COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

DETERMINANTS OF FERTILIZER USE OF CROP PRODUCTION ON SMALL HOUSEHOOLD FARMER (IN CASE OF HIDEBU ABOOTE WOREDA)

ASENIOR ESSAY SUMITTED TO THE DEPARTMENT OF ECONOMICSIN PARTIAL FULFILMENT OF THE REQUIREMENTFOR THE AWARD OF BACHELOR OF ARTS DEGREE IN ECONOMICS

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DECLARATION

I. Ayele Yazew declared that this work title" The determinant of fertilizer use of crop production on smallholder farmer in case of hidebu abote woreda." I have produced it independently except for the guidance and suggestion of the research adviser.

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Acronyms

AISCO = Agricultural input Supply Corporation.

CSA = Central Statistics Authority

FAO = Food Assistance Organization.

GDP = Growth Domestic Product.

GTP = Growth and transformation plan

IFDC = International fertilizer Development Center.

IMF = International Monetary Fund.

MDG = Millennium development goal.

MOARD = Ministry of Agriculture and rural development.

Mt = metric tone

NFIA = National Fertilizer Improvement Association.

SAP = Stagnant Adjustment Policy.

SSA = Sub-Saharan Africa.

TGE = Transitional Government of Ethiopia.

WB = World Bank.

Abstract

The aim of this study is to examine the determinant of fertilizer use on crop production by small holder farmers in case of hidabu abote woreda. Data for this study collected from primary data in 2010 cropping season. A simple random sampling is applied to select 88 samples which include both adopter and non-adopter in the selected kebeles. Both descriptive and inferential statistics were used to describe socio economic and institutional characteristics of the respondent through percentage in both fertilizers adopted and non- fertilizer adopted farmers. OLS model was employed to identify determinant of fertilizer application on crop production was regressed against eight explanatory variables so as to identify the determinant fertilizers application on crop production by small holder farmers. Regression result revealed that six explanatory variable such as credit access and safety net positively influenced and statistically insignificant variables. Whereas six variables I.e. family size, education level, farm size, number of oxen , number of livestock and extension service are statistically significant at 1, 5and 10percent. Therefore the study suggest that improve credit access and safety net program, giving attence are some of the important priority area for the success of future intervention strategies aimed at the promotion of increasing production for sustainable development in agricultural se

Key word: fertilizer, crop production, OLS, hidebu abote woreda.

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Agriculture is main economic pillars of the Ethiopian economy and the overall economic growth of the country is highly dependent on the success of the agriculture sector. The sector represents 42% of the GDP of the country and about 85% of the population gains their livelihood directly or indirectly from the agricultural production. Crop productions are highly important to enhance the food security of small holder farmers in Ethiopia (CSA, 2015).

Vulnerability to environmental and climatic shocks remains critical challenges of Ethiopia's agricultural sector. Despite improving yield, productivity remains very low partly owing to limited use of chemical fertilizers and improved farming practice. The agricultural sector faces a number of constraints such raising price of fertilizer, soil erosion, and densely populated. In spite of these challenges, the potential for growth in agriculture is enormous. Agricultural productivity is one of the lowest in sub- Sahara Africa (SSA), indicating untapped opportunities to increase production by promoting modern farming practices (AFDP, 2015).

One of the means by farm level productivity can be increasing through the introduction and dissemination of improved agricultural technologies. These include improved seed, chemical fertilizer and extension service for small scale poor farmers, particularly those cultivating staple crops. Agriculture in Ethiopia is characterized by its low productivity. The country for the use of limited agricultural technology and loss of soil fertility due to continuous cropping are the main reasons. According to CSA figures over 4.8 million hectares (about 43% of farmers) received fertilizer during 2010/2011 meher season. observations in the field were that uses of fertilizer increased in some cases with those farmers in high potential production areas, who had access to cash credit ,and whose yield were traditionally higher. Such farmers applying higher rate of fertilizers of 8 quintals of fertilizer per hectare. Normal fertilizer application recommendation's by extension worker to farmers ranged from 2 to 4 quintals per hectare (AFDP, 2015). According to agricultural marketing department [in 2011encyclopidia] 526485 tons of fertilizer is sold to

farmer. In Ethiopia, as agriculture is the dominant economic sector, the use of improved agricultural technologies is very crucial to boost agricultural production and productivity. Thereby ensure food security and reduce poverty, to materialize this objective, concrete measures have been taken by the government. This means increasing the availability and use of these improved agricultural inputs by farmers (AFDP, 2015)

In spite of the Oromia's government efforts to expand fertilizer use among rural households, its use in the region is also still at its lower level in terms of adoption cover age and intensity of use. At Oromia region report from individual households found out that about half (48.8%) of the households is use fertilizeHagos and holden (2002). It is therefore of critical importance for agricultural research and policy design to clearly understand the reasons behind the persistence of low adoption rate in the region. Lack of information on the characteristics of households that use fertilizer and those that do not is one of the important impediments for policy makers to design their policies to expand fertilizer use among rural households. Moreover, demand characteristics and constraints are not permanent and are volatile depending on the needs and perception so farmers to their micro environment at that particular point in time. Thus, the general objectives of this paper will to analyses these household characteristics over time in order to have a better understanding of the constraints and opportunities to increasing fertilizer use hagos and holden (2002)

1.2 Statement of the problem

Growth in agricultural production in the past achieved through expansion of farm land. During that time population is low, marginalized land is high.so farmers want to increase agricultural production by changing this marginalized land to arable land. But, today there is a little room for expansion of farm land. In the current period population growth is high, the marginalized land is low.

In Africa in general, and in Ethiopia in particular small holder farmers dominate the crop production. Even though small holder farmers occupy the majority of land and produce most of crop products; the yield of crop is very low. Because of low adoption of improved agricultural technologies, severe weather fluctuation, climate change, inappropriate economic price and rapid population growth. Because low level economic growth in least developed countries. Due to these reasons crop production in developing countries has not been able to satisfy the food

requirements of the people. Fertilizer use depends on various socio-economic characteristics like arable land size, house hold income, distance to input purchasing center, fertilizer price and transport cost (Bhondayi, 2004).

Sometimes Ethiopian peasants have become resistant to using fertilizer. This is not without sufficient reason (Kefyalew, 2013). There are a number of factors that determine fertilizer use such as providing extension service to the farmer, credit access, off farm income, farm size, number of oxen, family size, education level and age of households and others.

While there are considerable differences in the demographic characteristics of house hold between study zones, the only significant differences observed between fertilizer user and non-users are found in the sex and age of house hold .house hold that use fertilizer on at least some of their crops tend to be headed by younger men. In terms of educational attainment of the house hold head ,there are significant difference fertilizer user and non- users in the full sample for all three levels considered any formal education , completion of primary school, completion of secondary school. With regard to household asset ownership the general trend is the fertilizer users tend to be better endowed (Kasule etal, 2011).

This research differs from other researches by study area because there is no any research done in Hidebu Aboote woreda with this title. Therefore, this paper hopes to fill the gap on the problem, by adding the independent variable that is number of livestock which would hope to provide recent empirical evidence on fertilizer use.

1.3. Research Question

The research answers the following questions:

- What determines fertilizer use among farmer in the study area?
- What is the role of fertilizer for crop production?
- What is the ability of farmer in using fertilizers?

1.4. Objective of study

1.4.1 General objective

The general objective of the study is determine fertilizer use of crop production by small holder farmers in Hidebu Aboote woreda in 2010 cropping season.

1.4.2 Specific objective

- To examine determinant of fertilizer use among farmers in the study area.
- To determine the role of fertilizer for crop production.
- To determine the ability of farmer in using fertilizers.

1.5. Significance of the study

The information generate from this study is useful in the formulation of appropriate policies on house hold fertilizer utilization, thereby shaping the development of small holder agriculture. Furthermore, the analysis and identification of factors affecting utilization of input is vital in the process of promoting improved input use and enhancing food production as well as food security in the woreda. This study also provides information for further research and development activities that will benefit the small holder farmers in the study area. Analyzing of benefits and challenges of fertilizer it to help policy makers to know which factor improves the livelihood of the poor peoples. In addition, giving insights, the paper can serves as reference material for those who work on related issues.

1.6. Scope of the study

Although the benefit of chemical fertilizer is wide and multi-dimensional, this study examines the determinants of fertilizer use to increase crop production. Under the study of fertilizer use only hidebu aboote woreda is selected. Because this woreda is on low level to use chemical fertilizer to increase crop production. Thus, the study will be concern with the hidebu Aboote woreda in north shoa zone.

1.7. Limitation of the Study

The researcher highly motivation at the times of starting the research paper but some limitation may be faced the researcher. These limitations are:

- Inadequately prepared of the questioner
- Lack of available material and sources related with topics
- Lack of information related to the topics
- Inadequately transportation system
- Lack of sufficient computer to regress the model on STATA

1.8 Organization of the study

This paper will organize in five chapters. The first chapter is back ground, statement of the problem, objective of the study, significance of the study, scope of the study, limitation and research question. The second chapter includes review of literature which gives overall view about fertilizer. The third chapter contains methodology of the study and model specification. In fourth chapter it contains the data presentation and analysis. The fifth chapter provides conclusion & recommendation.

CHAPTER TWO

Review of Literature

2.1 Definitions and Concept of Agricultural Input

The concept of modern agricultural input includes fertilizers, improved seed, modern agricultural tools, agro chemical (such as pesticides, insecticides and compost) and etc. which are applied to improve farm products. Different literatures give different definitions for agricultural input.

Any substance that is added to soil to supply one or more plant nutrients and intended to increase plant growth is fertilizer (Cooke, 1972). Fertilizers are substances, which are added to the soil to supplement the soil with those elements required in the nutrition of plants. That means, any material organic or inorganic, natural or synthetic, that furnishes to plants one or more of the chemical elements necessary for normal growth is fertilizer (Berhanu, 2000). Inorganic fertilizers are usually simple chemical compounds made in a factory or obtained by mining, which supply plant nutrients and are not residues of plant or animal life (Cooke, 1972). Broadly speaking, any chemical compound used for supplying one or more of the essential plant -food elements are chemical fertilizer (Mcvickar, 1970).

All fertilizer materials that might be present on the fertilizer market and that are sold within the same trade are called commercial fertilizers (Callings, 1955). In general, chemical fertilizers are inorganic or synthetic materials of a concentrated nature. They contain one or more plant nutrients in easily soluble and quickly available forms (Berhanu, 2005).

According to central statistical report 1996 fertilizer refers to a substance that added to soil and intended to increase the amount of plant nutrient available for crops growth. In this survey two types of fertilizer (natural chemical) are enumerated. The natural fertilizer consists of the form yield manure and wood ashes while the chemical types of (ammonium phosphate) or UREA (ammonium nutrient) and improve seed is a crop variety with gives a significantly high yield and late quality compared to locally produced variety of seed. Pesticide are a chemical that are useful for the control mitigation or elimination of pests which are detrimental to crop. Pesticides include insecticide and herbicides.

According to the world book fertilizer is substance that is added to soil to help plant grow. Farmer uses various kinds of fertilizer to help produce abundant crops. Fertilizer contain nutrient that are essential for plant growth some fertilizer are made from organic waste such as manure and sewage other manufacture from certain mineral or are produce as synthetic compound in factories.

According to the book soil fertility management fertilizer can be defined as a mind or manufactured material containing one or more essential plant nutrient. The suitable mineral available in fertilizer can be rock phosphate, nitrogen, (N) and potassium (K).

2.2 Theoretical Literature Review

2.2.1 Historical Review of Fertilizer and Improved Seed Implicational In Ethiopia

An increase in use of fertilizer bring above an increase in the yield crop and hence income the farmer. To this has been stated the an increase use of fertilizer is essential because the rapidly declining soil fertility as well as while drought constitute the biggest threat to production in way parts of the country the problem due to declining of soil fertilizer is increasingly getting worse (malati; 1994).

Before introduction of fertilizer in the country in 1966 the Ethiopian government through MDA requested the FAN of united nation to launch a fertilizer program in Ethiopia. FAO and IAR started the fertilizer program which is known as FFHC the objective of the program was to introduce the use of chemical fertilizer the majority by small scale farms through the following three year of sample fertilizer demonstration (1997- 1969) on major crops the country was embarked a program of fertilizer distribution an efficient fertilizer marketing and credit system recognized as essential for increasing fertilizer use in developing country and fertilizer marketing is designed to help all person or institution involved in fertilizer distribution in those country (wierej, 1998; 66). In case of Ethiopia introducing and usage of fertilizer in small scale farm is very recent phenomenon when demand for fertilizer continued to raise become char that it was necessary that to establish on organization that could handle fertilizer supply and credit work on a country basis.

2.2.2 Pre-Revolution Supply System

Before FAO fertilizer program usually 100-200 tons of fertilizer was imported annually for use the state and big commercial forms such as tendaho and metehara.

During those times the supply of fertilizer as well as marketing was carried out by private companies which had not been efficient fertilizer distribution marketing, credit system and fertilizer field demonstration to small scale forms. Beside their activity was confined to certain area rather than national wide supply. This was mainly important they were profit oriented (FAO 1987; 40).

2.2.3 Post- Revolution Supply System

After the revolution of 1974 the government gave responsibility for the supply and distribution of organization in put product and includes fertilizer. This corporation handled the distribution of chemical fertilizer from 1977 up to and including 1983) even though the AMC (agriculture marketing center) was the principal supplier of fertilizer as the secondary while keeping the marketing of agricultural product as major activity.

Importing from different countries. Thus the main purpose AISCO under the MOA in 1984 was to import distributes and market agricultural input mainly fertilizer (AISCO 1987; 74).

2.2.4 Post 1991 Supply System

Prior to 1992, the government-run Agricultural Inputs Supply Corporation (AISCO) was the sole player in a subsidized fertilizer market network. Inefficiency and cost concerns led to partial liberalization in 1992, which allowed a few private companies and regional state-run agencies to enter the market. However, competing against a state-run enterprise for a limited market demand became difficult, which led these private firms to exit the market. By 2007 the regional state-run agencies were replaced by farmers' cooperatives, and in 2008 AISCO was renamed AISE, reverting to its prior status as the sole fertilizer importer. The share of the market for private firms decreased from 30 percent in 1996 to less than 10 percent by 2001 and then to zero in 2002. As the share of private companies diminished, regional state-run agencies took over but these were also replaced with cooperatives as AISE became the sole importer (IFDC, 2012).

It is true that until mid-1992 the fertilizer importation and marketing system was fully state controlled. In response to this problem, the transitional government of Ethiopia (TGE) a new marketing strategy was formulated in November 1991 with technological assistance from FAO. According to the World Bank report 1995 this new marketing strategy includes the following element. Private sector should supplement and not replaced the existing marketing arrangement through marketing center (MCR) and national bank of Ethiopia (NBE). Should permit the commercial bank of Ethiopia (CBE) to provide fertilizer credit to farmer and fertilizer retailer and wholesaler there by breaking the monopoly power of AIDB which has a limited branch network eventually elimination price and advocated an active role of the government in obtaining donor support for adequate and timely import of fertilizer (WB, 1995;8).

The liberalization policy permit privet sector to involve in the fertilizer import income with this AISCO was allowed to sale directly to farmers from MCS. The EAL (Ethiopian amalgamate limited) privet company imported some 25, 00 tons of DAP in 1992/93 EAL appointed 50 retail and 5 which sells to facilitate distribution. Therefore the involvement of privet sector cut the monopoly of AISCO in fertilizer distribution and marketing and brings about computation and efficiency thereby increasing consumption.

2.2.5 Economic Importance and Demand for Fertilizer

One of the major problems that have constrained the development of an economically successful agriculture in developing countries is the poor soil fertility for crop production (Fertilizer Research, 1995). Agricultural production can, of course, be boosted by increasing inputs and/or by introducing modern agricultural technology. That means agricultural growth based on continuous increase in yield requires technological changes. If there are soil fertility constraints, it is difficult to introduce and sustain such technological changes on millions of hectares of cultivated land without growing application of plant nutrients, chemical fertilizers are but one source of plant nutrients (Desai, 1991).

However, most of the growth in agricultural production in less developed countries over the last forty years has been due to area expansion and not to yield increase. Consequently, grazing land and considerable forestland have been put under cultivation and has resulted in environmental degradation Promotion of fertilizer usage, including the use of governmental subsidies, can be expected to have multiple benefits: growth in agricultural output, increased national food

security, increased income in the rural sector, maintenance of soil fertility and structure and the limitation of soil erosion and deforestation as the pressure to utilize more fragile ecosystems is reduced (Mohammed et al., 1994).

Similarly, fertilizer use increases land productivity through yield increase and eases the nutrient constraint to multiple cropping and land development programs. As a result, it relaxes the land constraint. Since the yield increase is proportionately more than the corresponding incremental labor applied, fertilizer use increases labor productivity. As fertilizer production, distribution and consumption increase, backward and forward linkages create additional employment, which is extremely important in labor surplus countries (Mudahar, 1978).

In general, agricultural output can be increased through the expansion of cultivable area or through improving the productivity of available land. With the gradual closing of the land frontier, however, future increase in agricultural output has to depend on increasing the productivity of land only. One of the crucial inputs to increase the productivity of land is fertilizer (Subramaniyan and Nirmala, 1991).

In the same way, the potential to increase farm production and agricultural growth is achievable, at least in short run, through land use intensification with the help of modern yield -increasing technologies. These technologies include, among other innovations, improved seeds and chemical fertilizers (Teressa and Heidhues, 1998).

With the introduction of high yielding varieties of various crops the possibilities of increasing farm yield and profit with intensive use of fertilizers has become financially feasible (Sirohi and Goes, 1972).

That means fertilizer is one of the most critical inputs in farming. It can bring about a rapid increase in agricultural production even in the short -run, which is the dire need of a developing country (Dhillon and Sankhayan, 1977).

Therefore, the provision of fertilizer is one of the essential factors, which play a great role in improving agricultural productivity. Agricultural revolution that has occurred in developed countries has led to a great increase in productivity, particularly due to the use of fertilizers (Gashu, 1985).

In line with this, the use of inorganic fertilizer has also a significant effect even on local crop varieties in which responses are generally believed to be low (Teressa and Heidhues, 1998).

The wise usage of fertilizer is one of the best investments a farmer can make. That means, with efficient use of fertilizer, the farmer expects a higher return on each unit of money spent on fertilizer (McVickar, 1970).

Though, all of the improved farm technologies must be applied together, it is generally true that proper use of fertilizer and high yielding variety seed offer the greatest opportunity for greater and rapid improvement in farm production especially for those small farmers suffering from shortage of capital and seasonal income fluctuations. Thus, investing on fertilizer and high yielding variety seed is more attractive than on fixed assets (Berhanu, 1993).

Profit from fertilizer use generally results from greater yield. For some crops improvement in quality can make the use of more fertilizer profitable, but generally the pay-off comes from increased production per hour. The nature of this greater yield, known as the yield response is governed by the well- known principle of diminishing returns. But the knowledge of the maximum physical production range is needed to determine the most profitable use of fertilizer (Nelson, 1968).

However, the continuous uses of fertilizer depend mainly on its profitability and physical availability at the right time (Dhillon and Sankhayan 1977).

It is a mere fact that fertilizer plays a pivotal role in augmenting crop production. Its importance cannot be over emphasized, especially in a country like Ethiopia, where the plants nutrients are mined for a century and crop production is stagnated as the result. With this fact, the demand for the input is expected to increase from year to year. To obtain the outcome expected from fertilizer use, genuine fertilizer at the required time, place and kind should reach the farmer (Bekele, 2000).

A producer's input demand is derived from the underlying demand for the commodity, which he produces within the given production. Thus the demand for fertilizer can be derived from a given aggregate production function for the agricultural commodities (Dholakia and Majumdar, 1995).

Demand for fertilizer is a derived demand, which is influenced, among other things, by (a) the yield response of fertilizer, (b) fertilizer prices and (c) price of the agricultural products. Changes in any one of the above three would affect the demand for fertilizer (Sah and Shah, 1995).

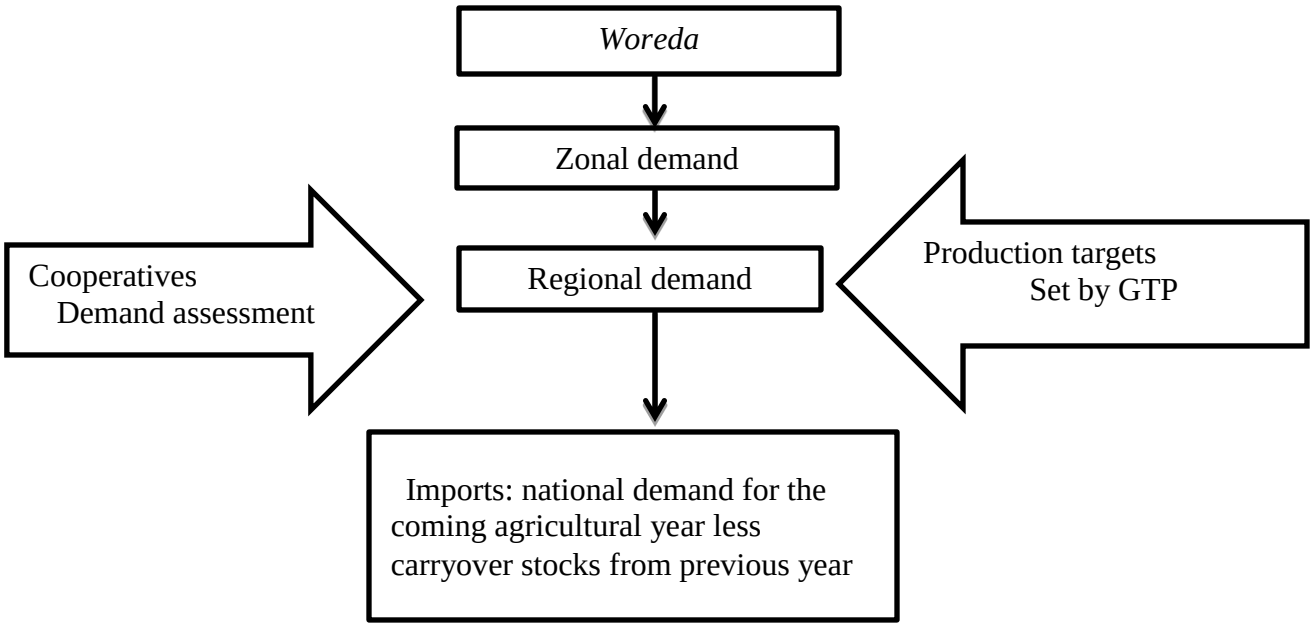
In general, fertilizer demand is dependent on various factors like weather condition, supply of the product, credit availability, input price, output price, knowledge and experience of the users.

2.2.6 Fertilizer Supply

Inputs such as fertilizer, improved seeds and crop protection chemicals are believed to be the most important production boosting factors to attain food self-sufficiency and thereby augment the income of farming households. In view of this, many efforts were made by the government to improve supply and use of fertilizer and other agricultural inputs. As a result, agricultural inputs and extension services have rapidly been expanded in a closely related manner. Despite the fact that the extension services on the use of improved inputs have started long ago, the level of utilization of this technology by the farmers is still very low. On average households in Oromia consumes 23.3kg of fertilizer in the year 2009 which is one of the lower fertilizer consumption in the world.in general fertilizer consumption in the region increases on average of 3.24% (BOARD, 2009).

Inputs that are mainly marketed are fertilizers (DAP and Urea). Both of them are imported since they are not produced locally. Therefore, planning of a season's supply must start at least six months in advance if the imports are to be in the country in the right time for distribution and sales. Regarding seasonal consumption as evidenced by annual sales volume, only 15 -20 percent of the fertilizer is consumed in the short rainy season (Belg) starting from February through March, while 80 to 85 percent of the average annual sale is consumed during the main season (Maher) starting from June to September. AISE is currently the sole importer of fertilizer in Ethiopia. An important decision that AISE must make every year is how much fertilizer to import in order to meet the anticipated demand from farmers. These estimates begin at the *kebele* level by MoARD agents, then aggregated to *woreda*, zonal, regional and national levels in order for AISE to initiate procurement in line with national GTP targets.

The following diagram illustrates this process.



Source: Authors, based on information collected from MoARD.

Figure 2.1 the Process of Estimating Quantities of Fertilizer Imports

Over the last 10 years, total fertilizer imports have increased by more than 50 percent, from less than 370,000 mt in 2002 to almost 570,000 mt in 2011, with a spike of 627,000 mt in 2009. Fertilizer carryover stocks averaged 33 percent of imports between 2002 and 2011, with a high of 61 percent in 2002 and a low of 12 percent in 2007. These stocks, resulting from the mismatch between actual fertilizer demand and imports, accentuate the year-to-year variability in fertilizer import levels,

2.3 Empirical Literature Review

Fertilizes uses or adaption decision are mode of the house hold level. So it is empirical to understand the set factor influencing house hold decision. Previous adaption and insanity studies in Ethiopia have examined a wide range of factor result have not always been consistent across studies.

Abebe, 2011, used multiple linear regression model to identify the variable that contributes to the amount of fertilizes use among respondent in Ada'a district of east Shoa zone. The result should that education level number of oxen owned, cultivates land size family sizes and saving habit of

the respondent were found to be the most significant variables contributing to the amount of fertilizes use that improving the livestock sector educating household and their family member giving attention in promoting saving are some of the important priority areas for the success of future intervention strategies aimed of the promoting production increasing technology and sustainable credit facilities.

Birhanu, 1993, analyzed factor influencing fertilizer is consumption in Ada'a woreda's east Shoa Ethiopia using multiple linear regression model. The study concluded that number of oxen owned, land fertility of faming income gross form income, farm size, family distribution, of fertilizes area under improved variety of seeds and education have significantly influenced fertilizer consumption out of these variable land fertility and farm size were inversely related to the level of fertilizer consumption.

According to kasule (2011) while there are considerable differences in the demographic characteristics of household between study zones, the only significant differences observed between fertilizer user and non- users are found in the sex and age of house hold .household that use fertilizer on at least some of their crops tend to be headed by younger men. In terms of educational attainment of the household head, there are significant difference fertilizer users and non- users in the full sample for all three levels considered any formal education, completion of primary school, completion of secondary school. With regard to household asset ownership the general trend is the fertilizer users tend to be better endowed.

Hagos and holden (2002) based on the information from the individual households found out that about half (48.8%) of households of the region use fertilizer. they also indicated that the most serious constraints faced by farmers for not using is high fertilizer price.

Itana, 1985, in his study adoption of improved variety and fertilizes in two extension area of western Shewa, Dilalla and Ollankomi by using tobit model that in Ollankomi, extension contact of farmers, level of education, family size, and adequacy of rainfall (as a proxy of risk) were found to affect fertilizers and improved variety adoption and in Dilalla, the above factor did not affect fertilizers and adoption of improved variety adoption. Instead, extension areas, farmers' asset position, rainfall, non-farm income, price of farm output are positively affecting the adoption of new technology.

Lelisa, 1998, used probit and Tobit model to identify the determinant of adoption and intensity of fertilizer use in Ejere district, west Shoa zone, Ethiopia. He include eighteen explanatory variable in the model to identify determinants of fertilizers application and reported that age of farmers, use of animal dung, and renting out land have negative and significant influence, while access to credit and oxen ownership have a positive and significant influence.

Teame, 2011used probit and panel tobit model to examine factors that determine the probability of fertilizer adoption and intensity of fertilizer use respectively in north Ethiopia Tigray region. the likelihood of fertilizer adoption were mostly explained by the head of households education status, labour endowment, farm size, number of plots that the farmer used, distance to the plot from the home steed, oxen ownership. on the other hand the intensity of input use were largely explained by the household heads education status, farm size, manure use, geographic location , economic, social, political, and other related factors also significantly affect both the likelihood of adoption the intensity of the input use. While time had its own significant impact in determining the intensity of the input use, it had effects on the likelihood of fertilizer adoption in the region.

2.4. Generalization of reviews

For family member respondents giving attention in promoting saving are some of the important priority areas for the success of future intervention strategies aimed of the promoting production increasing technology and sustainable credit facilities. On study improved variety of seeds and education have significantly influenced fertilizer consumption out of these variable land fertility and farm size were inversely related to the level of fertilizer consumption.

Consider to difference demographic characteristics of households between study zones, the only significant differences observed between fertilizer user and non- users are found in the sex and age of house hold .household that use fertilizer on at least some of their crops tend to be headed by younger men. Used probit and Tobit model to identify the determinant of adoption and intensity of fertilizer use in Ejere district, west Shoa zone, Ethiopia.

2.4.1. Strength

For their study centralized the respondent's behavior at different way and to solve the social problem.

2.4.2. Weakness

Previous adaption and insanity studies in Ethiopia have examined a wide range of factor result have not always been consistent across studies.

2.4.3. My value add

Depending to my additional independent variable I want to improve the fertilizer use of respondents by awareness to people for use livestock mud.

2.4.5. Conceptual frame work

The identity meaning full of variables is:

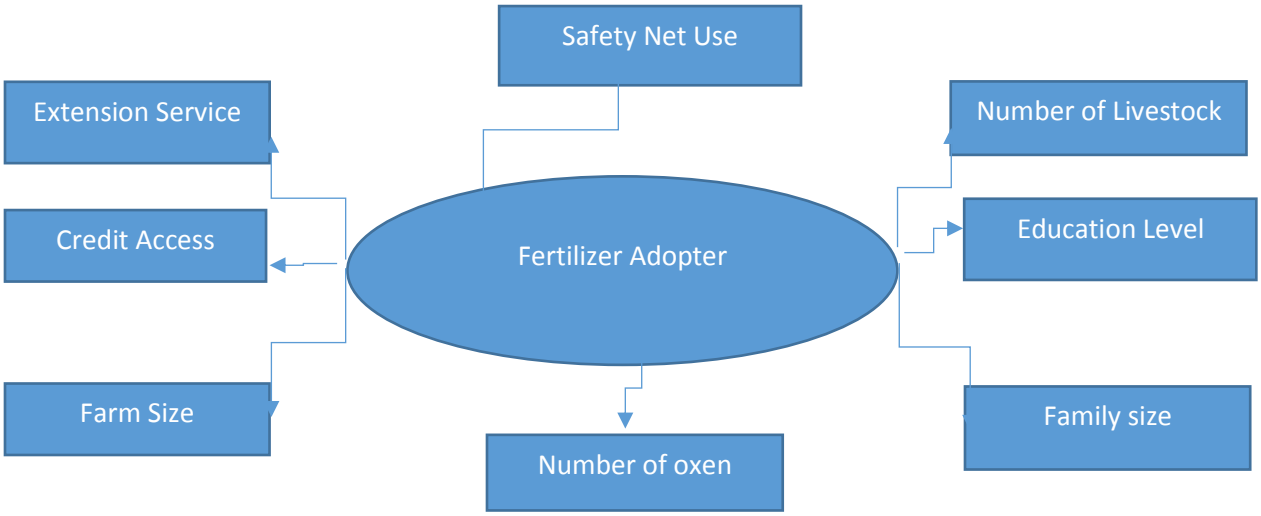


Figure 2.2 the figure of conceptual frame work

CHAPTER THREE

Methodology

3. Methodology of the study

3.1. Description of the study area

North shoa zone is amongst the Oromia region. North shoa zone has particularly (13) woredas. Hidabu Aboote woredas would select from north shoa zone for the study. It is found in the south west part of north shoa zone and bordered by kuyyu from the North West, from the south, Derra, from the north east Degam and also Degam from the east. Hidabu Aboote woreda has 20 rural kebeles and one urban center. As the land survey shows 32.8% peasants. The main cereal products produced in the worded are maize, teff and to small extent barley and wheat produced. Hidabu Aboote woreda has an estimated total population of 30456 of who 15250 were men and 15206 were women. About 16.4 of population are urban dwellers. According to national population housing of 2007.

3.2. Source of data

The primary data were required to attain the objective of the study. The study needs a large variety of information that can enable me to know the factors influencing adoption of fertilizer.

3.3. Method of data collection

The primary data is collect from the member farmers of the kebele (which include both adopter and non- adopter) through questionnaire's and interviewing. The questionnaire includes demographic characteristics, economic status, social aspects of households, assets of households, farming practice, technology adoption, fertilizer use and others. The survey questioner is prepared in English and then translates to local language (oromigna). Similarly the interview is collect from agricultural agents of the woreda and kebele.

3.4. Sample size and Sampling techniques

Basically, it is very difficult for us to collect information about the whole farmers available in the study area. Because of this, the study selects some sample from the total population and then collects information about each farmers include in the study. Then by dividing total population existed in select sample as fertilizer adopt on this study area, we will apply Yamane formula of n= N/1+N (e) ^{2} in order to take a total sample size relevant to target study.

$n=N/1+Ne^2$

Where, n=corrected sample size

N=the total number of population size (700)

e= margin of error (MoE) (10%) =0.1

$$n1 = \frac{700}{1+756(0.1)^2} = 88$$

In addition to this, we are going to use proportionate sampling that help us to taking samples from each sub strata' which are select from the target population.

Then we apply proportionate sampling to obtain how many respondents are selected from each stratum by using formulas: - A population is divided into three stratus so that N1 =223, N2=198 and N3=279. How should a sample of size n=88 be allocated to the three stratus, if we want optimum allocation using disproportionate sampling design?

$N=N'/N\times n$

Sample size for strata with N1=223

$n_1 = 223/700\times 88=28$

Sample size for strata with N2=198

$n_2 = 198/700\times 88=25$

Sample size for strata with N2=278

n_3 =279/700×88=35

Where, N=the total number of population.

N' =Population size from specific strata

n =Sample size

3.5. Method of data analysis

For the analysis data the researcher used both descriptive statistics and econometrics model. The descriptive analysis includes orderly arranging the data in tabulation frequency percentage and table forms. Econometric model (OLS model) is adopted in this study to analyze determinant fertilizer use in the study area. OLS model is preferred due to the fact that our dependent variable (fertilizer adopt) is dummy variable by its nature. In addition to this percentage were computed to analyze descriptive part of the data.

3.6. Model Specification

The dependent variable the dichotomous of the dummy variable code (1) if the respondents are fertilizers use, code (0) otherwise.

$YP = \beta0 + \beta1xli + \beta2x2i + \beta3x3i + \beta4x4i + \beta5x5i + \beta6x6i + \beta7x7i + \beta8x8i + ei$

Where: YP --- the probability of being fertilizer adopted

β0 -- is intercept parameter or constant.

β1 – is the coefficient of safety net use

β2- is the coefficient of family size.

β3- is the coefficient of educational level.

β4- is the coefficient of number of livestock owned.

β5- is the coefficient of number of oxen owned.

β6- is the coefficient of farm size owned.

β7- is the coefficient of extension service.

β8- is the coefficient of credit access.

€i- is error term

Table 3.6.1. Expected signs of the coefficients for fertilizer adopt in model

Variables	**Exceptive sign**
Family size	Negative
Educational level	Positive
safety net	Positive
Extension service	Positive
Farms	positive
Credit access	Positive
Livestock	Positive
No oxen	Positive

Hl = f (family size, edulvl, sft, ext, farms, credit, livestock, no oxen)

$Hl=\beta o+\beta_1 famiysize+\beta_2 edulvl+\beta_3 sft+ \beta_4 ext+\beta_5+\beta_6 farms+\beta_7 livestock+\beta_8 nooxen+ei.$

In this model some determinant of fertilizer use are expressed by dummy variables such as; edulvl safety net, extension service, credit access. This dummy variables expressed by the 1 and 0;

Eudulvl= 1 for educated and 0 for other wise

Safety net=1 if use safety net and 0 otherwise

Extension service=1 if contact with extension worker and 0 otherwise

Credit access=1 if house hold had credit access and 0 other wise

3.7. Variables of description

Dependent Variable

Fertilizer-adopt: it is a dummy variable which assumes 1 for fertilizers adopted, 0 for otherwise.

Independent variables

Safety net use (sft): it is a dummy variable which takes the value 1, if the household uses safety net and, 0 otherwise. Those who are member of productive safety net are closer to extension workers. So safety net use had positive or negative relation to fertilizer use.

Extension Service (EXT): it is dummy variable which takes a value (1) if the house hold had made contact with the extension worker and receive extension service during 2011 cropping season and 0, for otherwise. Access to extension agent will increase farmer awareness and information on the importance of fertilizers adoption. Therefore .This variable is expected to have positive or negative influence on fertilizer use.

Credit Access (CREDIT): It is a dummy variable which takes value 1, if the house hold had a credit access and 0, for otherwise. accessing credit by the house hold means Having potential to buy input in cash if the loan is in money therefore credit access is help house hold to finance required capital to buy the input and hypothesized to have positive or negative impact.

Farm Size (farms): this variable corporate the total amount of cultivated land. It includes own land, rented land promoter house hold land. A farmer who have larger farm can earn higher from production than farmer with small plot of land. Larger farm land is also important tools for farming purpose. Therefore these variables expected to have a positive or negative effect on fertilizer use.

Number of Oxen: it is a discrete variables represented by the number of oxen owned. Household who have more number of oxen have better performance in consuming fertilizers. Therefore it is hypothesized that the variable is influence fertilizers use positively or negatively.

Family Size: it is the number of family member living within the household. The larger the family member the more the labor force available for production purpose. Therefore there is possibility to more alternative source of income to overcome credit risk. Based On this, families with sufficient labor force would be expected to more fertilizers adoption. In contrast, since food

requirement increase with the number of adult equivalent in the family most of produce used for consumption as number of family member relatively low. Therefore it is expected that, this variable are a positively or negatively impact on fertilizers use.

Educational Level (EDU LVL): it is a dummy variable which takes the value 1 if the farmer is educated and, 0 otherwise. Education may be able farmers to be more aware of the importance of fertilizer. Therefore this variable assumed to be positive or negative influence on the fertilizers use.

Number of livestock (livestock): this variable is defined in terms of number not a tropical livestock unit (TLU) and represented the total number of livestock (sheep, goat, cattle, donkey, horse, and hen), excluding oxen owned by the house hold. Livestock may serve as a purchase of input such as fertilizer by selling them, or their products. Therefore, it is expected that this variable has a positive or negative influence on fertilizer use.

CHAPTER FOUR

Results and Discussion

This chapter presents the result of the descriptive and econometric analysis. The descriptive analysis made use of tools like. Percentage; employed to compare both fertilizers adoption and non- adopted fertilizers group with respect to some explanatory variable. Econometric analysis was carried out to identify the most important determinant of fertilizers application on crop production by small holder farmers and to measure relative important significance explanatory variables on fertilizers application by small holder farmers.

4.1 descriptive analyses

The demographic, socio -economic and institutional characteristics of the respondents such as , , family size, level of education, farm size, safety net, extension service, credit access and other variables related to fertilizers adopted (fertilizer adopted and non- fertilizers adopted) were analyzed by using descriptive statistic. .

4.1.1 Demographic characteristics

Table: 4.1.1 Distribution of respondents by family size.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Family size	Number	Percent	Number	Percent	Number	Percent
0-3	46	52	1	1	47	53
4-5	17	19	12	13	29	33
>5	1	1	11	12	12	14
Total	64	73	24	27	88	100

Source**:** own source, 2019

This survey data indicates that from the total fertilizers adopted respondents around 52% of farmers having between 0-3 family sizes followed by 19% of farmers having 4-5 family size, 1% of farmers having above 5 family sizes. While from the total non-fertilizers adopted respondents 13% of farmers having "between" 4-5 family sizes followed by 12% of farmers are having above

5 family size, 1% of farmers are having" between" 0-3 family size. This implies that, the farmers which having more family size have an alternative to use more labor force available for production purpose than that of having low family size.

4.1.2 Economic Characteristics of Household

Table: 4.1.2 Distribution of respondents by farm size.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Farm size in hect	Number	Percent	Number	Percent	Number	Percent
0-3	55	63	23	26	78	89
>3	10	11	0	0	10	11
Total	65	73	23	27	88	100

Source, own source, 2019

This survey data indicate that, from the total fertilizer adopted respondents about 55 (63%) farmers have owned"between"0-3 hector of lands followed by 10(11%) farmers have owned above 3hectar of land. While from the total non- fertilizer adopted respondents about 23(26%) have owned " between 0-3 hector and there is no land owned above 3hector of land. Therefore based on result the researcher concluded that, those farmers who have more farm size have a potential to use more agricultural input than that of farmer who have less farms size.

Table: 4.1.3Distributions of respondents by credit access.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Access of credit	Number	Percent	Number	Percent	Number	Percent
Yes	45	51	16	19	61	69
No	18	20	9	10	27	31
Total	63	71	25	29	88	100

Source: own source, 2019

The result of this survey data indicates that, from the total fertilizer adopted respondents around 45(51%) of respondents who adopt fertilizer are get enough credit service from different governmental and nongovernmental organization especially from cooperative and the remaining 18(20%) of respondents are not get enough credit access from those organization. While from the total non -fertilizer adopted respondents around 16(19%) respondents are get enough credit access from different organization and the remaining 9 (10%) are not get enough credit access from those organization .Therefore, based on this result the farmer who gets credit from different organization have a confidence to purchase agricultural input from the government and private cooperative organization in 2010 cropping season.

Table: 4.1.4Distribution of respondents by number of oxen owned.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Number of oxen	Number	Percent	Number	Percent	Number	Percent
<2	1	1	9	10	10	11
2	1	1	15	17	16	18
3	5	6	1	1	6	7
>3	56	64	0	0	56	64
Total	63	72	25	28	88	100

Source: own source, 2019

The result of this survey data indicates that from the total fertilizer adopted respondents about 56(64%) farmers have owned more than 3 oxen, followed by 5(6%), farmers have owned 3 oxen, 4 (16%) have owned 3 oxen, and 1(1%), of farmers have owned 2and less than 2 oxen and those farmers use these oxen uses on farming activities in 2010 cropping season. While from the total non- fertilizer adopted respondents around 15(17%) of farmers have owned 2 oxen for farming activity, followed by 9(10%), farmers owned less than 2 oxen. therefore based on the result of this survey the study conclude that the farmers those have more oxen they should be more use of fertilizer and more productive in agricultural activity.

Table 4.1.5 distribution of respondents on amount of fertilizer use

Amount in Kg	Adopter frequency	Percent
<50	7	8
50-100	20	23
>100	61	69
Total	88	100

Source own source, 2019

As the above table explains, most of the fertilizer adopter uses 50-100 Kg, which is followed by >100Kg (32%) of them and less than 50 Kg (which is 8% of them). This implies they uses low amount of fertilizer.

These fertilizer were used for crops like Teff, maize, gebs and in irrigation. Those who do not use fertilizer takes different alternatives such as animal dung, compost and others, the majority were use animal dungs because the area is suitable for animals.

4.1.3Social and Institutional Character

Table: 4.1.3.1Distributions of respondents by educational level.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Educational level	Number	Percent	Number	Percent	Number	Percent
Illiterate	23	26	24	27	47	53
Primary school	32	36	5	6	37	42
High school	4	5	0	0	4	5
Total	59	67	29	33	88	100

Source, own survey, 2019

The result of this survey data indicates that, from the total fertilizer adopted respondents about 32(36%) of farmers are attends primary school education from 1-4 followed by 23(26%) farmers are illiterate that means those farmers are not attend education and the 4(5%) farmers are attend high school. While, from the total non- fertilizer adopted farmers around 24(27%) are illiterate, And 5(6%) farmers are attend primary school from 1-4, no farmers attend high school. Therefore based on the result of this survey data the study concluded that, on the side fertilizers adopted farmers the majority of farmers are attend primary school but on the side of non- fertilizer adopted farmers majority are illiterate this difference in education level between the two creates difference in awareness about the effect agricultural input on agricultural productivity therefore the more the educated the more knowledge about agricultural input.

Table: 4.1.3.2 Distributions of respondents by extension service.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Did you get Extension service	Number	Percent	Number	Percent	Number	percent
Yes	58	65	2	3	60	68
No	5	6	23	26	28	32
Total	63	71	25	29	88	100

Source, own survey, 2019

The result of this survey data indicates that from the total fertilizer adopted farmers around 58(65 %) of respondents are get enough knowledge about fertilizers application from extension service agents, and the remaining 5(6%) of farmers does not get enough knowledge about the fertilizers application from extension service agent. While from non- fertilizer adopted respondents majority of farmers are not get enough knowledge from extension service agent about fertilizer application. Therefore based the result this survey data the study concludes that the farmers more contacted with extension agent gets more knowledge about the agricultural input than not contacted with extension agent.

Table: 4.1.3.3 Distributions of respondents by safety net.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Did you member of safety net program	Number	Percent	Number	Percent	Number	percent
Yes	48	54	16	19	64	73
No	15	17	9	10	24	27
Total	63	71	25	29	88	100

Source, own survey, 2019

The result of this survey data indicates that, from the total fertilizer adopted respondents around 48(58%) of respondents who adopt fertilizer are member of safety net and the remaining 15(17%) of respondents are not member safety net. While from the total non -fertilizer adopted respondents around 16(19%) respondents are member of safety net and the remaining 9(10%) of respondents are not member of safety net. Therefore, based on this result the farmer who are member of safety net are get more knowledge about agricultural inputs than no member of safety net.

Table: 4.1.3.4Distribution of respondents by number of livestock.

Determinant	Fertilizer adopted		Non fertilizer adopted		Total	
Number of livestock	Number	Percent	Number	Percent	Number	Percent
<4	1	1	13	14	14	16
4	2	3	7	8	9	10
5	2	3	5	6	7	8
>5	55	61	3	4	58	66
Total	60	68	28	32	88	100

Source: own survey, 2019

The result of this survey data indicates that from the total fertilizer adopted respondents about 55(61%) farmers have owned more than 5 livestock, followed by 2(3%), farmers have owned 4and5 livestock and 1(1%), of farmers have owned less than 4 livestock and those farmers use these livestock uses on sales activities to use fertilizer. While from the total non- fertilizer adopted respondents around 13(14%) of farmers have owned less than 4 livestock, followed by 7(8%), farmers owned 4 livestock and 5(6%) of respondents owned 5 livestock and the remaining 3(4%) are owned more than 5 livestock. therefore based on the result of this survey the study conclude that the farmers those have more livestock they should be more use of fertilizer and more productive in agricultural activity.

4.2. The major problem faced by farmers on input supply

As a data collected from different famers in the study area those which apply fertilizer or not the major problems that limit to get fertilizers is higher in price, not available on time, not get required amount. In addition to the above major problem there was a lot of common problem that affect input supply listed by the farmers. Generally, since agricultural technology of the country is not advanced, its success and failure is mainly dependent on the favorable weather conditions. Even though the occurrence of natural climate is not a common problem to adopt, by the time it occurred, its repercussion is difficult to overcome shortly.

In this survey, some members identified this phenomenon as a cause for the failures of timely. During the collection of data from respondents, 100 percent of the respondents who produced crop production in the cropping season of 2010 were mentioning as much reduction of crop production occurred due to the occurrence of frost. The last challenge the respondents mentioned was the ever increasing of input price. Since inputs (Fertilizers, some of improved seeds and chemicals) are imported from abroad with foreign Currency, their price depends on international market situation. In the last 2-3 years, the prices of these inputs increased more than double. This alarming rate of price increase shrank the demand for these inputs and ultimately resulted in the application of inputs far below the recommended.

4.3 Result of Econometrics Analysis

From the study researcher used to econometric analysis approved determinant of fertilizer use of crop production by small holder farmers. by use of econometric analysis this study could be measured determinants fertilizer such as fertilizer adopt, family size, extension service, safety net, education level, farm size, number of oxen, number of livestock and credit access.

The method estimation that is to use to conduct this study with OLS model method of estimation using command and linear regression model assumption which is the basic and the first is the error term or stochastic terms and in order to analysis the determinants of fertilizer use there is an observation of farmers that is regress net by a sample of 88 farmers.

4.3.1Model specification

Safety net use (sft); those farmers who are member of productive safety net are more closer to extension workers. So safety net use had positive relation to fertilizer use.

Extension Service (**EXT):** The households had made contact with the extension worker and receives extension service during 2010 crop production. So Access to extension agent will increase farmer awareness and information on the importance of fertilizers adoption. Therefore this variable is expected to have positive influence on fertilizer use.

Credit Access (**CREDIT**): accessing credit by the house hold means having potential to buy input in cash if the loan is in money therefore credit access is help house hold to finance required capital to buy the input and it have positive impact on fertilizer use.

Farm Size (**farms)**: this variable corporate the total amount of cultivated land. It includes own land, rented land promoter house hold land. A farmer who have larger farm can earn higher from production than farmer with small plot of land. Larger farm land is also important tools for farming purpose. Therefore these variables have a positive effect on fertilizer use.

Number of Oxen: Household who have more number of oxen have better performance in consuming fertilizers. Therefore it is hypothesized that the variable is influence fertilizers use positively.

Family Size: it is the number of family member living within the household. So large family size have less probability to use fertilizer. Therefore, this variable have a positively impact on fertilizers use.

Educational Level (**EDU LVL**: - Education may be able farmers to be more aware of the importance of fertilizer. Therefore this variable assumed to be positive influence on the fertilizers use because those who are educated would be more use of fertilizers.

Number of livestock (livestock): this variable is defined in terms of number not a tropical livestock unit (TLU) and represented the total number of livestock (sheep, goat, cattle, donkey, horse, and hen), excluding oxen owned by the house hold. Livestock may serve as a purchase of input such as fertilizer by selling them, or their products. Therefore, this variable has a positive influence on fertilizer use

4.3.2. Regression result

Table 4.10 OLS regression result

Source	SS	df	MS		
Model	16.1119121	8	2.01398901	Number of obs	= 88
Residual	1.78581522	79	.022605256	F(8, 79)	= 89.09
				Prob > F	= 0.0000
Total	17.8977273	87	.205721003	R-squared	= 0.9002
				Adj R-squared	= 0.8901
				Root MSE	= .15035

fertadpt	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
famlysiz	-.0489681	.0155792	-3.14	0.002	-.0799777	-.0179585
edulvl	.0766157	.0430292	1.78	0.079	-.0090317	.1622631
credit	.0381714	.0355773	1.07	0.287	-.0326435	.1089862
sft	-.0257651	.037103	-0.69	0.489	-.0996167	.0480865
ext	.2454576	.0526593	4.66	0.000	.1406419	.3502733
farms	.0441509	.0201176	2.19	0.031	.0041077	.084194
livestock	.0209006	.0060226	3.47	0.001	.0089128	.0328883
nooxen	.1083257	.0145181	7.46	0.000	.0794281	.1372232
_cons	-.0075036	.1158195	-0.06	0.949	-.2380367	.2230294

Computed by stata 12, source, own source 2019

4.3.3. Interpretation of model result

The estimation of model result can be interpreted as follows:-The null hypothesis of F.statistic (the overall test of significance of the model) that the R-squared is equal to zero is rejected at 5% level of significance as the p-value was sufficiently low. F value of 0.000 indicates strong statistical significance, which enhanced the reliability and validity of the model

The total variation in the dependent variable that can be explained by the independent variable is 89%. In this model, 89% of the performance of explanatory variable in this model explained the variation of dependent variable and the remaining 11% is explained by the other variables not

included in the model. Thus, these variables collectively have good explanatory variables of fertilizer use of crop production by small holder farmer in hedabu abote woreda.

Null hypothesis Ho=all the coefficients are jointly and simultaneously are zero and alternative hypothesis Hl=all coefficients are jointly and simultaneously different from zero. When P>/t/is less than 0.05, variables are statistically significant at the level of significance. When we say that test is statistically significant, we generally mean that we can reject the null hypothesis is that is the probability that the observed difference between the sample value and the hypothesized value is due to mere chance is smaller than level of significance. By the same taken, when we say that a test is statistically insignificant do not reject null hypothesis. In this case the observed difference between the sample value and the hypothesis. In this case the observed difference between the sample value and the hypothesized value could be very well be due to sampling variation or due to mere chance (that is the probability of the difference is much greater than level of significance.

Family size: =0.002 the variable family size is statistically significant at 1%level of significance. Because the p-value less than 0.01 reject null hypothesis at 1% level of significance.

Education level=0.079 this variable also statistically significance at 10% level of significance. Because p-value of Edulvl is less than 0.1 means 0.079 <0.1this indicates null hypothesis is reject at10% level of significance.

Extension service= 0.000 the variable of Extis statistically significance at 1% level of significance. Because the p-value of respondent's Ext is less than 0.01 then null hypotheses is reject at 1%.

farms= 0.031 this variables also statistically significance at 5% level of significance .Because the p-value of farm is less than 0.05 then the null hypotheses is rejected at 5%.

livestock= 0.001this variables also statistically significance at 5% level of significance .Because the p-value of livestock is less than 0.05 then the null hypotheses is rejected at 5%.

No oxen =0.000 this variable is statistically significance at 1% level of significance. Because the p-value of respondent's Ext is less than 0.01 then null hypotheses is reject at 1%.

The other variables when we see by p>/t/ from the estimation result, the value of p-value greater than 0.1 at 10% level of significance. This indicates null hypothesis is accepted, i.e. statistically insignificant. This means these variables do not mean unnecessary in the study. This problem may be created during collected data occurs miss information from a participants and maximum or minimum sample size in the study. According to Gujarat many times to solve these types of problem the researcher must use check econometric criteria or tests.

4.3.4 Interpretation of the coefficients

I. constant term= -0.0075036

Regardless of the fertilizer adopt, education level, family size, marital safety net, extension service, farms, livestock, and nooxen (all explanatory variables) the fertilizer use is estimated to be amounted -0.0075 per time.

II. Explanatory variables

Family size: - the impact of this variables found to be consistent with the theory, because it consistent with the expected sign. From our estimation result, keep other things remain constant, when size of household increase in number fertilizer use decreased by-0.0489per time.

Education level: - this variable on the other hand found to be significant and consistent with theory (expected sign). Therefore, it is clearly matched as discussed before than an increase education level leads to increase fertilizer use. Keep other variables as variables as remain constant, when a farmers want to increase their educational standard by one level, fertilizer use increased by 0.0766 per time.

Livestock: - this variable is found to be consistent with theory, consistent with expected sign as discussed before in the model specification. When number of livestock increase, fertilizer use increased by0.0209 per time (keep other things remain constant).

Farms: - this variable also impact on fertilizer use as discussed before in model specification. Keep other things remain constant, when farm size is increase, fertilizer use increased by 0.044per time.

Extension service: - the impact of this variables found to be consistent with the theory, because it consistent with the expected sign. From our estimation result, keep other things remain constant, when extension service of respondents are increase fertilizer use increased by 0.245 per time.

Number of oxen: - the impact of this variables found to be consistent with the theory, because it consistent with the expected sign. From our estimation result, keep other things remain constant, when nooxen of respondents are increase fertilizer use increased by 0.108 per time.

4.4 Econometric criteria

I. Test for multicollinearity

To detect multicollinearity, the paper used variables inflation factory (VIF). In this test if we have a choice, we would have VIFs to be smaller (other thing equal). But we have rarely choice, if we think a certain explanatory variables need to be included in regression to infer causality of explanatory variables, then we are hesitant drop them whether we think VIFs is "too high" cannot really affect that decision.

If say, our main interest is in the causal effects of one explanatory variable on dependent variable, then we should ignore entirely the VIFs of other independent variables coefficients. Finally setting the cut off value of VIF which have concluded multicollinearity is a "problem" is arbitrary and not especially helpful. Sometimes the value of 10 is chosen: if VIF is the above 10(equivalently, R2 above 0.9), then we concluded that 10 doesn't mean that standard deviation of the coefficients is too large to be use full because standard deviation depends on and SST and the later can be increased by increasing sample size. Therefore, just we look at the size of VIFs is of limited use although one might what to do so out of curiosity (Gujarati, 2004). Let we see VIF from the estimation result.

VIF table 4.4.1

Variable	VIF	1/VIF
nooxen	2.36	0.423450
ext	2.34	0.427005
famlysiz	2.25	0.443891
farms	1.83	0.545008
livestock	1.64	0.610479
edulvl	1.50	0.666502
sft	1.06	0.940771
credit	1.03	0.974946
Mean VIF	1.75	

Computed by stata 12, own source (2019)

The above table means of VIF and 1/VIF shows that there is no multicollinearity problem among variables. If mean VIF value greater than 10 and 1/VIF value greater than 1, say we can say there is multicollinearity. However, from our the study the estimation result is the VIF value less than 10 and 1/VIF than 1, implying this study is there is no problem of multicollinearity.

II. Tests of heteroscedasticity

Breusch- pagan test Look straight to the P-value is (preferable) 0.05 or smaller, then the null hypothesis is rejected and here is significant evidence there is heteroscedasticity, but if prob-chi2 is 0.05 or greater than, or then null hypothesis is rejected, here significant, evidence there is no heteroscedasticity problem (Gujarati, 2004). Look the following estimation result;

Table 4.4.2 test of heteroscedasticity

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of fertadpt

         chi2(1)      =     0.00
         Prob > chi2  =   0.9492
```

Computed by stata 12, own source 2019

From the above estimation result, we accept the null hypothesis at 1,5and10 percent level of significant which means there is constant variance or homoscedacity because pro>chi=0.9492 or

p.value greater than 0.05 level of significance, so we accept the null hypothesis meaning there is constant variance or homoscedacity.

III. Normality test

This normality test is determined by critical p-value at 5% of level of significance and chi2 prob>chi2. Let we see this test from estimation result by using of kurtosis

Test for normality data.

Skewness/Kurtosis tests for Normality

			------- Joint ------		
Variable	Obs	Pr (Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
resid	88	0.5245	0.6312	0.65	0.7235

Computed by stata 12, own source 2019

From the above normality test, our estimation result greater than critical p-value 5% of level of significance. That means our estimated result occurred is 0.7235. Therefore, 0.7235>0.05, so reject null hypothesis that the residuals are normally distributed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The aim of this study was to identify the determinants of fertilizers use on crop production by small holder farmers in 2010 cropping season which are created by different farmers in the selected kebele. To the study the problem input supply, institutional and a socio economic characteristic was included in the model. Primary data were collected from the farmers randomly in the selected kebele. More over secondary data were obtained from the kebele in order to see about the fertilizer use.

For data analysis, the descriptive statistics, OLS model were used. For descriptive statistics 73% of respondents are fertilizer adopted and the remaining 27% of respondents are non- fertilizer adopted. In addition to this the descriptive result shows some socio economic, institutional, and demographic characteristics of respondent by using percentage.

For econometric analysis the binary OLS model was employed so as to identify the determinant of fertilizers application on crop production by small holder farmers in the selected Kebele. The dependent variable that is the probability being fertilizer adopted was regressed against 8 explanatory variables, among which six of them were found to be statistically significant. The coefficient of the variables credit access, safety net are statistically insignificant at 1, 5, and 10 percent level, and hence do not emerge as the major determinant of fertilizer use on crop production by small holder farmers as set as expected sign. Whereas the coefficient level of family size, education level, extension service, farm size, livestock, number of oxen owned was found to be statistically significant at 1,5and 10 percent. Finally the sample respondent was asked to mention the major problem that faced by farmers agricultural input supply.

5.2 Recommendation

Based on the finding of the Study the Following Recommendations are forwarded.

- Oxen are an important farmer's asset that improved farmer's sufficient input purchase. It is, therefore, important more attention should be given to oxen quality rather than quantity to improve their genetic and feed system.
- The farmers engaged on livestock to earn more income and able to purchase agricultural input. This shows that, rural development program should not only emphasis on increasing agricultural production but concomitant attention should also give to the promoting livestock in the rural area.
- Credit facilities are an integral part of economic development, which engage people on economic activities that enhance self- reliance. Credit scheme increase the productive potential of poor farmer particularly women headed household. Credit facilitation through different governmental and nongovernmental organization plays a crucial role in agricultural production in country like Ethiopia if it managed properly.
- Educational level is positive influence farmers input (fertilizer) use. This clearly indicate that for effective utilization of improved technology, enhancing the educational status of farmers through adult education, training, and the expansion of primary education should be given due attention.
- Family size is negative influence related with fertilizers use or application. Since farmers with large family size is difficult to meet their food security, family planning with qualified human capital is important to increase productivity.
- Extension service is positive influence fertilizer use. This indicates that extension service plays a crucial role for the improvement of agricultural sector through giving training about the importance of agricultural input to the farmers. Therefore, the government should increase the number of extension service agent in order to improve the awareness of the farmers about the application of agricultural input.

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Appendix 1

Research questionnaires'

Dear, respondents my name is Ayele Yazew I am third year student at Wolkite University department of economics and first I would like to present you my heart full greeting and I conduct the study on the title "determinants of fertilizer use by small holder farmers in crop production in Hidabu Abote Woreda".so participation by giving truth and relevant information will have a greater role for the researcher, by considering this I would like to ask to give timing and relevant information for below listed questions. by choosing the best alternative to the closed ended questions and fill the blank space for the open ended questions.

NB: I would like to express this information is used only for academic purpose and set by security.

1. Age of the house hold head----------

2. Sex of house hold head: 1) male 0) female

3. Marital status of house hold head

1) Single 2) married 3) Divorced 4) widowed

4. Educational level of house hold head

1) Illiterate 2) Grade 1-4 3) grade 5-8

4) Grade 9-10 5) above grade 10

5. Family size of house hold…… male…….. Female……

6. Did you engage in off farming income activity during 2010 cropping season?

1) Yes 0) no

7. How many timid of land did you cultivate in 2010 cropping season?

1) Own land……...

2) Rented land…….

3) Shared in some one land …….

4) Total…….

8. Did you use any machine in 2010 cropping season?

1) Yes 0) No

9. If question No 8 is yes, specify it……..

10. How many oxen do you have for plough in 2010 cropping season?

11. How many livestock do you have in 2010?

Number	Type of livestock	Amount in No
1	Cattle	
2	Goat	
3	Sheep	
4	Donkey	
5	Hen	
6	Others	

12. Did you get credit access A) yes B) No

13. If questions No 12is yes what is the amount you get……..?

14. Did you use fertilizer for your cultivation in for the year in 2010?

A) Yes B) no

15. If yes for question 14, for which crop did you use the fertilizer?

Crop type	DAP(Kg)	UREA(Kg)
Teff		
Maize		
Wheat		
Others		

16. If no for question 14 what alternative did you use?

A) manure B) compost C) do not use

17. Did you get educational training from the extension agent in 2010cropping season?
A) Yes B) no

18. Are you a member of any association?

A) Yes B) No

19. Are a member of safety net program? A) Yes B) no

20. What problem did you face mostly on getting input?

A) Not available on time B) not gets required quantity

C) Higher in price D) other problem (specify

Appendix 2

```
sum
```

Variable	Obs	Mean	Std. Dev.	Min	Max
fertadpt	88	.7159091	.4535648	0	1
famlysiz	88	3.545455	1.552966	1	8
edulvl	88	.7045455	.4588614	0	1
credit	88	.7045455	.4588614	0	1
sft	88	.7272727	.447914	0	1
ext	88	.6818182	.4684397	0	1
farms	88	2.160795	1.085341	1	6
livestock	88	7.113636	3.425502	2	20
nooxen	88	3.909091	1.706218	1	8

```
reg fertadpt famlysiz edulvl credit sft ext farms livestock nooxen
```

Source	SS	df	MS
Model	16.1119121	8	2.01398901
Residual	1.78581522	79	.022605256
Total	17.8977273	87	.205721003

Number of obs	= 88
F(8, 79)	= 89.09
Prob > F	= 0.0000
R-squared	= 0.9002
Adj R-squared	= 0.8901
Root MSE	= .15035

fertadpt	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
famlysiz	-.0489681	.0155792	-3.14	0.002	-.0799777	-.0179585
edulvl	.0766157	.0430292	1.78	0.079	-.0090317	.1622631
credit	.0381714	.0355773	1.07	0.287	-.0326435	.1089862
sft	-.0257651	.037103	-0.69	0.489	-.0996167	.0480865
ext	.2454576	.0526593	4.66	0.000	.1406419	.3502733
farms	.0441509	.0201176	2.19	0.031	.0041077	.084194
livestock	.0209006	.0060226	3.47	0.001	.0089128	.0328883
nooxen	.1083257	.0145181	7.46	0.000	.0794281	.1372232
_cons	-.0075036	.1158195	-0.06	0.949	-.2380367	.2230294

```
predict resid,residual

sktest resid
```

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
resid	88	0.5245	0.6312	0.65	0.7235

```
swilk resid
```

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
resid	88	0.99304	0.517	-1.455	0.92721

```
. vif
```

Variable	VIF	1/VIF
nooxen	2.36	0.423450
ext	2.34	0.427005
famlysiz	2.25	0.443891
farms	1.83	0.545008
livestock	1.64	0.610479
edulvl	1.50	0.666502
sft	1.06	0.940771
credit	1.03	0.974946
Mean VIF	1.75	

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of fertadpt

         chi2(1)      =     0.00
         Prob > chi2  =   0.9492

.
```