

**EVALUATION OF SUBSIDY FERTILIZER DISTRIBUTION TO SMALLHOLDER  
FARMERS: A CASE OF MBEYA RURAL DISTRICT**

**BY**

**FRANK MNG'OLAGE**

**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
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## ABSTRACT

Mbeya district has been receiving fertilizer subsidy fertilizers since the reintroduction of the program by the government of Tanzania in 2003/04 crop season. The specific objectives of this study were; (a) to review the current design and conduct of fertilizer subsidy programme in the study area; (b) to examine the change in demand of fertilizer among smallholder farmers as a result of fertilizer subsidy programme and (c) to determine the effect of subsidy fertilizers in maize production by smallholder farmers. Data were collected using structured questionnaire with closed and open ended questions from a household head. The information was gathered from a sample size of 120 respondents, whereby 20 respondents were randomly sampled from each village out of six villages. A substantial part of the analysis was based on descriptive statistics. The Fertilizer demand model (FMD) was used in examining the effect of fertilizer subsidies on demand of fertilizer while the conditional outcome model (COM) was used in determining the effect of subsidy fertilizers on maize output produced by the smallholder farmers. Data processing and analysis were done using Statistical Package for Social Science (SPSS) version (13.0) computer software in conformity with the specific objectives of the study. The research findings have revealed that there is poor performance of the subsidy fertilizer programme in the study area to meet the demand of fertilizer by the smallholder farmers. The shortage of subsidy fertilizers and late delivery has resulted into using lower rates of fertilizer. To improve the performance of the subsidy fertilizer program it is recommended that; (i) farmers should be protected against low and volatile output prices by investing in irrigation, drought-tolerant crops and storage systems; (ii) the input delivery system to smallholder sector should be improved and enough funds should be allocated to the programme and (iii) A fertilizer factory be built in southern highland zone to solve the problem.

## DECLARATION

I, Frank Mng'olage, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and has not been or concurrently being submitted for a higher degree award in any other University.

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Frank Mng'olage  
(MSC -Candidate)

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Date

The above declaration is confirmed:

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Dr. Damian .M. Gabagambi  
(Supervisor)

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Date

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**DEDICATION**

To my father Jeremiah Majaliwa Mng'olage and my beloved mother Atuganile Mtonyole who laid the foundation of my education.

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## LIST OF ACRONYMS

ADP	Adenosine Triphosphate
AIDS	Acquired Immune Deficiency Syndrome
AISCO	Agriculture and Industrial Supplies Company
CAN	Calcium Ammonium Nitrate
CIF	Cost, Insurance and Freight
COM	Conditional Output Model
CRDB	Credit Rural Development Bank
DALDO	District Agricultural Livestock Development Officer
DAP	Diammonium Phosphate
DRT	Dar es Salaam Regional Trading Company
FAO	Food Agricultural Organization
FAI	Fertilizer Association of India
FDM	Fertilizer Demand Model
FOB	Freight on Board
FSD	Food Security Program
GDP	Gross Domestic Product
HA	Hectare
HBS	Household Budget Survey
IFA	International Fertilizer Association
IFDC	International Fertilizer Development Center
IFPRT	International Food Policy Research Institute
KGS/HA	Kilograms per hectare
MAC	Ministry of Agriculture and Cooperatives
MDB	Marketing Development Bureau
MOU	Memorandum of Understanding
NPK	Nitrogen Phosphorus Potassium
OGL	Open General License
OLS	Ordinary Least Square
RALDO	Regional Agricultural Livestock Development Officer
SA	Sulphate of Ammonia
SG-2000	Sasakawa Global -2000
SIGN.	Significant
SNAL	Sokoine National Library
SPSS	Statistical Package for Social Science
SSA	Sub-Saharan Africa
TFA	Tanganyika Farmers Association
TFC	Tanzania Fertilizer Company
TIP	Targeted Input Program
TRDB	Tanzania Rural Development Bank
TSh	Tanzania Shillings
TSP	Triple Super Phosphate
URT	United Republic of Tanzania
USA	United States of America
US\$	United States Dollar

## CHAPTER ONE

### 1.0 INTRODUCTION

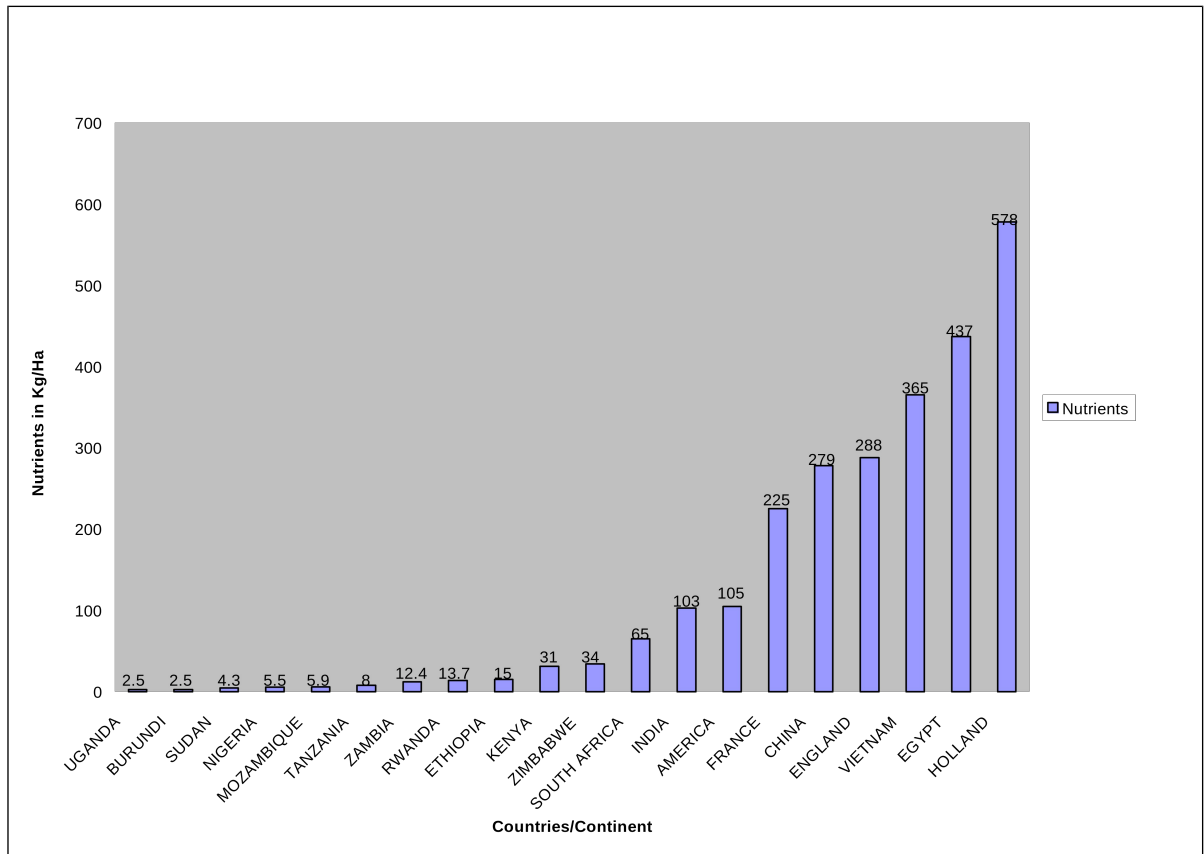
#### 1.1 Background

Agricultural subsidies have dominated the agricultural policy agenda in all economies—developed, developing, and transitional formally centrally planned economies. In the developed economies, agricultural subsidy fertilizers have been mostly in the form of price support for both domestic production and exports (Maene, 2000). Unlike the developed countries, developing countries like Tanzania have relied more heavily on input subsidies especially fertilizer subsidies (Gregory *at al.*, 2002; Debrah and Breman, 2000). The importance of introducing fertilizer subsidies was aimed at: accelerating the learning process, compensation of taxation in agriculture, reducing credit needs, improving value cost ratios, shielding from the volatility of international prices and stimulating domestic production of fertilizers (Gregory *at al.*, 2000; Segural *at al.*, 1986). Thus fertilizer subsidies became popular for both political and economic reasons. While implementing the structural adjustment programs in the 1980s, Tanzania like many other developing countries started the process of phasing out fertilizer subsidies for two reasons: failure of the subsidy scheme to mature into efficient behavior and unsustainable budgetary cost of subsidies and economic, political reforms which led to market based forces (trade liberalization).

The reintroduction of fertilizer subsidies in Tanzania and Sub-Saharan Africa (SSA) was inevitable due to a growing soil productivity crisis. Unsustainable farming activities have severely depleted soil nutrients throughout much of the region (Sanchez, 2002; FAO, 2003). According to IFDC (2003), 22 kilogram (kg) of Nitrogen, 2.5 kg of Phosphorus and 15 kg of Potassium are lost annually per hectare of cultivated land. Farmers apply about 9



kilogram per hectare (kg/ha) of fertilizer in Africa, compared to 86 kg/ha in Latin America, 104 kg/ha in South Asia, 142 kg/ha in Southeast Asia and 225 kg/ha in Western Europe (Kelly, 2006; URT, 2006) as presented in (Fig. 1).



**Figure 1: Quantity of fertilizer nutrients (kg/ha) used in different countries**

Source: (URT, 2006) Budget speech Ministry of Agriculture, Food and Cooperatives

Low fertilizer use contributes to Africa's lagging agricultural productivity leading to decline in food production per capita. Reversing Africa's decades-long decline in soil productivity levels poses a major challenge, and cannot be addressed without increased use of appropriate fertilizer nutrients. Depletion of soil fertility is a primary cause of low per capital food production in SSA (Bremen *et al.*, 2001).

Fertilizers have been applied to counteract loss of nutrients most consistently in the commercial and irrigated farming systems.

The global fertilizer nutrient consumption was 141.6 million tons in 2002/03 of which SSA nutrient consumption were less than 1% of the global total (Table 1). At country level, the quantity of the fertilizer use is even smaller (Gregory and Bumb, 2006). There is ample evidence from experience outside Africa that increased use of inorganic fertilizers has been responsible for important share of world-wide agricultural productivity growth contrary to organic farming. It is argued that fertilizer was important as seed in the Green Revolution (Tomich *et al.*, 1995), contributing as much as 50% of the yield in Asia (Hopper, 1993). Subsidy in fertilizer was removed in Tanzania in phases from 78% in 1990/91 to 0% in 1994/95 farming season. In 2003/04 season the government reintroduced subsidies on fertilizer in Southern highland regions after realizing that the use of fertilizers by the farmers had fallen since the removal of subsidies.

**Table 1: Global fertilizer consumption: 2001/02 to 2003/04**

Mt nutrients	2000/02	2002/03	2003/04	Variation over 2002/03
Nitrogen (N)	82.8	84.1	86.5	2.9
Phosphate (P <sub>2</sub> O <sub>5</sub> )	33.3	33.5	34.4	3.9
Potash (K <sub>2</sub> O)	22.7	23.2	24.0	3.2
<b>Total</b>	<b>138.8</b>	<b>140.8</b>	<b>145.4</b>	<b>3.2</b>

Source: IFA (2003) Short-term-prospects for world agriculture and fertilizer demand, 2002/03-2003/04”

## 1.2 Problems Statement

Since the reintroduction of fertilizer subsidy program by the Tanzanian government in 2003/04 season, the program has been reported to be constrained with several problems (Vedeld and Kengera, 2006). The farmers have been reporting that there have been

inadequate and untimely supplies of fertilizers at the farm level (DALDO, 2006). This problem is accompanied by the fertilizer agents to sell fertilizers under the program to the farmers using unofficial government retail price. In other areas it has been reported that traders have been selling fertilizer to neighboring countries illegally using perforated borders. This has led to shortage of fertilizers supply to intended areas. This showed that there was laxicity and inefficiencies in the monitoring of the program. The past state of knowledge did not give a clear picture on the performance of the program. That being the case there was a need to investigate the challenges by reviewing the whole policy through evaluating the distribution of fertilizer subsidy in Mbeya rural district to improve the situation.

### **1.3 Objective of the Study**

#### **1.3.1 Main objective**

The general objective was to evaluate the distribution of subsidized fertilizers to smallholder farmers in Mbeya rural district in a bid to address the challenges facing the subsidy fertilizer programme in the study area.

#### **1.3.2 Specific objectives**

- (i) To review the current governments design and conduct of fertilizers subsidy programme in the study area.
- (ii) To examine the change in demand of fertilizer among smallholder farmers as a result of fertilizer subsidies programme.
- (iii) To determine the effect of fertilizer subsidies in the production of maize by smallholder farmers.
- (iv) To recommend on what should be done regarding the research findings on subsidy fertilizer programme

### **1.3.3 Hypotheses**

- (i) There is no significant increase in demand of fertilizer as a result of fertilizer subsidy programme.
- (ii) Fertilizer subsidy has no significant effect on maize output produced by smallholder farmers.

### **1.3.4 Significant of the study**

In Tanzania there are limited research findings that have been conducted to investigate the performance of fertilizer subsidy programme to meet increased demand of fertilizer. The research findings have come up with suggestions that will help to improve the fertilizer subsidy policy to enable Tanzania to implement the programme efficiently hence ensuring food security, poverty reduction and income increase ultimately improving the living standards of the people. Policy makers will use the findings in improving the performance of the programme and other related sectors. Moreover the research findings have significant potentials to enrich the scientific and methodological insights and experience in studying the distribution of fertilizer subsidies in Tanzania

### **1.4 Limitations of the Study**

It was difficult to obtain past years data on quantities of fertilizer requested and received and the production trend of maize production from smallholder farmers. This was due to the fact that data depended heavily on the respondents' ability to recall past events. Convention of units was also a problem since some farmers use local units (e.g. tins, bags, etc.) which are not standardized. Farmers tended to mix units, for example acres and hectares. In some cases it was difficult to know the exact acreage owned by a farmer.

However, to improve the situation a lot of cross check questions and physical observations were used in order to minimize the problem.

### **1.5 Organisation of the Dissertation**

The dissertation is organized into five chapters. Chapter I describe the introduction that covers the background information, problem statement, objective of the study, hypotheses and the limitation of the study, Chapter II reviews relevant literature related to the study and overview of fertilizer industry in Tanzania. Methodology is covered in Chapter III. The empirical results of the study are presented and discussed in Chapter IV and the last Chapter V presents conclusions and recommendations based on the findings of the study

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Overview

This section reviews some of the available literature on fertilizer industry. Under this section the historical perspective of fertilizer supply in Tanzania, the current subsidy fertilizer programme, empirical studies on fertilizer subsidies and analytical framework are discussed.

#### 2.2 Definition of Key Terminologies Used in the Study

##### 2.2.1 Fertilizer

Fertilizer is defined as a synthetic chemical substance or mixture used to enrich soil so as to promote plant growth. In order for a plant to grow and thrive, it needs a number of different chemical elements. A mineral element is considered essential to plant growth and development if the element is involved in plant metabolic functions and the plant cannot complete its life cycle without the element. The most important of these are Nitrogen, Phosphorus and Potassium. These elements are important for building of basic blocks such as amino acids, cell membranes and Adenosine Triphosphate (ATP). To make plants grow faster, supply of elements that the plants need in readily available forms is necessary (Tisdale *et al.*,1997). A sustainable form of agriculture is based on the premise that nutrients which are removed with the harvested crops will be replaced. Mineral fertilizers allow farmers to supplement the nutrients which are already present in the soil.

##### 2.2.2 Subsidy

In economics a subsidy is a form of financial assistance paid to a business or economic sector and is used to support businesses that might otherwise fail, or to encourage activities

that would otherwise not take place (Pratap and Gupta, 1991). Subsidies can be regarded as a form of protectionism or trade barrier by making domestic goods and services artificially competitive against imports. Financial assistance in the form of a subsidy may come from one's government. The recipient of the subsidy may need to be distinguished from the beneficiary of the subsidy, and this analysis will depend on elasticity of supply and demand as well as other factors. Subsidy may also be used to refer to government actions which limit competition or raise the prices at which producers could sell their products, for example, by means of tariff protection.

### **2.2.3 Marketing**

Marketing is an ongoing process of planning and executing the marketing mix (product, price, place and promotion) for products, services or ideas to create exchange between individuals and organizations (David, 1997). Marketing tends to be seen as a creative industry, which includes advertising, distribution, and selling. It is also concerned with anticipating the customers' future needs and wants, which are often discovered through market research. Essentially, marketing is the process of creating or directing an organization to be successful in selling a product or service that people not only desire, but are willing to buy. Therefore good marketing must be able to create a set of benefits for the customer that delivers value through products or services (Wilson, 1997). The goal of marketing is to build and maintain a preference for a company and its products within the target markets. The goal of any business is to build mutually profitable and sustainable relationships with its customers. While all business domains are responsible for accomplishing this goal, the marketing domain bears a significant share of the responsibility.

#### **2.2.4 Trade liberalization**

Free trade is a market model in which the trade of goods and services between or within countries flows unhindered by government-imposed restrictions (Recardo and Mill, 2004). These restrictions may increase costs to goods and services, producers, businesses, and customers, and may include taxes and tariffs as well as other non-tariff barriers, such as regulatory legislation and quotas as explained by (Fuller and Geid, 2003) Trade liberalization entails reductions to these trade barriers in an effort for relatively unimpeded transactions.

#### **2.2.5 Free market economy**

A free market economy is an economic system in which individuals, rather than government, make the majority of decisions regarding economic activities and transactions (Dehaan and Sturm, 2006). A free market is a market in which prices of goods and services are arranged completely by the mutual consent of sellers and buyers. By definition, in a free market environment buyers and sellers do not coerce or mislead each other nor are they coerced by a third party. In the marketplace the price of a good or service helps to quantify its value to consumers and thus balance it against other goods and services. In a free market, this relationship between price and value is clearer than in a controlled market. Through competition between vendors for the provision of products and services, prices tend to decrease, and quality tends to increase (Dehaan and Sturm, 2007).

#### **2.2.6 Black market**

Black market is defined as a market consisting of all commerce on which applicable taxes and/or regulations of trade are being avoided. Under black market there is illicit sale of commodities in violation of government rationing and price- fixing.



## **2.3 Historical Perspective of Fertilizer Supply in Tanzania**

### **2.3.1 Pre-liberalization era**

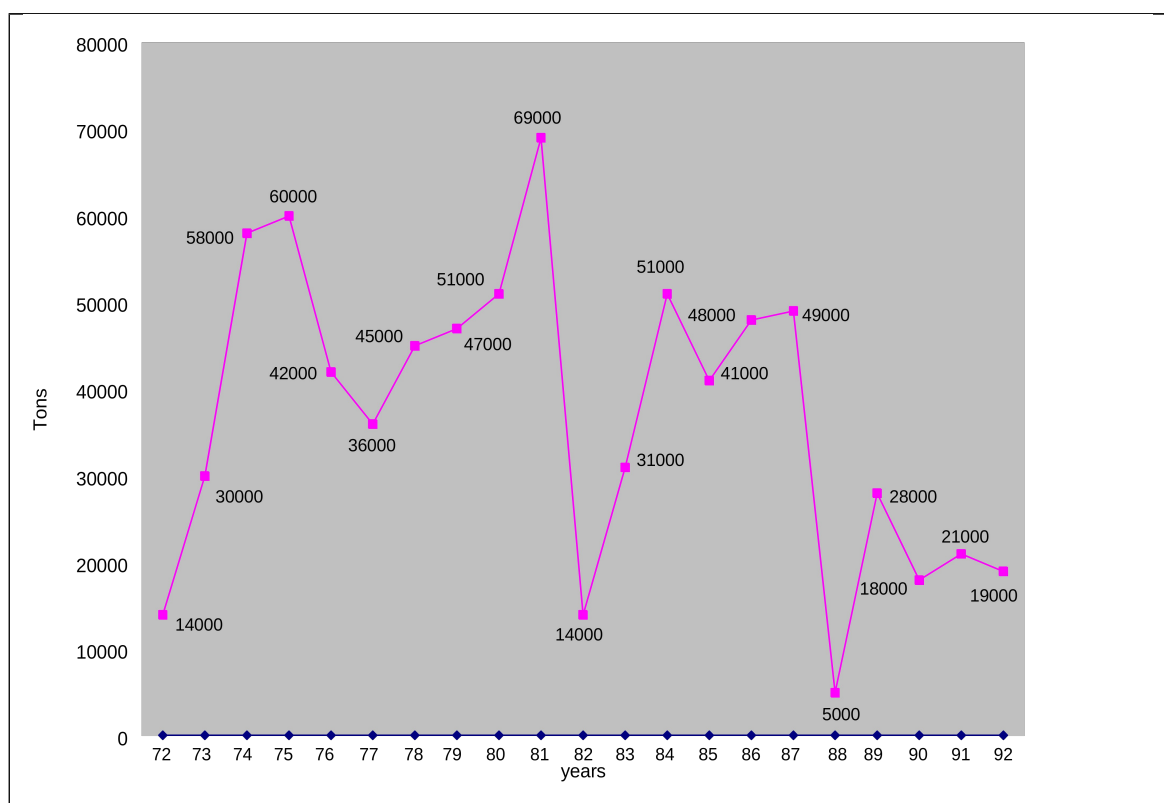
Before economic liberalization, fertilizer supply and distribution was done by Tanzania Fertilizer Company (TFC) and the Tanzania Rural Development Bank (TRDB) (Turuka, 1995; Hawassi, 1997). TRDB was responsible for provision of credit for fertilizers on crops which were covered under crop production credit programme. TFC was responsible for distribution of domestically produced fertilizers and fertilizer obtained through commodity aid while TRDB distributed fertilizer through cooperative unions, TFC distributed fertilizer through their regional depots and agents such as Agriculture and Industrial Supplies Company (AISCO) and Tanzania Farmers Association (TFA) (Mahundaza *et al.*, 1992). A detailed explanation on historical production of fertilizer in Tanzania, marketing of fertilizer and commercial imports of fertilizer are explained below.

#### **2.3.1.1 Fertilizer production in Tanzania**

The domestic production of fertilizer in Tanzania started in mid 1972 when the Tanga fertilizer factory was commissioned with an initial installed production capacity of 105 000 tons per annum. Eighty five thousand tons out of 105 000 were obtained from granulation plant and the remaining 20 000 tons per annum from ammonium sulphate plant. In the late seventies, the installed production capacity was increased to 125 000 tons, composed of 40 000 tons of Sulphate of Ammonia, 45 000 tons of granulated Triple Super Phosphate and 40 000 tons of blended NPK.

The Tanga fertilizer factory produced Sulphate of Ammonia (SA) (21% N), Triple Super Phosphate (TSP) (44-46%  $P_2O_5$ ), and compound fertilizers including Di-Ammonium Phosphates (DAP) and NPK compounds of 25:5:5 and 25:10:10 respectively. From the chart, (Fig. 2) the domestic fertilizer production has been fluctuating widely with the

maximum production achieved in 1981 with 69 031 tons, where as the lowest production was in 1988 with 5989 tons.



**Figure 2: Tanzania domestic production of fertilizer in metric tons, 1972/92**

Source: MALDC, (1993)

Mean production of the factory between 1972 and 1991 was 36 289 tons of the manufactured assortments per annum. However, the break-even production level of the plant was estimated at 50% of the installed production capacity equivalent to 63 000 tons (Mahundaza *et al.*, 1992). This implies that the Tanga fertilizer factory was operating below its capacity in (Fig. 2)

Mahundaza *et al.* (1992) pin-pointed four reasons which contributed to low level and fluctuation in domestic production of fertilizer; (a) untimely and insufficient supply of spare parts and deterioration of production facilities due to ageing of the plant; (b) shortages in the supplies of raw materials such as ammonia due to lack of foreign currency; (c) shortages in the supply of indigenous rock phosphate from the Minjingu mine because of lack of transport from Arusha to Tanga, and (d) the quality of the rock phosphate posed serious technological problems in processing it into phosphoric acid and subsequent TSP hence the locally produced TSP was not only of low quality in terms of nutrient contents (maximum 37%  $P_2O_5$ ), but also of poor physical appearance.

The Tanga fertilizer factory stopped producing fertilizers in 1991/92 production season due to lack of foreign currency to purchase raw materials and spare parts. Hence from mid-1992 there was no domestic production of fertilizers in the country and therefore the government has to depend entirely on commercial imports and grants for fertilizer supplies. In response to this, private businessmen, institutions, and stockist were allowed to import, procure and distribute fertilizers.

### **2.3.1.2 Marketing of fertilizer**

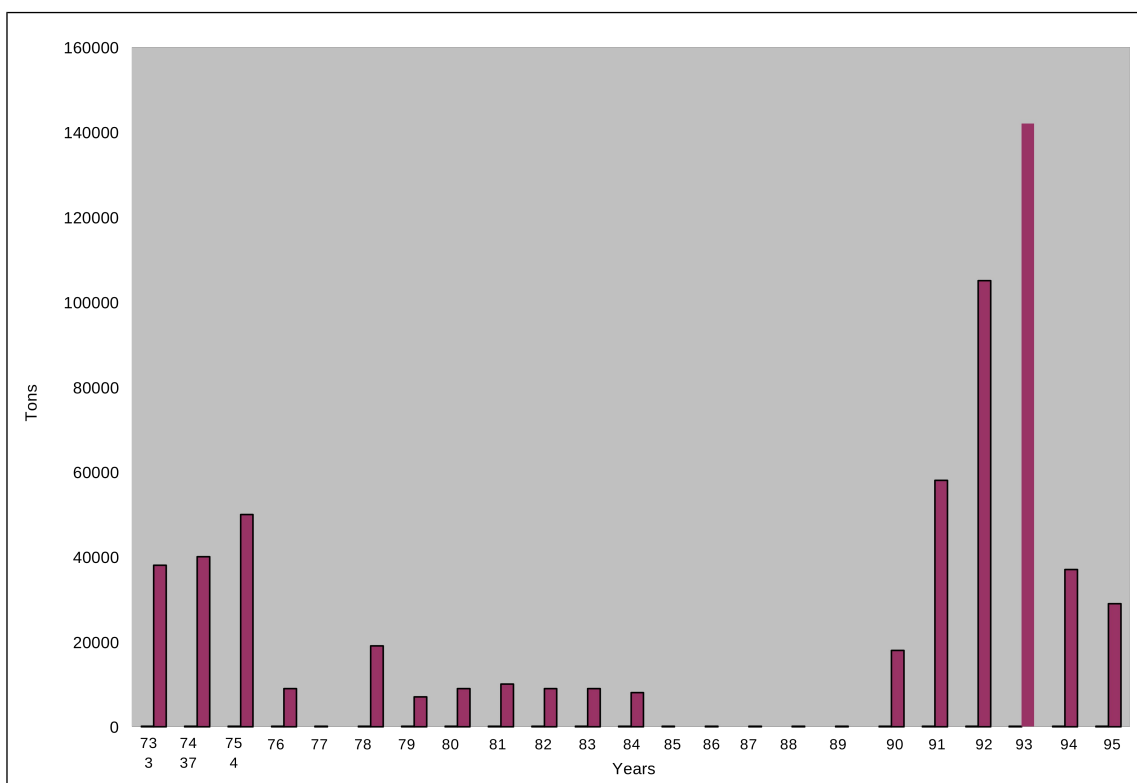
In the first years following the 1961 independence, agricultural output expanded rapidly in Tanzania. Input delivery and marketing systems were well functioning and world market prices were favorable (World Bank, 1991). The economic policy in this period was a continuation of pre-colonial policies. At the end of the 1960s the country embarked on a socialization path including wide range nationalization and increasing governmental control over prices and markets. In the late 1970s severe problems emerged in terms of economic stagnation, deterioration of physical infrastructure, and an increasing overvalued

exchange rate. Following these situations the government had to look for various ways to rescue the prevailed conditions.

### **2.3.1.3 Commercial imports of fertilizer**

The level of annual imports during 1960s are estimated to be at an average of 30 000 tons (Raikes, 1974). Moreover, consumption of fertilizers was by then confined to large scale farms (FAO, 1989). After the nationalization of private companies in 1967, procurement of fertilizers was confined to the Tanzania Fertilizer Company (TFC) which was formed in 1968 as joint venture between Tanzania and Germany. The TFC and Tanzania Rural Development Bank (TRDB) were the major fertilizer importers between 1971 and 1977.

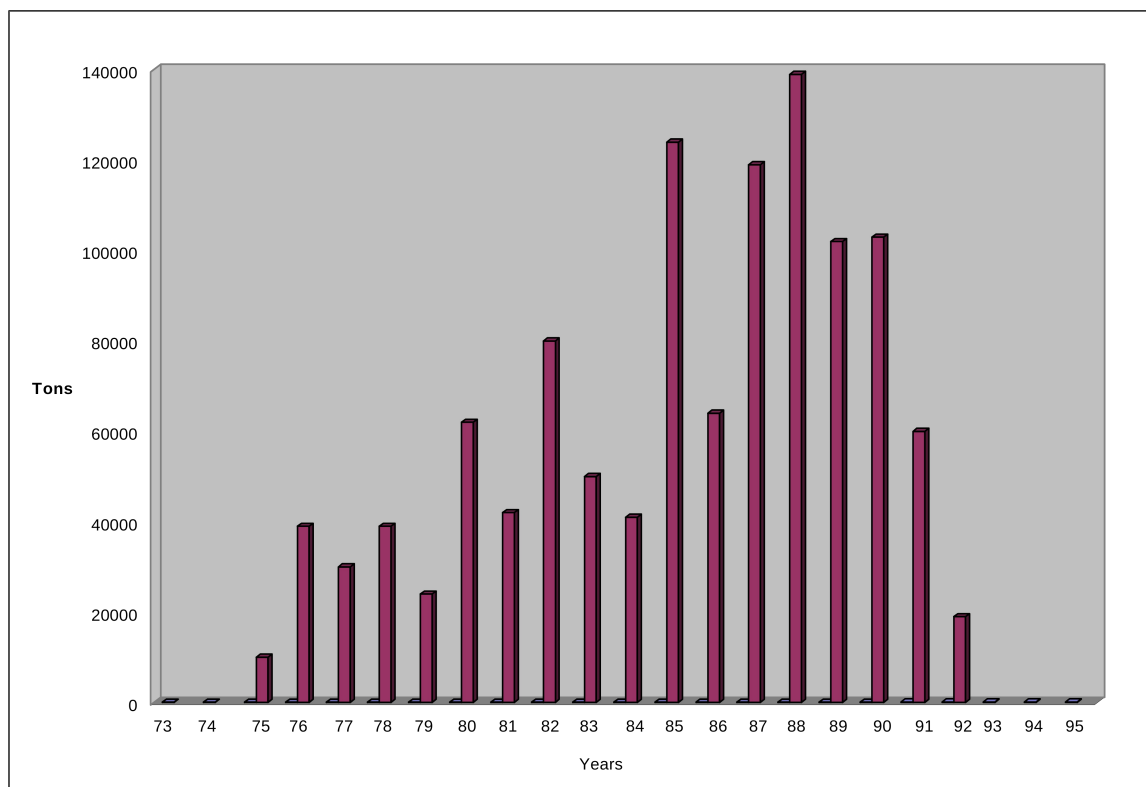
The role of the TRDB in fertilizer imports was directly linked to its role in the provision of agricultural credit. TFC assumed the monopoly of fertilizer production, importation and supply throughout the country in 1977. The TRDB on the other hand was only involved in fertilizer distribution to its clients requiring agricultural credit. It was also responsible for the special crop programme. Figure 3 depicts the trend in commercial fertilizer imports in Tanzania, and it can be noted that substantial commercial imports of finished fertilizers were made for few years from 1973 to 1978. The period thereafter is characterized by a relatively low level of commercial imports of fertilizers. It is also noted from the (Fig. 3) that between 1985 and 1989 no commercial imports of fertilizers were made. The situation of commercial fertilizer imports changed in the 1990s. The fertilizer imports increased sharply from 13 910 tons in 1990 to 143 474 tons in 1993 and dropped to 26 450 tons in 1995.



Source: Ministry of Agriculture, Livestock Development and Cooperatives (1995)

**Figure 3: Tanzania: Commercial import of fertilizer in metric tons, 1973/93**

Figure 4 below shows the trend in fertilizer grants in Tanzania. The grants have been fluctuating widely between 1973 and 1986 with a peak in 1998. Lack of foreign exchange needed to purchase raw materials and for major rehabilitation of the Tanga factory limited domestic production to only 5 989 tons in 1988. As a result total grants went up sharply from 66 691 tons in 1986 to 136 666 tons in 1988 and dropped by 84% to 16 691 tons in 1992.



**Figure 4: Tanzania fertilizer grants in metric tons, 1973/95**

Source: Ministry of Agriculture, Livestock Development and Cooperatives (1993)

It should however be noted that, during trade liberalization the trends of commercial imports and grants in fertilizers have been declining as shown previously in (Fig. 3 and 4). In fact, commercial imports of fertilizers depend largely on the availability of foreign currency. But during trade liberalization most donor agents stopped supporting importation of fertilizers through import support programmes and commodity aid programmes and channeled their import support funds to Open General License (OGL) through the Bank of Tanzania (BOT) where cash covers must be paid against their utilization. Under the OGL system, importers such as TFC had no alternative but to make open market purchases from international market. Such a transaction required 100% cash for establishment of letters of credit to initiate the procurement process. Therefore, the low levels of commercial fertilizer imports partly indicate an increasing foreign exchange shortage to import fertilizer. Thus, putting all the imports support funds in the general pool does not guarantee availability of

adequate fertilizer. The possible problem likely to emerge is shrinkage of overall fertilizer availability which will have an adverse effect on food crop production and overall performance of the agricultural sector.

### **2.3.2 Post liberalization era**

#### **2.3.2.1 Economic reforms**

From 1985 an economic recovery program was launched. A key objective was to stimulate agriculture by increasing producer incentives. The program also emphasized the need for structural reforms in the financial sector, the reorganizations of parastatals, and in the system of public administration. A number of governmental restrictions were phased out in the mid 1980s including a gradual elimination of price controls on outputs, credits, exchange rate and quantitative import controls. Input subsidies were removed together with restrictions on traditional exports and the retention of export receipts (World Bank, 1996). More responsibility was given to the private sector both on production as well as on marketing side. Following the complete liberalization of fertilizer marketing in 1990, private companies were allowed to import and distribute fertilizer in the country. The first private companies to enter the market were Tanganyika Farmers Association (TFA) and Mohamed Enterprises in 1992.

#### **2.3.2.2 Re-establishment of cooperative unions**

The establishment of crop authorities in 1976 following the dissolution of cooperative unions provided another channel for TFC to distribute fertilizers (FAO, 1989; Turuka, 1995). By 1984, following the re-establishment of cooperative unions most of the fertilizer was distributed by the cooperative union leaving small quantities to secondary agents such as AISCO and crop marketing boards. By this time TFC was the sole producer and importer of fertilizers while Credit and Rural Development Bank (CRDB) (formerly

TRDB) was responsible for the provision on inputs credits to cooperatives unions and crop boards (Turuka, 1995). Although fertilizer marketing was liberalized in 1990; private fertilizers retailers joined the business in 1988/89 season under TFC contract following the failure of cooperative union to distribute fertilizers due to financial problems (URT, 1994). Private retailers emerged rapidly in the southern highlands and by 1992/93 season there were 90 retailers in Iringa regions alone.

According to the Ministry of Agriculture and Cooperatives report (MAC, 1997b) fertilizer consumption in the southern highlands had declined from 70% of the country's total consumption in the early 1990s to 37 percent in 1996/97. The main reasons for the decline in consumption were higher fertilizer prices, low producer prices and collapse of the cooperative unions which used to give credits to farmers (MAC, 1997b). The Mbeya region authority has reported that, the production season 2006/07 fertilizer requirement was 70 000 tons but only 25% of the requirements were available (RALDO, 2006).

### **2.3.3 Agricultural input trust fund**

In order to respond to the problems of low use of fertilizers and its availability the government passed a bill in 1994 to establish the national input funds to facilitate access of inputs to smallholder farmers. This intended to ensure that inputs could be available in required amount at the right time and reasonable prices. Another important policy change included the removal of explicitly tax on agricultural products as the result of over valued Tanzania shilling. This enabled the private sector to be involved in the processing and marketing of coffee, cotton and cashew nuts. The policy also resulted in the removal of subsidy on fertilizers imports in the 1994-1995 budgets which led to a substantial drop in fertilizer use (Velded and Kengera, 2006).



In 2002, the Agricultural Input Trust Fund extended credit worth shillings 1.2 billion, out of the budgeted shillings 1.5 billion for procurement and distribution of inputs. In 2004, the fund through several banks offered 80 credit for agricultural inputs worth shillings 2.1 billion. The objective of this fund is to encourage the use of agricultural inputs, machinery and equipment in order to increase production and productivity of the sector (Economic Survey, 2002). Despite the introduction of this fund still there was a low use of fertilizer by smallholder farmers this led the government to look for more strategies to stimulate use of fertilizer by reintroducing the fertilizer subsidy programme.

## **2.4 The Current Subsidy Fertilizer Programme**

### **2.4.1 Fertilizer demand and supply in Tanzania**

Tanzania reintroduced fertilizer subsidies during the 2003/04 agricultural season by starting with the four Southern Highland regions of Iringa, Mbeya, Rukwa and Ruvuma after a period of 12 years removal of subsidy fertilizer. The fertilizer received under the subsidy programme in Southern Highland regions for the season 2003/04 was 59 429 tones as shown in Table 2.

**Table 2: Quantities of fertilizer distributed in Southern Highland regions in 2003/04**

Region	Quantity of fertilizer(tons)
Iringa	20 713
Ruvuma	17 481
Mbeya	18 225
Rukwa	3 007
<b>Total</b>	<b>59 426</b>

Source: RALDO (2006).

Fertilizer distribution is one of the key activities being implemented throughout the country, however the government fertilizer imports fell below the requirements, because

import prices were high and importers were not made aware soon enough of the governments' intentions; the subsidy stimulated fertilizer use and promoted food crop production where fertilizers reached farmers on time (MAFS, 2006).

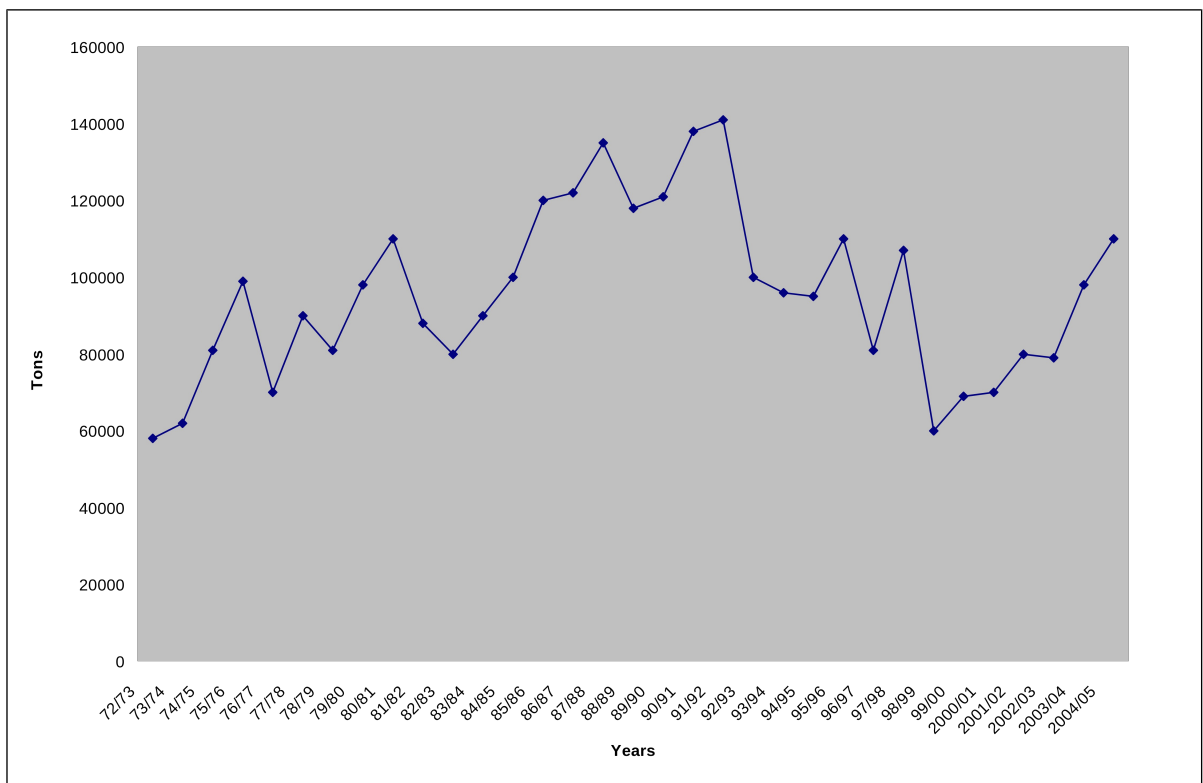
#### **2.4.2 Subsidy fertilizer handling logistics**

In 2005 the government decided to expand the fertilizer subsidy program to all regions. To implement the program, the government signed a Memorandum of Understanding (MOU) with traders across the country with different private companies. Under those arrangements, the government had to meet at 100% for DAP and UREA and 75% for the rest of fertilizers types the transportation costs from Dar-es-Salaam to designated distribution points. At such designated centers, DAP and UREA were sold at a fixed price of TSh 14 000 per 50 kg. Traders who were to distribute fertilizers from those distribution points into the interior added a small price margin to cover the additional transportation costs. The governments aimed at encouraging farmers to use DAP and UREA against other fertilizer types (MAFS, 2006). For the seasons 2006/07 and 2007/08 a bag of fertilizer was sold at shillings 19 500 and shillings 22 500 respectively to the final consumer (DALDO, 2007).

According to the Ministry of Agriculture and Food Security (MAFS, 2006), the government estimated the 2004/05 season fertilizer demand to be at 385 000 tons and about 164 000 tons of different fertilizer types were already in the country by the end of October of that year. This available amount was 42% of the estimated requirement and it was 88% of the effective 1999/00-2003/04 annual demand of 180 000 tons.

However the high prices of fertilizers, insufficient secondary distribution network, lack of credit facilities, poor infrastructure and low prices of agriculture outputs compared to

fertilizers affected the demand of fertilizers by the farmers. This has caused the overall fertilizers use in Tanzania to approximately 9 kg nutrients/ha, which is very low compared to the average use of fertilizer in most significant food crops where it had fallen from 70% in 1990 to 32% by the end of the decade (Veldeld and Kengera, 2006). (Fig. 5) below shows the general trend use of fertilizer in Tanzania from 1972/73 to 2004/05 seasons. It can be noted that fertilizer use started to rise from the time when subsidies were reintroduced by the government.



**Figure 5: Trend of fertilizer use in Tanzania from 1972/73-2004/05**

Source: Ministry of Agriculture and Food Security, (2006)

## **2.5 Review of Empirical Studies on Fertilizer Subsidy**

### **2.5.1 Contribution of fertilizers in food production**

Nutrients in crop production systems have come under increased scrutiny in recent years because of the environmental impact from inputs such as Phosphorus and Nitrogen. Studies on maize in United States of America (USA) and England showed that the average percentage of yield contributed by fertilizer generally ranged from about 40% to 60% as cited by Stewart *et al.* (2006). Despite the global resources available to produce food, Africa today is reported as a food deficit one, with only a few countries approaching anywhere near self-sufficiency as reported by Ryan *et al.* (2006). In order to have sustainable food production through fertilizer use, the concept of balanced fertilization in the interest of economic and environmental protection is suggested El-Beltag, *et al.* (2004). The International Fertilizer Center (IFDC) in 1999 argued that, increasing soil degradation and deforestation was one of the reasons for the low productivity of agriculture and sufferings from hunger and malnutrition to SSA's population.

It has been suggested that input markets must go hand in hand with building output markets and improving farmer access to both, and mitigating the crop production risk factors faced by farmers (Jonathan *et al.*, 2007). The study conducted by the Tanzania Agricultural and Rural Credit Project (TARCP) in 1990 reported that areas where soil fertility are depleted through continuous cropping, improved fertility is estimated to account for 66% (or 2 450 kg/ha) of the total maize yields of 3 700 kg/ha. Other improved practices estimated to account for 14% (500 kg/ha), and 15% (550 kg/ha) of the total yield at constant conditions (TARCP, 1991).

More relevant to this study is the fact that, the adoption of modern farm inputs has a smaller effect on overall smallholder maize productivity than is generally relied on even in

countries where considerable success has been achieved in making improved seeds and fertilizer available for smallholder (Rohrbach, 1988). In part this is of the bias in maize research and technology development towards large scale producers which has had the effect of encouraging high cost methods of maize production. In particular, the costs of the modern technologies and the associated risks, constrain the ability of small holders to move to higher levels of maize production technology (Blackie, 1990). This is due to the fact that, smallholder farmers are extremely sensitive to the cash requirements of improved technologies and thus will reduce their use sharply as agricultural produce prices fall, unless there is a comparable fall in input prices. Alternatively smallholder farmers may switch quickly to alternative crops as relative prices change (Blackie, 1990). Therefore, only large scale producers and smallholder farmers with better quality land are the main beneficiaries of improved technologies. This is because they are in a better position.

### **2.5.2 Rationale for government intervention in fertilizer pricing and marketing**

There are a number of reasons for the government to intervene in fertilizer pricing and marketing. A detailed account of the evidence of these issues can be found in (Ellis, 1992; Turuka, 1995). The governments intervened in the fertilizer markets partly because the private sector was unable to deliver the inputs with sufficient competitiveness, timeliness, quality, accuracy of information, and large geographical coverage.

The involvement of the government in the fertilizer market also aimed at combining the input delivery with the provision of credit. This was aimed at alleviating the working capital constraints on the adoption of fertilizer technology. Apart from supplying fertilizer, the fact that the extension services are usually provided by the government, it would have been easy for the government to combine fertilizer supply, distribution and provision of extension services which could avoid mistakes in fertilizer use by farmers, which might

have happened on a trial-and-error basis (Turuka, 1995). Also there is ample evidence that the complete removal of fertilizer subsidies in 1994/95 cropping season had significantly reduced maize output. Efficiency analysis results revealed deviations from the optimal use before and after complete removal (Hawassi, *et al.*, 1998).

Schuuman (1994); Fontaine and Sindzingre (1991) argue that fertilizer subsidies have been adopted to reduce farmers' cost, to encourage adoption of fertilizer and to increase use. They also argue that the provision of fertilizer subsidies is one of the ways of transferring income from urban to the rural sector. Other reasons include the encouragement to use high analysis fertilizers to correct imbalances as well as to provide an incentive for the domestic fertilizer production.

Ellis (1992) argued that the main purpose of subsidizing a farmer is to reduce the cost of production, which is incurred by adopting modern methods of agricultural production thus improving agricultural outputs. Despite the drawbacks of fertilizer subsidies (World Bank 2006e) high fiscal cost, difficult targeting, and crowding of commercial sales they continue to receive strong support, from farmers but also from some policy makers. Jonathan, (2007) adds that fertilizer subsidy is a common strategy to make fertilizers more affordable to farmers by governments to subsidize fertilizer prices. Coulter and Lele (1993) found that barring grain exports remained appropriate for the medium term and instead advocate a subsidy on fertilizers to induce progress and agricultural modernization in Tanzania. Lele *at al.* (1989) considers increased use of chemical fertilizers as a crucial ingredient in raising agricultural output. In discussing agricultural input subsidies Rao and Caballero (1990) stress the importance of focusing on fertilizer rather than on labor saving inputs in order to achieve gains in terms of employment. FAO, (1996) and Oygard, *et al.* (2002) reported that fertilizer subsidy program in agricultural production had been coupled

with smuggling of fertilizer both in Asia and Sub-Saharan countries across perforated borders.

From all the observations above the gap that exists on the fertilizer subsidies indicates that there are limited studies on evaluation of fertilizer subsidies distribution to smallholder farmers. This research intends to evaluate the challenges that face the distribution of fertilizer subsidies to maize smallholder farmers in Mbeya Rural District.

### **2.5.3 Determinants of fertilizer adoption and use**

It has been reported that the relative importance of the factors other than prices is reinforced by the inadequate explanatory power of prices for the variations in fertilizer consumption. Hossain (1985) observed that price factors explained about 4% of the variations in fertilizer consumption in Bangladesh. Abdoulaye and Sanders (2005) also argue that the fertilizer price relative to millet was always a highly significant determinant of fertilizer adoption in Niger. This suggests that there were factors other than the fertilizer –crop price ratio that supported the use of more fertilizers in Bangladesh and Niger.

Salam (1981) showed statistically that, the impact of years of schooling on fertilizer applied on wheat in Pakistan was positive with an estimated with an elasticity of 0.196. On illiteracy and lack of credit were the major constraints to fertilizer use among farmers in Western Niger (Thompson and Baanante, 1988). Baanante (1989) observed that farm level demand for fertilizer was inversely related to prices and directly related to prices and directly related to credit availability in Bangladesh.

Furthermore, the study conducted by Mbata (1994) identifies that labour, credit availability, membership of cooperative society, level of education of the farmers, contact

with extension agents and farm size were important factors influencing fertilizer adoption and use among small scale farmers in Kenya. He further emphasized that institutional and educational considerations are sometimes more important than economic factors as determinants of technology adoption among small-scale farmers. Investigation on credits by Foltz (2004) revealed its significance in the adoption of fertilizer use in agriculture.

Asfaw and Admassie (2004) findings on the role of education on the adoption of chemical fertilizer use under different socio-economic environments in Ethiopia indicated that the decision making process is a decentralized one which educated adult members of the household actively participate in the decision making process. Temu (2005) argues that output prices exert great influence on input purchases and that both fixed and variable transaction costs affect input use decision. Travel costs in input and output markets have distinct effects on input usage, implying distinct avenues for interventions to promote more intensive use of agricultural inputs.

#### **2.5.4 Importance of fertilizer subsidies to smallholder farmers**

According to Tsutom (2007) findings in Malawi the major similarity in the production costs structure of maize across the villages was the high cost of fertilizer. However use of fertilizer increased maize production and certainly improved the food security situation of households. Given the fact that it often becomes very difficult to purchase maize through markets in lean period's farmers may keep enough maize stock in household granaries. In order to increase land productivity farmers play a great role in nutrient recycling within their farm by using other sources of nutrients such as organic matter, but inorganic fertilizers have a quick effect in soil restoration (Hoffman *et al.*, 2001).



Bamire and Mangong (2004) argue that sustaining the productive capacity of the land resource under the existing land use system and increasing population pressure requires the use of appropriate technologies that will enhance farm productivity and income levels. Their findings revealed that farmers preferred to use inorganic fertilizer despite its inadequate supply because apart from enhancing higher return and net gains, it also improved output and provided an opportunity for the continuous use of scarce source. In Africa agriculture contributes about 35% of GDP, providing employment for 70% of its labour force, raw materials to agro-industries and export commodities for export (Moctar and Mahamood, 2001), while in Tanzania it is estimated that agricultural sector contributes about 50% of GDP and about 54% to Tanzania's export incomes, employing more than 80% of the total population. In the rural areas, more than 90% of the population earns their living through agriculture (Veldeld and Kengera, 2006).

According to (MAFS, 2006) agriculture growth in Tanzania is increasingly recognized as a central for sustained improvement in economic growth of the country and food security and nutrition for growing population. However, the major contribution of agricultural output in Tanzania, particularly food crops, is derived from smallholder farming where the farm production system is mainly traditional and productivity is low.

According to the economic survey (2004) the agriculture sector grew by 6% in 2004 compared to 4% in 2003. Food crops production increased from 11 979 000 tons in 2003 to 13 213 000 tons, equivalent to an increase of 10.3%. This increase resulted mainly from increased production of maize (36.9%), beans (16.6%) and paddy (11.8%) as shown in Table 3. Because of increasing population growth, declining soil fertility, increased deforestation, scarcity of food, decline in foreign exchange earnings and other related

problems, researchers and policy makers are hard pressed to develop appropriate farm production systems that would facilitate efficient and sustainable production.

**Table 3: Food crops production 2002/04 in (000s` tones)**

Crop	2002	2003	2004	% increase in production 2002/04
Maize	3 480	3 129	4 286	36.9
Paddy	1 069	921	1 030	11.8
Wheat	67	72	66	8.3
Millet	757	986	937	4.9
Cassava	2 058	2 656	2 440	7.0
Beans	574	517	603	16.6
Potatoes	1 025	1 197	1 245	4.0
Bananas	2 067	2 501	2 376	2.9
<b>Total</b>	<b>11 097</b>	<b>11 979</b>	<b>13 213</b>	<b>10.3</b>

Source: Economic Survey (2004).

### 2.5.5 Input accessibility

During the 1970s and 1980s, the government of Tanzania used to import and manufacture fertilizer. It was distributed free of charge, or at heavily subsidized prices, an attempt to boost agricultural production (Jayne *at al.*, 2002). At the pick in 1988, fertilizer consumption was more than 100 000 tones per year. The cost of this policy was estimated at more than \$10 million per year, which eventually became unsustainable. Markets were liberalized and now all the fertilizer is imported by the private sector, mostly from South Africa. Reardon *et al.* (1997) found that policy reforms and structural adjustment programmes in Sahelian countries have eliminated many public programmes, creating a vacuum that has not yet been filled by the private sector. For Sahelian farmers input use has stagnated or declined, yet higher population and less land expansion of cultivation make it vital to increase the productivity of already cultivated land through use of intensive agricultural production techniques.

Howard *et al.* (2003) argue that the Sasakawa Global 2000 technology was much more profitable in Ethiopia than in Mozambique, but varied depending on production location, fertilizer and transport costs, domestic and international prices, regional surplus or deficit conditions and productions as import substitute or export. The programs provide further evidence that high input technologies can be successfully introduced through well-funded high-profile programs.

Today, fertilizer and other purchased inputs are not widely used by small scale in Tanzania. National Sample Census of Agriculture (NSCA) found that in 1995, 15% of Tanzania farmers used fertilizer, 27% used improved seed and 18% used pesticides. Fertilizer use rates are also declining from 8.4 kilograms per hectare in the 1980s to 6.1 kilograms per hectare between 1996 and 2000. During the 1980s, fertilizer was mainly used for maize production. Today fertilizer is being used for coffee, vegetable, tobacco and other high value crops as reported by Jayne *et al.* (2003).

### **2.5.6 Typology of fertilizer programs**

A number of programs have been practiced in SSA in an attempt to promote use of fertilizer in order to stimulate agricultural growth include:-

#### **2.5.6.1 Controlled state input distribution programs**

The basic feature of this model is a controlled system of input and output marketing in which the state distributes fertilizer and other inputs (often on credit) to farmers and recoups the input loan at harvest time when the farmer sells crops to the state or its agents. Generally, input subsidies are applied broadly to reduce the market price of fertilizer without attempting to target subsidies to specific groups. Kherallah *et al.* (2002); Jayne and Jones (1997) and Donovan (1996) have reported that this model was practiced in countries

such as Kenya, Tanzania, Malawi, Zimbabwe, and Zambia in the 1980s until their implementation of structural adjustment policies. In many African cases, and for brief periods of time, this system successfully increased fertilizer use and food output to farmers, especially in more remote areas where fertilizer use was otherwise unprofitable.

#### **2.5.6.2 Cross-country experience of government input distribution in Africa**

In practice, targeted government input distribution programs in Africa have generally been unable to effectively channel fertilizer subsidies to relatively low-income farmers (Govereh *et al.*, 2002; Kherallah *et al.*, 2002). Moreover, to the extent that subsidized fertilizer is acquired by farmers with effective demand who otherwise would have purchased fertilizer from the market, the operation of government input distribution programs can erode the commercial demand for fertilizer that is necessary to develop well functioning private input delivery systems (Govereh *et al.*, 2002).

#### **2.5.6.3 Sasakawa/Global 2000 programs**

Crawford *et al.* (2005) reported that the Sasakawa/Global 2000 Program (SG-2000) initiated a series of joint programs with African governments to demonstrate that substantial productivity increases could be achieved when farmers were given appropriate extension messages and agricultural inputs were delivered on time at reasonable prices. Pilot programs were set up, typically in relatively productive areas, to provide credit, inputs, and extension assistance to participants willing to establish half-hectare demonstration plots on their own land. Over time, other farmers learn from the participating farmers, adopt the input use and management practices, and the technology diffusion process takes off. SG-2000 programs were implemented in a number of countries during the 1990s, including Ethiopia, Mozambique, Uganda, and Ghana.

Assessments by Howard *et al.* (1999; 2000) in Ethiopia and Mozambique indicated that farmers could significantly increase maize yields through the application of the recommended improved seed and fertilizer package. The increase in fertilizer use has been largely sustained through continued input distribution programs coordinated by the state but ostensibly implemented by private holding companies (Jayne *et al.*, 2003). The Mozambique evaluation provided a more mixed picture of financial profitability of the high-input fertilizer package, where only one of the three sites evaluated showed that the high-input technology was superior to alternative low-fertilizer technical packages (Howard *et al.*, 2000).

#### **2.5.6.4 Public sector facilitation of private sector fertilizer supply**

This model features a public goods investment approach to support private sector entry in the fertilizer sector. The general strategy is to improve the demand for inputs by farmers and the incentives for private companies to serve farmers' needs by engaging in activities that reduce the costs of agricultural production and marketing, example investing in roads, port facilities, and other forms of market infrastructure, improving agricultural production and marketing extension services, investing in more fertilizer-responsive. Allgood and Kilungo (1996) reported that by 1996, there were 12 major importers, 500 wholesalers, and roughly 5000 retailers distributing fertilizer in Kenya.

International Fertilizer Development Center (IFDC) (2001) estimates showed that the number of retailers rose to between 7000 and 8000 by 2000. Some of the largest importers were cooperatives and estate firms supplying their members, most of whom were small-scale farmers participating in tea, coffee, and sugarcane outgrower schemes. Several studies indicate that the market is generally competitive; particularly at the retail level (Argwings-Kodhek, 1996; Omamo and Mose, 2001; Wanzala *et al.*, 2002). Its successful is

that fertilizer consumption has increased substantially, rising from roughly 230 000 tons in the early 1990s to over 350 000 tons since the 2001/02 season.

#### **2.5.6.5 Starter pack programs**

According to Oygard *et al.* (2003) the program has been implemented in Malawi government with financial assistance from numerous donors since 1998/99 season by providing every rural smallholder household with a free pack consisting of 15 kilograms of fertilizer, two kilograms of hybrid maize seed, and one kilogram of legume seeds. The inputs were sufficient for cultivation of 0.1 hectares according to extension recommendations, with the objective of increasing maize yields, food security and countering soil nutrient depletion. The Starter Pack program was originally conceived as a technology-based plan that was cheaper than importing maize, but in later years it and its successor Targeted Input Program (TIP) program doubled as a relief effort. The program demonstrated the government's efforts to help rural households Levy and Barahona (2002).

## **2.6 Analytical Framework**

### **2.6.1 Estimation of fertilizer demand**

Different approaches have been suggested and adopted in the estimation of fertilizer demand in the literature. They range from single equations to systems of equations depending on the theoretical intuition. Timmer (1974) identifies two approaches used in estimating fertilizer input demand namely, indirect and direct approaches.

#### **2.6.1.1 Indirect approach of estimating demand of fertilizer**

The indirect approach largely involves deriving the demand functions from an underlying function. In this approach profit and cost functions are commonly used (Higgins, 1986; Burrell, 1989). Theoretically, the demand for any input, say, fertilizer is derived from

production function in particular; the input demand function is obtained by solving first order condition for the inputs in question.

Subramaniyan and Nirmala, (1991) derived the demand for fertilizer as follows:-

$$Y = A \cdot F^{b_1} \cdot L^{b_2} \cdot U_1 \dots\dots\dots (1)$$

$$\text{Profit identity: } \Pi = PY - P_1F - P_2L \dots\dots\dots (2)$$

Where:

Y=output,

F=fertilizer,

L=Labour,

$\Pi$ =profit,

P= output price,

$P_1$ =Fertilizer price, and

$P_2$ = Price of labour or price of any other farm input.

Using profit maximizing conditions, then finding out the first order conditions as indicated below:

By equating  $\frac{\partial \Pi}{\partial F}$  and  $\frac{\partial \Pi}{\partial L}$  equals to zero, one could arrive at

$$Y/F = P_1 \cdot U_2 / b_1 \dots\dots\dots (3)$$

$$Y/L = P_2 \cdot U_3 / b_2 \dots\dots\dots (4)$$

Where,  $U_2$  and  $U_3$  are random terms.

Expressing (1), (3) and (4) in logarithmic form and solving for F, we get

$$F = \frac{\text{Log } A + \text{Log } (P_1/b_{1,p}) (b_2-1) + b_2 \text{Log } (U_2-U_3) - \text{Log } P_2/P + \text{Log } (U_1-U_2)}{1-b_1-b_2} \dots\dots\dots (5)$$

Therefore, relation (5) indicates that the demand for any input depends upon the conditions of profit maximization and the nature of the production function. It should be noted that, as prices change the producers will alter their inputs to satisfy their first order conditions.

#### **2.6.1.2 Direct approach of estimating demand of fertilizer**

The direct estimation methods entail the estimation of demand functions directly from observed data on input consumption like input and output prices. A distributed lag formulations has been a common estimating procedure used when time series data are involved (Chambezi, 1990), and when a combination of time series data and cross section data are used (Penm and Vicent, 1987). The main motivation of using this approach is in most cases related to the question whether the existing output and input prices are adequate to induce farmers to maximize profits or whether the farmers have used fertilizers to their best advantage.

In this study, the direct approach was employed to estimate the demand of fertilizer using the fertilizer demand model (FMD) and conditional outcome model (COM) to determine the secondary effect of fertilizer subsidies on production of maize. This is reinforced by two reasons. On one hand, although estimation of a system of equations derived from a profit function is more efficient means of mutually consistent and statistically reliable estimates, the results are difficult to evaluate if the underlying assumptions are invalid (Burrel, 1989). On the other hand, profit maximization requires that the ratio between the value of the marginal product to the unit cost of fertilizer to be equal to one. However, evidence suggests that in a typical smallholder situation the ratio between the two is rarely



equal to one, indicating that these farmers rarely maximize profits (Quiggin and Builan, 1984).

The FDM evaluates the primary effect of fertilizer. The fertilizer programme aimed at providing benefit to smallholder farmers in the form of affordable prices. By this concept, the purchase price of fertilizer would be lower than what it should have been without government paying a portion of the price through public subsidy arrangement. Evaluating the impact of subsidy on demand of fertilizer by smallholder farmers is important to determine if the subsidy makes any difference.

Two biases often affect programme impact analysis: bias from heterogeneity at the community level and that from household or individual level. Pit and Khandor, (1998) adopted a quasi-experimental approach to control for both types of biases, using a cross sectional data.

When farming households are observed in more than one year, the FDM is written in the following reduced form by  $i^{\text{th}}$  household in  $j^{\text{th}}$  village in period  $t$  as:

$$F_{ij} = X_{ij}\beta + \eta_{ij}^c + \mu_j^c + \varepsilon_{ijt}^c \dots \dots \dots (6)$$

Where  $F_{ij}$  is the fertilizer demand by  $i^{\text{th}}$  household in  $j^{\text{th}}$  village in period  $t$ ,  $X$  is a vector of household characteristics,  $\beta$  is a vector of unknown parameters to be estimated,  $\eta$  is an unmeasured determinant of the fertilizer demand that is time invariant and fixed within the household,  $\mu$  is an unmeasured determinant of the fertilizer demand that is time invariant and fixed within the household, and  $\varepsilon$  is a non-systematic error.

### 2.6.2 Conditional outcomes model (COM)

The model concerns the determination of the potential secondary effects of fertilizer subsidy. Model describes whether fertilizer subsidy has translated into increased crop outputs and productivity to smallholder farmers. The COM such as land productivity ( $Y_{ij}$ ) conditional on the level of fertilizer demand or utilization ( $F_{ij}$ ) is given by:-

$$Y_{ij} = X_{ijt} \beta + F_{ijt} \delta + \eta_{ij}^y + \mu_j^y + \varepsilon_{ijt}^y \dots \dots \dots (7)$$

Where  $\delta$  is the effect of fertilizer. The model estimates the secondary impact of fertilizer subsidy on outcome of particular interest such as land productivity with cross sectional data (where  $t=1$ ), endogeneity arises as a result of the possible correlation among  $\mu^c$  and  $\mu^y$  and among  $\varepsilon_{ij}^c$  and  $\varepsilon_{ij}^y$  (Pitt and Khandor, 1998). Differentiating the  $Y_{ij}$  equation at two points of the yields the following outcome equation is obtained,

$$\Delta Y_{ij} = \Delta X_{ij} \beta + \Delta F_{ij} \delta + \Delta \varepsilon_{ij}^y \dots \dots \dots (8)$$

Consistent estimates of fertilizer effect  $\delta$  can be obtained from above equation using a household fixed effect under the assumption that the error terms of the fertilizer and outcome equations are uncorrelated. In determining the effect of fertilizer subsidy on demand of fertilizer by the smallholder farmers (IFPRT, 1998; Hawassi, 1998; Lamb, 2003; Ebor *et al.*, 2006) used the fertilizer demand model. Also Ebor *et al.* (2003) used the conditional outcome model in the determination of secondary effect of fertilizer subsidies on maize output.

## **CHAPTER THREE**

### **3.0 METHODOLOGY**

#### **3.1 Overview**

This section describes the location of the study area, the study design explains the sampling procedure and data collection process. The last two sections discuss about data analysis and the tools used to test the hypotheses.

#### **3.2 Study Location**

##### **3.2.1 Geographical location**

Mbeya rural district lies between latitudes 8°6' and 9°2' South and longitudes 33°3' and 34°0' East. The district is bordered by Mbozi district to the West, Mbalali district to the East, Chunya to the North and Rungwe to the South. The district has three divisions namely; Isangati, Utengule Usongwe and Tembela. It has seventeen wards and a total of 126 villages. The district lies in a high potential zone, with fertile soils and reliable rainfall ranging from 650mm-2700mm, between October and May followed by a cold and dry period between June and September. The growing season starts in November and continues to March. The district is within an altitude ranging from 2300 to 2800 meters above sea level (URT, 2005).

The area was chosen because the fertilizer subsidy programme has been conducted in this district since the re-introduction of the programme in 2003/2004 season. Also the district is one of the potential areas in the production of food crops in Tanzania and contributes to restore food security in the country (URT, 2003).

### **3.2.2 Human population, land area and use**

Mbeya rural district covers an area of 2,432 square kilometres. According to 2002 population census, the district had 254 897 people with an 88:100 male to female ratio and annual growth rate of 2.5 percent. Regarding age distribution, 113 280 of the population had an age of 0-14 years, 117 739 were 15-64 years old and from 65 years and more were 23 878 (URT, 2003; 2005). The average household size was 4.0 and the population density is 105 per square kilometer. The mainly economic activities are farming and livestock keeping. Food production is mainly maize, Irish potatoes, beans and sweet potatoes. Cash crops are dominated by Irish potatoes, maize, coffee, and pyrethrum (DALDO, 2006).

### **3.3 Study Design**

A cross sectional data were used in this study. The cross sectional research design allows data to be collected at a single point in time (Babbie, 1990). In this type of research study, a subset thereof is selected from the entire population from which data are collected to answer questions of interest. The design is called cross sectional because the information about the respondents that is gathered represents what is going on at only one point in time.

#### **3.3.1 Sampling procedure**

Bailey (1998) argues that regardless of the population size, a sample of 30 is the bare minimum for data collection. However Matata *et al.* (2001) argued that having 80-120 respondents are adequate for most socio-economic studies in Sub-Saharan Africa household. The sample size for this study was 120 households' respondents.

A purposive sampling technique was employed in selecting two out of three divisions. The divisions selected were Usongwe and Tembela. From these two divisions, six wards out of seventeen wards were selected randomly. A purposive sampling technique was used

in selecting six villages. From each village using a village check list was used as sampling frame, twenty farmers who had received fertilizer subsidies in the previous seasons were selected using a systematic random sampling technique with a random start to get a total sample size of 120 for an interview.

### **3.3.2 Data collection techniques**

#### **3.3.2.1 Type of data**

Both secondary and primary types of data were collected during a field survey carried out from October to December 2007. Primary data collection involved questionnaire design, preliminary field survey to pre-test the questionnaire and main field survey to administer the questionnaire to sample households and informal discussion with stockist and agents of fertilizers. Secondary data were collected to complement the information obtained from the sample farmers. The type of information gathered from secondary data included population statistics, rainfall statistics, crop production statistics, trend of supply and demand of fertilizers and prices. From the fertilizer agents information such as supply and consumption of fertilizers under the subsidy programme were collected in the study area. Secondary data were collected from, various publications of state and local governments such as Mbeya district council, Mbeya Regional Library, journals, books, research publications, Sokoine University Library (SNAL), Ministry of Agriculture and Food Security documents and internet.

### **3.3.2.2 Data collection process**

A structured questionnaire of (Appendix 1) was designed to capture both qualitative and quantitative data required in accomplishing the objectives of the study. It consists of both open and closed ended questions. The questionnaire contains four sections. The first section was designed to obtain information on characteristics of respondents. The second section was designed to obtain fertilizer demand and use data. The third and fourth were designed to obtain information on maize production and problems associated with fertilizer supply in the area of research. However, a preliminary survey was conducted before the main survey, the main objectives of the pre-survey were; (a) to familiarize with the areas where the main survey was to be conducted; (b) to pre-test the questionnaire, and (c) to establish sampling frames and units

The questionnaire was administered by the researcher to each household using Swahili language. Farmers were interviewed by means of a personal interview method, with a household head as the unit of investigation. Individual farmers were interviewed in their homes or village offices after initial appointments through the village leaders who introduced the researcher to all farmers to be interviewed. The objectives of the study were explained to each respondent which made them willing to cooperate. Majority of the farmers responded positively to the interview. Informal discussion with stockist and agents of fertilizer supply in the district were also conducted to get their views on the subsidy programme.

### **3.4 Data Analysis**

Data processing and analysis were done at Sokoine University of Agriculture, Morogoro Tanzania. The data collected were edited, coded and summarized prior to analysis using Statistical Package for Social Sciences (SPSS) version (13.0) computer software in conformity with the specific objectives of the study.

### **3.5 Analytical Tools**

A substantial part of the analysis is based on descriptive statistics to describe the response, characteristics and trends of some of the data and information. Other tools included cross tabs, Fertilizer Demand Model (FDM) and Conditional Outcome Model (COM).

#### **3.5.1 Descriptive statistics**

The first stage of data analysis involved the use of descriptive statistics techniques, including means, percentages and standard deviations. Descriptive statistics were used to compute for the pooled sample of households basing on social characteristics of the respondents such as age, gender, education, household size, experience etc. Cross tab was used to determine the average amount of fertilizer under the subsidy program was requested and received across the villages.

#### **3.5.2 Fertilizer demand model**

This model was adopted in (Ubor *et al.* 2006; Lamb, 2003; IFPRT, 1998; Hawassi, 1998) to determine whether fertilizer subsidy has significantly affected the demand of fertilizer by smallholder farmers in the form of affordable fertilizer prices. The fertilizer demand model used to estimate the fertilizer demand in this study included factors expressed in the fertilizer demand equation shown below.

$$\text{FERT}_{ij} = f(\text{PFERT}, \text{DST}, \text{EXTNV}, \text{FMS}, \text{POM}, \text{AG}, \text{EXP}, \text{FS}, \text{EDUC} \text{ and } \varepsilon) \dots \dots \dots (9)$$

$$\text{FERT}_{ij} = \alpha_0 + \beta_1 \text{PFERT} + \beta_2 \text{DST} + \beta_3 \text{EXTNV} + \beta_4 \text{FMS} + \beta_5 \text{POM} + \beta_7 \text{AG} + \beta_8 \text{EXP} + \beta_9 \text{FS} + \beta_{10} \text{EDUC} + \varepsilon_i \dots \dots \dots (10)$$

Where:

FERT<sub>ij</sub> = Quantity of fertilizer in kgs/ha used by a farmer,

PFERT = price of a bag of fertilizer,

DST = distance in Kilometers the farmer travel to purchase fertilizer,

EXTNV= Number of visits of the extension officer to the farmer per year,

FMS = Farm size in hectares,

POM = Price of maize output in shillings per 100 kilogram bag,

AG = Age of respondent in years,

EXP = Number of years the household head has been in farming activities,

FS = Number of dependants in the household,

EDUC = Number of years the respondent has been to school.

$\alpha_0$  and  $\beta_i$  = coefficients to be estimated, and

$\varepsilon_i$ =error term, which is independent normally distributed with mean zero and variance one.

The variables used to estimate the demand of fertilizer by the smallholder farmer in the study area summarized in Table 4.



**Table 4: Summary of variables in fertilizer demand model**

SNO	Variable code	Description	Units	Expected sign
1	FERT <sub>ij</sub>	Quantity of fertilize	Kilogram	Positive
2	PFERT <sub>r</sub>	Price of fertilize	Shillings/bag	Negative
3	DST <sub>r</sub>	Distance	Kilometer	Negative
4	EXTNV	Extension visits	Number of visits	Positive
5	FMS	Farm size	Hectare	Positive
6	POM	Price of maize	Shs/100kgs bag	Positive
7	AG	Age	Years	Positive
8	EXP	Experience	Years	Positive
9	FS	Family size	Number of dependa nts	Negative
10	EDUC	Education	Years	Positive

### 3.4.3 Conditional outcomes model

This model was used in the determination of secondary effects of fertilizer subsidy. It answers the questions concerning whether fertilizer subsidy has translated into increased crop output of maize in the study area. The conditional outcome model for maize output output ( $Y_{ak}$ ) on the level of fertilizer demand ( $F_{iji}$ ) is given by:-

$$Y_{ak} = (FERT, DST, EXTNV, FMS, POM, AG, EXP, FS, EDUC \text{ and } \varepsilon \dots\dots\dots)(11)$$

$$Y_{ak} = \alpha_0 + \beta_1 FERT + \beta_2 DST + \beta_3 EXTN + \beta_4 FMS + \beta_5 AG + \beta_6 EXP + \beta_7 FS + \beta_8 EDUC + \varepsilon_i \dots \dots (12)$$

Where:

$Y_{ak}$  = output of maize produced by smallholder farmer in kilogram per hectare.

$F_{iji}$  = Amount of fertilizer applied in (kg/ha),

AG = Age of respondent in years,

EXP = Number of years of household involved in farming activities,

FS = Number of dependants of household,

EDUC = Number of years the household head has been to school,

EXTN = Number of visits of the extension officer to the farmer per year,

FMS = Farm size in hectares;

DST = Distance from farm to procurement source,

PFERT = Price of fertilizer in shillings per bag of 50 kilogram,

POM = Price of maize in shillings per 100 kilogram bag,

$\alpha_0$  and  $\beta_i$  = coefficients to be estimated and  $\varepsilon_i$  = error term, which is independent normally distributed with mean zero and variance. Table 5 shows the variables used in the conditional outcome model.

**Table 5: Summary of variables used in conditional outcome model**

SNO	Variable code	Description	Units	Expected sign
1	Y <sub>ak</sub>	Quantity of maize output	Kgs/ha	Positive
2	F <sub>iji</sub>	Quantity of fertilize r used	Kgs/ha	Positive
3	DST	Distance	Kilometer	Negative
4	EXTV	Extension visits	Number of visits	Positive
5	AG	Age	Years	Positive
6	EXP	Experience	Years	Positive
7	FS	Family size	Dependants	Positive
8	EDUC	Education	Years	Positive
9	PFERT	Price of fertilize r	TSh/ 50kgs bag	Negative

## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSION**

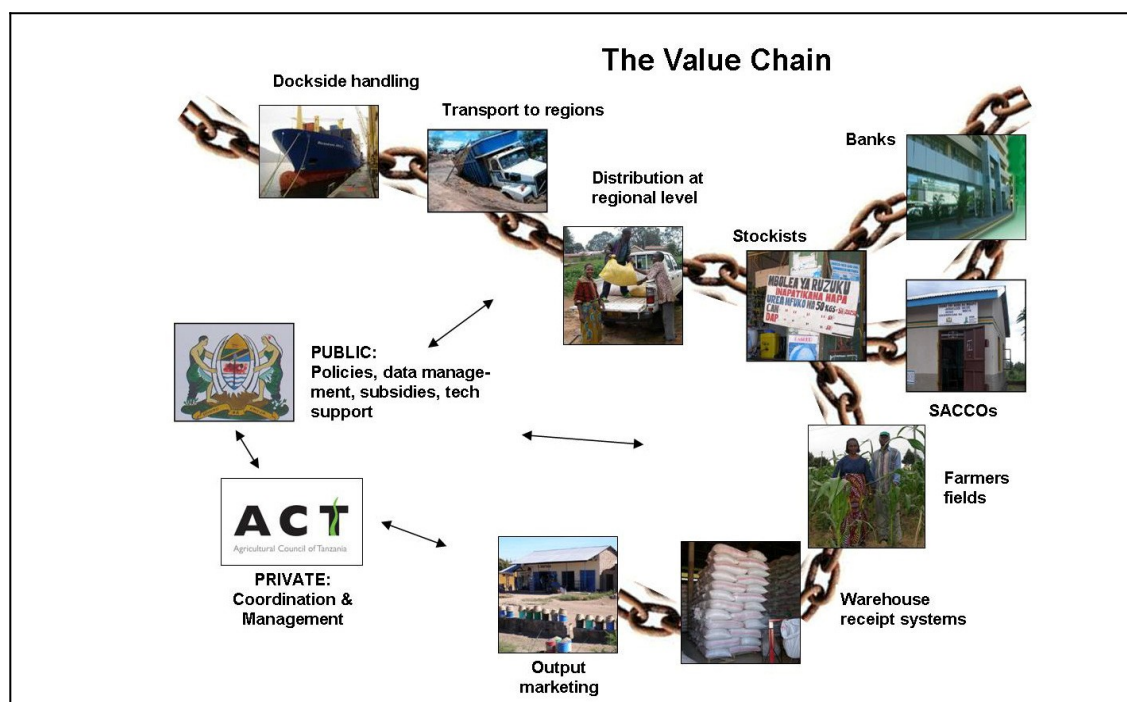
#### **4.1 Overview**

This chapter presents the results emanating from the formal survey and explaining the findings obtained from the study. The results presented rely heavily on the descriptive analysis complemented by results of the econometric analysis. The chapter is divided into five main sections. Section one presents and distribution of subsidy fertilizers in Mbeya region. Section two presents the demographic characteristics of a household head. This is followed by section three that present the use of subsidy fertilizers in maize production; fourth section presents the role of extension services in promoting the use of subsidy fertilizers while the fifth presents the demand of subsidy fertilizers.

#### **4.2 Conduct of Fertilizer Subsidy in Mbeya Region**

##### **4.2.1 Supply chain of fertilizer from port to the farmer**

With regard to specific objective (i) in section (1.32) the fertilizer value chain involves an array of factors in the supply and distribution of fertilizers to end users. The chain starts at the port where fertilizer is unloaded and bagged (Fig. 6). This step is followed by the distribution of fertilizers from the port to rural areas by private transporters to a few selected regional centers.



**Figure 6: Fertilizer supply chain from port to a farmer**

Source: Agricultural Council of Tanzania, 2007

At regional centers, where wholesalers and importers have depots, the fertilizers are taken by individual private merchants (stockists) who act as distributing agents to villages and farmers in the rural areas. By comparing the cost of a bag of fertilizer sold to a farmer in 1997 (Table 6) with that of today the farmer has been paying twice as much. The cost of a bag of fertilizer during the survey period was about TSh 21 500. The involvement of the government in marketing of fertilizers under the subsidy programme made farmers afford in purchasing fertilizers as the price of fertilizer on commercial basis was very high (TSh.40 000/bag) during the survey period.

**Table 6: Cost structure of UREA and DAP fertilizers from FOB Eastern Europe to ex-warehouse Dar es Salaam in 1997**

Cost elements	US\$/MT	TSh/MT	TShs/Bag
FOB Price (in bulk)	180	108 000	5 400
Freight	50	30 000	1 500
Insurance:1.4% of FOB; PSI fee 1.2%			
of FOB; TCFB certificate 5% freight	7.2	4 320	216
Duty and sales tax 5%	11.5	6 900	345
Shore handling, internal transport,			
stacking charges, bagging and bags	40	24 000	1 200
Losses and pilferage (@1%)	2.3	1 380	69
Bank costs: remittance charge, stamp			
duty, collect and withholding tax	11.5	6 900	345
Interest costs: 10% annual rate for US\$,			
for 4 months at CIF value	7.8	4 680	234
Administration and overhead at 10%	31	18 600	930
Price ex-warehouse Dar es Salaam	341.3	204 780	10 239
TFC price to stockists Dar es Salaam		205 400	10 270

Source: [http://www.icra-edu.org/objects/anglolearn/Sukuma -9 Fertilizers](http://www.icra-edu.org/objects/anglolearn/Sukuma-9 Fertilizers)

However a number of constraints have been identified that affect the fertilizer supply and distribution to the stakeholders and are outlined. The farmers who are the final consumer are the most affected and are faced with the following constraints in the chain:-

- (i) Economic constraints limit fertilizer application (particularly basal fertilizers);
- (ii) High prices of fertilizers;
- (iii) Limited opportunities for crop diversification and markets;
- (iv) Weak smallholder capacity to develop strategies to respond to changing markets;
- (v) Poor accessibility to fertilizers (infrastructure) and
- (vi) Difficult physical access to finance

In order that supply and distribution of fertilizer subsidies benefit the above stakeholders the problems facing at each level should be addressed for the transformation of agriculture sector.

#### 4.2.2 Availability of fertilizer in Mbeya region

It is observed from Table 7, that in all years under discussion, the supply of fertilizer in the region has always been less than the actual demand.

**Table 7: Trend in supply of fertilizer in metric tons in Mbeya region 1990/91 -1993/94**

Type of input	1990/91		1991/92		1992/93		1993/94	
	demand	Supply	demand	Supply	demand	Supply	demand	Supply
TSP	9 551	4 415	5 000	6 932	6 850	1 332	7 551	1 565
CAN	28 014	11 37 8	9 800	8 758	22 700	9 613	10 500	7 500
UREA	7 769	5 667	8 000	7 186	6 950	6 741	7 661	5 147
SA	3 820	2 587	1 000	2 354	5 549	1 310	6 029	1 130
NPK	7 354	3 993	8 200	5 949	7 313	6 181	2 885	2 480
SSP	507	-	-	997	-	996	900	-
SOP	209	10	-	188	100	98	900	-
DAP	-	-	-	-	-	2783	500	1 567
<b>TOTAL</b>	<b>56 717</b>	<b>28 457</b>	<b>32 000</b>	<b>31 964</b>	<b>49 372</b>	<b>29 059</b>	<b>36 926</b>	<b>20 241</b>

Source: URT, (1997) Mbeya region Socio- Economic Profile.

In 1990/91, the actual supply was less by 50%, 1991/92 by 0.1%, 1992/93 by 41% and in 1993/94 actual supply of inputs was less by 45%. Inputs requirement for agriculture in the region in 2000/01 season was about 30 000 tones of chemical fertilizer. The supply of chemical fertilizer, which was 32 739.3 tons, exceeded the requirement by 6.4% (Table 8). The demand of fertilizer subsidies during in 2006/07 season was 70 000 tons, but the supply was only 25%; supply of fertilizer has been declining annually (RALDO, 2006).

**Table 8: Demand and supply of fertilizer in metric tons 2000/01**

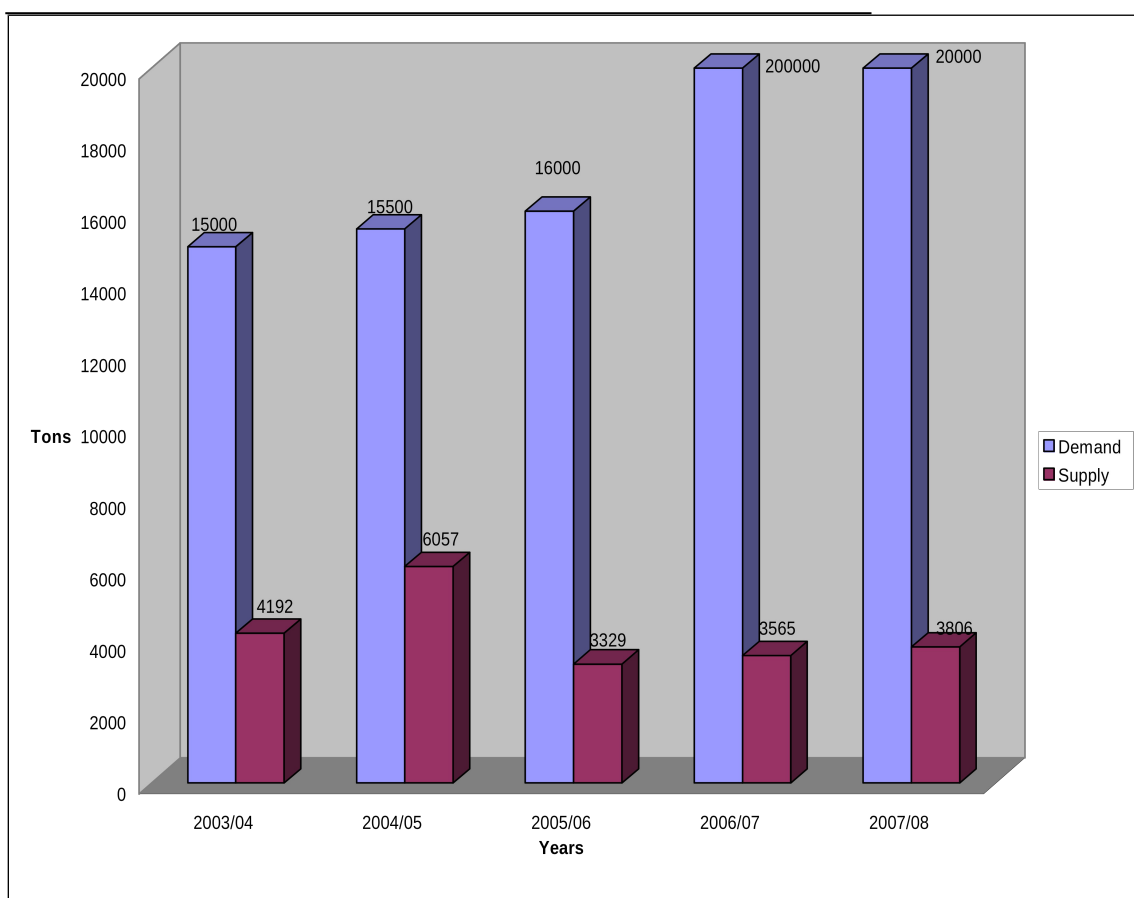
Type of fertilizer	Demand	Supply	Surplus/deficit
UREA	6 320	7 773	+1453
CAN	9 400	12 060	+2660
SA	1 045	1 440.8	+395.4
DAP	9 750	9 295	-455
TSP	1 750	6 10.5	-139.5
NPK	2 500	1 560	-940
Total	30 765	32 739.3	2174.3

Source: United Republic of Tanzania: Mbeya region Socio- Economic Profile, 2003

#### **4.2.3 Distribution of fertilizer subsidies in Mbeya region in 2003/04-2006/07**

Fertilizer received under subsidy program in the Southern Highland Zone for 2003/04 season was 59 429 tons and Mbeya region received only 18 225 tons which was only 25% of the requirements in the region (RALDO, 2006). Figure 7 shows the quantities of fertilizer the region received from 2003/04 to 2007/08 seasons.

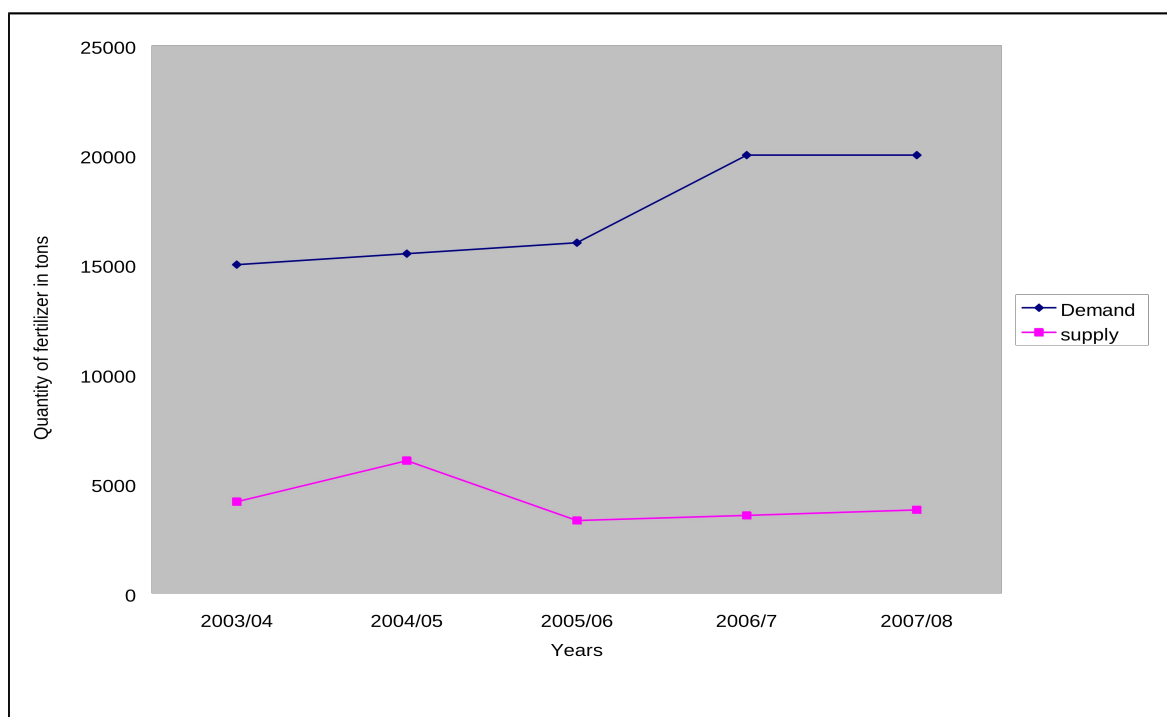




**Figure 7: Quantity of fertilizer (tons) received by Mbeya region 2003/04 -2007/08**

Source: RALDO Annual report, (2006)

Generally there have been shortages of fertilizer subsidies in the district since the programme was reintroduced. The supply of fertilizer subsidies has been fluctuating widely. The demand of the district is about 20 000 tons but the district has been receiving about 25% of the requirement (Fig. 8). Fertilizer traders' efforts to increase supply of fertilizer in the study area and the region as whole are confronted by a number of constraints. Based on informal discussion with stockists and importers in Mbeya Urban, it seems lack of foreign currency, poor transportation system, lack of credit and high transportation costs were the most important factors limiting the distribution of fertilizer to farmers in the study area in particular and the whole region in general. In most cases fertilizer in the district was localized to area which had access to transport and the problem of unavailability of fertilizer at the right time and place was a common phenomenon.



**Figure 8: Quantities of subsidy fertilizers supplied to Mbeya rural district 2003/07**

Source: DALDO Annual report, 2006.

Importing and distributing fertilizer subsidy in Southern Highland Zone has been done by several companies as shown in Table 9.

**Table 9: Companies distributed fertilizer in Mbeya region 2006/07 season**

Name of Company	Type of fertilizer					
	DAP	UREA	CAN	TSP	NPK 25:5:5	NPK 20:10:10
EXPORT TRADING COMPANY PREMIUM	2 300	-	-	-	-	-
STACCO	1 200	3 500	1 000	1 000	200	200
TFC	225	4 715	1 280	150	80	90
DRTC	1 200	1 600	500	-	-	-
NUTRICARE	-	3 800	2 500	175	-	-
	-	100	600	-	-	-
<b>TOTAL</b>	<b>4 925</b>	<b>13 715</b>	<b>5 880</b>	<b>1 325</b>	<b>280</b>	<b>290</b>

Source: RALDO Annual report 2006

However a number of different companies have been increasing in the distribution of fertilizer subsidies in the region. For the seasons 2005/06 companies that were involved in distributing subsidy fertilizers are shown in Table 9 above, but during the seasons 2006/07

there were more companies which signed a contract for distributing fertilizer. The distributions of fertilizer under the program from the district level to smallholder farmers have been done by individuals, cooperative societies, and small production groups. These distributing agents are given the task by the district authority after having qualified their application. Normally this depends on the economic capability of the businessman or groups (DALDO, 2006).

Due to these constraints facing the programme production of maize has slightly remained constant since the program was inaugurated as shown in table (Table 10). Low production of maize is attributed to using fertilizer below the recommended rates. Therefore the contribution of fertilizer subsidies in maize production is not realized unless the performance of the program is improved.

**Table 10: Maize production trend from 2000/01- 2005/06**

YEAR	Estimates		Actual		
	Area (Ha)	Quantity(Ha)	Area (Ha)	Quantity (tons)	% increase/decrease
2000/2001	57 000	140 000	57 000	142 000	
2001/2002	58 290	151 554	57 000	145 735	2.6
2002/2003	62 200	161 000	65 000	169 000	16.0
2003/2004	62 200	161 000	65 000	169 000	0.0
2004/2005	65 000	165 000	65 000	175 500	4.0
2005/2006	67 000	174 200	67 000	174 200	-0.1

Source: DALDO Annual report, (2006)

### **4.3 Influence of Demographic Attributes on Subsidy Fertilizer Demand**

#### **4.3.1 Sex influence**

As far as sex is concerned in relation to subsidy fertilizers demanded, Table 11 shows that household of the surveyed area comprised of 69.2% of men and 30.8% were women. This shows that 83 men demanded 654bags (7.9bags/person) and 37 women demanded 278 bags (7.5bags/person).

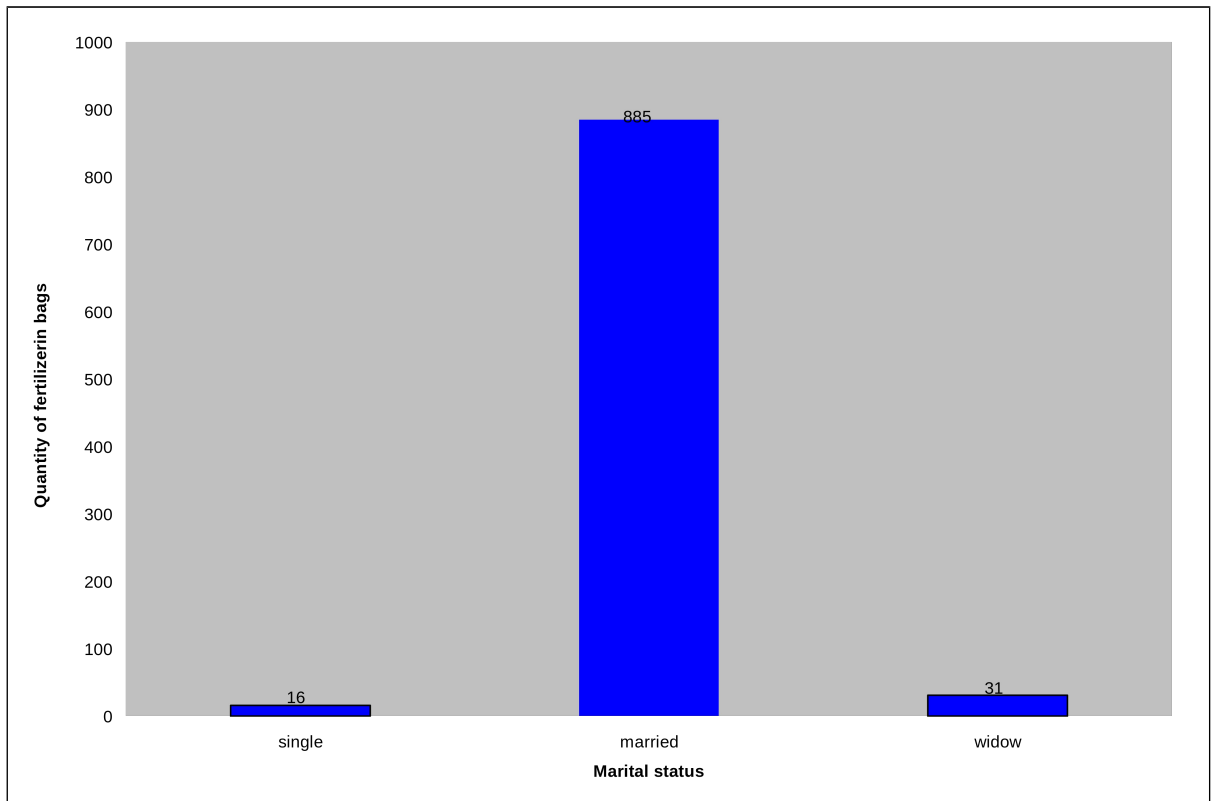
**Table 11: Relationship between sex and demand subsidy fertilizers (n=120)**

Sex of the respondent	Frequency	Percent	Quantity of fertilizer demanded	bags per person
Male	83	69.2	654	7.9
Female	37	30.8	278	7.5
<b>Total</b>	<b>120</b>	<b>100</b>	<b>932</b>	

From these findings basing on average (bags/ person) of men was more or less the same as that of women in the study area. Therefore in a limited supply of subsidy fertilizer sex of the household head may not be an important dimension of the locus in the responsibility and authority of household. Bagachwa (1994) mentioned that empirical evidence from many studies has always maintained that female headed households are more likely to have low income than male headed households. Even though income has not been a very proper measure of socio-economic strata, studies show that income has its potential for adoption of new technology.

#### 4.3 Marital status

Results from (Fig. 9) show that about 95% of the respondents were married while only 1.7% were single and widow, 3.3%. From these findings it is evident that married couples demanded the largest amount of fertilizer (885 bags) while single and widow respondents demanded only 16 bags and 32 bags respectively.



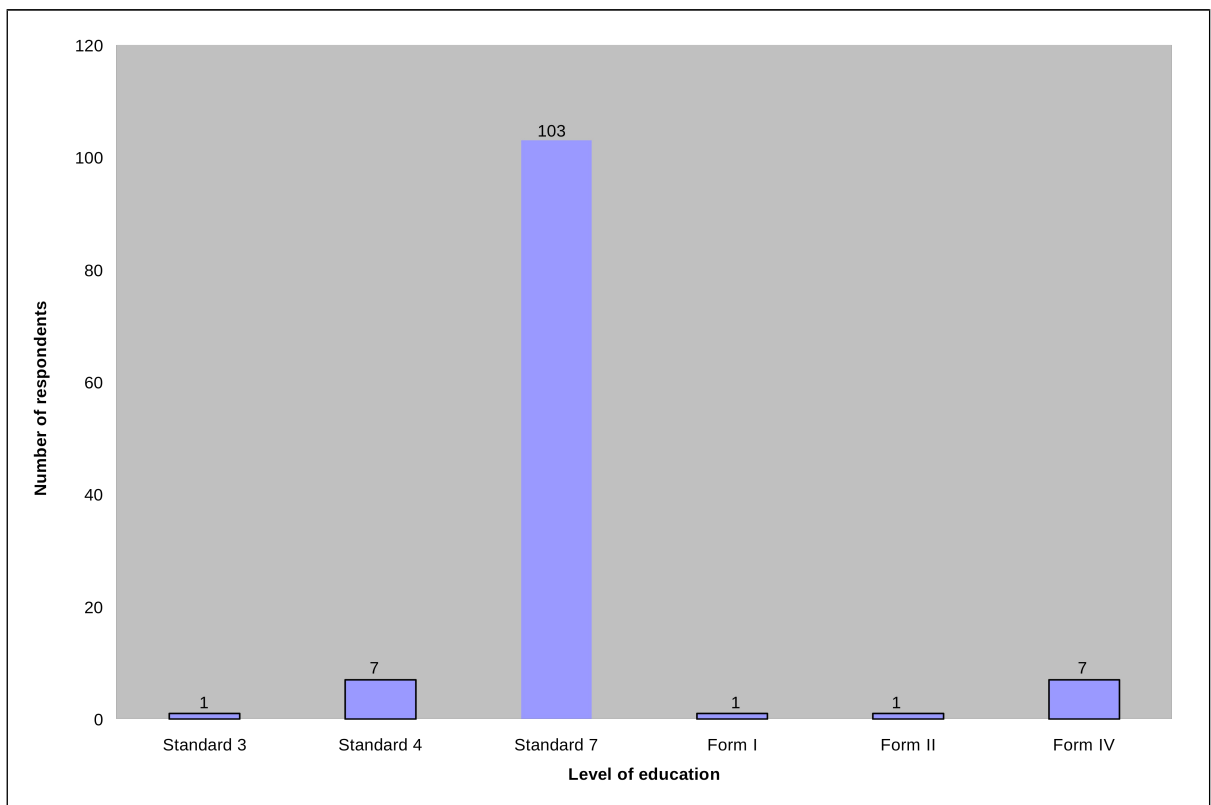
**Figure 9: Marital status and demand of subsidy fertilizers**

These results show that married people have an access and control of resources and capitals through diverse cultural, political, economic, ecological and agricultural settings. The nature of the relation between access and control of diverse assets may allow couples to negotiate in making decision on priorities in their family such as quantity of inorganic fertilizers to use in farming activities with respect to their farm size. These results imply that large proportion of the respondents in the surveyed area were married and mature people, revealing the typical characteristics of many rural areas in Tanzania.

#### **4.3.3 Education level of a household head**

Findings from (Fig. 10) show that 86% of the household heads were standard seven leavers, 6% of the respondent were secondary school leavers while the rest had attended

four to three years to school. From (Fig. 10) it is evidenced that the largest amount of fertilizers was demanded by standard seven leavers.



**Figure 10: Education level of household head**

However Secondary schooling is still a challenge to rural families as it is considered relatively expensive. Aman *at al.* (1984) argued that education in agriculture contributes total agriculture output in Tanzania. Mbata (1994) on the other hand observed that educational consideration is more important than economic factors as determinant of technology adoption. Thus prosperous agricultural development requires a broad educational base of the rural population. The fact that, majority of the respondents had attended primary school implies that the household heads had an adequate formal education to enable them cope with technological changes in the agricultural sector.

#### 4.4 Subsidy Fertilizers Use and Maize Production

##### 4.4.1 Farm size and subsidy fertilizers requested and received

The area in which the household cultivates, quantity of fertilizer requested and quantity of fertilizer received in packed bags each weighing 50 kilograms in the fertilizer subsidy program are shown in Table 12. The fertilizers that are involved are DAP for basal application and UREA for top dressing. On average the sampled household's heads had an average farm size of 2.7 acres which ranged from 0.5 to 10 acres. Their farm size led to the determination of quantity of fertilizers in bags to request from the authority. Farmers whose farm size ranged from 0.5-1.5 acres requested on average about 2.5 to 7.0 bags, unfortunately the farmers received only 1.7 to 3.5 bags only from the program.

**Table 12: Relationship between farm size and subsidy fertilizers requested (n=120)**

Farm size in acres	Quantity of fertilizer requested in bags	Quantity of fertilizer received in bags
0.5-1.5	2.5-7.0	1.7-3.5
2.0-3.0	5.0-7.0	3.0-5.0
4.0-5.0	8.0-11.0	4.0-5.0
6.0-10.0	14.0-40.0	5.0-14.0

In general the farmers have been receiving less amount of fertilizer than their demand. Apart from the deficit above the researcher witnessed the poor performance of this program when the village leaders of Swaya were receiving 28 bags of DAP instead of 678 bags and 412 bags of UREA instead of 281 bags an excess of 131 bags. For DAP the village authority distributed two bags to accommodate for the eleven sub-villages.

Due to shortage of fertilizer supply farmers were likely to receive just a granule of fertilizer. In Inyala village where the area is access to transport farmers received only 300

bags of DAP while they requested 1500 bags, but a large percent was UREA. A seasoned farmer in the village claimed that he received only UREA but he needed DAP for basal application therefore he was forced with the situation to use UREA for planting. Shortage of fertilizers has caused farmers to delay in planting.

Bisanda *et al.* (1998) argues that in Southern highlands of Tanzania it is estimated that timely planting and weeding can raise yields from 700kg/ha to 1200kg/ha and in Kenya studies showed that 70 kilograms of grain /ha/day were lost when planting was delayed for two days. In comparing with the late delivery and shortages of fertilizers in the study area it implies that farmers have been losing large quantity of crop output accelerated by the poor performance of the program. Also from Table 18, findings show that on average a farmer received 1.7 bags per acre (0.68 bags/ha) which is about 16 kg of N /ha which is quite low compared to the recommended rate made by Bisanda *et al.* (1998). They recommended that basing on type and nutrient deficiency for basal application, P should be applied at a rate of 20-40 kg/ha and for top dressing, N at a rate of 50-60 kg/ha.

In view of the research findings of the study area, it implies that there is a very short supply of fertilizer, late delivery of fertilizers, and low use of fertilizer per unit area. In such a situation where all these prevailing conditions exist, the objectives of the subsidy programme cannot be met unless efforts are made to address the problem.

#### **4.4.2 Influence of fertilizer subsidy on maize output**

The study shows that production of maize has not increased adequately after the reintroduction of fertilizer subsidy programme. The yield of maize before the introduction of fertilizer subsidies was 1498 kg/ha while maize yield was 1621 kg/ha after the introduction of fertilizer subsidies (Table 13).



**Table 13: Maize yield before and after introduction of subsidy fertilizers (n=120)**

	Maize production before subsidies 2002 and below	Maize after subsidies From 2003/04 season	Farm size in hectares After subsidies	Yield before subsidies in kg/ha	Yield after subsidies in kg/ha
Mean	1 678	1 816	1.12	1 674	1 749
Std deviation	1 296	1 675	0.65	935	874
Minimum	100	100	0.18	123	123.4
Maximum	700	12 000	4	5 250	5000
Sum	201 400	218 000	333		

The results show that there was a marginal increase by 123 kg/ha of maize output after the fertilizer subsidy program was introduced. This implies that if there was adequate availability of fertilizer to meet the demand, a substantial amount of maize output could have been produced.

#### 4.4.3 Fertilizer –crop price ratio

Table 14 shows that on average a bag of maize with 100kgs was sold between TSh 9 000-24 000/= and the average price was about TSh 15 854 per bag. This means that on average a farmer was supposed to sell two bags of maize to get a bag of fertilizer as shown in the table below.

**Table 14: Fertilizer –crop price ratio (n=120)**

	Price of a bag of maize (100kgs)	Price of a bag of fertilizer (50kgs)	Crop price: fertilizer
Minimum	9 000	18 500	1:2
Maximum	24 000	19 500	1:0.81
Mean	15 854	19 300	1:1

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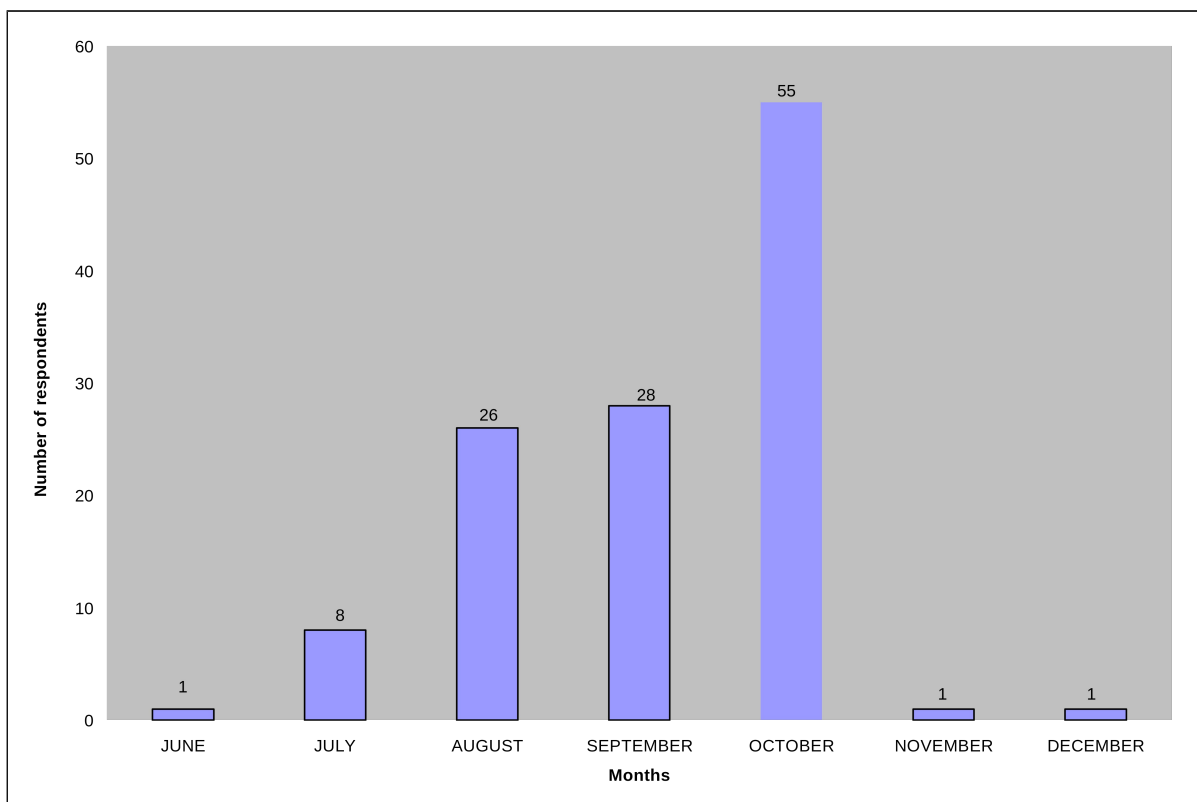
Std deviation	3 023	284
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In the study area DAP and UREA were sold at TSh 19 500/= as final price to the farmer. The fertilizer –crop price ratio, which is the ratio between the purchase price of a unit weight of fertilizer and the selling price of the same weight of the harvested crop, indicates that a farmer needs to sell more quantities of maize to buy a unit of fertilizer. Despite the drawbacks of fertilizer subsidies, high fiscal cost, difficult targeting and crowding out of commercial sale, they receive strong support, mainly from farmers and from some policy makers (WB, 2006). Since the aim of subsidizing a farmer is to try and reduce the costs of production which are incurred by adopting modern methods of agricultural production and because the farmers have responded positively to demand more fertilizers, the government should play a great role so that a farmer is again not exploited.

#### **4.4.4 Timing of subsidy fertilizer distribution in the study area**

Majority of the farmers proposed the government to distribute fertilizer in October as seen from (Fig. 11), because during this month farmers have enough money from their crop sales.



**Figure 11: Best month for subsidy fertilizers distribution**

Other reason is that this is the best month for field and inputs preparation for planting maize on November. Also due to diversity of climate in the district other areas is the planting period. Up to early December the researcher witnessed the distribution of fertilizer for basal application were still being distributed while farmers had already sowed to avoid late planting which bring about loss from the unrealistic rainfall and unforeseen events. Although there were few farmers proposing fertilizer to be distributed in August and September, their observations cannot be neglected because other parts of the district planting is between August and September using the high moisture content of the soil that prevail in their area.

The implication of these findings is that the government should enthusiastically play a big role in supervising the fertilizer distribution. The farmers want the type of fertilizers

wanted to be supplied timely. The ideal time is October fertilizer should be in their hands. Demand of fertilizers is seasonal demand. Therefore fertilizers delayed are basically fertilizers denied. Such delays also result in unnecessary costs (especially storage and opportunity costs of money used) by procuring agencies because traders cannot recover their costs until the next season.

#### **4.4.5 Farmers views on subsidy fertilizers**

The subsidy fertilizer programme in the study area is highly supported by the farmers. The low price of subsidy fertilizers compared to the market price, allows farmers to use more in production when available in amount requested. It encourages farmers to use fertilizer and thereby increasing production. Subsidies would raise the net income from a given level of input use and move farmers closer to the profit-maximizing level. This stimulates domestic food production which is an alternative to food aid. Therefore Tanzania should continue to implement the program with the aim of restoring food security and well being of the farmers.

#### **4.4.6 Sources of income for purchasing fertilizers**

The findings indicate that 77.5% of the respondents depended on sales of crops as the major source of cash to finance fertilizer purchase. However loan from cooperatives, petty business and borrowing from friends and /or relatives accounted for 1.67%, 18% and 2.5% respectively as sources of cash to purchase fertilizer (Table 15). The results also indicate that none of respondents pointed loan as source of cash to finance fertilizer. This implies that smallholder farmers in the study area are not accessible to loans from formal financial institutions. These findings support the general statement that agriculture is the backbone of the Tanzania economy and it remains to be the main and most reliable source of

household's income for majority of people in rural areas, therefore much efforts should to improve the program.

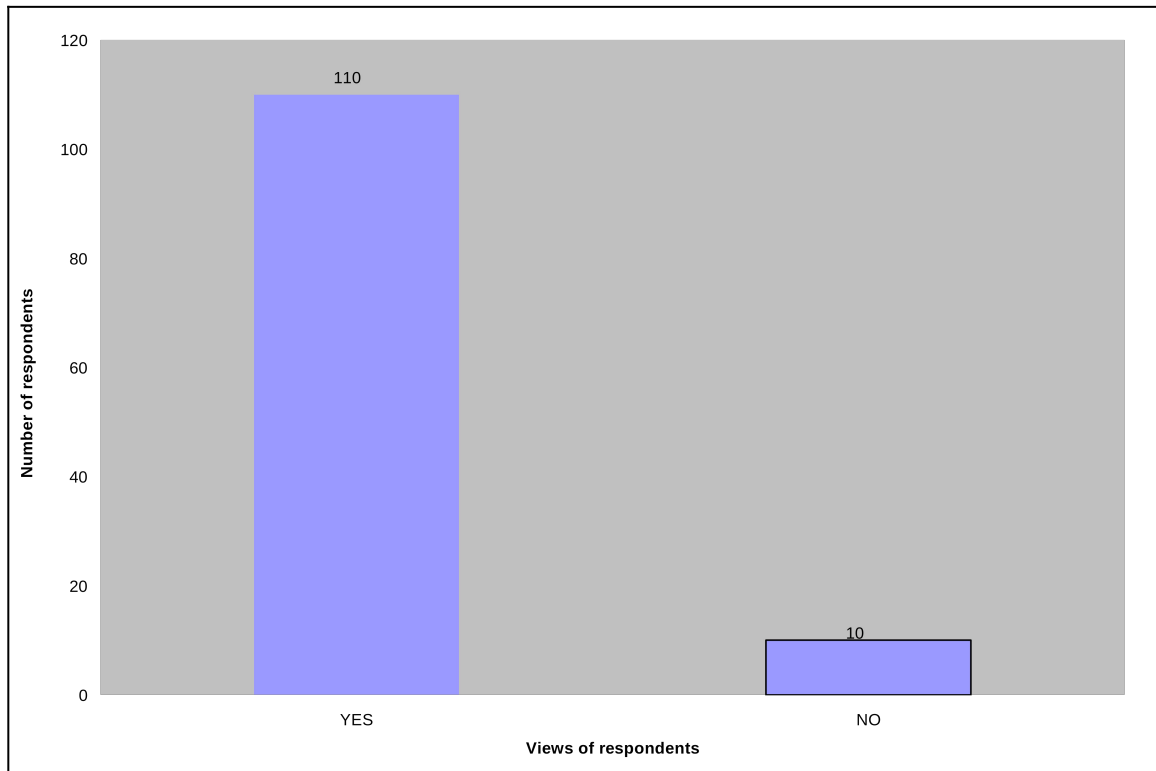
**Table 15: Sources of income to finance purchases of fertilizer (n=120)**

Sources of income	Frequency	Percent
Sales of food and cash crops	93	77.5
Borrowing from friends/relatives	3	2.5
Loan from local cooperatives	2	1.67
Petty business	22	18.0
Loan from bank	0	0.0
Total	120	100.0

#### **4.4.7 Role of extension services in promoting fertilizer use**

According to findings from (Fig. 12) the availability of extension services in the study area is 92%. Nkonya *et al.* (1997) argues that extension services focus on imparting key messages to farmers on each visit, with the complexity of these messages being increased in subsequent visits. Initial messages aim at improving basic production techniques, with attention being focused on land preparation, the timeliness of operations, crop spacing, plant population sizes, the use of better seed varieties and on weeding. After the simple messages, attention shifts to more complex message such as those relating to fertilizer use. . Access to such sources of information can be crucial in effective demand of fertilizers and other agricultural technologies in the study area and other areas which share similar environment.

Despite the fact that, the findings above imply that the study area was accessible to extension services, however extension officers in the study area claimed that subsidy fertilizers has created disharmony with farmers. The reason is that the extension officers motivated the farmers to register for the inputs but the farmers received less and sometimes nothing.



**Figure 12: Availability of extension services in the study area.**

#### 4.5 Empirical Results

Fertilizer demand in this study refers to the actual quantity of fertilizer used by the sample households rather than actual fertilizer demanded. Regression analysis was used to ascertain the factors that best explain the variation in the use of fertilizer at the household level as shown in (Table 16) on fertilizer demand model (FDM) and (Table 17) for conditional outcome model (COM).

##### 4.5.1 Fertilizer demand for sample households

The factors investigated are shown in Table 16. The  $R^2$  value indicated that the variables included in the equation explained about 54.2% of the variation in total consumption of fertilizer among farmers in the study area. The remainder of the variation might be due to other factors excluded in the regression equation. Price of fertilizer, maize farm size in

hectares, and quantity of maize produced in the previous seasons using fertilizer subsidies and number of extension visits were statistically significant in explaining the variation. Variable such family size had negative sign but not significant. The rest of the variables were not significant and are not discussed in this study.

**Table 16: Estimated fertilizer demand by farmers (n=120)**

Variables	Standardized coefficients				
	B	Std. Error	Beta	t	Sign.
CONSTANT	8.801	28.027		.314	.754
FMS	2.895	.954	.311	3.034***	.003
AG	.060	.053	.089	1.129	.261
EDUC	.101	.268	.025	.375	.708
FS	-.068	.130	-.039	-.524	.601
EXP	.033	.060	.047	.548	.585
DST	.189	.223	.055	.848	.398
QMAIZE	.002	.000	.441	4.385***	.000
EXTNV	.477	.282	.110	1.696*	.093
PFERT	-.001	.001	-.03	-.435***	.000

\*\*\* Significant at 1%; \* Significant at 10%

Adjusted R-square = 0.542, F=16.7

The coefficient of price of fertilizer of 0.03 was statistically significant in explaining the reduction in fertilizer use among farmers, indicating that a unit change in fertilizer price resulted in a reduction in fertilizer demanded by 0.03 kg. These results are supported by Khellarh *et al.* (2001) who reported that price of fertilizer had a negative effect, as economic theory would suggest on fertilizer use in Benin. The result suggested that household demand of fertilizer decreased as its price increased.

The implication of the findings above is that farmers are sensitive to price changes however in this study the changes have been narrowed by the subsidies delivered by the governments. There could be a rapid decline in fertilizers demand by the farmers if the

government could allow the forces of market operate freely which would have harmed the smallholder farmers

The coefficient of farm size (FMS) had also a significant influence on the fertilizer demand among farmers, in which a unit change in farm size resulted in an increase in fertilizer demand by 0.31kgs. Similarly the coefficient of maize produced (QMAIZE) using subsidy fertilizer was positive and statistically significant such that a unit change in maize production using the fertilizer subsidies stimulated the demand of fertilizer by 0.44 kg. The number of extension visits to the farmers contributed the demand of subsidy fertilizers by 0.11 kg.

Farm size generally has a positive impact on a households' decision to adopt and use a new technology such as fertilizer. These results on farm size are supported by Doss and Morris (2001) who argued that larger farm sizes do positively affect the use of both modern varieties of maize as well as fertilizer in Ghana. The implication of these findings is that for effective estimation of demand of fertilizer, assessment of the areas under cultivation or to be brought under cultivation in relation to crop and ecological recommended rates should not be neglected.

The multiple regression results discussed above supports the hypothesis that there is no significant increase in demand of fertilizer as a result of fertilizer subsidy programme. It is clearly from Table 16 that price of subsidy fertilizer was statistically highly significant in explaining the reduction of fertilizer use among farmers and therefore the hypothesis cannot be rejected.



#### 4.5.2 Conditional outcome model results

This model was used to determine the impact of fertilizer subsidies on maize output produced by smallholder farmers. It answers the question concerning whether fertilizer subsidy programme has translated into increased crop output of maize in the study area as shown in Table 17. The R<sup>2</sup> value indicated that 67.4% of the variation in the production of maize was contributed by number of dependants, farm size, education and quantity of subsidy fertilizers whose value were statistically significant.

**Table 17: Effect of subsidy fertilizers on maize production**

Variable	Standardized coefficients				
	B	Std. Error	Beta	t	Sig.
(Constant)	11733.077	6488.775		1.808	.073
FS	-80.391	29.868	-.168	-2.692***	.008
DST	-95.645	53.681	-.100	-1.782	.078
FMS	505.923	81.700	.498	6.192***	.000
PFERT	-.598	.336	-.101	-1.781**	.078
AG	18.538	12.664	.099	1.464*	.146
EDUC	-217.959	60.858	-.194	-3.581***	.001
EXP	8.155	14.509	.042	.562	.575
POM	.048	.032	.086	1.480*	.142
FERT	258.408	50.174	.349	5.150***	.000
EXTN	-21.277	66.645	-.018	-.319	.750

Adjusted R-square = 0.674

\*\*\* Significant at 1%; \*\* Significant at 5%; \* Significant at 10%, F=25.65

A unit change in family size led to a household head to reduce production in maize by 0.168kg. The effect of family size on adoption of technology can be ambiguous. It can hinder the adoption of technologies in areas where farmers are very poor and the financial sources are used for other family commitments with little left to purchase farm inputs (Hassan *et al.*, 1998a). In this study family size has been found to affect the production of maize significantly, suggesting that any program to be introduced by government or nongovernmental organisations must consider the economic status of the farmers.

Farm size (FMS) coefficient of the smallholder farmer was found to be 0.498 statistically significant. For each unit change in farm size maize output was increased by 0.498 kgs. Other studies found that farm size affected the results observed by Sain and Martinez (1999) when were studying the use of improved maize seed in Guetemala. Nkonya *et al.* (1997) found that farm size to be significant, but negatively related to improved maize seed use, indicating that households with smaller cropped areas used improved maize seed intensively than did larger farms in Tanzania. In this study farm size of the smallholder was a determinant factor of maize output.

Education (EDUC) of the household head is assumed to have an important positive impact upon the adoption and use of technologies. The education coefficient of the household head of 0.194 was found to be statistically significant in explaining the reduction in maize output by smallholder farmers. A unit change in number of years to school by a farmer led to decreased level of maize production by 0.194 kg.

However these results are similar to Sain and Martinez (1999) who found a contradictory result in Guetemala where the level of education of the household head was found to have a negative impact on use of improved maize seeds. This result shows that education levels have a negative effect on production of maize. The researcher suspects the reason might be; with increasing number of years to school people tend to avoid involving with cropping due to risks and uncertainty involved in this sector.

On quantity of fertilizer (FERT) use when analyzed its coefficient was found to be 0.349 and statistically significant in explaining the increase in maize production by indicating that a unit change in subsidy fertilizers used by a farmer led to increase of maize output by 0.349 kg. It is true to argue that when nutrients are removed without being replaced

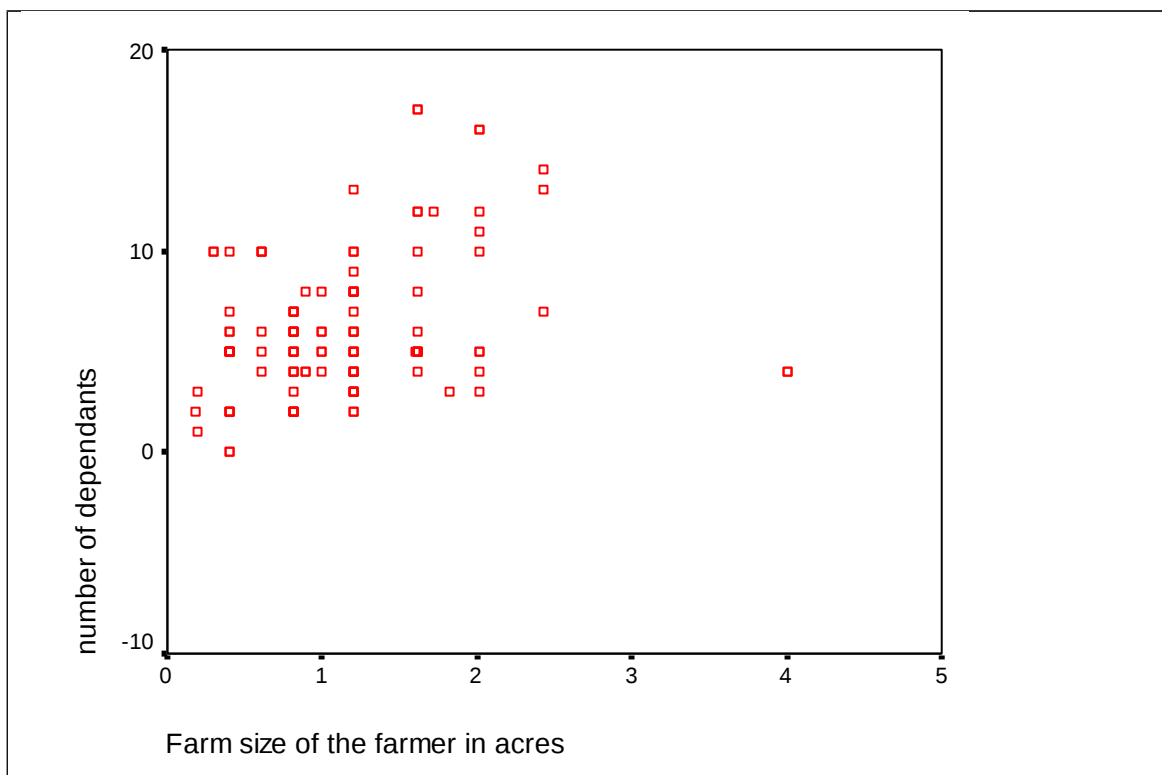
generally its soil fertility will suffer in spite of high-yielding seed. Arnon (1987) argued that, the use of fertilizer is important even in early stages of agricultural development for practical and physiological reasons. The practical reason is that returns are quick. The physiological reason is that few other inputs have such striking visible effect on crops. The fertilizer itself is a tangible input, so that relation between cause and effect is most evident. From the findings above there is a positive effect of fertilizer use on the production of maize in the study area. Therefore these results have failed to accept the null hypothesis but support the alternative one that fertilizer subsidies have significant effect on maize output produced by smallholder farmers. From Table 16 subsidy fertilizers use was highly significant in explaining the increase in maize production by smallholder farmers in the study area.

Despite of the subsidy fertilizer program, increase in price of subsidy fertilizer affected by distance (DST) from the buying point, maize output decreased by 0.101 kg. This shows that not all smallholder farmers can afford to buy subsidy fertilizer.

In detecting whether the independent variables were free from multicollinearity to obey the assumptions of model specifications two methods were used:-

- (i) Scatter plot and
- (ii) Correlation matrix

The scatter plot in (Fig. 13) shows that there is a linear relationship between the variables proving that the variables were free from multicollinearity.



**Figure 13: Scatter plot showing the linear relationship between farm size and the number of dependants.**

Variable in Table 18 show that there was a low correlation coefficient among the variables in that manner they did not cause multicollinearity in the model used.

**Table 18: Correlation coefficients showing the relationship between variables**

	Age	Family size	Distance	Education	Experience	Farm
Age	<u>1.000</u>	<u>0.370</u>	<u>0.105</u>	<u>-0.092</u>	<u>0.040</u>	<u>0.268</u>
Family size	<u>0.370</u>	<u>1.000</u>	<u>0.159</u>	<u>0.002</u>	<u>0.420</u>	<u>0.311</u>
Distance	<u>0.105</u>	<u>0.159</u>	<u>1.000</u>	<u>0.200</u>	<u>0.058</u>	<u>0.058</u>
Education	<u>-0.092</u>	<u>0.002</u>	<u>0.058</u>	<u>1.000</u>	<u>0.058</u>	<u>0.058</u>
Experience	<u>0.536</u>	<u>0.416</u>	<u>0.058</u>	<u>-0.140</u>	<u>1.000</u>	<u>-0.095</u>
Farm	<u>0.262</u>	<u>0.311</u>	<u>0.184</u>	<u>-0.095</u>	<u>0.492</u>	<u>1.000</u>



## CHAPTER FIVE

### 5.0 CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusion

This research was conducted in Mbeya rural district with a general objective of evaluating the distribution of fertilizer subsidy fertilizers to smallholder farmers in a bid to address the challenges facing the program. The specific objectives of the study were, (a) to analyze the effect of fertilizer subsidies to smallholder farmers on demand of fertilizer (b) to determine the impact of fertilizer subsidies in the production of maize by smallholder farmers and (c) to review the current governments design and conduct of fertilizers subsidies distribution to smallholder farmers in the research area.

This study has provided information on demographic characteristics of household head, farm size in relation to quantity of fertilizer requested and received, production of maize before and after the introduction of subsidy fertilizer, sources of income to purchase fertilizers, availability of extension services, marketing of maize output, best month for the distribution of subsidy fertilizer, results on regression analysis basing on fertilizer demand model and conditional outcome model and general constraints affecting the supply and distribution of fertilizer subsidies among stakeholders.

The study found that 50% of the respondents aged between 36 to 46 years old while male were 69.2% and female 30.8%. On marital status 95% were married, 1.7% were single and 3.3% widow. Regarding family size, 47% of the respondents had a family size of 5 to 8 dependants. Majority of the respondents in the study area were standard seven and accounted for 86% with the largest share of fertilizer demand.

The study also found that the farm size ranged from 0.5-10 acres, while the household head had an average farm size of 2.7 acres. Farmers used farm size as determinant of fertilizer demand; the farmer received an average of 1.7 bags per acre under the program which was about 16 kg N /ha which was quite low compared to the recommended rates of 50-60 kg N/ha due to supply shortage of fertilizers.

Findings on sources of income showed that 77.5% of the farmers depended on sales from maize crop as their major source of income for purchasing fertilizer and none of them pointed loan from bank as their source of income. Production of maize with fertilizer subsidies and without fertilizer subsidies was 1498 kg/ha and 1621 kg/ha respectively; a marginal increase of 123 kg/ha. Statistically there was no significant difference between output produced before and after the introduction of fertilizer subsidies. Marketing of maize in relation to prices of fertilizer subsidies still is a bottleneck to the farmer. A farmer is supposed to sell about two bags in favor of buying a bag of fertilizer (50kgs).

The study showed that majority of the farmers wanted the subsidy fertilizer to be distributed in October in the study area, because during this period farmers have access to money from crop sales in September.

Results on regression analysis on demand of fertilizer by smallholder farmers showed that farm size, maize produced using fertilizer subsidies, and the price of fertilizer were significant factors affecting the use of fertilizers. The price change of fertilizer reduced the probability of buying fertilizer by 0.03 while farm size increased the probability of using fertilizers by 0.31 while maize produced on the last season increased the probability of fertilizer use by 0.44 Thus the subsidy fertilizer affected the demand of fertilizers in the study area.

On determining the effect of fertilizer subsidies on maize production it was observed that factors such as family size, education, and quantity of fertilizer used were significant factors affecting maize production. A unit change in family size decreased the production of maize by 0.168 because the household head directed the resources to other family commitments. The unit change in farm size increased the probability of producing maize by 0.498 and level of education reduced the probability of producing maize by 0.194. Apart from the findings above a number of constraints on supply and distribution fertilizer subsidies to stakeholders such as importers, wholesalers, retailers and farmers have been identified.

## **5.2 Recommendations**

Based on the findings of this study the following recommendations are suggested towards improving the performance of the subsidy fertilizer programme. The recommendations can as well be useful to other areas in Tanzania.

- (i) Policy makers should continue to encourage and support the private sector to invest input acquisition and distribution so that inputs are available when farmers need them. By improving farmers ability to purchase fertilizer, improved seeds and other inputs by improving access to credit, phased and incremental use via smaller and hence more affordable bags that allow farmers to use risk free collaterals for commercial loans.
- (ii) Farmers should be protected against low and volatile output prices by investing in measures to production variability like irrigation, drought-tolerant crops and storage systems.



- (iii) The government should strengthen soil crop research and extension by supporting the public agencies and the public private partnerships for sponsoring farm trials and demonstrations. This will help to evaluate official application rates and types of fertilizers as applied in general by farmers for each of crop.
- (iv) Government policy should strengthen the input delivery system for the smallholder sector which produces more than 85% of maize in Tanzania. Farmers must be made aware of the possibilities and be offered a sound incentive, with readily available supplies of fertilizer in the desired combination at the right time and place. Fertilizer subsidies should reach farmers one month before planting seasons. The supply chain should be reduced. The longer the chain the higher the cost to the final consumer.
- (v) The government should encourage the building of warehouses in the rural areas to improve the marketing efficiency of fertilizers, so that supply of fertilizers is timely and sold at low cost.
- (vi) Although extension services were available in the study area, there is a need to improve its performance. Extension efforts need to be strengthened to increase the flow of information to farmers. More efforts should be directed toward appropriate recommendations for fertilizer use; a majority of farmers use inefficient practices. Farmers should be advised on the use of organic fertilizers to supplement chemical fertilizer. Furthermore, extension efforts should be directed toward the adoption of improved varieties and other field managerial practices.

- (vii) Formal credit is not available to all maize farmers. With rising input prices, providing credit to farmers becomes increasingly important. In collaboration with the government and other stakeholders, the formal credit system should address the credit problems faced by small-scale farmers, especially their lack of knowledge (information) about formal credit and the bureaucratic procedures for obtaining it. The formation of farm groups should be encouraged, because lending to groups tends to reduce transaction costs and improve the rate of loan recovery.
- (viii) The government should make sure that farmers have an access to fertilizer subsidies so that benefits accrued are distributed equally to all farmers as the cost of production is lowered through fertilizer subsidies.
- (ix) Given that fertilizer prices are sensitive to transportation costs it is recommended that the government should reduce the distribution costs by improving road and rail infrastructure to lower transport costs.
- (x) The government should reduce the fertilizer sourcing costs by lowering trade barriers to increase the size of national and regional markets, enabling importers and eventually manufactures to capture the economies of scale this action will reduce the smuggling of fertilizers and crop outputs across the borders.
- (xi) The government should put into action her intention of building a fertilizer industry in Mbeya region to feed all the Southern Highland regions and beyond the borders as this will reduce the cost of transport, procurement and selling the net excess to neighbor countries to improve the economy of the country.

- (xii) The government should allocate enough funds to pay for subsidies from its internal budgets without depending on donors. Depending on donor contributions in most time the availability of funds becomes a serious constraint, and delay in the availability of funds leads to all sorts of problems downstream, such as delay in procurement of inputs and untimely supply of fertilizer at farm level. Such delay also results in unnecessary costs for procurement agencies because they cannot recover their costs until next season.

### **5.3 Further Study**

The area covered by the study is smaller than the ideal size anticipated. This is because collection of data was limited to a small area and respondents in some areas had poor record keeping. Therefore some of the information obtained relied on memory recall of respondents. In such area the researcher had to spent longer time to probe for more accurate information. However, the results provide some important conclusions which may be important for further evaluation of fertilizer subsidies distribution in the country. Therefore it is proposed that further detailed studies with wider coverage should be done.

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## APPENDICES

### Appendix 1: Farmers questionnaire

Date \_\_\_\_\_

#### EVALUATION OF FERTILIZER SUBSIDY DISTRIBUTION TO SMALLHOLDER FARMERS: A CASE OF MBEYA RURAL DISTRICT.

##### A. HOUSEHOLD CHARACTERISTICS

1. Division \_\_\_\_\_
2. Ward \_\_\_\_\_
3. Village \_\_\_\_\_
4. Date of Interview \_\_\_\_\_
5. Name of respondent \_\_\_\_\_
6. Age of respondent \_\_\_\_\_
7. Gender/sex of the respondent
  - 1= male
  - 2= female
8. How many years have you been to school? \_\_\_\_\_
9. Marital status of the respondent
  - 1= Single
  - 2= married
  - 3= widowed
  - 4= separated
10. What is the size of your family?
  1. Members of age >18 years old ( )
  2. Members of age 10-18 years old ( )
  3. Members of age <10 years old ( )
11. How many years have you been in farming activities (experience) \_\_\_\_\_

##### B. THE USE OF FARM INPUTS (FERTILIZER SUBSIDIES).

1. For which crop do you normally apply fertilizers? (List them in order of priority).
  - 1 \_\_\_\_\_
  - 2 \_\_\_\_\_
  - 3 \_\_\_\_\_
  - 4 \_\_\_\_\_
  - 5 \_\_\_\_\_
2. Which type of fertilizers under subsidy program were available last seasons?  
\_\_\_\_\_
3. What was the price of each type of fertilizers above for the last season?

Type of fertilizer	government retail price per bag	Total number of bags bought	Total amount paid (Tshs)
UREA			

DAP			
SA			
CAN			
TSP			

4. What is the reason for applying fertilizer for the crop mentioned above?

- 1=profitable to use.
- 2=important food crop
- 3=easily available
- 4=given on credit
- 5=important cash crop,
- 9=others (specify)

5. Which crops don't you apply fertilizers in your farm?

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_

6. What are the main reasons for not using fertilizers for the above crops?

- 1=Not easily available
- 2=Price of fertilizer is too high
- 3=Do not know how to use
- 4=No cash to buy fertilizers
- 5=Natural fertility is adequate
- 6= Use of manure
- 9= others (specify)

7. What is the amount of fertilizer subsidy did you demand last seasons for maize production?

	Total number of bags requested	Total actual number of bags obtained	Deficit/surplus
2003/2004	UREA		
	DAP		
	SA		
	CAN		
	TSP		
	NPK		
2004/2005	UREA		
	DAP		
	SA		
	CAN		
	TSP		
	NPK		
2005/2006	UREA		
	DAP		
	SA		
	CAN		
	TSP		
	NPK		
2006/2007	UREA		
	DAP		
	SA		
	CAN		

	TSP			
	NPK			

8. Did you buy all fertilizers at the government retail price?

1=Yes

2=No

9. If No indicate the total number of fertilizers and their type.

Type of fertilizers	Price of one bag	number of bags bought	Total amount of money paid

10. Where do you buy fertilizers?

1=Local shop

2=Town shop

3=Cooperatives societies 4=Village office

9=other (specify).

11. What is the distance in kilometers from this area to fertilizer procurement sources?

12. How many hours do you spend to the procurement source? \_\_\_\_\_

13 .By what means of transport do you use?

1=Vehicle

2=Bicycle

3=by cart

4= on foot

9=others (specify)

25. Is fertilizer more available now than before fertilizer subsidy program was introduced?

1=yes

2=no

14. What is the size of your farm in acres? \_\_\_\_\_

27. Is there any change in the rate of fertilizer (kg of fertilizer/ha) application as a result of fertilizer subsidy program implementation?

1. Yes

2. No

15. If YES, indicate the following:-

crop	Rate before program kg/ha	Rate after the program kg/ha	Output kg/ha

16. Do you get credits for buying fertilizer?

1. yes

2. no

**C.PRODUCTION TRENDS OF MAIZE 2003/07**

1. What is the amount of output of maize did you get on using fertilizer subsidies for the last four seasons?

SEASONS	Area cultivated in acres	Total output (Kgs)
2003/04		
2004/05		
2005/06		
2006/07		

2. What amount of maize did you produce before the introduction of fertilizer subsidy program?

Season	Area in acreage	Total Output (Kgs)
2001/02		
2000/01		
1999/08		
1998/07		

3. In your opinion has the production of maize changed after the subsidy program?  
1=yes      2=no

**D.MARKETING OF MAIZE OUTPUT**

1. For what reason do you produce maize?

1=for food

2=commercial,

3=both for food and commercial

2. What is the price of one bag of maize at the market during harvesting period?  
\_\_\_\_\_

3. Does the price meet the production cost?

1=yes

2=no

4. Do you have an extension worker in this area?

1= Yes

2=No

5. Did the extension worker ask you what amount and type of fertilizers were you demanding last seasons?

1=Yes; 2=No

6. Is the fertilizer under subsidy program available in time?

1=Yes

2= No

7. What are the procedures to follow in order to get the fertilizer under the program?  
\_\_\_\_\_

8. What problems do you face in purchasing the fertilizers under subsidy program?  
\_\_\_\_\_  
\_\_\_\_\_

9. When do you want the fertilizer to be distributed in your area? \_\_\_\_\_

10. What are the reasons for your argument above?

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11. Should the government of Tanzania continue to implement this subsidy fertilizer program?

1=Yes

2=NO

12. Why do you think so?

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13. What are your comments for the fertilizer subsidy program to be successful?

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**THANK YOU FOR YOUR COOPERATION**