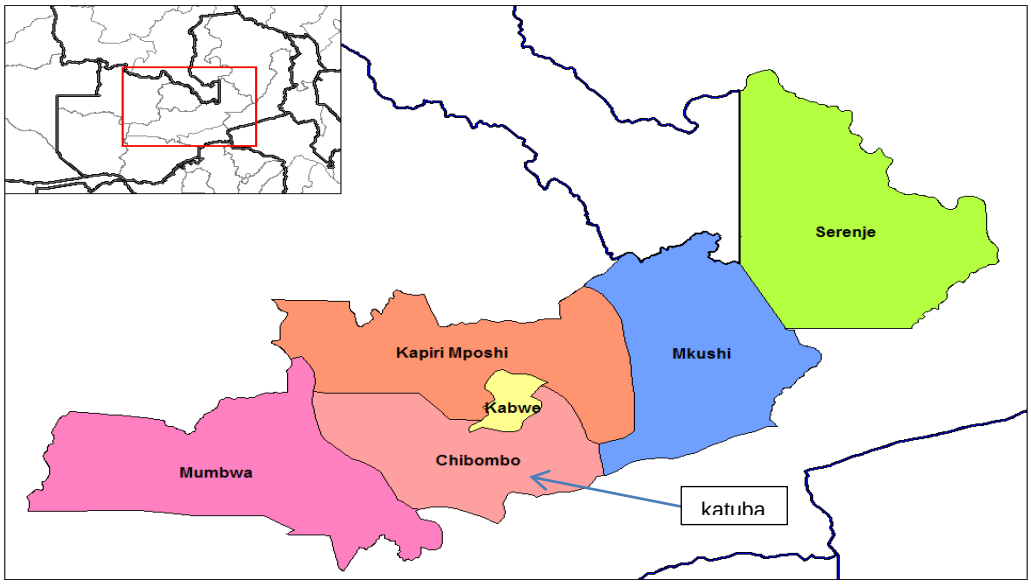
1.5 Katuba constituency in Chibombo district

Due to the limited information about Katuba constituency and Chibombo as a district some of the information given relates to central province or Lusaka province. Katuba is a rural settlement area approximately 20 km from Lusaka (Zulu *et al*, 2006) the capital city of Zambia and is one of the three (3) constituencies in Chibombo district, Central province of Zambia. The other two (2) constituencies are Chisamba and Kembe. Chibombo district is surrounded by Lusaka in the southern part, Mumbwa in the western, in the northern part there is Kabwe and Kapiri mponshi and in the south-east part there is Mkushi district (*see* map below)[1]. Chibombo district as a whole has a total population of 241,612 from which Katuba constituency makes up a population of 56,628. The ratio of male to female in the area is around 50.24% and 49.76% respectively. There are about 9,800 households found in its five (5) administrative wards which are Chunga, Kabile, Katuba, Munchenje and Mungule wards (CSO, 2003). The place is home to the Lenje speaking people under chief Mungule although other tribes such as Ngoni, Lozi, Bemba, Tonga, Shona, and other tribes have settled there because of it being close to Lusaka city.

Being in close proximity with Lusaka city, Katuba constituency has similar climatic features as Lusaka. The altitude is about 1272m above sea level with maximum temperatures in summer around 31.6 °C and 10.1°C as minimum temperatures during winter period. The annual rainfall is around 800mm per annum (ZTB, 2011). Katuba falls within an agro ecological zone region type 2a which are plateau areas of Lusaka, Central, Eastern and Southern provinces and these regions are the most productive parts of the country for food and cash crops (FEWS NET, 2007). Farming is the main activity in Katuba although there are other income generating activities such as animal raising, handcrafts, running shops or restaurants. The crops grown in the area include maize which is the main crop used for consumption, animal feeding with the surplus being sold, sorghum, coffee, amaranth and groundnuts (Zulu *et a*l, 2006). On the other hand, the Central province in which Katuba is part of has 133,109 agricultural households with only crop producing households accounting for 22.3%. The crops grown in the province include maize, sorghum, millet, rice, cassava, mixed beans, soya beans, cotton and groundnuts with maize accounting for 11.3% of the total national production in 2000. In addition cattle, goats and pigs are raised in the province and there are about 26,956 livestock raising households (CSO, 2003).

[1] A detailed map could not be accessed during the research period.

Figure 1: Map showing the location of Katuba in Chibombo district in Zambia



Source: Wikimedia, 2007.

1.6 Problem statement

The government through the Ministry of Agriculture expected that the reduction of the subsidised input pack size would ensure that small scale farmers are able to manage their crop through better management practices thus increasing maize yield. The government noticed that most of the small scale farmers were failing to effectively manage a one (1) hectare plot of maize from the inputs given hence the low yield. There has been no assessment carried out to determine whether the reduction of the input pack size has resulted in improved yields for the small scale farmers.

1.7 Research Objective

The objective of this research was to have a better insight on whether the reduced Farmer Input Support Programme (FISP) pack size has affected small scale farmer's maize crop yield in Katuba area in Chibombo district.

1.8 Research Questions

1.8.1 Main question

What has been the effect of the reduced FISP pack size on small scale farmer's maize crop yield?

1.8.2 Sub-questions

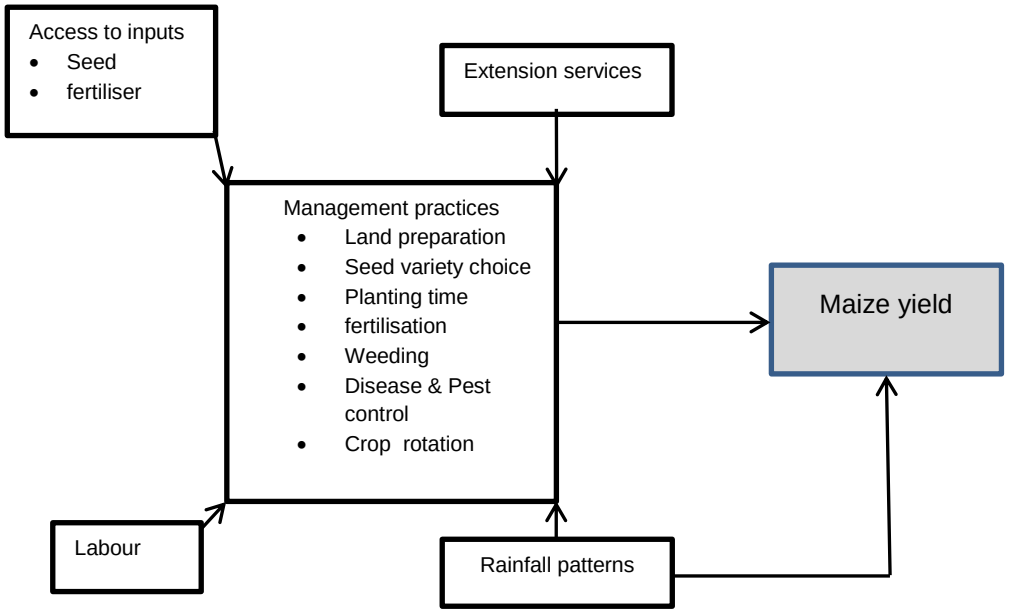
a) What is the maize yield following the reduction of the input pack size?
b) What are the factors affecting maize crop yields?

1.9 Conceptual framework for the research

Maize yield for this research is used to mean the quantity of maize grain produced per unit area. The unit of measure adopted is tonnes per hectare. The yield in maize can be said to

be influenced by various factors. The possible factors identified include management practices which have been discussed further in the next chapter, climatic factors (weather), access to inputs, labour and extension services. The management practices which are the major focus of this research have been limited to the ones listed in the conceptual framework below and are mostly controlled by the small scale farmers themselves. Under access to inputs the research has considered access to hybrid maize seed and fertiliser that is under the control of the FISP programme. Access to labour has been considered in the context of labour source and adequacy that the small scale farmer can influence. Extension services have been limited to the provision of services that relate to maize production and this is mostly done by the government through the Ministry of Agriculture. The climatic factor that the research has considered is the rainfall performance in relation to maize production. The performance of the management practices is greatly dependent on the accessibility of labour and inputs. Rainfall has a bearing on certain management practices like land preparation, planting and weeding. The availability of extension services would have an influence on how the small scale farmers perform the management practices that in turn affect the yield. In a nutshell these theoretical considerations can be presented in the following conceptual framework below that gives the various factors that would affect maize yield among the small scale farmers.

Figure 2: Conceptual framework on the factors that would affect maize yield



2 MANAGEMENT PRACTICES IN MAIZE CULTIVATION

This chapter gives the management practices in maize cultivation for the small scale farmers. This is particularly important because it has a bearing on the maize yield. Because there was no information about the management practices that the small scale farmers were using in the study area, management practices from different authors on the subject have been discussed. These management practices were used together with the information gathered from the key informant to assess whether the small scale farmers were using good management practices in their maize cultivation.

2.1 Land preparation

Good land preparation helps to produce a seed bed by crumbling and loosening the soil and help crop establishment thus making it easier for a crop to grow and produce good yields. The loosening of the soil makes it easier for plant roots to grow and produce stronger crops and better yields while good tillage will let air enter the soil to help plants grow strong (UZ Group Extension Guide, n.d). According to CIMMYT (n.d) land preparation should aim to create a soil structure that encourages the seedlings to emerge rapidly, allows the young plants ready access to the nutrients, control weeds, pests and diseases and ensuring good drainage. King (2000) suggests that the soil should be ploughed to a depth of atleast 25cm and burying crop remains to allow them time to rot into humus. He further suggests that the depth of ploughing should be changed slightly each year to prevent a 'hard' pan forming beneath the ploughed soil.

2.2 Seed selection

The chosen maize variety determines the potential yield that can be achieved. In selecting which maize hybrid seeds to plant NDSU (1997) states some of the factors that should be taken into account as:

- The period of maturity that should correspond with the maturity rating suitable for the area in which the maize will be grown.
- Hybrids with consistently high yields across a number of locations must be selected and the standability of the maize stock must be considered, that is the ability to stand well throughout the season.
- Consider the resistance to disease of the variety and seed quality.

Table 1 shows some of the various hybrid maize seed varieties that are grown in Zambia by the small scale farmers with their potential yields and period of maturity.

Table 1: Some hybrid maize seed varieties grown in Zambia

Seed variety	Producer	Maturity (days)	Potential yield (tonnes/ha)
MM 441	Zamseed	110- 115	6-7
ZMS 606	Zamseed	115-125	8-10
ZMS 616	Zamseed	125-130	10-12
PAN 53	Pannar	125-135	10
PAN 4M-19	Pannar	110	8-10
PAN 6777	Pannar	140-155	11

SC 621	Seedco	148	3-8
SC 627	Seedco	138	8
SC 403	Seedco	125	6
DK 8031	Dekalb	105	5-8
DKC 8053	Dekalb	120-130	10
DKC 8073	Dekalb	140-145	12

Source: Zamseed, Seedco, Pannar and Dekalb

2.3 Planting

Sowing follows after land preparation and according to JAICAF (2008) in Zambia, seeds are sown by mid-December for rain-fed cultivation during the rainy season and recommends to sow 20-30kg/ha of seeds with between the row spacing of 75-100cm, inter-stock space of 15-30cm and seeding rate of 4-5 stocks/m^2. It further notes that the emergence of buds is best when seeds are sown at the depth of 5cm and in hard soils a depth of 3-4cm. Delkab (2009) cautions against shallow planting that would often result in poor root development and should be avoided in all tillage systems. However, when the soil is usually moist and evaporation rate is low it suggests sowing the seed shallow of not deeper than 4 cm. Kaliba *et al* (1998) on the other hand state that spacing for maize depends on the maturity of the variety with medium maturity and late maturity varieties should have a spacing of 90cm x 50 cm and two (2) plants per hill, or 75cm x 60cm and two plants per hill, for a population of 44,444 plants/ha while early maturing varieties should be spaced like the medium maturity varieties, but farmers should have three plants per hill for a population of 66,666 plants/ha. For improved germination EEOA (n.d) suggests soaking the maize seed overnight or for at least three (3) hours before planting.

2.4 Fertilising

Fertiliser application is another important stage in maize production. The purpose of fertilising is to provide the maize plant with nutrients that might be low or absent in most soils. To provide nitrogen urea, calcium ammonium nitrate or sulfate of ammonia can be used and nitrogen may be divided into two applications, with 30-50% of the total amount being applied at planting and the remaining part when maize is about one meter high (Kaliba *et al*, 1998). With particular reference to Zambia JAICAF (2008) recommends farmers to apply 300-400kg/ha of D-compound (N:P:K=10:20:10) for basal dressing and 250-300kg/ha of urea for top dressing for hybrid varieties noting that fertiliser application has little effect on traditional varieties grown in Zambia. Benson (1999) advises that care must be taken particularly with urea not to place the fertiliser in contact with the maize seedling as urea can burn the seedling or even killing it. Benson (1999) further emphasises that urea should be placed about 10 cm away from the plant and should be covered with soil after application to prevent the loss of some nitrogen in urea to the air. For the sake of small scale farmers, EEOA (n.d) urges them to apply top dressing six (6) weeks after planting or when the top of the maize leaves are knee high and applied once but if the rainfall has been excessive and/or the soil is very sandy, it suggests splitting the top dressing fertiliser into two applications, one at 4-5 weeks and one at 7-8 weeks after planting. EEOA (n.d) further notes that the best time to apply top dressing is when it is raining or when the rain is about to start then it will not be necessary to cover the fertiliser since there are significant losses of nitrogen if urea is left on a dry soil surface.

2.5 Weeding

Weeding is also considered to be an important stage in crop management and according to FAO (1983) weeds compete with crop plants for soil nutrients, moisture and sunlight. It also states that the extent of competition depends upon the weed intensity, weed and crop species and the growth stage of both the crop and weeds. Sigh *et al* (1996) reports a yield loss of 50-60% in maize due to weeds and these weeds also harbour many insect-pests, disease organisms and serve as alternate hosts when there are no crops in the field. FAO (1983) further states that competition as a result of weeds is most serious when the crop is young and makes it clear that delayed weeding until the weeds have already inflicted adverse effects on the growth and development of the crop plant is a wasteful operation. Keeping the crop free of weeds for the first third of its life cycle usually assures near maximum productivity (Doll, 2003 as cited in Gianessi, 2009). Gianessi (2009) also notes that a delay of one week in first weeding may reduce maize yields by one-third and two week's delay in second weeding may reduce maize yields by one-quarter.

After planting the first weeds emerge with the maize about 4-5 days and weeding should be done when weeds are no more than 5cms tall because very young weeds are easy to destroy and as their roots are not developed, they will not survive as transplants (EEOA, n.d). Shallow inter-row cultivation can destroy young weeds in the first 3-4 weeks after sowing. Once the maize crop reaches approximately 80 cm the plants will restrict weed growth as it out competes them for sunlight (Yani n.d). FAO (1994) identifies some methods of weed control that can also be applied in maize as: *prevent methods* that include quarantine procedures to prevent the entry in the country or territory of any exotic weed. Secondly, it identifies *physical methods* (hand pulling, hoeing, slashing and cultivation), then *cultural methods* that involve crop rotation, land preparation, use of competitive cultivars, crop spacing, inter-cropping, cover crops, mulching and water management. The rest of the methods are *chemical control* through the use of herbicides and *biological control* through the use of natural enemies specific to weed species. The majority of small scale farmers use hand weeding in weed control and to produce maximum yield in maize 276 hours/ha is required (Akobundu, 1987 as cited in Gianessi, 2009).

2.6 Gapping (replanting)

EEOA (n.d) defines gapping as the term used for replanting empty holes where the original seed has not germinated or where rodents and birds have eaten the seeds. Gapping should be completed within 10 days of the original planting and late gapping is a waste of time and money (EEOA, n.d). When deciding whether to replant a field farmers should consider the original planting date and plant stand, earliest possible replanting date and plant stand, and cost of seed and pest control for replanting (Delkab, 2009).

2.7 Disease and pest control

Diseases can reduce both the quantity and quality of maize grain that is harvested. Worldwide, losses in maize production due to diseases is around 10.9% and in certain seasons with climatic conditions favourable for the development of disease, diseases can develop into epidemics, resulting in even bigger yield losses (Pannar, n.d). In Zambia the common maize diseases that can reduce plant yield are:

a) Grey leaf spot: Lesions begin as small, regular, elongated brown-gray necrotic spots growing parallel to the veins these lesions may reach up to 3.0 x 0.3 cm and minimum tillage practices are attributed with an increase of the disease (CIMMYT, 2004). Guantai and Seward (2010) points out on some of the management and control of the disease as ploughing under the infested plant debris and applying only modest amount of nitrogen fertiliser to reduce the incidence of the disease. They also

suggest for farmers to plant resistant varieties, open pollinated varieties, use of registered fungicides and practicing crop rotation (maize and beans or sunflower).

b) Maize streak virus: The virus is transmitted by leafhoppers and transmit the virus for most of its life after feeding on an infected plant with early disease symptoms beginning within a week after the infection and consist of very small, round, scattered spots in the youngest leaves (CIMMYT, 2004). KARI and ISAAA (2000) observes that the virus causes stunting, bareness, and death among others in maize and the younger the crop at the time of germination the higher the yield loss that can easily reach 100% if the virus infects a maize crop in its first 3 weeks. Management of the disease is usually by effective and efficient control of leafhopper vectors and regularly scouting for the hoppers followed by spraying with a registered insecticide (Guantai and Seward, 2010). Kloppers (2005) also recommends control that is aimed at the insect that transmits the virus and must be done at planting, in the planting furrow or as a suitable seed treatment.

c) Maize ear rot: Maize ear rots reduce grain yield and quality with implication on food security and health (Mweshi 2009). Alakonya *et al* (2008) also state that apart from causing yield losses the maize ear rot fungi can contaminate infected grains with mycotoxins. Maize ear rot disease (or cob rot) may occur either as a pre-harvest infection or as storage moulds (causing kernel rots) after harvest (Mweshi, 2009). In the case of Zambia very early planting in November increases the vulnerability of crop to ear rot infection as a result of the crop maturing mid-way the rain season thus predisposing it to high rates of infection (Mweshi, 2009).

There are a number of pests that have negative impacts on maize in the field. Armyworms are leaf-eating caterpillars that cause damage to many crops and are common in Zambia. They usually feed heavily leaving only stems and mid-rib of leaves and control is through chemical control at a young stage with contact insecticides (FAO, 2011). Where termites are a problem topping is advised and is done by cutting the stalks just above the cob as soon as the maize is mature and the stalks are put on the ground so that they are attacked by the termites instead of the maize stand (EEOA n.d). The other pests that may be a problem to maize are cutworms which are greasy-looking, grayish caterpillars, which feed on green plant material and FAO (2011) advises leaving the land weed free for about six weeks prior to planting and applying pyrethroid sprays in bands over the rows.

2.8 Crop rotation

Crop rotation can simply be defined as the practice of growing a series of different types of crops in the same space in sequential seasons for various benefits such as to avoid the buildup of pathogens and pests that often occurs when one species is continuously cropped (Berklian, 2009). The important thing about crop rotation is that it avoids a decrease in soil fertility, as growing the same crop in the same place for many years in a row depletes the soil of certain nutrients (Wikipedia, 2011). With regard to pest and disease control and management crop rotation is one of the most practical control measures as life cycles of many pests, weeds and disease-causing microorganisms are altered, disrupted and even destroyed (Nieves and Carino, 2011). Peel (1998) indicates that crop rotation can result in greater overall efficiency in the utilisation of soil water and improvement in soil tilth and structure. In terms of maize production rotation is mostly done with leguminous crops and the yields are positive (Bogale *et al*, 2001).

3 METHODS OF DATA COLLECTION

This chapter describes the methodology that was used in conducting the research. It begins with the sources of information for the research, the study area, then briefly describes the research design and strategy used and the sampling procedure. The research tool used in collecting data has been described and later information about the key informant is given. Pre-testing, analysis of results, limitations and scope of the study has been explained.

3.1 Sources of information

The sources of data for the research were primary data and secondary data. Primary data was collected from the respondents using a survey research strategy with questionnaires used as tools for data collection. Secondary data was collected through a desk study. Desk study is a research strategy where researchers do not collect empirical data on their own but depend upon on the material produced by others (Verschuren and Doorewaard, 2010). Kusek and Rist (2004) gives the advantages of secondary data as being cost effective and that it can be used in situations when it is not practical or possible to collect primary data frequently like large scale and expensive household surveys. Secondary data collected for the purpose of this research was collected from journals, books and reports from the Ministry of Agriculture. These materials were accessed through the use of the internet, Library and physical access to materials at work place. Secondary data provided information on agricultural subsidies, management or agronomic practices in maize production both in Zambia and outside the country.

3.2 Selection of the study area

The study was carried out in Katuba constituency in Chibombo district as described in Chapter one. This area was purposively selected because it has a lot of small scale farmers that have been benefiting from the FISP programme and the farmers in the area are easily accessed by road which is the main mode of transport.

3.3 Research design and strategy

The research consisted of a desk study were relevant literature related to the research was used. The other strategy that was used was a survey research that involved empirical data collection. Verschuren and Doorewaard (2010) describe a survey as a type of research that the researcher tries to gain an overall picture of a comprehensive phenomenon spread out over a stretch of time. They further give some of its characteristics as consisting of larger number of research units, extensive data generation, and more breadth than depth. This method was chosen because the researcher needed to get an over view of the effect of the reduced FISP input pack size on the maize crop yield from a larger number of small scale farmers hence needed to use less time consuming methods of collecting data.

3.4 Sampling procedure

The sampling technique called snow ball sampling was used. This technique was used because it was difficult to locate the exact place of the beneficiaries from the list that was provided from the agricultural office as Katuba has no street names and physical addresses displayed on houses or farms. Snowball sampling is where data is collected from few members of the target group that can be located then ask the same individuals to give the information needed to locate other members of the population that they know (Babbie, 2009). Castillo (2011), gives the advantages of the method as being cheap, needs little planning and allows to reach populations that are difficult to sample by other methods. However, the main disadvantages of the method are that the researcher has little control over the sampling method and the representativeness of the sample cannot be assured. The first respondent (pre-testing) on the first day of the interviews was picked with the help of a local headman in Kapopo village. In the subsequent interviews that followed each

respondent directed the researcher to the other small scale farmers they knew had benefited from the input support programme before.

A total of thirty (30) small scale farmers were interviewed in the study area. The sample size was taken to be representative of Katuba area because these small scale farmers have similar livelihoods and thus this number was considered sufficient for a survey by the researcher. In the research farmers that did not benefit from the current input support programme but benefited from the old one were not considered for the interview. On the other hand farmers that have benefited from both the new and old programmes were considered for the interviews and even those that have benefited only once from the new programme were interviewed too. On average each interview with the respondent lasted for about 45 minutes and approximately five (5) respondents were targeted per day. The language for communication for the interviews was Nyanja which everyone understood and two (2) respondents were able to communicate in English language clearly. The collection of data relied on farmer estimation which involves surveying farmers to obtain their estimates of the total crop that was harvested and dividing this by estimates of how much land they planted to calculate estimated yields. According to Diskin (2007) studies in several countries have suggested that post-harvest farmer estimates of cereal crop yields may be just as accurate (or even more so) and is simpler, less costly and permits greater sampling efficiency than crop cuts.

3.5 Research tools

The research tool used to gather data in the field was a questionnaire. Rubbin and Babbie (2009) simply defines a questionnaire as a document containing questions and other types of items designed to solicit for information appropriate for analysis. The main reason why the questionnaire was used is that responses were able to be collected in a standardised way and large amounts of data could be gathered within a short period from a lot of people. The questionnaire which contained both open and closed questions was used to interview the small scale farmers. This type of questionnaire was used because the information required for the research was both qualitative and quantitative in nature. Open ended questions were mainly for qualitative information where respondents were required to give opinions or reasons for their responses and also the questions provided room for the interviewer to ask more information or clarifications. Closed ended questions were mostly for the data that needed to be quantified during the analysis stage. Interviews with the key informant was done using the questionnaire that had open ended questions and was purposely done in order to extract as much information as possible during the interview. The open ended questionnaire also gave the researcher an opportunity to ask questions that were not part of the questionnaire but arose during the interviews.

3.6 The key informant

In this research a key informant was considered to be a person who was knowledgeable or experienced on certain issues or problems and was willing to share the knowledge. The informant chosen was a Camp Agricultural Extension officer with the Ministry of Agriculture. This person is the one who has a direct link with the small scale farmers with regard to the provision of extension services to them. The key informant provided useful data with regard to the extension services that were offered to the small scale farmers and the management practices these farmers were practicing in their maize fields. The key informant was interviewed after the interviews with the respondents and this was done to cross check on some of the responses gotten from respondents like the delivery of inputs, the management practices and how the rain performed in relation to maize production.

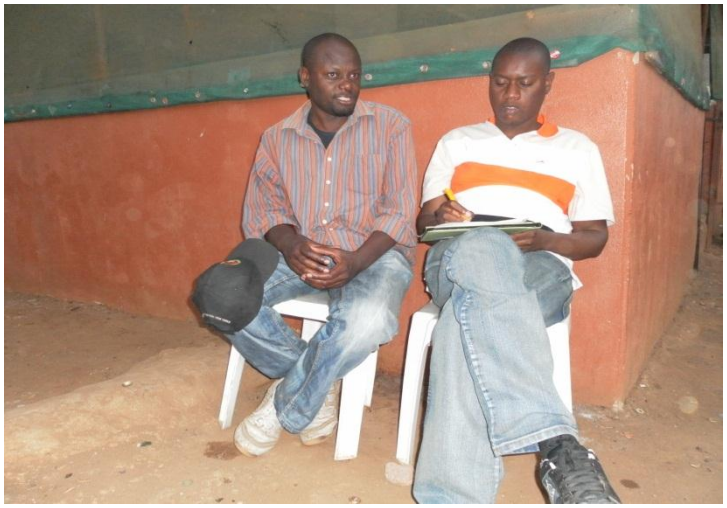


Photo 1: An Interview with the Camp Agricultural Extension Officer in Katuba
Source: own fieldwork

3.7 Pre-testing

This was done in order to assess the type of responses expected to get from the small scale farmers and make adjustments to the questions that may need to be changed. This activity was done on the first day of field data collection. Pre-testing the questionnaire was done with three (3) small scale farmers that have accessed the inputs through the FISP programme in Kapopo village. The language used was Nyanja both the respondents and the researcher were able to speak it. During the process of carrying out these interviews it was discovered that a part on crop rotation was omitted which has a bearing on soil fertility and diseases in the maize fields and this was later included in the subsequent questionnaires. Question 5(a) in the questionnaire was discovered to be similar to 5(c) but no adjustment was made as it was considered not to have any implications on the results of the research. Pre-testing also revealed that there was a need to adjust to the time it took to complete an interview. The interviews on average were taking over an hour but after getting used to speaking and recording at the same time there was an improvement in the speed and the interviews with the small scale farmers were now taking approximately 45 minutes to complete. Lastly, it was later learnt that the best time to do the interviews with the small scale farmers was between 9 hours and 11 hours in the morning and 15 hours to 17 hours in the afternoon as the respondents seemed active (not tired) around these times and were much willing to grant the interviews and as a result all the interviews were done within the stated times.

3.8 Analyses of results

The data that was obtained from the interviews with the small scale farmers was both qualitative and quantitative. Data compilation was done using a spread sheet in Excel. The data was grouped according to the sequence of the questions on the questionnaire. Every response was entered as raw data under the question it was falling under in a spread sheet. Then percentages and figures were presented on responses that could be quantified and for the responses that were more qualitative descriptions were made. The analysis involved presenting the results in the form of tables, graphs, calculating averages and using descriptions. The data from the small scale farmers was compared with what was obtained from the key informant and during secondary research. The comparisons were made on the management practices that the farmers were using with the management practices described in the literature and what the key informant gave.

3.9 Limitations and scope of the study

The study was limited to studying only some small scale farmers in Katuba. Because of the sample size of the research not all the villages were covered but the research made sure that as much as possible a wider coverage was made. The research relied upon on the information given by the small scale farmers. Information on how the farmers were managing their crops in the fields was totally based on the oral interviews and no field observations were made since the research was done during the off-farming season. Observations were only done with the amount of maize that was harvested in the 2010/11 farming season and not the previous season. The researcher acknowledges that there could be other management practices and other factors that could not have been identified despite conducting a literature search on the subject matter. The other limitation for the study was the method used in determining the yield in that this method did not consider post-harvest losses in the field hence the figures obtained could be lower than the actual yield before harvest. The results obtained from this research cannot be generalised as representative for the whole country as situations and conditions might differ in the different parts of the country.

4 INTERVIEW OUTCOMES

This chapter presents the outcome of the interviews with small scale farmer respondents. It starts by giving the raw data that was collected on the general information of the respondents, access to inputs, management practices, and rainfall performance. Data on labour, extension services and harvest has also been presented.

4.1 General Information about the Respondents

The total number of respondents which was thirty (30) came from five (5) villages in Katuba area of which thirteen (13) were male farmers and seventeen (17) female farmers. The table below summarises the number of respondents by sex in Kapopo, Mapili, Mpandika, Muntemba and Shimalosa villages.

Table 2: Number of respondents by sex in the five (5) villages

No.	Village	No. of Males	No. of Females	Total
01	Kapopo	5	4	9
02	Mapili	2	2	4
03	Mpandika	2	5	7
04	Muntemba	0	4	4
05	Shimalosa	4	2	6
Total		**13**	**17**	**30**

4.2 Access to inputs

4.2.1 Quantity of fertiliser and quality

In the 2009/10 farming season twenty six (26) respondents each received four (4) bags (2 compound D and 2 Urea) of fertiliser. In the following farming season which is 2010/11 farming season twenty-four (24) received four (4) bags with the same composition as in 2009/10 season.

Table 3: Number of respondents that received fertiliser

Respondents	Farming season	
	2009/10	2010/11
No. Received both types of fertiliser	26	24
No. Did not receive any fertiliser	4	6
Total	**30**	**30**

On the quality of the fertiliser twenty-eight (28) respondents said that it was of good quality, one (1) respondent considered it to be of poor quality and one (1) was not sure of the quality.

4.2.2 Hybrid seed quantity and quality

The respondents received different hybrid maize seed varieties. The table below gives a summary of the varieties received. The quantity of hybrid maize seed received by each farmer was a 10 kg bag and twenty-six (26) respondents received it 2009/10 and twenty-four

(24) in 2010/11 farming seasons. Four (4) and six (6) respondents did not receive the seeds in 2009/10 and 20010/11 respectively.

The overall quality of the hybrid maize seed was rated to be good by many respondents. A total of twenty-seven (27) respondents said the seed quality was good and three (3) considered the quality to be poor for both farming seasons.

Table 4: Different types of hybrid maize seed received by respondents

Variety	**Producer**	**No. of respondents 2009/10 season**	**No. of respondents 2010/11 season**
ZMS 606	Zamseed	2	1
DK medium maturity	Dekalb	12	12
SC 627	Seedco	6	3
SC621	Seedco	0	1
PAN 53	Pannar	0	1
MRI 624	MRI	5	5
Not sure	-	1	1
Total		**26**	**24**

4.2.3 Time of input delivery and utilisation

Fertiliser and seed were delivered together as a pack to the farmers. A total of fourteen (14) respondents received the input pack late in the 2009/10 season and twelve (12) received early. In the 2010/11 season ten (10) respondents received late the inputs and fourteen (14) received early. The remaining number of the respondents from the total of thirty (30) are the ones that did not receive the inputs in that particular farming season.

The majority of the respondents used the inputs they received for the intended purpose. Twenty-five (25) respondents said they used all the inputs for growing the maize and five (5) did not use all the inputs for growing maize.

4.3 Area cultivated

The respondents had a total area under maize cultivation of 17.4 hectares for the 2009/10 farming season and 18.65 hectares for 2010/11 season (refer to Appendix C for land size for individual respondents). The average land size for each respondent was about 0.64 hectares in 2009/10 farming season and 0.78 hectares in 2010/11 farming season.

4.4 Bags of maize harvested

A total of 606 bags of 50 kg each of maize were harvested in the 2009/10 farming season by the twenty-six (26) respondents (refer to Appendix C). In the 2010/11 season the harvest was 655 bags of 50 kg each by twenty-four (24) respondents. All the farmers said they had not used some of the maize while it was in the field but instead used local (traditional) varieties which they said were good for green maize.

4.5 Management practices

4.5.1 Time of land preparation and planting

The majority of the respondents prepared early with a few preparing their fields late (see Table 5). While there was a variation in the time when maize was planted the majority planted late as shown in Table 6 below**.**

Table 5: Time of land preparation by respondents

Time land prepared	**No. of respondents**	
	2009/10	**20010/11**
Early	19	16
Late	7	8
Total	**26**	**24**

Table 6: Time of planting by the respondents

Time of planting	**No. of respondents**	
	2009/10	**2010/11**
Very early	5	4
Early	7	9
Late	14	11
Very late	0	0
Total	**26**	**24**

4.5.2 Seeds per station and spacing

The research revealed that twenty-two (22) respondents planted one (1) seed per station or spot and seven (7) planted two (2) seeds per station. One (1) respondent planted more seeds per station which was four (4). The majority of the farmers did not know the exact spacing for their crops and they just demonstrated how they do it. Eighteen (18) respondents measured the spacing for their crop using footsteps. Of this number seventeen (17) measured one (1) foot step as the distance between plants in a row and two (2) footsteps as the distance between the rows. The remaining respondent measured the spacing as one (1) by three (3) footsteps as the spacing. Some other farmers used measuring ropes and had various spacing. Four (4) farmers had the spacing ranging within 30-45cm x 70- 90cm and were sure of the measurements while the rest of the eight (8) respondents were not very sure of the figures they were giving.

4.5.3 Number and time of Weeding

Weeding by the respondents was mostly done either once or twice with fifteen (15) respondents weeding once and fourteen (14) twice in the farming season. Only one (1) respondent weeded three (3) times within the farming season.

Table 7: Times of weeding by the respondents

Times of weeding	No. of respondents	Percentage (%)
Never	0	0
Once	15	50
Twice	14	47
Three or more	1	3
Total	**30**	**100**

The respondents that weeded their maize crop only once had done it at four (4) different stages of the maize plant. The majority of the respondents (11) weeded when the maize plant was at knee high level. One (1) respondent weeded when the plant had about three (3) leaves and two (2) respondents at about six (6) leaves. The remaining one had done weeding when the crop was reaching waist high level. On the other hand the respondents that had weeded more than once their crop, eight (8) had done their first weeding when the maize plant had about three (3) leaves, three (3) respondents at six (6) leaves and four (4) at knee high level. Second weeding was carried out at knee high level by five (5) respondents, waist high level by nine (9) respondents and one (1) respondent said second weeding was done every time weeds re-appeared in the field. Only one (1) respondent did third weeding and was done at waist high level.

4.5.4 Time and method of fertiliser application

The two (2) types of fertiliser that the respondents received were mostly applied at different times. The table below gives the different times at which compound D fertiliser was applied which shows that the majority of the respondents applied fertiliser at planting time. Urea fertiliser was applied at knee high level by eighteen (18) respondents and eight (8) at waist high level. One (1) respondent applied at tasseling stage. The remaining respondents are the three (3) that mixed compound D fertiliser and urea.

Table 8: Time of compound D fertiliser application

Time of compound d fertiliser application	No. of respondents	Percentage (%)
At planting	14	47
At seedling emergence	2	7
At three leaves	7	23
At six leaves	3	10
Knee height (mixed with the other type)	3	10
Waist level	0	0
Never	1	3
Total	**30**	**100**

The common way that was used to apply the fertiliser is using hands with all respondents using this method for compound D fertiliser which is broadcasted in the field and in rows. As for urea, all the farmers apply it per station/spot with only three (3) of the total respondents using fertiliser cups, one (1) using a teaspoon, one (1) using a table spoon, and another one (1) using a coca cola bottle top. The rest of the farmers used hands for urea application and a handful is applied on three (3) to six (6) stations.

4.5.5 Thinning and pest/disease control

Among the respondents that were interviewed, twenty-nine (29) did not do any thinning in their field. The only respondent that thinned the crop did so because a type of conservation farming known as pot holing was used and at planting time four (4) seeds per station had to be planted which later on was thinned to two (2) per station.

In terms of controlling pests and diseases in the maize fields twenty-nine (29) respondents said they did not do any form of controlling diseases and pests with some stating that the varieties that are planted are resistant to diseases and weeding the fields helped to control the diseases. Only one (1) respondent controlled the pests through the use of mousetraps.

4.5.6 Intercropping and crop rotation

The most intercropped crop with maize was pumpkins in which twenty-three (23) respondents cultivated it. From this figure two (2) respondents also planted beans and one (1) respondent planted cucumbers. Seven (7) respondents did not grow any other crop apart from maize in their fields.

Besides intercropping, the majority of the respondents did not practice any crop rotation with only seven (7) practicing it. The twenty-three (23) respondents that never practiced crop rotation gave the reason that land was not adequate to rotate maize with other crops because they needed to be growing maize every farming season.

In the 2009/10 farming season twenty-eight (28) respondents said the rainfall was adequate for growing of maize. Two (2) respondents could not comment because they had not grown maize in that particular season. In the 2009/10 farming season there were mixed views about the rain season. Eight (8) respondents said the amount of rainfall was adequate for maize cultivation while nine (9) said it was good but the in the month of February it was dry. Eight (8) respondents said the rain season was not good because there were dry spells in January/February and five (5) did not comment because they had not cultivated that farming season.

4.6 Labour

The sources of labour for the respondents were both own (family) labour and hired labour for their maize fields of which ten (10) used own labour only, thirteen (13) both own and hired labour and seven (7) had used hired labour only. Twenty (20) respondents paid for labour and the ten (10) that did not pay for labour was because they used family labour which is normally free.

In terms of the labour adequacy for the main farm activities, the majority said they did not have enough labour in weeding compared to the other activities (see table below).

Table 9: Labour adequacy for each farming activity

Labour adequacy	Activity			
	Land preparation	Planting	Fertiliser application	Weeding
Adequate	25	24	23	17
Inadequate	5	6	7	13
Total	**30**	**30**	**30**	**30**

4.7 Extension services

The results of the research have revealed that twenty-three (23) respondents did not receive any extension services from the Ministry of Agriculture or any other organisation. The seven (7) that received the extension services, three (3) received the services twice in the whole season, one (1) received the services three (3) times in a season, one (1) received four (4) times in a season, one (1) once per month and one (1) twice a week during the farming period. In relation to the services received five (5) rated them as good, one (1) as very good and the remaining one (1) as very poor.

4.8 Summary of interview with key informant

4.8.1 Extension services offered

The key informant explained that the extension services that they offered to the farmers were conservation farming practices such as pot holing, oxen reaping and crop rotation. They encouraged farmers to use certified seed and not recycled ones, also the use of herbicides as they are more effective as they eliminate more weeds than manual weeding. The key informant explained that herbicides are cheaper because less time and money is spent compared to manual weeding.

4.8.2 Number of visits

The key informant explained that they do not visit individual farmers because they do not have adequate extension workers and each extension worker carters for over one (1) thousand small scale farmers thus it is difficulty to meet farmers individually. The farmers were normally visited through their cooperatives and associations and said they did not visit them frequently although could not give how many times they visited them.

4.8.3 Delivery of inputs

Inputs in the 2009/10 were delivered late around December and mid-January. In the 2010/11 farming season the inputs came early but the problem was with the pay points were farmers were to deposit the money. These pay points were far and farmers had problems with transport thus they received the inputs late. The seed varieties distributed to the farmers included SC 514, SC 627, SC 727, MRI 554, ZMS 606, DK 8031 and DKC 8053.

4.8.4 Land preparation

The key informant observed that most farmers prepared land late because farmers wait until the soil is wet so that they can use animals to plough and they do it around December and January. He recommended preparing land in around early November and should also use improved tillage like reaping and pot holing.

4.8.5 Planting
The key informant noticed that farmers plant behind the plough and this results in low germination because a lot of soil covers the seed. The key informant said almost 90% of the farmers use this method. He also recommended planting four (4) seeds per station for those using pot holing with a spacing of 75cm x 90cm and those using the reaping and conventional methods to use 25cm x 90cm.

4.8.6 Fertilisation
The key informant explained that some farmers apply compound D fertiliser at planting, seed emergence and others mix compound D and urea. He explained that those that mix do it because the inputs arrive late and it is wrong to do that because it does not improve yields. The majority of the farmers apply compound D wrongly because they do it after seed emergence instead of applying during planting as compound D encourages root development. Urea is applied mostly at the correct time (knee high) but the methods farmers use to apply are not good such as using hands. He recommended using fertiliser caps or match boxes to apply per station. On the quality of the inputs the key informant explained that they were good.

4.8.7 Weeding
Some farmers weed early but majority weed late. He also explained that farmers use hand hoe methods and oxen to weed as these are not effective at weed control but recommended the use of herbicides. He also advised farmers to weed when the maize plant is at five leaf stage and at tasseling stage.

4.8.8 Disease and pest control
The key informant explained that few diseases are encountered but still urged the farmers to maintain their fields weed free and not to mix carry over crop with new crop. In terms of pest control he mentioned that farmers only do this post-harvestly and mice were the common pests in the area and advised on the use of mice traps.

4.8.9 Challenges
The challenges included lack of adequate access to extension services by the small scale farmers, late input delivery and high transport costs.

4.8.10 Extra information
The key informant provided extra information that did not appear on the questionnaire. On crop rotation he explained that very few farmers practiced this because the land in the area is limited. On the rainfall performance he said the 2009/10 farming season had adequate rainfall but in 20010/11 farming season there was a three (3) week dry spell in the month of February.

5 RESULTS AND DISCUSSION

This chapter presents the results of the study using the methodology described in Chapter three (3) of this report. This chapter begins with the results on the general information of the respondents in the study area. Results on small scale farmers' access to inputs in form fertiliser and hybrid maize seed have been presented and discussed. This is followed by the results of management practices that were used by the small scale farmers while the last part looks at the yields achieved and the possible reasons farmers achieved these yields.

5.1 General Information about the Respondents

The results of the research show that more women than men were interviewed. The women represented a 57% of the total farmers interviewed. The interviews were done in five (5) villages namely Kapopo, Mapili, Mpandika, Muntemba and Shimalosa. Kapopo had more farmers interviewed with 30% of them coming from this area. The reason could be that more time was spent in the area as there were no clear demarcations of the villages and sampling by village was not part of the methodology hence some villages had more respondents than others. The two (2) villages had the least representation of the farmers with each having 13% of the total small scale farmers that were available for interviews. The photo below shows one of the interviews with the small scale farmers in Kapopo village.

Photo 2: An interview with one of the small scale farmers in Katuba area
Source: own fieldwork

5.2 Access to inputs by small scale farmers

5.2.1 Fertiliser

The fertiliser pack consisted of compound D fertiliser which is commonly known as basal fertiliser and Urea also known as top dressing fertiliser. The number of bags that each small scale farmer was entitled was two (2) bags of compound D fertiliser and two (2) bags Urea fertiliser. All the small scale farmers in this research received the number of bags that the FISP programme entitled them to receive thus none of them received less or more of what they were supposed to get. It is important to note that receiving the required amount of inputs by the small scale farmers would be one of the contributing factors towards achieving better yields by the farmers and thus making a positive contribution towards achieving food security. The results from the research have shown that the government through the Ministry of Agriculture in this respect has done well as compared to the old FSP programme where it was reported that the majority of the farmers did not receive the required amount of inputs despite paying for them. The 2009/10 farming season indicates that 87% of the small scale farmers received both types of fertiliser (compound D and urea) while 13% did not receive.

The reasons attributed for those who failed to access it were that they had no money towards making the purchase of the fertiliser. However, in the 2010/11 farming season there was an increase of 7% in those who did not access the fertiliser but had accessed it the previous year. This means that of the total respondents twenty-four (24) had managed to get the inputs for the 2010/11 farming season giving an 80% access to the inputs. The majority (20 farmers) managed to have access to fertiliser consecutively for 2009/10 and 2010/11 farming seasons which is an indication that the government managed to provide inputs to the farmers and those who failed had other reasons other than the government not supplying enough to the eligible small scale farmers.

Having the small scale farmers access the required amount of the fertiliser is not good enough without determining the quality of the same fertiliser. In the research fertiliser quality was explained to small scale farmers in terms of whether it was received dry, the bags were leaking, had lumps, foreign material and affected the germination of seeds particularly for compound D fertiliser which some farmers applied at planting. The quality of the fertiliser that was distributed by the government was considered as good by the small scale farmers. Almost all the farmers (28) rated the quality of both compound D and Urea fertiliser as good. Good growth of the maize plant was another reason why some respondents felt that the quality was good. The key informant also mentioned that the quality of the fertiliser was generally good and there had been no major complaints from coming from the farmers. The quality of the fertiliser is important in the growth of maize and any defects in the quality will have an effect on the yield of the crop. In this regard, the government did not disappoint the farmers in the quality of the fertiliser that was delivered to them.

5.2.2 Hybrid seed

Hybrid maize seed is given together with the fertiliser and those who received the fertiliser also got a 10 kg bag of seed, therefore, the same numbers that received fertiliser in 2009/10 and 2010/11 farming seasons is the same with those that benefited from the seed. The varieties the farmers received for this area were early to medium maturity varieties. The reason for this is that Katuba and the surrounding areas are not high rainfall areas hence these varieties could perform better in this condition compared to planting late maturity varieties that need plenty of rainfall to reach maturity. The seed varieties received included Seedco, Zamseed, MRI, Pannar and Dekalb medium maturity varieties with potential yield of 5-10 tonnes/hectare. The majority of the seeds distributed were the Delkalb medium maturity varieties which accounted for almost half of the total maize seed farmers received. All the farmers that grew this variety did not know the exact variety of the maize seed. However, looking at the seed varieties that the key informant mentioned, the Dekalb seed varieties that these farmers planted could either be DK 8031 or DKC 8053 with the potential yields of 5-8 tonnes/ hectare and 10 tonnes/ hectare respectively as indicated in Table 1.

The quality of the seed was explained in terms of presence of foreign matter, variations in grain size and germination. The overall quality of the seed was said to be good with the majority of farmers being satisfied with its performance as the germination and growth were considered to be good. On the other hand, 10% percent of the respondents expressed dissatisfaction with the quality of the seed owing to the poor germination experienced in their fields for the two (2) farming seasons and in particular one (1) respondent said that the seeds looked different from the usual hybrid varieties that are received in terms of the grain size. It can now be concluded that the overall quality of both fertiliser as mentioned earlier and seed were good and any poor performance by the small scale farmers cannot particularly be said to be due to poor quality of both inputs. The inputs, can, however, deteriorate after receiving them by the farmers due to poor handling or storage.

5.2.3 Time of input delivery

The delivery of inputs for the two (2) farming seasons was done between the months of October and December. During the two (2) farming seasons over half of the respondents received the inputs late especially for hybrid maize seed and compound D fertiliser which are normally put together at planting time by some farmers. The key informant also confirmed the late delivery of inputs for the two (2) farming seasons due to the distant location and fewer number of pay points were farmers are required to deposit the money before getting the inputs. Consequently, some of the affected farmers had to delay their planting even though the rain had come earlier due to the non-availability of the planting material and compound D fertiliser. This also necessitated some few farmers to mix both types of fertiliser as compound D fertiliser could not be applied since it was too late to apply it alone. This late delivery of inputs has the potential to affect the maize yield due to the fact that the study area does not receive a lot of rains to enable late planting. There were no complaints over the time at which Urea fertiliser was delivered because farmers normally apply it when the maize plant reaches knee high level or six (6) weeks after planting and it arrived earlier than the time it was due to be applied.

5.3 Management practices

The management practices by the small scale farmers have been analysed on the basis of comparisons with what has been discussed under literature review and the information gathered from the key informant for the research.

5.3.1 Input utilisation

The subsidised inputs received from government are supposed to be used in the growing of maize which is Zambia's staple crop in order to enhance the country's food security. Based on the responses from the respondents most of the inputs received were used for the intended purpose of growing hybrid maize. This represents a figure of 83% of the farmers that used the inputs for growing the hybrid maize which clearly indicates that very few farmers diverted the inputs for other uses. Some of the reasons for using all the inputs especially fertiliser were that in order to achieve the desired maize yield all the fertiliser was supposed to be used for the quantity of seed received. Using the inputs for other purposes would affect the yield and undermine government's efforts in trying to achieve food security. The Insufficient quantity of fertiliser and seed received by some farmers meant to grow only a half hectare also caused farmers to utilise all the inputs in their field for maize cultivation with little or nothing left for growing other crops. Somehow this amount of inputs forces the farmers to use all of it unlike in the previous input support programme where small scale farmers were reported to be using only part of the inputs and selling the remainder because the amount was double than what they are currently getting. A few farmers did not utilise the fertiliser (17% of respondents) for growing maize as it was used for growing other crops and vegetables that would provide "quick cash" for them. Diverging fertiliser for other uses other than growing maize would affect the yield since the hybrid maize being cultivated requires sufficient amount of fertiliser for it to perform well.

5.3.2 Land preparation and planting

The common method of preparing land in the study area is by way of using ploughs attached to oxen and the use of hand hoes. These two (2) methods affect the time when land is prepared in readiness for planting. According to the key informant for the research many farmers especially those using oxen wait for the rain to come in order to plough in the wet soils. This is mostly done around December and January of each farming season when the rains are already established and is rather late to do land preparation around this period. The key informant recommends doing land preparation by early November using improved tillage methods such as reaping which does not destroy the soil and is only done where one

wants to plant and is cheaper. The key informant also recommends adopting potholing that increases the plant population and yield.

However, almost three quarters of the respondents said they prepare land early and various reasons have been attributed to early land preparation. Inadequate rainfall makes some of the farmers prepare their land early enough and take advantage of the early rain so that they are able to plant early that will enable them achieve a good harvest before the rain disappears. While some farmers prepare land early because they have enough labour and use animal drought power that consume less time compared to hand hoe methods of land preparation. The farmers that prepared land late did so because of the late arrival of inputs and could only prepare land after receiving the inputs. The use of hand hoes was the other reason for late land preparation thus planting the fields late.

Following land preparation, some small scale farmers plant their fields by planting behind the plough. This method is said to reduce the germination percentages since more soil covers the seed thus reducing the plant population. Farmers who use hand hoes plant the fields after land has been prepared. The time of planting has an impact on the growth and yield for maize and based on the responses from the farmers almost half planted late for the two (2) farming seasons as shown in the two (2) figures below.

The majority of farmers planted late because hybrid maize seed and compound D fertiliser were received late despite the fields being ready for planting. Late preparation of land, inadequate labour, lack of farming implements were some of the reasons the farmers planted late and according to the key informant planting is considered late when it is done December month end and beyond. This is also supported by literature under the chapter on management practices discussed earlier. The farmers that planted very early and early did so because they had to take advantage of the early rain that normally comes in early November, some received inputs early and others had animals that could be used for planting.

Figure 3: Time of planting in 2009/10 season

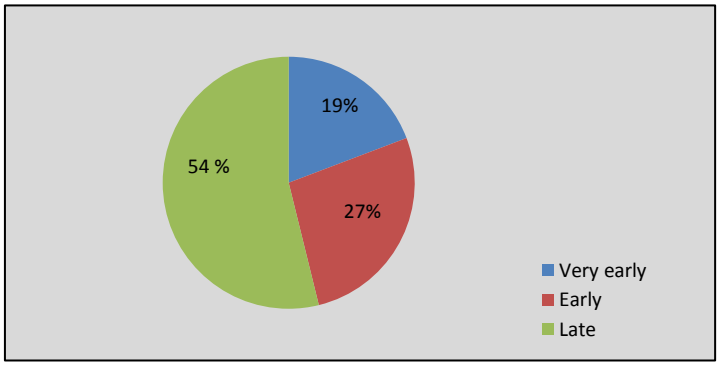
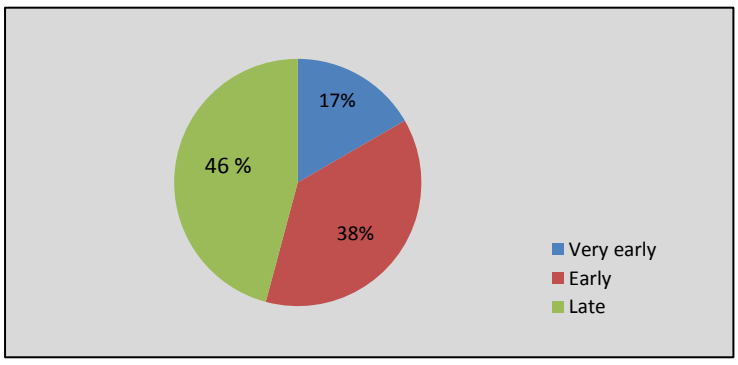


Figure 4: Time of planting in 20010/11 season



Other than the time at which the maize seed is planted, the number of seeds per station and the spacing would have an influence on the yield since maize crop has to be adequately spaced to allow it access nutrients and light with less competition. Almost three quarters of the farmers plant one (1) seed per station with the rest planting two (2) seeds per station. The farmers are quite aware on the importance of planting one (1) or two (2) seeds per station with the main reason being not to over crowd the plants which might affect the growth and yield for maize. The farmers that plant two (2) or more seeds do so because they want to improve the survival rates for the seedlings so that if one dies then there would be one plant per station remaining. The key informant recommends two (2) per station for optimal growth and yield. As for the spacing, farmers have varying measurements for both between stations and inter-rows. All the farmers planted their seeds in rows and none of them broadcast their seeds which would affect uniformity in terms of spacing. The common way of spacing the crops by the farmers is by use of one's footsteps to measure the distance and over half of the respondents use this method with the spacing of one (1) footstep between the stations and two (2) footsteps between rows. About 40% of the farmers used ropes for spacing and planting in rows of which eight (8) farmers did not know the exact distances of the spacing. However, following the analysis of the other farmers that were able to determine the spacing it can be concluded that the majority of the farmers spaced their crops correctly and was close to the spacing of 25cm x 90cm as stated by the key informant and would result in a plant population of over 44,000/ hectare as given in the literature. Therefore, many farmers interviewed followed the recommended number of seeds per station and the spacing although they have adopted different methods of measuring distances.

5.3.3 Weeding

Weeding was done by all the respondents in the two (2) farming seasons. The two (2) methods of weeding by the farmers were the use of hand hoes and ploughs. These methods are not very effective as they leave out lots of weeds in the field this was as noted by the key informant. Almost an equal number of farmers either weeded their field once or twice during the farming period.

Some farmers weeded once because they use ridgers, ploughs and oxen that they claim to be effective at weed control and inadequate labour is also another reason. One (1) farmer used herbicides against weeds hence there was no need to carryout second weeding. Some of the farmers weeded twice because they wanted to have clean fields when harvesting and remove most of the weeds that would otherwise affect the growth of maize.

The time that weeding is carried out has a bearing on the performance of the maize crop. Over three quarters of the farmers that weed once do it when the maize crop is at the knee high level. This is rather late considering that at this stage most of the weeds would have established themselves and compete more with the crop. The key informant advises weeding when the plant is at five (5) leaf stage and the literature under management practices recommends when the weeds are 5cm. The farmers that weeded twice do it early with the majority doing their first weeding when the maize plant has three (3) leaves with the second weeding at knee high level and the key informant recommends second weeding before tasseling stage. Thus it can be said that the farmers that were weeding twice did more effective weed control and the weeding was carried at the right times.

5.3.4 Fertiliser application

The two (2) types of fertiliser applied by the farmers were Compound D and Urea fertiliser that is supposed to be applied at different stages. Compound D fertiliser is supposed to be

applied at seed sowing so as to encourage root development and urea needs to be applied when the plant reaches the knee height level in order to achieve the best yields. This is according to the key informant for the research. However, less than half of the respondents applied compound D fertiliser when planting the seeds with some farmers explaining that they had been applying fertiliser after the emergence of the seedling. From the sample size only two (2) farmers applied compound D fertiliser at seedling emergence and seven (7) farmers when the maize plant reached the three (3) leaved stage. Although this is not the recommended stage to apply the fertiliser it can be considered not to be very late because the maize plant is still very young at these stages. Twenty-three percent (23 %) of the farmers could be considered to have applied compound D fertiliser late. These farmers applied the fertiliser when the plant had six (6) leaves and others at knee height level. According to the key informant applying compound D fertiliser at these times would have little impact on the on the yield and is considered to be a waste of time and money. The other unconventional way some farmers applied compound D fertiliser was mixing it with Urea fertiliser in the ratio 1:1 and applying it at knee height level which is still late application.

Urea application was mostly done at the right time with 90% of the farmers applying it at knee height and waist level which is the right time to apply. The remaining 10% of the farmers are the ones that mixed the two (2) types of fertiliser. Coming to the methods of fertiliser application, hand application is the commonest amongst the farmers with 77% using this method. With this method measuring the right amount of fertiliser to apply is quite difficult since the farmers just guess the amount to apply. Compound D fertiliser is broadcasted in the field which can be considered to be wasteful because fertiliser is applied to some parts where there are no plants or seeds. Although all the farmers applied Urea per station which can be considered to be good, most of them did not have a standard of measuring the amount as they used hands to apply. From this it is clear that the majority of the farmers are not using the right amount of fertiliser in their fields owing to the different methods used in applying the fertiliser. The key informant recommends using fertiliser cups or a match stick box for measuring the amount of fertiliser to be applied which is one (1) cup or box per station for both types of fertiliser. But the majority of the farmers gave the reason for the low use of fertiliser cups and match stick boxes that these consume a lot of time hence using hands is much quicker although there is no uniformity in the amount applied at each station.

5.3.5 Thinning and disease/pest control

Thinning is normally done to remove the maize plants that are weak or are overcrowded so that the remaining ones have enough space to grow and competition is lessened. Almost all the farmers did not do any thinning in their fields. This is because at planting time the majority of the farmers had the right spacing for their crop and thinning due to overcrowding was not necessary. The good quality of the seed that the farmers received can also be attributed to lack of thinning since the quality of the seed affects the health of the plant too during the growth stage. The only respondent that thinned the crop did so because a type of conservation farming known as pot holing was used and at planting time four (4) seeds per station had to be planted which later on was thinned to two (2) per station. In addition, all the respondents did not experience any crop diseases that would affect their yield and claimed that the maize varieties that were planted were resistant to most diseases. Disease control was also achieved through weeding which all the farmers practiced although only 10% of the farmers were aware of this as being part of disease control. The common pests that attacked the maize crop in the field were mice that destroyed the seeds and seedlings. This was also echoed by the key informant. All the respondents said they experienced this type of problem but only (1) was able to control them through the use of mice traps which was said to be effective. The consequence of lack of mice control is low plant population in the field thus low maize crop yield. The key informant noticed that most of pest control is done post-harvest and very few diseases are encountered in the field by the farmers. He advised

maintaining weed free fields and not mixing carry over crops with new crops to reduce the incidences of diseases.

5.3.6 Intercropping and crop rotation

Intercropping or interplanting is growing a second crop between the rows of the main crop (King, 2000). The majority of the farmers (77%) intercropped their maize and all of them grew pumpkins. The respondents that grew pumpkins reported that the crop had no negative effects on the growth of the maize crop. Intercropping maize with pumpkins can be beneficial in that pumpkins act as a cover crop that reduces evaporation, soil erosion and suppress weed growth.

Crop rotation was only practiced by 23% of the respondents. The tendency of growing maize in the same field for a number of years can lead to soil degradation and disease outbreaks in the field but because farmers have limited land they are left with no choice but to be growing maize which is their main cash and staple crop. The few farmers that practiced crop rotation planted groundnuts, beans, sunflower and cotton after maize which is a good practice because these crops are not in the same family as maize and some improve soil fertility because of their leguminous nature.

5.4 Rainfall performance as observed by farmers

The amount and frequency of rainfall has an influence on the growth and potential yield of the maize. Rainfall performance in this researched was rated according to how it affected the respondents' maize crop or someone's else crop from the time of land preparation up to the time the crop was considered to have matured. All the respondents that cultivated maize in 2009/10 farming season had the general overview that the rain was good enough for maize cultivation with no major drought spells that would affect maize growth negatively. The key informant had the same view that the amount rainfall received for this season was generally good. Therefore, it can be said that the 2009/10 farming season in terms of rainfall was good for maize production and if it had any negative impact in yield then that would be considered minimal. In the 2010/11 farming season generally the rain was good but a lot of farmers said the month of February was not good because the rain disappeared for a period of close to three (3) weeks and had affected the growth. Some farmers reported that there maize stock was also almost wilting and this could have effects on the harvest.

Table 10: Rainfall performance for 2009/10 and 2010/11 seasons

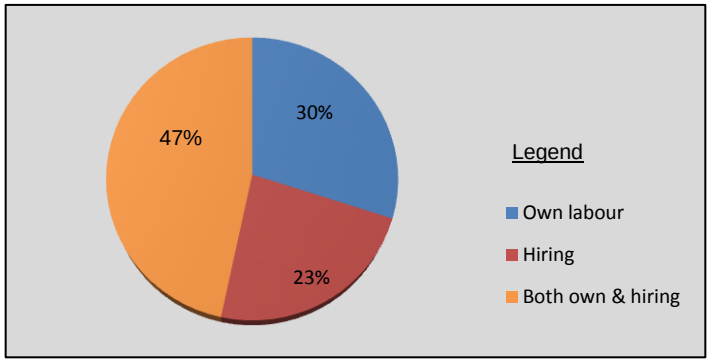
Performance of the rain season	**Percentage of respondents**	
	2009/10	**2010/11**
Good	93%	60%
Poor	0%	23%
No comment	7%	17%
Total	**100%**	**100%**

5.5 Labour input

This factor was studied because it has influence on the ability of the small scale farmers to conduct management practices more effectively. Labour shortages would affect most of the activities that are done in the fields consequently impacting on maize yield. Almost half of the respondents used both own and hired labour for all the activities in the field as shown in the

figure below. This is because some farmers could not manage to use own labour alone hence the need to source for hired labour. All the labour that farmers hired was either paid for in kind such as bags of maize, beer or paid for in cash. But most of the farmers had to pay in kind because it was easy for them as compared to sourcing for cash to pay the helpers. Fewer farmers used hired labour alone because most of them could not afford to pay for it and only depended on family labour that was free.

Figure 5: Proportion of farmers that used own and hired labour



Overall it was observed that labour as an input was not a major constraint in the performance of the management activities like land preparation, planting and fertiliser application as the majority of the farmers had no complaints on the availability of labour for their fields (*see* table below). However, thirteen (13) farmers representing over 40% had complaints about lack of adequate labour during the weeding stage. This stage takes a lot of time and requires sufficient labour to adequately weed the fields at the right time and any delay due to inadequate labour would affect the maize crop.

Table 11: Percentage of farmers that had adequate labour

Labour adequacy			
Land preparation	Planting	Fertiliser application	Weeding
83%	80%	77%	57%

5.6 Extension services

Qamar (2005) defines the concept of extension as a function of providing need-and demand-based knowledge and skills to rural men, women and youth in a non-formal, participatory manner, with the objective of improving their quality of life. Agricultural extension services ensure that knowledge and skills transfer are carried out mostly from research institutions through extension agents to the needy farmers. Over three quarters of the respondents have never received any extension services either from government or private organisations. Most of the farmers acquire knowledge and skills on maize production from fellow farmers and through experience which most of the knowledge and skills cannot be relied upon in order to achieve optimal yields. The 23% farmers that received extension services testified that on average the quality of the services were good and most of the services ranged from pre-planting up to post-harvest activities. On average the extension agents visited the farmers two (2) times during the whole farming season. This is not enough considering that the farmers need to be visited almost on every stage of maize production to ensure that they are

doing the correct things in their farming activities. The key informant observed that the number of extension staff in the Ministry of Agriculture is very low in some instances one (1) camp extension officer is assigned to carter for over a thousand farmers. Therefore, it is not possible to meet all the farmers individually thus most of them are met in groups through their cooperatives and associations.

5.7 Maize crop yield by small scale farmers

5.7.1 Land area under cultivation

The small scale farmers that received the subsidised inputs that were meant for the cultivation of a half a hectare of maize did not exactly cultivate on a half hectare plot. Some could only manage less than half a hectare while others managed to cultivate more than the required area compared to the inputs received. In the 2009/10 farming season almost half of the farmers used the inputs to cultivate more than a half hectare plot which was the same case for the 2010/11 farming season. Only 23% and 29% of the farmers used the inputs to cultivate a half hectare for both 2009/10 and 2010/11 farming seasons respectively. This shows that the majority of the farmers did not adhere to the recommended area of cultivation and were only able to use the inputs depending on how much land was available for cultivation. Those that had more than a half hectare plot were trying to make sure that they covered as much land as possible with the little inputs they received. This means that they were under applying the amount of fertiliser and would affect their yields. It is the same with the farmers that used fertiliser on less than a half hectare plot since they would not use the correct amount thus leading to wastage of the fertiliser.

Table 12: Farmers that cultivated more or less than half a hectare

No. of farmers that grew:	**Farming season**	
	2009/10	2010/11
Less than half a hectare	8	3
Half a hectare	6	7
More than half a hectare	12	14
Total	**26**	**24**

The total area under cultivation by the number of farmers was 17.4 hectares for the 2009/10 farming season with an average area of 0.7 hectares per farmer. In the 2010/11 farming season the total cultivated area was 18.7 hectares with each farmer cultivating on average 0.8 hectares of land. Considering gender, women on average cultivated 0.72 hectares and 0.75 hectares per farmer for the 2009/10 and 2010/11 farming season respectively. Men cultivated less than women in 2009/10 farming season with an average of 0.62 hectares per individual farmer. In the 2010/11 farming season men cultivated more land with an individual farmer cultivating on average 0.82 hectares.

5.7.2 Maize yield

In determining the yield the researcher needed to know the total quantity of maize that was harvested and the plot size for the crop. The common way in which the small scale farmers measured the amount of maize harvested was through the use of a standard 50 kg bag from the government agency called Food Reserve Agency (FRA). This type of bag is the only one that is authorised to be used if farmers are to sell their maize to the agency. Hence farmers also use them when selling their maize to other buyers. In terms of their plot sizes they use

ropes of pre-determined lengths for measuring the dimensions and the same ropes are used in planting the maize seeds in rows.

It was seen in the first chapter that one of the reasons the government reduced the fertiliser input pack size by half was to allow the small scale farmers manage smaller plots more effectively that would enable them achieve on average yields of 3- 4 tonnes from a half a hectare plot or 6-8 tonnes per hectare. This section looks at whether the small scale farmers managed to achieve the yields the government had set for them following the reduction of the input pack. Please refer to the Table below and Appendix C.

Table 13: Average maize yields per farmer in each village

Village	**Quantity of maize harvested (tonnes)**		**Total area (hectares)**		**Maize yield (tonnes/hectare)**	
	2009/10	*2010/11*	*2009/10*	*2010/11*	*2009/10*	*2010/11*
Kapopo	12.75	13.05	5.2	5.95	2.45	2.19
Mapili	3.6	1.85	2.8	2	1.29	0.93
Mpandika	4.6	6.6	4.2	4.3	1.09	1.53
Muntemba	2.75	3.25	1.4	2	1.96	2.95
Shimalosa	6.6	8	3.8	4.4	1.73	1.82
Total	**30.3**	**32.75**	**17.4**	**18.65**	**1.74**	**1.76**

Photo 3: Some of the harvested maize being packed in 50 kg bags
Source: own fieldwork

5.7.2.1 Maize yield by village

Kapopo village

This village had farmers who relatively performed better than some farmers from other villages. The average yield for this village was just over 2 tonnes/ha for the two (2) farming

seasons. The highest maize production was 60 by 50 kg bags of maize by an individual farmer in the 2010/11 season. The same farmer produced the highest number of bags of 50 by 50kg in the previous farming seasons with yields of 2.5 and 3 tonnes/ha for 2009/10 and 2010/11 farming seasons respectively. The highest yield achieved in this village by an individual farmer was 6.25 tonnes/ha in the 2010/11 season while the lowest yield was 1.09 tonnes/ha in the same farming season. All but one failed to reach the minimum yield of 6-8 tonnes/ha set by the government.

Mapili village

Compared to other villages respondents from this village had the lowest yield for the 2010/11 farming season recording an average yield of 0.9 tonnes/ha while the highest achieved by an individual farmer was 1.88 tonnes/ha in the 2009/10 season. All the farmers interviewed could not manage to achieve the minimum yield the government wanted.

Mpandika village

Based on the respondents Mpandika village had the least average yield of 1.09 tonnes/ha for the 2009/10 farming season compared to the other villages. The yield for 2010/11 farming season was higher than the previous one at 1.53 tonnes/ha with highest yield achieved by an individual farmer at 2 tonnes/ha for both seasons. The lowest yield from the respondents in the village was 0.5 tonnes for the 2009/10 farming season and as with the other villages, no farmer produced the minimum yield required.

Muntemba village

The village had the highest average yield of 2.95 tonnes/ha compared to the other villages for the 2010/11 farming season and was second at 1.96 tonnes/ha for the previous farming season. The highest achieved by a respondent in the village was 3 tonnes/ha in the 2009/10 season with the lowest being 1.25 tonnes in the same season.

Shimalosa village

The yields for the farmers in this village averaged 1.73 tonnes/ha and 1.82 tonnes/ha in the two (2) farming seasons respectively. The highest yield produced by an individual farmer was 3.4 tonnes/ha in the 2009/10 season followed by 2.19 tonnes/ha for the 2010/11 season while the lowest was 0.375 tonnes/ha in 2009/10 season.

5.7.2.2 Maize yield according to gender

This part has analysed the yields according to gender in order to determine which gender group had better yields. In the 2009/10 farming season male farmers produced a total of 15.8 tonnes of maize from the cultivated land of 7.5 hectares. This gives an average yield of 2.1 tonnes/ha which is more than that of produced by their female counterparts who had a yield of 1.5 tonnes/ha arising from a production of 14.5 tonnes of maize from a total of 9.9 hectares of land. In the following farming season males farmers had the same yield of 2.1 tonnes/ha with the total production of 16.15 tonnes from the land size of 7.65 hectares. The female farmers also maintained the same yield of 1.5 tonnes/ha with the total production of 16.6 tonnes from the land area of 11 hectares. It is obvious that the female farmers' performance is not very impressive and they are not near to achieving the desirable maize yield compared to the inputs used. Although the performance from the male farmers is equally bad, they are much better than their female counterparts.

Photo 4: A small scale female farmer with her harvested maize

5.7.2.3 Overall performance by the small scale farmers

The farmers considered for this study had approximately a total production of 30.3 tonnes for the 2009/10 farming season. This production gave them an average yield of 1.74 tonnes/ha. There was no significant difference in the yield for the 2010/11 farming season that stood at 1.76 tonnes/ha although this shows a slight improvement in the yield. The total production from the 2010/11 was at 32.75 tonnes of maize. As indicated earlier only one (1) farmer out of the thirty (30) managed to produce the yield that the government had wanted these small scale farmers to achieve. The rest of the farmers could only achieve yields of 3 tonnes/ha and below with some farmers only getting as low as 300 kg in a hectare. These yields are far much less from the potential yields that could be achieved by growing the hybrid maize seed varieties (*see* Table 1).

5.7.3 Possible reasons for low yields

This research has established that the maize crop yield for the farmers falls short of the government's desired levels of 6-8 tonnes/ ha. The low yields reflect that the small scale farmers are unable to achieve the potential yields owing to a number of factors. The reasons that can be attributed to the low yield based on the analysis of data obtained from the respondents and the key informant in the study area are:

5.7.3.1 Late delivery of inputs and planting

In as much as the quality of the fertiliser and seed was considered to be good on average by the farmers, these inputs were delivered late as indicated by most farmers. Compound D fertiliser which is normally applied when planting was delivered as late as January to the farmers which is already two (2) months late after the commencement of the rain season instead of around October when the farmers prepare their fields. Definitely this affected the yields because when this type of fertiliser is applied late its impact on the yield is minimal. Because compound D fertiliser was delivered together with the hybrid maize seed, it is obvious that farmers planted their fields late. All the respondents that received the inputs late and consequently planted late had the lowest yields recorded for the two (2) farming seasons.

Photo 5: Unshelled maize believed to have been affected by late input delivery and poor rainfall in February 2011
Source: own fieldwork

5.7.3.2 Late weeding

It has already been seen that farmers were not weeding their fields like they were supposed to like weeding early and every time weeds appear in the fields. Some farmers had to wait to do the weeding until the maize was reaching their knee high level so that they can apply fertiliser urea fertiliser immediately after that. This is late because any delay in weeding reduces the yield. Also the frequency of weeding matters in achieving good maize yield but some farmers only weeded their fields once as opposed to two (2) times which is normally recommended for this location as said by the key informant. Insufficient labour for weeding would be the reason some farmers were unable to weed their fields more effectively since this activity consumes a lot of time and requires some resources to carry it out.

5.7.3.3 Poor fertiliser application

Besides receiving the fertiliser late, it has been observed that farmers were applying the fertiliser in their maize fields incorrectly. Mixing the two (2) types of the fertiliser would have affected the yields for the farmers that did this because these two (2) types have different roles at a certain stage of the maize plant and mixing them does not help much. The use of hands is another method that can be considered not good because of the non-uniformity in the quantity of fertiliser applied. Farmers are encouraged to use standard fertiliser cups but have complained that this method consumes a lot of time thus they opt to use hands. Another problem observed is the practice of applying compound D fertiliser way after seed germination and is considered not so good because it is supposed to be applied together with the seeds at planting time to help the maize plant develop the root system effectively. Broadcasting of compound D fertiliser in the field is another factor that may have led to lower yields because this method is wasteful as the fertiliser is also applied in areas where it is not required and instead just promotes the growth of weeds in the field. Using the four (4) bags of fertiliser to cover more than a half hectare of maize indicates that some farmers were applying little fertiliser because the number of bags are recommended to be used in a half hectare of maize.

5.7.3.4 Lack of pest control

As earlier indicated mice attacked the farmers' fields and the attacks were mainly on the seeds that were planted and the emerging seedlings. These pests reduced the plant population in the field as testified by the farmers and those that did not replant their fields within a short period of time the yields got affected. Lack of control of effective control of

these pests by the farmers would not help in improving the yields even if other good management practices were to be done.

5.7.3.5 Poor rainfall patterns

Inconsistent rainfall patterns could also be the contributing factor to the low yields some farmers achieved especially in the 2010/11 farming seasons although the yields for the previous season were also low despite the rain season being good. The month of February, 2011 was blamed for the low yields because this is when the farmers experienced a dry spell which is the period they are required to apply their top dressing or Urea fertiliser for good maize production.

5.7.3.6 Lack of crop rotation

The few numbers of farmers that practiced crop rotation indicates that farmers have been ploughing their fields for maize over and over a period of time. Although no, study was done to determine the fertility of soil it is apparent that soil fertility has been affected due to the practice of growing maize in the same field in each and every season coupled with the improper use of chemical fertilisers. Because maize depletes the soil of its nutrients continuous growing of maize in every season would eventually render the land barren or incapable of producing desired crop yields.

5.7.3.7 Lack of extension services

The inability of agricultural extension workers to visit the small scale farmers entails that these farmers were unable to learn modern techniques and innovation that was supposed to help them achieve good yields. The poor management practices discussed above by the farmers can be connected to the lack of extension services in their localities. Most farmers have stuck to some traditional farming practices that do not contribute to crop yield much because there are no extension workers to teach them on suitable management practices and techniques that would help in improving the yields. Although the government reduced the pack size hoping that farmers would improve their management practices for their fields because of the smaller plots, all the farmers did not adhere to the good management practices required of them for better yields in one way or another

5.7.3.8 Post-harvest losses

Because of the method employed in yield calculation for this research which is determined post-harvestly, the grain losses arising from harvesting in the field by the farmers had not been considered and would have contributed to the low figures obtained as opposed to if the yield was calculated using the other methods of sampling whilst the maize was still standing in the field. Also it was discovered during field interviews that some small scale farmers stored their unshelled maize in structures that were not well protected and would lead to losses through pests and grain coming off the cobs (*see* photo below). Having proper grain storage facilities by the farmers would contribute to low post-harvest losses thus having more bags of maize by the small scale farmers.

Photo 6: Unshelled maize stored in one of the makeshift storage structures. This puts the maize more susceptible to pest and weather attacks.
Source: own fieldwork

6 CONCLUSION AND RECOMMENDATIONS

This chapter draws the conclusion based on the findings and analysis of the study that was done in Katuba area, Chibombo district of Zambia. Recommendations arising from the study have also been made. The study aimed at finding whether the reduced agricultural input pack had any effect on the yield of the maize crop due to the fact that farmers were now managing smaller plots and thus were expected to put it all their efforts that would eventually lead to higher yields. Each farmer was atleast expected to achieve a yield of 6-8 tonnes/ha or better.

6.1 Conclusion

Arising from the interviews of the thirty (30) small scale farmers that had benefited from government initiated Farmer Input Support Programme (FISP) and carrying out an analysis of the data collected, the study has revealed that farmers were not able to improve the maize yield that the programme wished to achieve. The study shows that the small scale farmers only managed to produce average yields of 1.74 tonnes/ha and 1.76 tonnes/ha for the 2009/10 and 2010/11 farming seasons respectively. The targeted yield would be said to be an overestimation because from the previous national averages small scale farmers only achieved a yield of 1.7 tonnes/ha. Expecting the farmers to improve the yields by almost three folds as a result of good management practices and techniques to levels that are obtained by research stations would be a challenging task for them. As this study has shown, all the farmers did not practice what would be termed as 'good management practices' owing to a number of factors. It has been shown that the majority of the farmers received the inputs late. In instances where the government might have delivered the inputs on time to the issuing centers, still the farmers could not access them on time due to the remoteness of the pay points and transport logistical problems. This ultimately caused the farmers to plant late and apply the fertiliser particularly compound D late too. Because hybrid maize seed is used for production any delay in planting or applying the fertiliser has consequences on the yield of the crop.

A problem of poor management practices also meant that the farmers could not achieve better yields as desired. The small plots the farmers were cultivating did not result in good management practices by them as expected. The study showed that the majority of the farmers were weeding their fields late and inadequate labour had been attributed to late weeding. The improper use of fertiliser particularly in the methods of application indicated that the farmers were either applying too little or too much fertiliser as they had no standard measure of the quantity they were supposed to apply. Instead the farmers relied on using their hands in determining the quantity to be used and to make it worse application especially for compound D was by broadcasting it in the field that normally leads to wastage. The farmers are supposed to use the required quantities of fertiliser for their maize using the recommended measuring cups. The other poor practices observed in this study were lack of pest control by the farmers despite knowing that their fields were infested with mice that destroyed their planted seeds and seedlings and also the inability by the farmers to rotate their crops as they have stuck to cultivating maize in the same fields for long periods of time. These poor management practices have been linked to lack of extension services from the Ministry of Agriculture or any other organisation. It has been established that a lot of farmers have never had any extension worker visit their fields or even meeting them in groups.

Finally, the inconsistent rainfall patterns, it has been concluded, contributed to the low maize yield although this was beyond the farmers' control. The farmers clearly indicated that the inconsistent rain especially in the 2010/11 farming season reduced their crop yields in addition to the already stated factors. Therefore, it can be concluded that the farmers failed to achieve good yields in both the 2009/10 and 2010/11 seasons following the reduction of the input sizes because the inputs were delivered late thus farmers planted late; weeding

was done late; improper use of fertiliser; lack of pest control; lack of crop rotation; and poor rainfall patterns.

6.2 Recommendations

Following the findings of this study recommendations are herewith made. It is hoped that these recommendations shall help the government or any other concerned stakeholders in addressing the problems of low maize yields that the small scale farmers have been getting in the two (2) farming seasons under review.

a) The government through the Ministry of Agriculture must ensure that it addresses the late distribution of inputs to the farmers. The ministry must ensure that inputs are delivered to the receiving stations as early as the month of September in each year to enable the farmers access the inputs and plan early for the oncoming farming season. There is also a need for the ministry to increase the number of pay points for the inputs since most small scale farmers complained over the remoteness of these points that resulted in them accessing the inputs late due to transport problems.

b) The Ministry of Agriculture should consider revising the pack size which is pegged at 4 x 50 kg bags of fertiliser and a 10 kg of hybrid seed to the amount that each individual small scale farmer is willing to access as long as measures are put in place to ensure that these farmers utilise all the inputs they get for the intended purpose. This is so because the small scale farmers have different abilities in cultivating their fields and allocating uniform quantities to every farmer entails that those that can perform better are constrained due to the limited quantity of inputs they are entitled to acquire. A flexible input pack size will enable small scale farmers acquire the inputs according to the land size they are able to cultivate.

c) The FISP programme should include a variety of other crops too so that only farmers that are willing to cultivate maize do it as this will enable the more serious farmers manage their maize fields better. In the current system every farmer is compelled to receive hybrid seed as maize or as rice in certain districts and this allows even unproductive maize farmers access the inputs that later result in low yields.

d) Extension services must be enhanced through assigning more staff to visit the farmers. The current situation where each extension worker is assigned to carter for over a thousand farmers can not lead to better yields as these workers are never in touch with individual farmers to monitor how their fields are performing. A mechanism must be put in place where the performance of each farmer is regularly monitored throughout the farming season as opposed to visiting the farmers only once which does not help much in improving their management practices. Furthermore, the few extension workers that are available are faced with transport problems hence their mobility is affected and are not able to reach most of the farmers.

e) Owing to the few numbers of extension workers, the Ministry of Agriculture must encourage farmers to form workable farmer associations where they can learn a lot about the best management practices for various crops and extension workers or other relevant officers assigned to teach these groups.

f) The government should in the long run promote irrigation schemes for the small scale farmers in order to mitigate the effects of poor rainfall patterns on maize production. Since the farmers cannot dictate on the amount of rainfall to receive any change in rainfall patterns significantly affect the yields for the farmers unless reliable irrigation systems for the small scale farmers are in place.

g) The government should set the time frame in which farmers can be expected to achieve the desired results so that the FISP can be evaluated against its intended purpose.

h) It is also recommended that further research be done on the effect of the reduced input pack size on maize crop yield on a larger scale to cover more districts and small scale farmers as this research was limited to Katuba area of Chibombo district with a small sample size.

REFERENCES

Alakonya, A., Monda, E. and Ajanga, S., 2008. American-Eurasian Journal of Agricultural and Environmental Science: *Effect of Delayed Harvesting on Maize Ear Rot in Western Kenya.* IDOSI Publications. Available at: http://idosi.org/aejaes/jaes4(3)/16.pdf (Accessed on: 08/07/2011).

Babbie, E., 2009. The Basics of Social Research. 5th Edition. Belmont: Cengage Learning.

Banful, A., 2010. IFPRI Discussion Paper 01002: Old Problems in the New Solutions? Politically Motivated Allocation of Program Benefits and the "New" Fertilizer Subsidies. Available at: http://www.ifpri.org/sites/default/files/publications/ifpridp01002.pdf (Accessed on: 04/06/2011).

Benson, T., 1999. Area-Specific Fertilizer Recommendations for Hybrid Maize Grown By Malawian Smallholders: A Manual for Field Assistants. *Action Group I Maize Productivity Task Force.*

Berklian, Y.U., 2009. Crop Rotation. Nova Science Publication Inc.

Birner, R., *et al*., 2006. From Best Practice To Best Fit: A Framework For Designing and Analysing Agricultural Advisory Services. ISNAR Discussion Paper No. 5. Washington, D.C.: IFPRI. Available at: http://www.ifpri.org/sites/default/files/publications/dsgdp37.pdf (Accessed on: 09/04/2011).

Bogale, T. *et al*, 2001. Legume Fallows for Maize Based Systems in Eastern Africa: Contribution to Maize Yield. Seventh Eastern and Southern Africa Regional Maize Conference. Available at: http://apps.cimmyt.org/english/docs/proceedings/africa/pdf/68_Regional1.pdf (Accessed on: 04/07/2011).

Castillo, J.J., 2009. Snowball Sampling. Available at: http://www.experiment-resources.com/snowball-sampling.html (Accessed on: 07/09/2011).

Central Statistical Office (CSO), 2003. Zambia 2000 Census of Population and Housing.

CIMMYT, n.d. Wheat Doctor. Available at: http://wheatdoctor.cimmyt.org/en/production-problems/list/57-land-preparation (Accessed on: 10/07/2011).

CIMMYT, 2004. Maize Diseases: A Guide for Field Identification. 4th edition. Mexico, D.F.

Delkab, 2009. Corn Basics: Corn Crop Management. Available at: http://www.dekalb-asia.com/pdf/CB2_CornCropManagement.pdf (Accessed on: 09/07/2011).

Dekalb, n.d. seed guide [leaflet].

Diskin, P., 1997. Agricultural Productivity Indicators Measurement Guide. Available at: http://www.pronutrition.org/files/Agricultural%20Productivity%20Indicators%20Measurement%20Guide.PDF (Accessed on: 28/06/2011).

Dorward , A., Chirwa, E., Jayne, T., 2010. The Malawi Agricultural Inputs Subsidy Programme, 2005/6 to 2008/9. Available at:

http://siteresources.worldbank.org/AFRICAEXT/Resources/258643-1271798012256/MAIP_may_2010.pdf (Accessed on: 05/06/2011).

Dorward, A., 2009. Rethinking Agricultural Input Subsidy Programmes in a Changing World. Centre for Development, Environment and Policy, SOAS- University of London. Available at: http://www.fao.org/es/esc/common/ecg/586/en/Dorward_FAO_Subsidy_Paper_FINA .pf (Accessed on: 04/06/20011).

EEOA, n.d. Maize. Available at: http://asp.ramboll.se/Docs/infopacks/Maize.PDF (Accessed on: 05/07/2010).

FAO, 1983. Improving weed management: Proceedings of the FAO/IWSS Expert Consultation on Improving Weed Management in Developing Countries, Rome. Available at: http://books.google.co.uk/books?id=hG_C560jLoC&pg=PA17&dq=what+is+weeding+in+crops&hl=en&ei=ws8STvyON4S8-QbdxZX1Dw&sa=X&oi=book_result&ct=result&resnum=3&ved=0CEUQ6AEwAg#v=onepage&q=what%20is%20weeding%20in%20crops&f=false (Accessed on: 07/07/2011).

FAO, 2011. Technologies and Practices for Small Agricultural Producers: *Pests and Diseases Management in Maize, Uganda.*

FEWS NET, 2007. Annual Harvest Report for the 2006/07 Production Season. http://www.fews.net/docs/Publications/1001479.pdf (Accessed on: 27/08/2011).

FSP Study Team, 2009. Report on Proposed Reforms for the Zambian Fertilizer Support Programme. Available at http://www.acf.org.zm/pdf/PANs/ACF%20Policy%20Advisory%20Note%20FSP.pdf (Accessed on: 16/12/2010).

Gianessi, L., 2009. Solving Africa's Weed Problem: Increasing Crop Production and Improving the Lives of Women. Crop protection research institute. Available at: http://www.whybiotech.com/resources/tps/Solving_Africas_Weed_Problem_Report.df (Accessed on: 05/07/2011).

Guantai, S. and Seward, P., 2010. Kenya Maize Handbook. Nairobi:Kenya Maize Development Programme.

JAICAF, 2008. The Maize in Zambia and Malawi. Tokyo: Association for International Collaboration of Agriculture and Forestry. Available at: http://www.jaicaf.or.jp/publications/Zambia.pdf (Accessed on: 05/08/2011).

Kaliba R.M., *et al*., 1998. Adoption of Maize Production Technologies in Central Tanzania. Mexico, D.F.: International Maize and Wheat Improvement Centre (CIMMYT), the United Republic of Tanzania, and the Southern Africa Centre for Cooperation in Agricultural Research (SACCAR).

KARI and ISAAA, 2000. Advances in Maize Streak Virus Disease Research in Eastern and Southern Africa, Workshop Report, 15-17 September 1999.

King, A.N., 2000. Agriculture- An Introduction for Southern Africa. Cambridge: Cambridge University Press.

Klopper, R., 2005. Maize Diseases: Reflection on the 2004/2005 season. Southern Africa Society for Plant Pathology. Available at: http://saspp.org/content/view/2/11/ (Accessed on: 10/07/2011).

Kusek, J.Z. and Rist, R.C., 2004. Ten Steps to a Results Based Monitoring and Evaluation System.

MACO, 2009. Ministerial Statement: Farmer Input Support Programme. National Assembly of Zambia. Available at: http://www.parliament.gov.zm/index.php?option=com_content&task=view&id=1022&Itemid=86 (Accessed on: 16/12/2010).

MACO, 2010. Statement on the. Farmer Input Support Programme in the Year 2010. Available at: http://www.parliament.gov.zm/index.php?option=com_docman&task=doc_view&gid=723 (Accessed on: 06/06/2010).

Minot, N. and Benson, T., 2009. IFPRI, Fertiliser Subsidies in Africa: Are Vouchers the answer? Available at: http://www.ifpri.org/sites/default/files/publications/ib60.pdf (Accessed on: 05/06/2011).

Mweshi, M., 2009 Genetic Improvement of Zambian Maize (*Zea mays* L.) Populations for Resistance to Ear Rots and a Survey of Associated Mycotoxins. Ph.D: University of Kwazulu- Natal

NDSU, 1997. Corn Production Guide – Index. Available at: http://www.ag.ndsu.edu/pubs/plantsci/rowcrops/a1130-2.htm (Accessed on: 26/08/2011).

Nieves, A.C. and Carino, A., 2011. The Value of Crop Rotation in Corn. Available at: http://www.agribusinessweek.com/the-value-of-crop-rotation-in-corn/ (Accessed on: 04/07/2011).

Pannar, n.d. Know The Maize Plant. Available at: http://www.pannar.com/uploads/products/151/Know%20The%20Maize%20Plant.pdf (Accessed on: 08/07/2011).

Pannar, n.d. Product Catalogue: Varieties for Zambia [Leaflet].

Peel, D., 1998. Crop Rotations for Increased Productivity. NDSU. Available at: http://www.ag.ndsu.edu/pubs/plantsci/crops/eb48-1.htm (Accessed on: 28/08/2011).

Qamar, M.K., 2005. Modernizing National Agricultural Extension Systems: A Practical Guide for Policy-Makers of Developing Countries. Available at: ftp://Ftp.Fao.Org/Docrep/Fao/008/A0219e/A0219e00.Pdf (Accessed on: 11/07/2011).

Rubin, A., and Babbie, E., 2009. Essential research methods for social work. 2nd Edition.

Seedco, 2004. Product manual [leaflet].

Sigh, C.M., Angiras, N.N. and Kumar, S., 1996. Weed management. New Delhi: MD Publications Pvt Ltd.

Tiba, Z., n.d. Targeting the Most Vulnerable: Implementing Input Subsidies. In Prakash, A., Ed. 2011. Safeguarding Food Security in Volatile Global. Rome: FAO. Ch. 26.

UZ Group Extension Guide, n.d. Available at: http://www.uz.ac.zw/agriculture/cropscience/CD/cve/eg/cmm/Module%201%20Tillage%20and%20land%20prep%20cotton.pdf (Accessed on: 07/07/2011).

Verschuren, P. And Doorewaard, H., 2010. Designing a Research Project. 2nd Edition. The Hague: eleven international publishing.

Vina, A., Fransen, L., Faeth , P., Kurauchi, Y.,2007. WRI Policy Note- Agricultural Subsidies, Poverty and the Environment: Supporting a Domestic Reform Agenda in Developing Countries. Available at: http://pdf.wri.org/aspe_domestic_reform.pdf (Accessed on: 04/06/2011).

Wiggins, S. and Leturque, H., 2011. Farming First- The Role of Subsidies in Raising Agricultural Growth in Africa. Available at: http://www.farmingfirst.org/2011/02/the-role-of-subsidies-in-raising-agricultural-growth-in-africa/ (Accessed on: 05/06/2011).

Wikimedia Commons, 2007. Chibombo District Map. Available at: Http://En.Wikipedia.Org/Wiki/File:Chibombo_Town_District_Location.PNG (Accessed on: 24/08/2011).

Wikipedia, 2011. Available at: *http://en.wikipedia.org/wiki/Agricultural_subsidy* (Accessed on: 04/06/2011).

Wikipedia, 2011. Available at: http://en.wikipedia.org/wiki/Crop_rotation (Accessed on: 06/07/2011).

World Bank, 2010. Report on Zambia Impact Assessment of the Fertilizer Support Program: Analysis of Effectiveness and Efficiency. Available at: http://siteresources.worldbank.org/INTDEBTDEPT/Resources/468980-1218567884549/5289593-1224797529767/DFSG01Zambia.pdf (Accessed on: 09/06/2011).

Yani, G., n.d. Growing Maize for Silage- A Guide for the Dairy Farmers.

Yawson, D., Armah, F., Afrifa, E. and Dadzie, S., 2010. Journal of Sustainable Development in Africa (Volume 12, No.3, 2010)- *Ghana's Fertilizer Subsidy Policy: Early Field Lessons From Farmers In The Central Region.*

Zambia Tourism Board, 2011. Environment/Geography. Available at: http://www.zambiatourism.com/travel/hisgeopeop/geograph.htm (Accessed on: 28/08/2011).

Zamseed, n.d., Product Catalogue: Seed [Leaflet].

Zulu, L., 2006. Report of Project meeting and Field Study in Zambia including MoMs. Renewable and Efficient Energy for Poverty Alleviation in Southern Africa (REEPASA). Available at: http://reepasa.energyprojects.net/documents/Annex_D4_2_4__Report_Survey_Zambia.pdf (Accessed on: 02/09/2011).

APPENDICES

Appendix A: Questionnaire for small scale farmers

For Small-Scale Farmers that have Benefited from the Current FISP

Name of respondent *(optional)*:……
Sex:…….
Date: ……..
Place/location: ……

1. **Access to inputs**
   a) How many bags (kg) of fertiliser did you receive in 2009/10 and 2010/11 seasons?
      Compound D Fertiliser…… Urea fertiliser …….....
   b) What is your comment on the quality of the fertiliser? …….
      Give reasons ……...
   c) What hybrid maize seed variety did you receive in 2009/10 and 2010/11
      ……
   d) How many bags (kg) of hybrid maize seed did you receive in 2009/10 and 2010/11 seasons? Give reasons: ……
      ……
   e) What is your comment on the quality of the hybrid maize seeds? …….....
      Give reasons ……...
   f) Did you receive the inputs on time in both 2009/10 and 2010/11 seasons?
      …….....
      ……
2. **Crop yields**
   a) How much land did you cultivate for maize in 2009 and 2010? …….....
   b) How many bags (kg) of maize did you harvest in 2009 and 2010?
      ……
   c) Give an estimate of how much was harvested as green maize for both years?
      ……
      …….....
3. **Management practices**
   a) Did you use all the inputs that you received for growing maize?
      Explain your answer: ……..
      ……
      ……
   b) What time was land prepared before the planting season? Early ☐ Late ☐
      Reasons: ……..
      ……
      ……
   c) What time did you plant/sow the maize seed?
      Very early ☐ Early ☐ Late ☐ Very late ☐
      Reasons: ……..
      ……
      ……..
   d) How many seeds did you plant per spot/station? …….
      Reasons: ……..

e) What was the spacing between lines and between plants? .....
Reasons: ……..
f) How many times did you weed your maize field? …….
Reasons: ……..
……
g) At what stage of the plant did you weed your field? …….
h) When did you apply your fertiliser both basal and top dressing? …….....
……
i) How did you apply the fertiliser? Explain
…….
……
……
j) Did you do any thinning in your maize field? .....
k) How do you control the pests and diseases in the maize field?
……
……
……
l) Did you plant any other crops in your maize field? If yes, specify …….....
……

m) Did you practice any crop rotation? ……
Give reasons for your answer…….....
……
……
n) What can you say about the amount of rainfall received in relation to maize production for both 2009/10 and 2010/11? …….....
……
……

4. Labour

a) What is the source of labour used in your maize production for both 2009/10 and 2010/11? ……..
b) Did you pay for the labour? …….....
c) Did you have enough labour during:
   - Land preparation? …….
   - Planting? …….
   - Fertiliser application? ……
   - Weeding? …….....

5. Extension services

a) Did you receive any extension services from the Ministry of Agriculture in relation to your maize production? Yes/No…….. If yes, specify ……...
……
b) How many times did the extension staff visit you? …….....
c) What extension services did you receive in relation to maize production?
……
……
d) How would you rate the services you received in relation to your maize production? Very good ☐ Good ☐ Poor ☐ Very poor ☐
Reasons : …….
……
……

Thank you!!

Appendix B: Questionnaire for the key informant

Name:……
Position: ……...
Organisation: ……
Date: …….

1. What extension services do you offer to the small scale-farmers in relation to maize production?
2. How often do you visit these farmers?
3. What time are inputs made available to the farmers?
4. What is your observation on the management practices by the farmers in relation to:
    i) Land preparation
    ii) Planting
    iii) Fertilisation
    iv) Weeding
    v) Pest control
5. What challenges are small-scale farmers facing in relation to maize production?

Appendix C: Maize yields by respondents

Respondent no.	Sex	Village	Area cultivated (ha)		No. bags harvested (50 kg)		Yield (tonnes/ha)	
			2009/10	2010/11	2009/10	2010/11	2009/10	2010/11
1.	M	Kapopo	0.4	0.4	20	50	2.5	6.25
2.	M	Kapopo	1	1.75	35	38	1.75	1.085714
3.	F	Mpandika	0.8	0.8	14	25	0.875	1.5625
4.	F	Mpandika	0.5	0.5	20	35	2	3.5
5.	F	Mpandika	-	0.5	-	7	-	0.7
6.	F	Mpandika	1	1	10	15	0.5	0.75
7.	F	Mapili	1	1	15	17	0.75	0.85
8.	F	Mapili	0.4	-	15	-	1.875	-
9.	M	Mpandika	0.5	0.5	20	20	2	2
10.	F	Mpandika	1	1	20	30	1	1.5
11.	M	Mapili	1	1	30	20	1.5	1
12.	M	Shimalosa	-	1	-	60	-	3
13.	F	Muntemba	0.5	0.5	30	15	3	1.5
14.	M	Mpandika	0.4	-	8	-	1	-
15.	M	Kapopo	0.4	-	35	-	4.375	-
16.	F	Kapopo	0.5	0.5	20	15	2	1.5
17.	F	Kapopo	1	1	45	35	2.25	1.75
18.	M	Kapopo	0.5	0.5	35	24	3.5	2.4
19.	F	Muntemba	0.5	0.5	15	20	1.5	2
20.	M	Shimalosa	0.8	0.8	30	35	1.875	2.1875
21.	M	Kapopo	0.4	0.4	15	15	1.875	1.875
22.	F	Shimalosa	1	1	35	30	1.75	1.5
23.	M	Kapopo	1	1	50	60	2.5	3
24.	F	Muntemba	-	1	-	30	-	1.5
25.	M	Shimalosa	0.8	0.8	55	25	3.4375	1.5625
26.	F	Kapopo	-	0.4	-	24	-	3
27.	M	Mapili	0.4	-	12	-	1.5	-

28.	F	Muntemba	0.4	-	10	-	1.25	-
29.	M	Shimalosa	0.4	-	6	-	0.75	-
30.	F	Shimalosa	0.8	0.8	6	10	0.375	0.625

Source: own fieldwork