ANALYSIS OF SMALLHOLDER FARMER’S PARTICIPATION IN PRODUCTION AND MARKETING OF EXPORT POTENTIAL CROPS: THE CASE OF SESAME IN DIGA DISTRICT, EAST WOLLEGA ZONE OF OROMIA REGIONAL STATE

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By

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Declaration

I, the undersigned, declare that this thesis is my work and that all sources of materials used for the thesis have been duly acknowledged.

Geremew Kefyalew Gobena

Signature _______________
Abstract

Analysis of Smallholder Farmer’s Participation in Production and Marketing of Export Potential Crops: The Case of Sesame in Diga District, Oromia Regional State

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Agriculture in Ethiopia remains to be the key sector. It is still the main source of foreign exchange earnings (up to 90%) and the largest labour force employer (about 83%). Of the total agricultural output, about 95% was covered by smallholder agriculture sub-sector. However, a number of factors limit smallholder farmers from participating in export potential cash crops. The main objective of this paper is to identify household specific factors determining sesame production and marketing participation. The study was based on data collected from a sample of 120 households drawn from Diga Wereda.

The study highlighted that farm landholding size, family labour, number of oxen owned, access to credit, availability of family food, and distance to extension service significantly explain the decision to produce sesame. On other hand, the number of oxen owned, farmers experience on sesame production, number of working family members, sesame crop yield and access to credit service determine the level of sesame production participation considerably. Furthermore, the study verified that in addition to the quantity of sesame marketed, market price, selling channels, selling time, distance from the nearest market and access to market information significantly determines the level of income earned from sesame sale. The implication is that livelihood improvement could be assisted through better participation of smallholders in sesame production and marketing in the area.
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Abbreviations and Acronyms

ADLI - Agricultural Development Led Industrialization

CSA - Central statistical Authority

ECX-Ethiopian Commodity Exchange

FYGTP - Five year Growth and Transformation Plan

GDP - Gross Domestic Product

GTP - Growth and Transformation Plan

Ha - Hectare

HH - Household

KG - Kilogram

MoARD - Ministry of Agriculture and Rural Development

OLS - Ordinary Least Square

PAs - Peasant Associations

PIF - Policy and Investment Framework

S.E. - Standard Errors

R.S.E - Robust Standard Errors

USAID - United States Agency for International Development
CHAPTER ONE: INTRODUCTION

1.1. Background

Smallholder and family farming agriculture remain to be the key and leading sector in overall economic development of many developing countries in the world (Quan, 2011). According to (Quan, 2011), in addition to producing staple crops for domestic markets; smallholder farmers produce large shares of traditional exports in these countries. This shows how the economy of many developing countries still reliant on smallholder-based agriculture. In East African countries like Kenya, Ethiopia, Uganda and Tanzania, for example, smallholder farming accounts for about 75 percent of agricultural production (Salami et al., 2010).

Particularly in Ethiopia, smallholder farmers cultivate approximate to 95 percent of the total area cultivated and produce more than 95 percent of the total agricultural output (Mahlet, 2007; S.Tafesse et al., 2007; MoARD, 2010). According to Ministry of Agriculture and Rural Development (2010), about 11.7 million smallholder households in the country approximate to represent 95 percent of the agricultural GDP (MoARD, 2010). It is this figure that accounts for 41 percent of the country’s gross domestic product (GDP), and covers more than 90 percent of the country’s foreign currency earnings (Ethiopian Investment Agency, 2012). This confirms the dominant contribution of smallholder farmers to the overall agricultural growth in the country. In short, as the overall economy of Ethiopia depends on agriculture sector development, the entire movement of the agriculture sector depends on what is happening in smallholder sub-sector.
It is in this regard that the government of Ethiopia through its different policy and growth strategy, including the current Growth and Transformation Plan (GTP)\textsuperscript{1}, positions smallholder farmers as a principal source of agricultural growth; and agriculture as the main source of overall economic growth. For example, commercialization of smallholder farming received high government policy priority through GTP (MoFED, 2010). In this regard, the major effort was placed to support the intensification of marketable farm products - both for domestic and export markets-by both small and large scale farmers. Such fundamental strategy involves an enhancement of producing high value crops - paying a special focus on high-potential areas to do so.

Thus, promotion of export potential cash crop is one among the current governments’ strategy for raising agricultural GDP and rural income. This also helps to promote a diversification out of low-value crops into higher value crops for the markets including the export market, which in turn helps the improvements of agricultural marketing systems in the country. Especially, promotion of export potential cash crop is crucial since it generates income for the producers and government and it is one of the fundamental government policies for acquiring foreign currency.

In this regard, the empirical record suggests that export potential cash crops can provide higher returns to land and labor than food grains and thus present major opportunities to promote smallholders income growth, food security, and national foreign exchange generation ((Jayne, 1994; Poulton et al., 2001, Lukanu et al., 2004; Poulton et al., 2006, Schneider and K.Gugerty, 2010). According to Chauvin (2012), cash crops are a major source of export revenue for a large

\textsuperscript{1} The GTP is a medium term strategic Ethiopian national framework for the five-year period (2010/11-2014/15) and it is directed towards achieving the Millennium Development Goals (MDGs), Ethiopia’s long term vision and sustaining the rapid, broad based and equitable economic growth in the country (MoFED, 2012).
number of sub-Saharan African countries and the livelihood basis for millions of rural households who grow those crops (Chauvin, 2012). Sesame seed can be taken as an example, in few areas of Ethiopia like Diga Wereda\textsuperscript{2} in this case. It is currently among the major Ethiopian export crops and is one among the agricultural crops in which Ethiopia is known in international markets (Sorsa, 2009).

Different reports indicate that Ethiopia is among the top-five sesame producing countries in the world, ranked at fourth place in 2011/2012 (FAOSTAT, 2012). And it is the third world exporter of sesame seed after India and Sudan (Alemu and W.Meijerink, 2010). Accordingly, sesame is the major oilseeds crop in the country in terms of exports next to coffee, accounting for over 90 percent of the value of oilseeds exports (Mheen_Sluijer and F.Cecchi, 2011). In addition, different reports indicate that there is still potential arable land in different areas of the country to grow the crop and there is a considerable demand for Ethiopian sesame seed at international markets (Sorsa, 2009). This indicates that, growth and improvement of the sesame sector can substantially contribute to the economic development at national, regional and family levels.

Therefore, given the agriculture based economy of Ethiopia and the dominance of smallholder sub-sector, it is imperative to conduct a study which focuses on identifying factors determining smallholder farmers’ participation in production and marketing of export potential crops. Thus, analyzing smallholder farmer’s participation in production and marketing of sesame in Diga Wereda is the main concern of the current study.

\textsuperscript{2} The major sesame growing areas in Ethiopia includes Humera, Metema, and East Wellega, (Ethiopian investment agency, 2012). Diga is found in East Wellega Zone and is one of the well known areas in sesame production in the Zone.
1.2. **Statement of the Problem**

Ethiopia is known to be the center or origin and diversity for cultivated sesame (ECX, 2010). It is among the major cash crops by which Ethiopia is known at international markets (Sorsa, 2009). Sesame is currently the country’s principal export oilseed and is mainly raised by small-scale farmers. Different reports indicate that there is huge potential to grow sesame seed in the country and there is high market demand at international levels (Sorsa, 2009; Mheen Sluijer and F.Cecchi, 2011). Thus, as a smallholder farmer’s crop and an export potential crop, it is an opportunity for smallholder farmers to produce sesame and change the available potential into the livelihood improvement.

However, in addition to the limited availability of agro-ecologically suitable areas for sesame production and productivity in the country\(^3\), smallholder farmers’ production and marketing participation is not as such satisfactory. That is, even in the agro-ecologically suitable areas for sesame production; smallholder farmers’ participation is far below the available potential. For example, in Diga Wereda (part of East Wellega), there is suitable agronomic conditions for growing sesame and there is high potential arable land to do so. This is an opportunity for smallholder farmers in this area, since sesame seed is an export potential cash crop. Despite the available potentials and opportunities, majority of smallholder farmers are not participating in sesame production and marketing in this area. This indicates that there are external and internal (household specific) factors that constrain some households from participation in the activity. In addition, the extent to which the participant farmers participate varies significantly and the overall participation is incomparable with the available potential. Similarly, producer farmers’

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\(^3\) While it has the potential to grow in different parts of the country, sesame grows mainly in the northern and northwestern regions of Ethiopia -Humera, Metema and East Wellega (ECX, 2010).
face a number of marketing problems, which influences the income these farmers could derive from sesame sale. Due to these factors, smallholder farmers in Diga Woreda are differently responding to the available potential and thus obtain different welfare benefits from the available opportunities.

Some case studies were undertaken regarding sesame production and marketing in Ethiopia so far by different authors (Aysheshm, 2007; Amare, 2009; Sorsa, 2009, Wijnands et al., 2007 and 2009; Alemu and W.Meijerink, 2010; Thomas, 2011; and, Mheen Sluijer and F.Cecchi, 2011). However, majority of these studies have mainly focused on marketing aspect of the crop and some have considered the common sesame production related problems, ignoring factors affecting production participation decisions at individual household levels. That is, the main efforts made by these authors were spent on general production and trade arrangement problems. This allowed them to examine factors which are mainly external to individual farm households and common to all farmers in the area. However, identifying household specific factors, which are responsible for limiting some households from sesame production and marketing participation is imperative. This could be analyzed by considering specific agro-ecologically feasible areas for growing the specified crop. The current study is, thus, designed to analyze household specific factors influencing participation decisions of smallholder farmers in sesame production and marketing in Diga Woreda, by considering one particular production year, 2011/2012.

Based on the above statement, the study is intended to empirically answer the following empirical questions: what factors influence smallholder farmers’ decision to produce sesame in Diga Woreda? What are the determinants of the extent of smallholder farmers’ sesame
production participation in this area? What factors determine the income these producer farmers could derive from sesame sale?

1.3. Objectives

The general objective of this study is to analyze factors that influence smallholder farmers’ participation decisions in production and marketing of sesame in Diga Wereda, East Wellega Zone of Oromiya regional State.

The specific objectives of the study are to:

- analyze determinants of participation decision of smallholder farmers’ in sesame production
- identify factors determining household’s level of sesame production participation, and
- analyze factors affecting and explaining marketing of sesame in the study area

1.4. Significance of the Study

Smallholder farming is necessarily powerful in various ways in different countries and for different types of economic activities (Quan, 2011). In addition to providing staple crops for domestic and international markets, smallholder farmers also produce large shares of traditional export crops. Sesame is one of the Ethiopian export crops and is the major cash crop cultivated by smallholder’s in selective areas of the country such as in Diga Wereda, even though it is not as such compared to the available potential and opportunities. Thus, encouraging these farmers in its production and making conducive market environment for their produce can be considered as one possible way of improving their livelihoods in these areas. And this is possible if studies, like this, support the policy by identifying factors influencing farmer’s participation decisions in
production and marketing of such crops. Therefore, this study can give a better insight to enrich the stock of existing but limited literatures regarding smallholder farmer’s participation in sesame production and marketing and can serve as an input for policy makers and researchers who wish to work in this area.

1.5. Scope and Limitation of the Study

In any research, there would always be certain limitations. The primary limitation of this study is its limited scope of being in a single district/Wereda. That is said because, this study is designed to identify demographic, socioeconomic, physical and institutional factors explaining the participation status of smallholder farmers in production and marketing of sesame in Diga Wereda alone. However, the issue of sesame production and marketing by smallholder farmers would have been better understood in the country if the process dimension is studied through time, and at least cover an additional potential Weredas under the investigation.

1.6. Organization of the Thesis

This paper contains five chapters. The first chapter displays the overview of the study. Following the introductory chapter, chapter two is devoted to relevant literature review. Presentation of the research methodology and description of the study area is the subject of the third chapter. Chapter four is where the findings are presented and discussed. The fifth chapter summarizes and concludes the finding, and reflects some recommendations and policy implications.
CHAPTER TWO: REVIEW OF RELEVANT LITERATURES

2. Introduction
This chapter reviews some relevant literature review regarding smallholder cash cropping. First, section 2.1 reviews the theoretical issue of smallholder farmer’s cash cropping in developing countries context. Then in the next section (section 2.2.), we presents some relevant empirical literatures on factors affecting smallholder cash crop production participations in these countries (specifically, we review and presents factors explaining and constraining sesame production and marketing in Ethiopia from previous studies on the issue). Finally, section 2.3 highlights some recent statistics on sesame production and marketing in Ethiopia.

2.1. The Issue of Smallholder Farmers Cash Cropping in Developing Countries

In almost all developing countries, when any one talks about agriculture, the issue of smallholder commercialization comes forth. And one of the common forms in which smallholder commercialization occurs in these countries is through production of cash crops in addition to staple crops. A cash crop is a crop that is primarily produced for market and largely sold, thus generating income for the farming households (Maxwell and Fernando, 1989; Poulton et al., 2001; Lukau et al., 2004). In theory, it is generally conceivable that the basic motivation of cash crop is higher returns to used resources for its production. In this regard, many recorded literatures reflect the importance of cash cropping in developing countries as it can be defined in terms of land use, employment, output, income or export at household, village, regional or national levels (Maxwell and Fernando, 1989; Von Braun and Kennedy, 1994, Poulton et al., 2001).

4 Another form of smallholder commercialization is through production of marketable surplus of staple food over what is needed for own consumption (Gebre-ab, 2008).
However, the issue of cash crop production is strongly controversial in many ways, especially in Africa (Maxwell and Fernando, 1989). According to Maxwell and Fernando (1989), for one thing, cash cropping are favored from their potential contribution to growth, employment and external balances. These authors further explained that, the expansion of cash cropping is recommended to exploit comparative advantage and provide the basis for industrial development through internal linkages. According to these authors, on the other hand, cash crops are opposed by those who disagree with these benefits and point out to additional drawbacks, especially in the spheres of food security. This part of literature argues that, this contrary view is particularly associated with the sustained critique of the food-first tendency (Maxwell and Fernando, 1989). These bodies of critics describe cash crops as the enemy of food security. Of course, the main debate in this case was comes from the fact that cash and food crop productions competes for farm household resources (especially in developing countries where these resources are scarce and limited). And this competition is fierce particularly under missing or imperfect food markets in which households prefer to produce their own food crops to secure household consumption at the expense of higher returns from cash crop production (de Janvry et al. 1991; Jayne, 1994).

Despite these arguments, many household level studies show the complementary nature of food and cash crop productions at household levels (Maxwell and Fernando, 1989; Von Braun and Kennedy, 1994, Poulton et al., 2001; Schneider and K.Gugerty, 2011). Their argument bases itself on the income and financial linkages between the two types of crops. Maxwell and Fernando (1989) argued that income from cash crops might be used either to purchase food crops from a market, which permits allocating most household resources to cash crop production, or to purchase external inputs for the production of food crops that enhance food crop productivity.
According to Maxwell and Fernando (1989), cash cropping necessarily never associated with declining of food production at either the household or national levels (Maxwell and Fernando, 1989).

Similarly, Poulton et al., 2001; argue that although food and cash crop productions often seen as mutually exclusive alternatives, increased cash crop production need not reduce food production at household levels. They reason out this that, income from cash cropping may enable households to invest in lumpy assets such as animal traction and helps to use more modern production inputs such as fertilizers and others that increases productivity of the food production. The study presented by Von Braun and Kennedy (1994) also suggests that households participation in cash cropping need not reduce own food production or nutritional status.

In general, the bodies of literature suggest that, increased productions of crops for markets are both an inevitable feature of rural development and essential in the counties where agricultural sector was believed to support the general economic development in these countries. This part of literature evidences the accompanying greater productivity and higher household incomes as a sign of such development benefit from cash crop production by smallholder farmers. This evidence suggests that in many cases small-scale cash cropping is both technically and economically efficient (Maxwell and Fernando, 1989). Poulton et al. (2006) argue that, in general, traditional export cash crops can make a significant contribution to poverty reduction when there is broad based participation by farmers in an area, labor-intensive production processes, and potential positive linkages to staple crop productivity in cash crop production.
Further more, many different studies indicates that, in sub-Saharan Africa, cash cropping remains the most important income sources for farmers and governments (through exports). In this regard, Chauvin (2012) suggested that cash crops are the major source of export revenue for a large number of Sub-Saharan African countries and the livelihood basis for millions of rural households who grow those crops (Chauvin, 2012). The author recommended that poor farmers in the cash crop sector should stand a better chance to rise out of poverty on the back of export market prices which normally bring better returns (ibid).

Inline with this, Poulton et al. (2001), have listed some trends which will encourage the move toward cash cropping across a wide range of developing countries. For example, the increasing high demands for cash (e.g. for schooling, health, high cost of production inputs, etc) encourage participation of smallholder farmers in cash cropping for those whom crop sales are the major source of income. In addition, these authors argues that, the exchange rate policy (e.g. real devaluation) of a county make production of internationally tradable crops relatively more profitable than production of crops sold only on local markets, hence enhances smallholder cash crop production participations in those countries. Furthermore, Poulton et al (2001) suggested that long-term changes in the relative prices (on international markets) encourages those households who grow these crops for cash and may result in greeter market-orientation of rural households. This indicates that, cash cropping contributes to growth through production linkage effects; in which it permit diversification away from the subsistence farming to some what market-oriented behaviors (Maxwell and Fernando, 1989).

In summary, the main lesson that we learnt from these recorded literature is that, at least in theory, production of cash crops may enable farm households to obtain more income that they
could obtain by devoting the same household resources to staple crops. In addition these theoretical ligatures suggest that, cash crops are the main source of export revenue for many developing countries. This is also true in Ethiopian case, since Ethiopian export is primarily agricultural commodities. And many reports and facts indicate that, these crops are basically produced by smallholder agriculture sub-sector. Thus, it is important to analyze the status of smallholder farmers in production and marketing participation of export potential cash crops, based on the available theory. Here the main effort is not to analyze the issue by considering these smallholders as they are specialized in cash cropping, rather we focus on analyzing the issue by considering as these farmers can produce the two crops simultaneously by well management of household resources. Of course, production of some cash crops may entirely depend on agro-ecological conditions. This also requires special focus and we accounted for the issue in this study. With these theoretical establishments, we turn to focus on factors affecting smallholder farmers to participate in production of these crops.

2.2. Determinants of Smallholder Farmers Cash Propping Participations

This section reviews some relevant literatures on smallholder farmers’ participation in cash crop production and marketing. We start with the available literatures on different cash crops production participation observed in different countries and then we go to review of specific literature on sesame production and marking in Ethiopian case.

Govereh & Jayne (2003), in their study of cotton production in Zimbabwe observed that the most critical determinants of smallholder decision to produce cotton in Zimbabwe include farmer education levels, distance from the nearest buyer, and the early clearance of the tsetse fly. Their
result also revealed that traction equipment and draft power were among the key determinants of households’ ability to diversify into cotton production in the country (Govereh & Jayne, 2003).

Cadot et al (2006) demonstrated that private asset accumulation is a prerequisite for smallholders’ graduation from subsistence production. The author suggests that one avenue for farmers to accumulate private assets is to enter into cash cropping. And investment in public infrastructure such as roads, and information communication facilities are the major determinants of participating in cash crop productions (Cadot et al., 2006).

Jayne (1994) argues that high costs related to purchasing food on the market make cash crop production unattractive, despite higher returns of cash crops on the farm. The author suggests so that, it is economically unviable to replace food crop production with cash crop production in this cases. Thus, according to the author food security condition is the one possible factor in limiting smallholder farmers to produce any cash crops.

Similarly, Boughton et al (2007) argued that the main challenge and constraint factor for smallholder farmers’ to participate in cash crop production is the low productivity in food crop production and its market failure. According to these authors, as farmers have access to secure their food demand they are most likely to participate in production of market-oriented cash crops (Boughton et al., 2007).

According to Lukanu et al (2004), it is generally expected that farmer’s decision to cultivate a given cash crop can be influenced by factors including household characteristics; economic factors (including the crop profitability and market availability); institutional factors (e.g. availability of extension, inputs and credit services); and environmental factors that involve the crop’s compatibility to existing climate, soil, disease and pest conditions (Lukanu et al., 2004).
The current study is particularly designed to analyze factors that affect smallholder farmers’ participation in production and marketing of sesame which is a smallholder cash crop in Ethiopia. So far, some empirical and survey studies were undertaken in this regard in the country. For example, Aysheshm (2007) assessed a sesame value chain analysis in Metema Woreda and verified that lack of improved variety seed that properly fits the woreda agro-ecology and lack of agro-chemicals supply at the right time and at fair prices constrained sesame production in Metema. In addition, according to Aysheshm, water logging problems has a contributing factor for the reduction of output, yield and thus marketed supply of sesame in the area (Aysheshm, 2007). Furthermore, Aysheshm (2007) findings indicates that sesame marketing has been constrained by diverse factors such as shortage of modern inputs, shortage of capital, lack of timely and accurate market information, and poor quality of packing materials as a few of the inherent problems in the field (ibid).

The study by Alemu and W.Meijerink (2010) suggests that the presence of high transaction costs, related to the lack of sufficient market coordination between buyers and sellers, the lack of market information, the lack of trust among market actors, the lack of contract enforcement, and the lack of grades and standards narrows market channels in Ethiopia at present (Alemu and W.Meijerink, 2010). They argued that the persistence of such high transaction costs and contract risk have resulted in limited arbitrage and weak investments by private traders, leading to limited market volumes, weak responsiveness to price signals and high price volatility, all of which have a negative impact on smallholder producer livelihoods (ibid).

In addition, according to Alemu and W.Meijerink (2010), the current sesame marketing system in Ethiopia is characterized by lack of reliable and timely market information, limited quality assurance, limited role of cooperatives and their unions and their limited ability to compete
equally with local traders, high transportation cost due to the existence of physical movement of the product before transaction are made, and considerable default in case of mistrust among market actors (Alemu and W.Meijerink, 2010). The same authors also found that, another challenge is the limited ability of market actors, especially producers, to be able to quickly understand and interpret market information. Their findings again suggests that, the limited availability of international market information in terms of prices and production levels, which is reflected in poor transmission of price trends with the national market, is expected to be another challenge considerably affecting the competitiveness of the Ethiopian sesame in the international markets (Alemu and W.Meijerink, 2010).

Wijnands et al., (2007) suggested that sesame production system in Ethiopia has suffers from traditional farming practices, unimproved seed and lack of fertilizer use (Wijnands et al., 2007). They suggested that these situations were resulted in low productivity of the sesame crop per hectare to be far below the estimated FAO potential (16 quintals/ha), which is only 8.52 quintals/ha in Ethiopia in 2010/2011 cropping season (CSA, 2011).

In addition, in his survey study at Humera and east Wellega Zone, Sorsa (2009), argued that despite the potential for increasing the production and productivity of sesame seed in Ethiopia, a number of challenges inhibits its production and productivity in the country. Among the many production constraints the author have listed, the most important includes lack of improved cultivars, poor seed supply system and a lack of adequate knowledge of farming and post-harvest crop management. In addition, the author found that the severe biotic stresses were also the major sesame production related problems in Humera and east Wellega areas. The same author concludes that smallholder farmers’ lack the necessary technical and material input to improve their sesame production and productivity in Ethiopia (Sorsa, 2009).
Furthermore, the finding by Sorsa (2009) suggests that there exists a high significant difference between the farmers in East Wollega and Humera regarding sesame production techniques and business orientation activities. According to this survey result, farmers in Humera are in an advanced situation in terms of technology compared to farmers in East Wollega. Accordingly, his result revealed that over 92 percent of the interviewed farmers in Humera used tractors to cultivate their land that they either own or rent, and on average they cultivated about five hectares per producer. Yet, in East Wellega over 92 percent of the sampled farmers depend on oxen for sesame cultivation and the rest depends on hoe agriculture. According to the author, the most important problems in East Wellega are a lack of improved seed, a shortage of input supply and high input prices, pest infestation and the theft of sesame in the fields (Sorsa, 2009).

In general, despite sesame seed is considered as high value export potential product by Ethiopian government in the recent years following high demands with high prices at international markets (Wijnands et al, 2009). And according to different reports, the potential to increase the crop production and export volume is still huge throughout the county. However, this substantial contribution to the economic development at national, regional and at family levels can be revitalized, if the above constraining factors could be eliminated or minimized. In line with this, the current study wants to contribute some empirical output into the existing literature by examining factors that determine cash crop production and marketing.
2.3. Sesame Production and Marketing in Ethiopia

2.3.1. Sesame production in Ethiopia

The world of sesame seed market is a billion dollar industry that supports the livelihoods of millions of farmers throughout the world (USAID, 2010). World production of sesame seeds is estimated at 3 million tones, and is steadily growing. Currently, Ethiopia is among the top five producers of sesame seed in the world, ranked at fourth place by covering about 8.18 percent of the total world production (FAOSTAT, 2012).

Next to coffee, sesame seed is the second largest agricultural export earner for Ethiopia, involving a number of small-holder farmers in its production throughout the nation (CSA, 2011). In 2010/2011 production year, about 763, 893 smallholder farmers participate in sesame production; while in year 2011/2012 the number of participants has increased to about 893, 883 private peasants (CSA, 2011). This indicates as sesame sector has potential to involve more smallholders under its production, hence one way of linking them to domestic and international markets.

Besides, in Ethiopia produces large variety of sesame seed can be produced, among which the Humera, Gondor and Wollega type are well-known in the world markets. On one hand, the Humera and Metema sesame seeds are suitable for bakery and confectionary purposes due to their white color, sweet taste and aroma. On the other hand, the high oil content of the Wollega sesame gives it a major competitive advantage for edible oil production (USAID, 2010).

According to different reports, sesame seed is an important export crop in Ethiopia and the country has a substantial role in the global sesame trade. It is the third world exporter of the commodity after India and Sudan (Alemu and W. Meijerink, 2010). In this regard, in the last few
years, sesame production and marketing has confirmed highly significant growth. In 1997, the total area under sesame production was about 64,000 ha (Aysheshm, 2007). In 2010/2011 cropping season, the total area under sesame production reaches 384,682 hectare and about 327,740.92 ton of sesame seed has produced in the country (CSA, 2011). Despite, these trends in 2011/2012 production year sesame production and area under its cultivation has declined by about 25.31% and 12.26% respectively, compared to the preceding year. Accordingly, only 337,505.41 hectare of land has cultivated under its production and only about 2,447,833.59 quintal of output was produced, (CSA, 2012). This indicates that not only the size of land allocated to sesame and its production volume was decreased, but also the crop yield too decreased from 8.52 quintal/hectare in 2010/2011 to 7.25 quintal/hectare in 2011/2012, by about 14.9% (CSA, 2012).

2.3.2. Sesame Marketing in Ethiopia

Sesame marketing is highly linked with the international market and highly volatile following changes in the supply and demand at international markets. The major actors in the Ethiopian sesame market are exporters, wholesalers, brokers/agents, local traders (Assemblers), primary cooperatives and their unions, commercial farms and small-scale farmers (Alemu, 2009). Understanding of the scattered and small-scale nature of the Ethiopian production system, the role of aggregation in improving the agricultural marketing system is given due emphasis in the national agricultural marketing strategy and this is sought to be achieved through cooperatives and their respective unions (ibid).

Alemu (2009) indicates that following the above strategies, the Council of Ministers Regulation No.178/2010 (the “Regulation”) passed on 22 May 2010, mandates that sesame seed trading in Ethiopia shall be conducted only at primary transaction centers and the Ethiopian Commodity
Exchange (ECX). According to Alemu, article 18 (2) of the Regulation reserves the right for any producer to export sesame seed directly, individually or through a cooperative in which he/she is a member (Alemu, 2009). However, as a result of the enforcement of the mandatory trading provisions of the Regulation, nearly all of the country’s sesame will be traded through Ethiopian Commodity Exchange (USAID-Ethiopia Agribusiness and Trade Expansion Programme, 2010).

Sesame in Ethiopia is grown mainly for the export market (Aysheshm, 2007; Alemu and W.Meijerink, 2010). According to Aysheshm (2007), only about 5% is believed to be consumed locally. Ethiopia is a major sesame seed exporter in the world market. For example, in 2005/06 Ethiopia exported 237, 565 tons of sesame seed, accounting for roughly 94% of the total export earning from oilseeds and 19% of total national export earning (EXC, 2010). In addition, reports suggest that there is a considerable international market demand for Ethiopian sesame seed, and it is expected to continue increasing in the future (Sorsa, 2009). According to the same author, this increasing international market demand for the crop is not only evident in the rise of export volume but also in new buyers coming to the market (ibid). Currently, China is the largest import market for Ethiopia’s sesame followed by Israel, Turkey and Jordan in 2011, respectively (Ethiopia Revenue and Custom Authority, 2012).
CHAPTER THREE: RESEARCH METHODOLOGY

3. Survey Methodology

3.1.1. The setting

Diga Wereda\(^5\) is one of the 262 districts in the Oromia regional state, located in the south-west of the Abbay basin and at 09 01’ 29.2” N; 036 27’ 28” E approximately 343 Kms west of Addis Ababa. The Wereda is bordered in the north east by Guto Gida district, in the west by the Dhidhessa River, in the north by Sasiga district and in the south and southeast by Jimma Arjo and Leka-Dulecha districts. The area is one of the highest rainfall regions of the Ethiopian highlands. Despite fluctuations over the years, generally, the Woreda has a mono modal rainfall pattern whereby it receives rain from mid-March through November. The rains are particularly heavy from June to September. January to mid-March is known to be the dry season in the Woreda. In some places mean annual rainfall exceeds 2,000mm. The altitude in the area varies from 1,200 to 2,342m.a.s.l. The midlands are steep, formerly forested terrain which is being rapidly cleared of trees. The Woreda comprises both lowland (60%) and midland (40%) agro-ecologies. The lowland, bordering the Didessa River, is less steep than the midlands, comprising more rolling terrain and in recent years there has been a large influx of people into this lowland area. Most rivers in the Woreda are perennial but in recent years scarcity of water during the dry season for livestock and people has become an increasingly common phenomenon. Local experts attributed water scarcity to: population pressure; lack of soil conservation measure to reduce erosion; deforestation; and overgrazing (Birhanu et al.2010).

\(^{5}\) Information regarding the description of this Wereda was obtained from the Wereda’s Agriculture and Rural Development office and from different websites (Wikipedia and International Water Management Institution-IWMI website).
There are 21 Kebeles and 16 Farmers Service Cooperatives in the Wereda. The Woreda has a total population of 68,906 (Wereda’s Agriculture Office document, 2011). On average a household has 7 persons in the Wereda. Out of the Wereda’s total area of 40,788.96 hectares of land, 27,817ha (68.2%) is arable land, 4999 ha (12.2%) is grazing land, 6894 ha (16.9%) is forest land and the rest 1078 ha (2.6%) is used for roads, housing, etc (Wereda’s Agriculture Office document, 2011).

The Woreda features a crop-livestock mixed farming system. The types of crops grown and the general livelihood adaptation in the Woreda have been shaped by agro-ecology. In the midland part of the Woreda, teff, neug, coffee, maize, barley and faba bean take the major share of production; while the lowland area is dominated by maize, sorghum, sesame, fruit trees like mango and soybean. Sesame is the major cash crop in the lowlands followed by livestock and maize productions. According to Diga Weredas’ Agriculture and Rural Development Office, more than 12 thousand hectares of land can be used for production of sesame in the Wereda. However, only about 3,500 hectare of land was under sesame cultivation during 2011/2012 production year. In addition, as a predominantly smallholder production, sesame is commercialized at a very low level and small scale farmers face a number of marketing problems.

3.1.2. Sampling design

3.1.2.1. Sample selection and sampling procedures

A combination of different sampling procedures was used to select the samples to successfully meet the objectives of the study. The sample size was determined largely by the financial and time constraints. However, effort was made to improve the reliability of the samples by taking care at each level of data collection processes.
3.1.2.2. Selection of the study sites

The study was conducted in Diga Wereda, East Wellega Zone in Oromiya Regional State, Ethiopia. The Wereda was purposefully selected based on conditions of its agro-ecological suitability for the selected crop (sesame). To select representative study sites within the Wereda, use of administrative units was necessary. And the smallest administrative unit in the Wereda is locally called Ganda, which means Peasant Association (PAs) or Kebele. The selection of these Kebeles was approached based on their agro-ecological locations. Since the production of the selected crop is limited to a suitable agro-ecological location by nature, a representative Kebeles were selected only from the lowland agro-ecological zones purposely, which is suitable for sesame production. Accordingly, four (4) Kebeles were purposefully selected from the lowland areas of the Wereda, out of 14 Kebeles in which sesame is commonly produced.

3.1.1.3. Selection of respondents

One hundred twenty (120) household heads were selected for interview. An average of thirty farmers per Kebele was selected and considered in the survey. This is done by taking a list of household heads from each Kebele agriculture and rural development office. Then, we selected thirty (30) household heads randomly from each Kebele. Table 3.1 presents the list of the selected Kebeles and respondents.
Table 3.1: Kebeles and the number of Household’s selected

<table>
<thead>
<tr>
<th>S.no</th>
<th>Name of PAs (Kebeles)</th>
<th>No of household heads</th>
<th>Agro-ecological zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>1</td>
<td>Arjo Farmers Association</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Biqila Kebele</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Dagaga Dhidhessa kebele</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Wayessa Dimtu</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>104</td>
<td>16</td>
</tr>
</tbody>
</table>

Source: survey result, 2012

3.2. Data Collection Process

Random sample of 120 individual households were interviewed from four Kebeles during February-March of 2012. Then, both qualitative and quantitative data were collected and used for the study analysis. Discussions with agricultural experts in the Wereda and the key informants were also used to strengthen the individual interviews. Individual households were interviewed using structured questionnaire (see Annex A) at the village level. The questionnaire covered different topics in order to capture relevant information related to the study objectives. And it was prepared as simple as possible, which was later translated to Afan Oromo (the local language) in order to channel answers by the respondents. However, it was not possible during this study to pre-test the questionnaire because of the limitations in time for the fieldwork. Rather the questionnaire was made as comprehensive as possible and correction was made along the way considering its relevance to local conditions from everyday lesson learnt while interviewing the farmers. Four diploma and one degree graduates who are native to the study area and know the language were hired as interviewers and trained for two days on the content of the questionnaire and interviewing procedures. The enumerators were well experienced on the data.
collection as they have worked many times with different IWMI (International Water Management Institute) researchers in different fields in the Wereda\textsuperscript{6}.

3.3. Model Specification

3.3.1. Theoretical model

The supply of agricultural commodities (food crops or cash crops) to local, regional, national or international markets depend upon the activities of large numbers of farm households. These farm households choose to produce food crops for home consumption or cash crops for market, based on the available comparative advantages from production of these crops. In the basic agricultural household model\textsuperscript{7}, households chose the level of land (l) and capital (k) to invest in the production of staples (q\textsubscript{s}) and cash crops (q\textsubscript{c}). Then it is assumed that, these choices are made to maximize utility from consumption of staple crops (C), leisure (L) and all other goods purchased in the market (M). With this established the household optimization problem becomes maximizing utility subject to a list of constraints and can be specified as:

\[
U = U(C, M, L) \quad \text{..................................................} \quad (3.1)
\]

This utility maximization objective is assumed to be constrained by the prevailing production technology constraints, resource (time, land, capital, labour, others) allocation constraints and cash income constraints. Production technology constraint is basically assumed to describe the link between input and output, by considering other production shifters. Mathematically, one can represent the production technology constraint as follows:

\textsuperscript{6} Diga Wereda is one of the International Water Management Institute (IWMI) research site in Ethiopia in addition to Jeldu (West Shewa Zone of Oromia region) and Fogera Weredas (Amhara region).

\textsuperscript{7} The theoretical model presented and used in the present study is adopted from Henderson et al., 2010 with some modifications. And this model is based on the period of one production year with the assumption that the production year starts just prior to planting (Henderson et al., 2010).
\[ Q = Q(q, n, Zq) \]…………………………………………………………………………………………..(3.2)

where \( q \) -is quantity of farm produce, \( n \)-is the production input which is relevant in specific crop production including land, labour, capital, time, etc and \( Zq \) describes unknown shocks to production, but revealed to farmers after production decisions are made.

Similarly, the cash income constraint states that the income from sales of farm produce (i.e. from sale of cash crops or surplus staple crops and from livestock productions), plus off-farm work minus the costs of purchased variable inputs cannot exceed the sum of available cash for purchase of consumer goods, production inputs and other household expenditures. Mathematically, this relationship can be specified as follows:

\[ pC + mM + wL = wL + R + \Pi = Y \]………………………………………………..……. (3.3)

where: \( P \)- represents price of home produced goods, \( m \)-price of purchased consumer goods, \( w \)-labour price(wage), \( Y \)-describes the full income from farm profit together with total value of off-farm incomes and transfers (\( R \)).

After all, maximization of household utility subject to these constraints can be solved by maximizing the corresponding lagrangian function; and the optimal production decision can be derived by differentiating this lagrangian function with respect to each specific variables. The point here is just to select the optimal production decision to maximize the stated utility maximization objective. This requires, linking these two decision problems together and the finding the optimal utility level from production decision. In cash crop productions farm households can be treated as a commercial firm, hence it is assumed that the intention to produce such crop is to sell all of the output produced to the market, with a single objective of maximizing profit. Thus, one can apply the recursive model and identify what factors determine
smallholder farmer’s participation in to these cash cropping. According to Upton (undated) in recursive or separable household models, production decision and utility maximization problems are linked through the full income constraint which incorporates the production function as one of its argument.

Hence the objective of the current study is to identify what factors determine the production participation decisions of smallholder farmers in one of the cash crops (sesame); our model tries to link production decision and utility maximization problems together. To do so, we assume that farmers decide on input demand (i.e. production decision); by considering the expected comparative advantages from participation in the activity which will be compared with respect to the other alternatives.

With this principle, we turn to the first stage production decision specification as follows. For this purpose a reduced production technology equation is assumed, and the quantity of output produced is considered as already given. Then the decision rule for production participation can be defined as:

\[
Q = f(q, n, Zq, X) \quad \text{..........................................................} \quad (3.4)
\]

\[
P_i = 1 \text{ if } q > 0, \text{ and } P_i = 0 \text{ if } q = 0
\]

where \( P_i \) - is the binary indicator, indicating whether the farmers decide to produce the specific crop and \( X_i \) are vectors of factors relevant in crop production processes. In addition, as the focus of the current study is to analyze factors affecting both the level of crop output produced and the binary indicator, the empirical model will include these both issues (production participation and the level of participation decision issues).
3.3.2. Method of Analysis

Different methods can be employed to analyze the above discussed farm household decision problem. One approach to analyze the issue is to use the well-known Tobit model. However, Tobit model assumes that both the decision to participate in activity and the level of participation are determined by the same variables and with the same sign (Wooldridge, 2002). That is, according to Tobit model, the decision to participate in production of a certain crop and the intensity of production participation are jointly determined and influenced by the same parameters. This is the main limitation of the Tobit model in which it restricts variables and coefficients in the two decisions (production participation and the level of participation decisions) to the same sign and signature (Wooldridge, 2002). That is why recent empirical studies have shown the inadequacy of the Tobit model in cross-sectional analysis, stressing the relevance of alternative approaches.

In this regard, one alternative approach is to employ the Heckman two step procedures. This model assumes that the decision to produce a crop and the intensity of production participation may not necessarily be jointly determined (R.Humphreys, 2010). In this case, factors that determine the production participation decision and the decision on extent of participation could be different. However, the Heckman selection model is appropriate if there is a censoring process in measuring the intensity of production participation (ibid). That is, the Heckman procedure assumes there is some potential production levels in the sample population, but are not observed due to sample selection problem. In general Heckman’s sample selection model is designed to account for the fact that the observed sample may be non-random. In our case, zeros in level of
sesame production (the dependent variable in the second stage) is due to non participation in sesame production, hence not either due to corner solution (Tobit) or sample selection problem.

In this case, the appropriate approach is to use the double-hurdle model. This model assumes farmers faced with two hurdles in any agricultural decision making processes (Cragg, 1997; Sanchez, 2005; R.Humphreys, 2010). Accordingly, the decision to participate in an activity is made first and then the decision regarding the level of participation in the activity follows. In this study, thus, double-hurdle model was chosen because it allows for the distinction between the determinants of production participation and the level of participation in sesame production through two separate stages. This model estimation procedure involves running a probit regression to identify factors affecting the decision to participate in the activity using all sample population in the first stage, and a truncated regression model on the participating households to analyze the extent of participation, in the second stage. In our case, we will apply the first stage of double hurdle model to examine the factors determining the decision to participate in sesame production and it is analyzed by a means of the probit regression.

According to Burke (2009), double hurdle model is useful because it allows a subset of the data to pile-up at some value without causing bias in estimating the determinants of the continuous dependent variable in the second stage, hence you can obtain all the data in the remaining sample for the participants (Burke, 2009). Thus, in double hurdle model, there are no restrictions regarding the elements of explanatory variables in each decision stages. That means it is possible to separately analyze the determinants of production participation decision and the level of participation decisions. Due to this separability, the estimates of production decisions can be obtained by a means of probit regression and that of the level of production participation
decision can be analyzed by use of a truncated regression. According to Burke, the separability in estimation may not be mistaken for separability in estimation is possible (Burke, 2009).

Then to derive the likelihood function, we begin in the first stage (production decision) where households are identified according to whether they are producers or not, using probit analysis. To do so, let \( P_i \) denote a binary indicator function taking value “1” if farmers participate in sesame production in 2011/2012 production year and “0” otherwise. Further, let \( Q_i \) denote the quantity of sesame produced in the specified production year. Then we can derive the likelihood function for the standard double hurdle model as follows:

\[
L = L(\alpha, \beta) = \pi \left[ 1 - \Phi(P_i \alpha) \Phi \left( \frac{X_i \beta}{\sigma} \right) \right] \\
\left[ \frac{\Phi(P_i \alpha)}{\sigma} \frac{\Phi(Q_i - X_i \beta)}{\sigma} \right]
\]

where \( \Phi \) denotes the standard normal CDF, \( \phi \) is the univariate standard normal PDF, and \( \sigma \) is the variance of error terms. The first portion (top line) is the log-likelihood for a probit, while the second portion (bottom line) is the log-likelihood for a truncated regression, with truncation at zero value of the continuous dependent variable in the second stage (the amount of sesame produced in the survey year, in our case). Therefore, the log-likelihood from the Cragg type double hurdle model is the sum of the log-likelihood from a probit and a truncated regression. More useful, is the fact that these two component pieces are entirely separable, such that the probit and truncated regression can be estimated separately (Ground and Koch, 2008; Aristei and Pieroni, 2008; Burke, 2009).
3.3.3. Empirical model specification

Based on the above backgrounds, the linear probit model can be specified as the follows:

\[ P(Y_i = 1) = \beta_0 + \beta_1 X_i + \epsilon \] \hspace{1cm} (3.5)

where \( P \) is the probability of an individual farm household to participate in sesame production in the specified survey production year (2011/2012), \( \beta_i \) is the vector of parameters to be estimated, \( X_i \) is the vector of exogenous explanatory variables expected to influence the participation decision probability and \( \epsilon \) is the error term.

Probit model specifies the functional relationship between the probability of participating in an activity (sesame production in our case) and the list of various explanatory variables thought to influence the participation decision. These factors can be either continuous or discrete explanatory variables. Therefore, the reduced functional relationship between the binary dependent variable (producing sesame or not) and a list of explanatory variables for the empirical analysis of the current study can be specified as follows using basic probit model specification:

\[ \Pr(\text{PRODPART}=1) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} \]
\[ + \beta_8 X_{8i} + \beta_9 X_{9i} + \beta_{10} X_{10i} + \epsilon_i \]

where \( \Pr \) - is the probability at which an individual household participate in sesame production in 2011/2012 production year represented by (PRODPART=1),

\( \beta_i \)'s – are the coefficients to be estimated,

\( X_1 \) – is age of hh head \( (AGEH) \)

\( X_2 \) – educational level of hh head \( (EDCN) \)
$X_3$ – is the number of working family labour (FAMLAB)

$X_4$ – total household landholding size (FARMSZE)

$X_5$ – access to credit service (CREDIT)

$X_6$ – number of oxen owned (OXEN)

$X_7$ – access to non-farm activities (NONFRM)

$X_8$ – family food availability (FOOD)

$X_9$ – the actual distance between household’s home and the nearest market place (DSTMRKT)

$X_{10}$ – the traveling time from households’ home to the extension service centers (DSTEXTN)

e_i – is the error term

Using probit regression method we can compute estimates of the coefficients ($\beta$’s) and their corresponding standard errors that are asymptotically efficient. As noted in Wooldridge (2002), the estimated coefficients from probit regression give the signs of the partial effects of each $X_i$ on the response probability (dependent variable). Thus, to assess the impact of the regressors on the dependent variable, it is necessary to analyze their marginal effects. This involves decomposing the unconditional mean into the effect on the probability of producing sesame and the effect on the conditional level of production participation and differentiating these components with respect to each explanatory variable. For the continuous explanatory variables, these marginal effects give partial effects of these variables at the sample means. While for the discrete or categorical variables, the marginal effects are used to calculate percentage changes in the dependent variable when the variable shifts from zero to one, ceteris paribus (Newman et al., 2003).
In the second stage of double-hurdle model we examine factors affecting the level of sesame production, conditional on participation decision, which is implemented using the truncated regression analysis. Thus, it involves the truncated regression that can be specified as:

\[ Q = Q^* \text{ if } Q^* > 0 \text{ and } Y=1 \]

\[ Q=0, \text{ otherwise} \]

From this, we can specify the reduced form of the truncation model as:

\[ Q = \beta_0 + \beta_i Z_i + u_i \]

where \( Q \) is the observed quantity of sesame produced, \( Q^* \) is the latent variable which indicates the level of sesame production is greater than zero, \( \beta_i \) is the vector of parameters to be estimated, \( Z_i \) is the vector of exogenous explanatory variables and \( u \) is the error term.

The empirical model used in this study assumes that the total quantity of sesame produced in the survey production year (2011/2012) is a linear function of continuous and dummy explanatory variables and is specified as follows:

\[ Q = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + U_i \]

where \( Q \) – is the quantity of sesame produced in 2011/2012 production year (SESPROD11)

\( \beta_i \)'s – are the coefficients to be estimated,

\( X_1 \) – is the number of working family labour (FAMLAB)

\( X_2 \)– educational level of hh head (EDCN)

\( X_3 \)– sex of household head (SEX)
Finally, the third objective of the present study can be achieved by defining the amount of income earned from sesame sale as a linear function of continuous and binary explanatory variables. The intention here is to identify important factors explaining marketing of sesame in the study area and determines households’ income which is generated from sesame sale in this area. This can be analysed by using the truncated regression model, because the dependent variable in this case has many observations at zero. And as noted in Pindyck and Rubenfeld (1991), analyzing such problems using an OLS method would yield biased and inconsistent results (ibid). Thus, a truncated regression model is chosen for this purpose since it is appropriate in the sampling scheme which excludes part of sampled observation on the basis of the value of the dependent variable (Wooldridge, 2002). That is, the truncated regression is used to model dependent variables for which some of the observations are not included in the analysis because of the value of the dependent variable. In our case - under this part, this can possibly happen since we consider sesame producer farmers, who have some positive incomes from producing sesame and marketing it. Due to this we might forced to exclude non-producer farmers from the analysis, because the value of dependent variable (the amount of income earned from sesame
sale) is zero for non-producer farmers. One can also use the Tobit model in this case. However, Tobit model assumes all zero observations as a corner solution. This is to mean, Tobit model assumes as zero observations are the outcome of households’ deliberate choice to sell a zero commodity. Yet, in our case zero observations are resulted from a non-participation in sesame production, rather than from farmers preference to sale nothing of their sesame produce. Therefore, by using the truncated regression model, we can account for these zero observations; hence this model provides a more accurate estimation (Wooldridge, 2002). Thus, the truncated regression model is chosen and takes the following specification:

\[ Y_{i}^* = \beta_0 + \beta_1 W_i + v \]  

\[ Y_i = Y_{i}^* \text{ if } Y_{i}^* > 0 \]  

\[ Y_i = 0, \text{ otherwise} \]

where \(Y_{i}^*\) is the observed latent variable; \(Y_i\) is the actual observed outcome (in our case, the level of income generated from sesame sale); \(\beta_1\) is the vector of parameters to be estimated, \(W_i\) is the vector of explanatory variables and \(v\) is the error term.

The empirical model used in this study assumes that total farm income earned by a farm household from sesame sales is a linear function of continuous and discrete independent variables and is specified as follows:

\[ Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + V_i \]

where \(Y_i\) – is the household income generated from sesame sales (INCOME04)
\(\beta_i\)’s – are the coefficients to be estimated,

\(X_1 – is \ sesame \ quantity \ marketed \ (QUANTITY)\)
X₂-X₅ – are time of sesame sells (ONEMNTYH, TWOMNTH, THREEMNTH, LATTER), respectively

X₆ – is traveling time to the nearest market place (DSTMRKT)

X₇-X₈ – major buyer of sesame produces from farmers (COOP, MRKTRAD)

X₉-X₁₀ – are sesame selling channels (DIRECT, BROKERS)

V₁ – is the error term

3.4. Statistical and Specification Tests

Before executing the final model regressions, all the hypothesized explanatory variables will be checked for the existence of statistical problems such as multicollinearity problems. Basically, multicollinearity may arise due to a linear relationship among explanatory variables and the problem is that, it might cause the estimated regression coefficients to have wrong signs, smaller t-ratios for many of the variables in the regression and high R² value. Besides, it causes large variance and standard error with a wide confidence interval. Hence, it is quite difficult to estimate accurately the effect of each variable (Gujarati, 2004; Woodridge, 2002).

There are different methods suggested to detect the existence of multicollinearity problem between the model explanatory variables. Among these methods, variance - inflating factor (VIF) technique is commonly used and is also employed in the present study to detect multicollinearity problem among continuous explanatory variables (Gujarati, 2004). In Gujarati (2004) it was defined that VIF shows how the variance of an estimator is inflated by the presence of multicollinearity (Gujarati, 2004).
Mathematically, VIF for individual explanatory variable \( X_i \) can be computed as (ibid):

\[
VIF (X_i) = \frac{1}{1-R^2}
\]

where \( R^2 \) is the coefficient of correlation among explanatory variables.

According to Gujarati (2004), the larger the value of VIF indicates the more collinearity among one or more model explanatory variables. As a rule of thumb, if the VIF of a variable exceeds 10, which will happen if a multiple R-square exceeds 0.90, that variable is said to be highly collinear (Gujarati, 2004).

Alternatively, we can use the inverse of VIF \((1/VIF)\) called Tolerance (TOL) as a measure of multicollinearity. The closer is TOL of one explanatory variable \( X_i \) to zero, the greater the degree of collinearity of that variable with the other regressors. On the other hand, the closer TOL of \( X_i \) is to 1, the greater the evidence that \( X_i \) is not collinear with the other regressors (Gujarati, 2004).

Similarly, contingency coefficient (CC) method was used to detect the degree of association among discrete explanatory variables (Healy, 1984). According to Healy (1984), the discrete/dummy variables are said to be collinear if the value of contingency coefficient (CC) is greater than 0.75 (Healy, 1984). Mathematically:

\[
CC = \sqrt{n/\left(\frac{X_2}{n} + \frac{X_2}{#}\right)}
\]

where CC- is contingency coefficient

\( n \)- is sample size

\( X_2 \)-is chi-square value
Finally, the double hurdle model can be tested against the Tobit model using a standard likelihood ratio test, as the Tobit model is nested in the double hurdle model (Humphreys, 2010). That is, the Tobit model can be tested against the double hurdle model, by restricting the parameters of the participation probit model to be equal to the parameters of the truncated regression (level of participation). To do so, let $\text{LL}_{\text{DH}}$ be the log likelihood value from the double hurdle model (which is the sum of log likelihood values from Probit and Truncated regressions) and $\text{LL}_{\text{T}}$ is the log likelihood value from the Tobit model. Then the likelihood ratio test can be carried out as follows:

$$LR = -2(\text{LL}_{\text{DH}} - \text{LL}_{\text{T}})$$

and the test statistic has a $X^2$ distribution with degrees of freedom equal to the number of parameter restrictions made to get the Tobit model (the difference between variables included in the probit model and truncated model).

### 3.5. Definitions of Model Variables

**Production participation decisions (PRODPART):** This is a binary dependent variable taking value “1” if the farmers participate in sesame production in 2011/2012 cropping year and “0” otherwise.

**Amount of sesame produced in 2011/2012 cropping season (SESPROD11):** This is a continuous dependent variable and measured in terms of quintal. And it represents the amount of sesame produced by each household in the specified production year (2011/2012 cropping year). We use this variable as dependent variable to analyze factors that influence the extent to which farmers decide to produce sesame (the level of production participation, based on the decision to produce the crop) by using truncated regression.
**Income generated from sale of sesame in year 2011/2012 (INCOME04):** This variable is also a continuous dependent variable to analyze factors that determine the income farmers generate from sale of sesame. This allows us to identify those factors that explain the marketing of the crop in the study area.

**Independent Variables:**

**Total farm size (FARMSZE):** Land is one of the major and the key asset for farmers everywhere. Thus, the decision made by any household is basically and highly influenced by their land holding size. Especially, in our case the decision to produce cash crop is mainly influenced by farmers land holding size, because cash crop and other staples crops mainly compete for such basic resources. Sesame seed is mostly grown in the semi-arid and sub-tropical regions around the world; hence agro-ecologically suitable land is required for sesame production. Thus, we expect that a household who holds a greater farm land are more likely to participate in sesame and allocates a significant size for its production.

**Sex of household head (SEX):** This is a discrete variable that takes a value of “1” if the household head is male and “0”, otherwise. In this study, it is assumed that male household heads have more exposure and access to information and new interventions than female household heads, which might enable them to participate in production of sesame. Thus, male household head is taken as a reference variable and expected to participate more than female household heads.

**Age of household head (AGEHH):** This is a continuous variable and defined as the number of years of household head age. In this study it is assumed that as age increases farmers would acquire knowledge and experience through continuous learning which help them to actively
participating in production of market-oriented cash crops. Thus, in this study this variable is used as a proxy for farmers experience in farming.

**Educational level of household head (EDCN):** It is generally recognized that education equips individuals with the necessary knowledge of how to make living. Thus, for the purpose of this study, we believe that those who are literate and have at least some education are better able to make the transition to cash crops. This is so because it is believed that producers with higher levels of education tend to have greater access to production and market information, hence expected to produce market-oriented cash crops.

**Number of oxen owned (OXEN):** This is a continuous variable that refers to the number of oxen the respondents owned. An ox is the most important means of land cultivation in poor rural areas and is one of the major assets to farm households in Ethiopia. Thus, we expect that the number of oxen available to the household positively enhances the probability of being producing sesame and encourages in producing a significant amount.

**Number of active family labour (FAMLAB):** This is a continuous variable referring to farmer’s access to family labor. In this study, we consider active family labour as who can participate in agricultural activity in the household. Thus, this variable is expected to positively affect the probability decision to produce sesame and the amount to be produced. This is because sesame is a labour intensive crop, thus requires high labour and in these rural areas there is no market for labour or if any imperfect. Thus, family labour is the main source of labour force in such cases.

**Access to Credit (CREDIT):** It is a dummy variable, which takes value 1 if farmers have access to credit service and 0 otherwise. Since production of any cash crop requires capital which is
lacking by poor smallholder farmers, we expect that this variable importantly explain smallholder farmers’ decision to produce sesame. Especially sesame requires high capital throughout its production processes, farmers who have more access to credit service are expected to produce market-oriented cash crops like sesame.

**Availability of family food for the whole year (FOOD):** Smallholder farmers in developing countries are always argued to participate in production of cash crops only if they could produce more family foods. This is because these farmers first want to secure foods for their family. Thus, if farmers have potential and experience in producing sufficient family food for the whole year, we expect these farmers more likely to participate in production of cash crops such as sesame in the study area.

**Household’s access to off-farm activities (NONFRM):** This is a dummy variable indicating farmer’s access to off-farm activities. If farmers have access to alternative works to farm income sources they less likely to participate in sesame production. On other hand, since sesame production requires high working capital it is argued that farmers who have access to non-farm activities and generate additional income, will likely to produce high value cash crops such as sesame. There, the impact of this variable on farmers’ decision in sesame production participation is indeterminate (either positive or negative).

**Distance to extension service centers (DSTEXTN):** This variable is a continuous variable represented by walking time (in minute) from farmers’ residence/home to the nearest extension service centre. We consider this as possible factor in farmers’ decision to produce sesame and their level of production since farmers receive a number of services from extension centers including technical services on its production. Thus, it is expected that farmers who lives near to
such service centre are likely to have regular contacts with agricultural experts, hence motivated to produce crops which have high returns to the resource used.

**Households’ membership status in local cooperatives (MEMCOP):** It is conceivable that, cooperatives have a number of contributions for smallholder rural farmers in developing countries. For example; cooperative institutions provide necessary inputs, market information and buy their produce at better prices. In this study, we expect those farmers who are members of local cooperative more likely produce sesame and earn better income in the study area.

**Traveling time to the nearest market place (DSTMRKT):** This is a continuous variable represented by walking time (in minute) from home to the nearest market place. Proximity to market centers motivate farmers to produce market-oriented crops through making easy access to inputs and market related accesses such as transportation and price information. It is, therefore, expected that household who lives nearer to market center have better chance to participate in sesame production and get better price for his/her produce than others.

**Farmer’s experience on sesame production (EXPER):** This is a discrete variable used to account for farmers’ experience in sesame production. By asking farmers whether they participate in production of sesame in the last two production years, we proposed this variable as one possible factor in determining the extent of farmers’ sesame production participation. Accordingly, this variable takes value 1 if households were produced sesame in the last two years and 0 otherwise. Thus, it is expected that farmers’ who have participated in production of sesame in the recent years have good experience on its production and likely to produce more amount in the survey year.
**Land size cultivated under sesame (LANDCULT):** This is a continuous variable representing the size of land allocated to sesame production in specified year by producer farmers and is measured by hectare. We expect that, as cultivated land size increases, provided other associated production factors remain constant, the likelihood that the farmers produce more sesame produce is high.

**Productivity of the crop–yield (PRDVTY):** This is a continuous variable represent the crop yield (quintal produced per hectare cultivated). The plausible explanation to consider this as a possible explanatory variable is that, when we analyze the factors that affect farmers’ production level, productivity of the crop may cause production level variation among the sampled farmers, in addition to other factors. This means, each household produces different amount of outputs, sometimes on the same land size cultivated. More clearly, farm household may records different crop yield (quintal/ha), due to a number of factors. This implies that the variation in the level of that crop production might also be influenced by this crop yield variation, in addition to factors that cause different level of production participation. Therefore, in this current study we proposed this variable as one possible explanatory variable in determining the level of sesame production participation. This allows us to account for possible effects of crop yield on smallholder farmer’s level of production participation.

**Access to market information (MRKTEINFO):** This is a dummy variable taking value 1 if farmers have access to price information by any means, and 0 otherwise. This is an important variable in any marketing because price information highly influences the commodity prices, and hence has a significant impact on income earned. Therefore, it is hypothesized that access to price information positively affects the income earned from sesame sale in the study area.
Major buyers of sesame from farmers (LOCTRAD, COOP, and MRKTRAD): This is a dummy variable representing for whom producers sell their produce in the study area. We used three dummy variables in this case. Where dummy variable “LOCTRAD” is to mean farmers have sold their produce to local traders, variable “COOP” represents farmers have sold their produce to cooperatives and “MRKTTRAD” refers to farmers sold their produce to traders at markets. These variables are considered since the type of buyer to whom farmers sale their produce may matter for price they receive, hence determine the income earned from sesame sale.

Selling Channels (DIRECT, BROKERS): This is a dummy variable referring the channel through which farmers sell their produce. This is also expected to influence the price that farmers can receive which also has an impact on their income. The available options include selling directly to their buyers and selling through brokers. Thus, by using the first dummy variable (DIRECT) as a reference, we can identify whether there is difference in income earned from sesame sale among producer farmers due to using these two channels.

The quantity of sesame marketed in 2011/2012 (QUANTTY): This is a continuous variable referring the amount of sesame marketed in the specified year, measured in quintal. Quantity marketed is one of the major and key factors in determining the amount of income received by farmers. Even, sometimes this alone determines the amount of income generated from agricultural sale. However, in this study we assume that this variable alone cannot be considered as the determinant of income framers are receiving from sesame sale, because there are also other factors that determine their income. Whatever the case, we expect positive and significant result for this particular variable.
**Market price of sesame (MRKTPRICE):** This is continuous variable representing market price of sesame in the study area. This variable is also an important variable in determining the amount of income earned from sesame sale. Thus, we expect a direct impact of this variable on the dependent variable considered under the marketing aspect of sesame in the study area.

**Time of selling (IMMIDIATE, ONEMNTH, TWOMNTH, THREMNTH, and LATTER):**

This is also a categorical variables indicating the time in which farmers sold their produce. These categorical variables allow us to understand the role of time in which farmers has sold their sesame produce in explaining the price they received and, hence the income they earned. Thus, we expect that these variables explain the income farmers earned from sesame sale.
CHAPTER FOUR: RESULTS AND DISCUSSIONS

This chapter presents and discusses main findings of the study. Determinants of smallholder’s decisions to participate in sesame production, the extent of production participation and the marketing issue of the crop in the study area will be presented and discussed.

4.1. Descriptive Results

4.1.1. Socio-demographic characteristics of sampled households

Totally, 120 household heads were considered in this study. Out of these interviewed farmers, 16 (13.33%) of them were female headed and the remaining 104 (86.67%) were male headed households. The overall mean age of the sampled household head is about 40.3 years.

The average family size for sesame producers was about 6.2 persons per household, and about 6.01 persons per household for non-producer farmers. Table 4.1 presents summary statistics of sampled household’s demographic characteristics in terms of the two sample groups (sesame producer and non-sesame producer).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Non-producers</th>
<th></th>
<th></th>
<th></th>
<th>Producers</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs.</td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
<td>Obs.</td>
<td>Mean</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Total hh size</td>
<td>29</td>
<td>6.1</td>
<td>1</td>
<td>11</td>
<td>91</td>
<td>6.2</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Active family labor</td>
<td>29</td>
<td>2.6</td>
<td>1</td>
<td>5</td>
<td>91</td>
<td>3.70</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Dependent family</td>
<td>29</td>
<td>1.66</td>
<td>0</td>
<td>7</td>
<td>91</td>
<td>1.70</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: Survey result, 2012
The composition of household members in terms of dependency ratio is nearly similar for sesame producers and non-producers. However, the number of active family labour is greater for sesame producers when compared to non-producers.

Educational status of the household head is also an important element in smallholder economic activities. The survey result revealed that 27.5 percent of the sampled farmers never attended any schooling, while 72.5 percent were literate at different levels of schooling. The percent of illiterate household heads for sampled sesame producers is about 24.18 and it is 37.93 for sampled non-producers. Among the literate farmers, majorities (about 40%) of them attended schooling below grade five and none these farmers have attended above grade twelve. Table 4.2 presents full information on different educational levels of sampled farmers.

| School levels | producers | | | | | | Non-producers | | | Total Sample | | |
|--------------|-----------|---|---|---|---|---|---|---|---|---|---|
|              | Frequency | Percent | Frequency | Percent | Frequency | % | | | | | |
| ≤ 5          | 41        | 45.05 | 7 | 24.14 | 48 | 40 |
| 6-8          | 19        | 20.88 | 7 | 24.14 | 26 | 21.7 |
| 9-10         | 7         | 7.59 | 4 | 13.79 | 11 | 9.17 |
| 11-12        | 2         | 2.20 | 0 | 0 | 2 | 1.70 |
| ≥ 12         | 0         | 0 | 0 | 0 | 0 | 0 |

Source: survey result, 2012

4.1.2. Land ownership status of sampled farmers

Survey result indicates that about 92.5% of respondents own land. That means, only 7.5% of sampled farmers did not posses their own land. The farm size of sampled farmers varies from 0.4 to 13 hectare and the average farm size for these sampled farmers is found to be 3.24 hectare.
As indicated in Table 4.3, 94.5% of farmers who have participated in the production of sesame in 2011/2012 production season cultivated on their own land while the remaining 5.5% of them used rented land in this survey year. The minimum cultivated land under sesame is found to be 0.125 hectare and the maximum is 2 hectare. And the average cultivated land under sesame in this survey year is about 0.78 hectare.

4.1.3. Livestock ownership of sampled farmers

Livestock is one of the major assets for farmers. And it is one way of indicating farmer’s level of wealth in some areas of Ethiopia, since the number of livestock owned by each household is considered as the indicator of living standards in rural areas. Especially, in a mixed farming system the contribution of livestock to crop production is great. For example, livestock sector in the study area (Diga Wereda) can be used as draught power; an alternative source of income, as a means of transportation and serve as a store of wealth.

Oxen and donkeys are among the major livestock resource used in any crop production. These two resources are considered as the main influential variables in decision of farmers to produce and to what extent they can participate in any agricultural production. For example, this survey
result revealed that, 95.5 percent of the sampled households use ox for land preparation purposes, while the remaining portion use donkey and traditional hand hoe for the same purpose.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Producers</th>
<th></th>
<th></th>
<th>Non-producers</th>
<th></th>
<th></th>
<th>Total Sample</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>oxen</td>
<td>Donkey</td>
<td>Oxen</td>
<td>donkey</td>
<td>oxen</td>
<td>donkey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>6.59%</td>
<td>39.56%</td>
<td>37.93%</td>
<td>72.41%</td>
<td>14.17%</td>
<td>47.55%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14.29%</td>
<td>48.35%</td>
<td>34.48%</td>
<td>24.14%</td>
<td>19.17%</td>
<td>42.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td>62.64%</td>
<td>12.09%</td>
<td>27.59%</td>
<td>3.45%</td>
<td>54.17%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 3</td>
<td>16.48%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>12.5%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: author survey result, 2012

As we can observe from table 4.4, 6.59% of sesame producers; 37.93 percent of non-sesame producers and 14.17% of the whole sampled farmers have no any oxen. Similarly, 39.59% of sesame producers, 72.41% of non-sesame producers, and 47.51% of the overall sampled households own no any donkey. In addition, according to the survey result, about 14.29% and 48.35% of sesame producers owns only one ox and donkey, respectively. Similarly, 34.48% and 24.14% of non-sesame producers own only one ox and donkey, respectively. This survey result also revealed that, on average, about 19.17% and 42.5% of the total sampled households owns only one ox and donkey respectively. Further, 62.64% of sesame producers own 2 to 3 oxen. However, only about 27.59% of non-sesame producers own 2 to 3 oxen. Only 12.5% of sampled farmers reported as they own more than three oxen and all these farmers are sesame producers.

4.1.4. Sesame production and associated problems

Respondents listed a number of problems associated with sesame production in the study area. Among the major problems, lack of improved sesame seed in the study area is the serious
problem that these farmers complain. All of the sampled farmers reported that lack of improved sesame seed is the major and serious problem in the study area. In this regard, a number of studies have also demonstrated this lack of improved seed varieties as the major production constraint in Ethiopia (Aysheshm, 2007; Sorsa, 2009). The main problem in this regard is that, these farmers usually used the traditional seed that results in low crop yield and it is vulnerable to the recent climate change associated problems. This requires immediate intervention through finding improved sesame seeds that properly fits the agro-ecology of Diga Wereda.

Table 4.5: Perception on major problems associated with sesame production

<table>
<thead>
<tr>
<th>Problem type</th>
<th>Sesame - producers</th>
<th>Non-producers</th>
<th>Total sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases</td>
<td>69.66(%)</td>
<td>50(%)</td>
<td>66.36(%)</td>
</tr>
<tr>
<td>Pest infestations</td>
<td>15.73(%)</td>
<td>16.67(%)</td>
<td>15.89(%)</td>
</tr>
<tr>
<td>Rainfall problems</td>
<td>8.99(%)</td>
<td>11.11(%)</td>
<td>9.35(%)</td>
</tr>
<tr>
<td>Hailstone</td>
<td>5.62(%)</td>
<td>22.22(%)</td>
<td>8.41(%)</td>
</tr>
<tr>
<td>Lack of improved sesame seed</td>
<td>100(%)</td>
<td>100(%)</td>
<td>100(%)</td>
</tr>
</tbody>
</table>

Source: author survey result, 2012

Sesame diseases are another serious problem that affects sesame production in the study area. These farmers very much complain about this problem as it destroys the crop at different stages and they become experiencing well it from the recent years, which discourages most of farmers to participate in its production. And according to sampled farmers’ reports, there is no attempt by local governments to solve the problem, even though they complain so many times.

Moreover, sesame production constraint that sampled farmers mentioned is the problem of pest infestation. There are different pest infestation problems that affect the production of sesame in different areas. About 15.89% of sampled farmers responded that, pest infestation is one among
the major problems that affects sesame production and productivity in Diga. Rainfall and hailstone associated problems are also mentioned by these sampled farmers as the major problem in the study area in affecting sesame production and productivity. Thus, if well participation of smallholder farmers in sesame production is needed in the study area, it is necessary to solve or minimize such problems.

4.1.5. Income Sources of Sampled Household’s

The survey data revealed that the major source of income for the sampled farmers is on-farm activities (from both crop and livestock production). Only 20% of the respondents reported that, they have access to non-farm activities in the study area and generates some additional income. However, all of these farmers (who have access to non-farm income) reported that, it is not their main source of income.

Majority of sampled farmers (62%) reported that crop production is the major and only source of their income. And they reported that maize, sorghum and sesame produce are their main source of income. The average income farmers generated from sale of sesame in 2010/2011 year was about 1766.30 birr. In 2011/2012 production season, the average income from sale of sesame is about 2549.50 birr, with a minimum of 500 birr and a maximum of 8540 birr. The other possible source of cash for rural household is credit. Accordingly we asked the farmers if they have access to credit from any rural institution. Half the respondents (exactly 50%) replied that they have access to credit. The remaining 50% answered they have no access to any credit.
4.1.6. Sesame Marketing Practices in Diga

The survey data indicates that majority (97.44%) of sesame producer reported that they supplied their sesame produce to market. Sampled farmers were also asked to identify their usual way of selling their produce. About 90.22% of them reported that they sell directly to traders or purchasers at local or primary markets. Only about 9.78% of sesame producers said they sold their produce through brokers. Similarly these sampled farmers reported that the usual time they sell their produce was one month after harvest, (about 33% of farmers reported). In addition, about 65 percent of them replied that they sold their sesame produce immediately after harvest. Only about 2% of sesame farmers said they stored their produce for two months after harvest. The reason they present is that sesame seed lost its weight if it is stored at home longer. Thus, they prefer to sell immediately after harvest without expecting high price in the future.

The respondents also complained about existence of serious problems at market place at the time of selling their produce. According to the survey data, 86 percent of farmers reported that there is a serious problem regarding weight or scale cheating at markets by traders.

4.1.7. Institutional Issues on Sesame Production in Diga

Among the institutional issues; membership status of farmers in rural cooperatives, access to different technical advisory services and access to any contractor opportunities with different bodies in production/marketing of agricultural products were assessed. Results of the survey revealed that about 80 percent of the respondents were a member of local cooperatives. In addition, different necessary technical advisory services from agricultural extensions are also important and required by rural farmers. In this regard sampled farmers are expecting more services from these institutions. One very important issue they raised is the problem of different
diseases affecting different crops such as sesame, mango and banana. They are looking for immediate solutions for the problems attacking these crops. Finally, survey result revealed that there are no any farm contract activities on sesame production in the study area.

4.2. Econometric Results

4.2.1. Production Participation (Probit regression)

In this section, we analyze factors affecting farmers’ participation decision in sesame production by taking 2001/2012 production year as a reference. To analyze the problem we employed the probit regression and ten explanatory variables (seven continuous and three discrete), were hypothesized to influence the probability of participation decisions and included in the analysis.

However, prior to running the final regression analysis, both the continuous and discrete explanatory variables need to be checked for the existence of multicollinearity using Variance Inflating Factor (VIF) and the contingency coefficient (CC) methods, respectively.

Accordingly, as can be seen from the results presented in Table 4.7 and 4.8, our test result suggests that, there is no serious multicollinearity problem in our model, since there is no strong association among the hypothesized explanatory variables. Therefore, all of the proposed potential explanatory variables were included in the final probit regression.

<table>
<thead>
<tr>
<th>Table 4.6 VIF test result for continuous explanatory variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>OXEN</td>
</tr>
<tr>
<td>FARMSZE</td>
</tr>
<tr>
<td>FAMLAB</td>
</tr>
<tr>
<td>DSTEXTN</td>
</tr>
<tr>
<td>DSTMRTK</td>
</tr>
<tr>
<td>AGEHH</td>
</tr>
<tr>
<td>EDCN</td>
</tr>
<tr>
<td>Mean VIF</td>
</tr>
</tbody>
</table>

Source: own computation, 2012
Table 4.7 Contingency Coefficient test (for discrete explanatory variables)

<table>
<thead>
<tr>
<th></th>
<th>SEX</th>
<th>CREDIT</th>
<th>FOOD</th>
<th>NONFARM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CREDIT</td>
<td>0.2213</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOOD</td>
<td>0.1419</td>
<td>0.4118</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>NONFARM</td>
<td>-0.0407</td>
<td>-0.1547</td>
<td>-0.3174</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Source: survey result, 2012

Informed by these test results, the probit model regression was carried out and the result is presented in Table 4.9. From the regression result, we obtained Pseudo R-square value of 0.8028 which shows 80 percent of the model was explained by the included regressors. In addition, the estimated probability greater than chi-square value (Prob > chi-square = 0.0000), suggests that all the model parameters are jointly significant in explaining the dependent variable at less than 1 percent significance level.

**Significant explanatory variables from probit regression:**

Out of the included regressors, the coefficients of six variables were found to have a significant impact on the likelihood of participating in the production of sesame in the study area. According to Wooldridge (2002), the probit regression coefficient gives signs of the partial effects of each explanatory variable on the response probability of the dependent variable (Wooldridge, 2002).

**Household’s landholding size (FARMSZE):** The estimated coefficient result for this variable was found to be positive, reflecting positive effect on likely of producing sesame. This result implies that farmers, who have more farm size, are most likely to produce sesame, keeping the effects of other variables constant. In other hand, it indicates as households’ farm size increases, the probability to produce sesame increases, ceteris paribus. This result is expected since land is one of the basic factors of production in any agricultural activities, including cash productions.
This is supported by the obtained statistically significant coefficient at less than 1 percent probability level, which confirms the logical association between producing any cash crop and the level of farm size owned by smallholder farmers. The study by Poulton et al (2001) suggests that land is an important factor in influencing farmer’s decision to produce any cash crop (Poulton et al., 2001), hence support the finding of the current study.

**Number of active family labour (FAMLAB):** The estimated result also shows that, having more working family member increases the probability of producing sesame. The positive and significant coefficient obtained for this variable confirms that, existence of higher number of working family labour encourages the production of sesame as a cash crop, ceteris paribus. The result is expected since family labour is the major source of labour force in the area, hence those households who have access to more family labour are likely to produce more quantity of sesame seed. The reason is that labour markets are lacking in this area but sesame production - from land preparation to its harvest, requires labour. For example, sesame harvesting is a very critical activity which should be completed at a short period of time; otherwise rainfall associated problems can damages the crop within a short day. This suggests that labour is among the critical variable in influencing decisions of households to produce sesame. The findings by Sorsa (2009) and Mheen_Sluijer and F.Cecchi (2011) support the finding of the present study. The studies by these authors suggest that since sesame production is highly labour intensive, shortage of labour is one of the major sesame production constraints in Ethiopia (Sorsa, 2009; Mheen_Sluijer and F.Cecchi, 2011).
### Table 4.8: Determinants of sesame production participation (Probit regression)

**DEPENDENT VARIABLE: PRODPART(=YES)**

| INDEPENDENT VARIABLES | COEFFICIENTS (dF/dx) | ROBUST S.E. | P>|z| | x-bar |
|-----------------------|-----------------------|------------|------|------|
| FARMSZE               | .014***               | .026       | 0.002 | .780 |
| AGEHH                 | -.000                 | .000       | 0.906 | 40.30 |
| SEX(male)             | -.001                 | .003       | 0.383 | .87  |
| FAMLAB                | .002***               | .004       | 0.009 | 3.52 |
| DSTEXTN               | -.008**               | .0002      | 0.018 | 47.31 |
| DSTMRKT               | .000                  | .000       | 0.967 | 82.83 |
| CREDIT                | .010*                 | .020       | 0.052 | .792 |
| NONFARM               | .001                  | .003       | 0.332 | .267 |
| FOOD                  | .067***               | .081       | 0.003 | .825 |
| OXEN                  | .003***               | .006       | 0.000 | 2.10 |
| EDCN                  | .002                  | .0005      | 0.528 | 3.68 |

obs. P. 7583333

pred. P. 9989603 (at x-bar)

Number of obs = 120

Prob > chi2 = 0.0000

Log pseudolikelihood = -13.30

Wald chi² (11) = 34.16

Pseudo R² = 0.8001

***, **, * shows significance of the coefficients at 1%, 5% and 10% probability levels, respectively

Source: survey result, 2012

**Access to credit (CREDIT):** The obtained result for this variable confirms that access to credit service significantly influences the likelihood of producing sesame. The estimates show that, farmers who have access to credit are more likely to produce sesame than their counterparts, ceteris paribus. The plausible explanation is that, access to credit enables smallholder farmers to finance purchase of inputs and other production equipments, hence encourage farmers to produce a given cash crop like sesame. Thus, as credit becomes more available for farmers, they are more likely to produce market-oriented crops. The findings by Immink and Alarcon (1993); and
Lerman (2004) supports the finding of the current study by arguing for agricultural credit as it plays a vital role in the process of smallholder commercialization (Immink and Alarcon 1993; Lerman 2004).

**Traveling time to extension service centre (DSTEXTN):** Evidence from the probit regression result also indicates that the actual distance of households’ home from extension service centre significantly influences the probability decision to produce sesame in the study area, which is statistically significant at less than 5 percent probability level. The estimated coefficient for this variable shows that there is a negative correlation between distance from agricultural extension service centers to households’ home and the likelihood of producing sesame. This result suggests that farmers require advisory and other services to actively participate in production of market-oriented crops, thus those farmers who live near the extension service centre are more likely to participate in production of the considered crop, ceteris paribus.

**Number of oxen owned (OXEN):** The estimated coefficient for this variable suggests that, having more number of oxen increases the probability of producing sesame and their association is statistically significant at less than 1 percent significance level. This result indicates that household’s who have a larger number of oxen are more likely to participate in production of sesame, keeping the effects of all other variables at constant. This is so since ox is used as a major means of land preparation in the study area. The survey finding by Sorsa (2009) supports the finding of the current study. According to Sorsa (2009), in east Wellega zone, more than 92.5 percent of sampled farmers used oxen for land preparation purposes and the remaining use hand hoe, which makes them quite different from Humera farmers as over 92 of percent the interviewed farmers used tractors (Sorsa, 2009). Thus, we obtained evidence that shows the
importance of having more oxen in influencing the likelihood of producing sesame in the study area.

**Availability of family food (FOOD):** Our regression result also reveals that, availability of family food for the whole year has a substantial effect on increasing the probability of producing sesame in the study area, keeping the value of other variables constant. The plausible explanation is that as farmers have good experiences and ability to produce the family food for the whole year, their likelihood to participate in the production of high value cash crops like sesame is higher under ceteris paribus assumption. In other words, this is to mean households who can produce family food for the whole year are more likely to produce sesame than those farmers who can not produce the family food for the whole year, ceteris paribus. This is informed by the obtained coefficient result for this variable with positive sign and statistically significant at less than 1 percent significance level. The study by G.Lukanu et al (2004) verified that household food availability is one among the factors that affects farmers’ decision to cultivate a given a cash crop (G.Lukanu et al., 2004), hence supports the current finding.

**4.2.2. Factors Determining the Extent of Sesame Production Participation in Diga**

This section focuses on factors determining the extent of farmers’ sesame production participation, conditional on decision to produce sesame. Truncated regression is used in this case, which is the second stage of the double-hurdle model, to analyze the problem.

However, before running the final regression, it is necessary to check for existence of statistical problems such as multicollinearity. In this regard, we employed the Variance Inflating factor (VIF) technique for continuous explanatory variables and the Contingency Coefficient (CC) method for discrete regressors. These test results are presented in table 4.10 and table 4.11.
Table 4.9: VIF test result for continuous explanatory variables

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>R²</th>
<th>VIF</th>
<th>1/VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAMLAB</td>
<td>.1333</td>
<td>1.15</td>
<td>0.866727</td>
</tr>
<tr>
<td>PRODVTY</td>
<td>.1222</td>
<td>1.14</td>
<td>0.877755</td>
</tr>
<tr>
<td>EDCN</td>
<td>.0969</td>
<td>1.11</td>
<td>0.903134</td>
</tr>
<tr>
<td>FARMSZE</td>
<td>.0842</td>
<td>1.09</td>
<td>0.915844</td>
</tr>
<tr>
<td>OXEN</td>
<td>.0671</td>
<td>1.07</td>
<td>0.932854</td>
</tr>
<tr>
<td>Mean VIF</td>
<td></td>
<td>1.11</td>
<td></td>
</tr>
</tbody>
</table>

Source: survey result, 2012

According to Gujarati (2004), VIF value greater than 10 indicates a severe collinearity among regressors. Similarly, Contingency Coefficient (CC) test uses a correlation coefficient of 0.75 as its tolerable critical value in which CC value more than 0.75 indicates collinearity problem. The test estimates show that there is no serious correlation among the proposed explanatory variables. Thus, all of the proposed explanatory variables were included in the final model estimation.

Table 4.10: Contingency Coefficient test result for discrete regressors

<table>
<thead>
<tr>
<th>SEX</th>
<th>EXPER</th>
<th>PRBLYR</th>
<th>CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPER</td>
<td>0.1085</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>CREDIT</td>
<td>0.0793</td>
<td>0.1446</td>
<td>-0.0911</td>
</tr>
</tbody>
</table>

Source: survey result, 2012

Here, we also use the likelihood ration (LR) test to check the relevance of Tobit model⁸ in this case. On the basis of a likelihood ratio (LR) test, the Tobit model was found to be irrelevant (LR = 93.32), with a critical $X^2 (3)$ value of 11.34. The implication of this result is that production decision participation and the level of production participation decisions are not based on the same decision-making process. That means, these two decisions are influenced by different parameters with different signs and signatures. This supports the inadequacy of the Tobit model in our case.

⁸ One can see the Tobit regression result from Annex B, at the end of this paper.
Informed by these test results, we proceed to present the truncated regression result. Analyzing the estimated parameters, it is possible to highlight that the coefficients of five variables are statistically significant at different significance levels.

One of the significant variables in influencing the level of sesame production participation in the study area is the number of active working family members (FAMLAB). This variable has an important impact on the extent of farmers’ sesame production participation and the result was significant at less than 1 percent probability level. This positive and significant obtained coefficient reveals the importance of family labour in the intensity of sesame production participation as well as the decision to produce crop. The possible explanation is that as we have said in the above section (probit analysis), sesame production is labour intensive and in rural areas where labour markets are non-existent or lacking, family labour is the key and the only source of farming labour. Thus, access to more family labour significantly influences farmers’ participation decision in any agricultural activity and determines the level of participation in those activities.

Inline with this, we found similar result from the probit regression, in which this variable significantly and positively influences, households’ decision probability in sesame production participation. This shows the importance of working family labour to participate in production of sesame as a cash crop in the study area.
Table 4.11: Determinants of the extent of sesame production participation

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>COEFFICIENTS</th>
<th>ROBUS T S.E.</th>
<th>P&gt;z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landholding size (FARMSZE)</td>
<td>.002</td>
<td>.040</td>
<td>0.969</td>
</tr>
<tr>
<td>Sesame crop yield (PRODVTY)</td>
<td>.210***</td>
<td>.052</td>
<td>0.000</td>
</tr>
<tr>
<td>Being male headed hh (SEX)</td>
<td>-.280</td>
<td>.258</td>
<td>0.276</td>
</tr>
<tr>
<td>Educational level of hh (EDCN)</td>
<td>.012</td>
<td>.035</td>
<td>0.739</td>
</tr>
<tr>
<td>Number of working family labour (FAMLAB)</td>
<td>.280***</td>
<td>.067</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of oxen owned (OXEN)</td>
<td>.186**</td>
<td>.076</td>
<td>0.014</td>
</tr>
<tr>
<td>Access to credit (CREDIT)</td>
<td>.414***</td>
<td>.159</td>
<td>0.009</td>
</tr>
<tr>
<td>Experience on sesame production (EXPERNCE)</td>
<td>.298**</td>
<td>.150</td>
<td>0.047</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>.750</td>
<td>.356</td>
<td>0.035</td>
</tr>
<tr>
<td>/sigma</td>
<td>.782</td>
<td>.082</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Number of obs = 91
Wald chi² (8) = 85.19
Prob > chi² = 0.0000
Log pseudolikelihood = -106.78

***, ** shows significance of the coefficients at 1% and 5% levels, respectively

Source: survey result, 2012

The next significant variable in truncated regression estimation is the dummy variable indicating access to rural credit service (CREDIT). The estimated coefficients for this dummy variable reveal the existence of different level of sesame production participation based on credit access status. The obtained result suggests that, those farmers who have access to credit service are more likely to produce significant amount of sesame than their counter parts, ceteris paribus. This highlights the importance of access to rural credit service in both decision to produce sesame and the level of production participation in the study area.

We also considered sesame produced per hectare as one possible explanatory variable in this analysis to take account of the effect of the crop productivity on variation in the amount of sesame
produced among the participants. That is, household who allocated small plot of land may produce larger amount of sesame, by employing different productivity enhancing technologies. Or through producing on fertile and fresh land that gives higher crop yield. Thus, to capture this effect, we considered this variable as additional regressors in our analysis. Accordingly, we obtained positive and significant estimated coefficient for this variable from the truncated regression, giving evidence that shows sesame produced per hectare is one among the possible factors in influencing the extent of sesame production participation, ceteris paribus.

The estimated coefficient for the dummy variable indicating households’ experience on sesame production (EXPERNCE) reveal the positive and significant impact of this variable on the level of sesame production participation in the study area. The plausible reason is that, farmers who have an experience on the sesame production are most likely to produce the crop in significant amount. This result indicates that household’s, who have produced sesame at least in the last two years produces more amount of sesame than their counterparts –keeping the effects of other variables constant.

The positive and significant coefficient obtained form the variable “OXEN” gives evidence that shows the number of oxen owned has a positive and significant impact on the level of sesame produced by sampled farmers. This implies that households who have more oxen are likely to produces more amount of sesame, giving evidence that shows oxen is one of the important factor in determining the extent of sesame production participation in Diga Wereda. This further indicates that sesame production in the study area is still dominated by the traditional means. The result from this regression, coupled with result obtained from the previous probit regression, confirms the key role of having more oxen in sesame production participation in the study area.
4.2.3. Factors Affecting Sesame Marketing in Diga

This section focuses on factors explaining marketing of sesame by smallholder farmers in Diga. The objective is to analyze factors that affect marketing of sesame, by taking the amount of income generated by sampled households as a dependent variable. We can run our model and analyze the problem, given that all the proposed regressors are uncorrelated with the error term, assuming all regressors are exogenous. However, in our model we suspect that the quantity of sesame marketed is likely endogenous variable to the model, which may result in inefficient estimation result. Basically such problems arise if some factors explaining the variation in the dependent variable (in this case, total income generated from sesame sale) could also affect of the potential regressor (e.g. quantity of sesame marketed).

To be cautious about the suspected problem, we made tests of endogeneity\(^9\) for the suspected regressor, using different endogeneity tests. The common test in this regard includes the regression - based Hausman test\(^{10}\) and the post estimation tests of Durbin-Wu-Hausman endogeneity test. To do so, we proposed two instruments (quantity of sesame produced and access to transportation) for the suspected endogenous variable (quantity of sesame marketed). Regarding the regression based test result, which was obtained after many steps; the predicted residual was found to be statistically insignificant (P-value of 0.457) giving evidence that shows the suspected variable is not endogenous.

---

\(^9\) If endogeneity test is passed, we need to consider the instrumental variable (IV) procedure and employ a two stage least squares (2SLS) method for final analysis.  
\(^{10}\) Three step procedures are needed for this purpose. In the first step, we run the original (structural) model by considering the suspected endogenous variable as a dependent variable against all other exogenous explanatory variables included in the original model (and by adding some other proposed instruments from outside the original model (if any). In the second step we predict and save the residual from this regression, and in third step we estimate the original model but using the predicted residual from step one as an explanatory variable. Then if the coefficient of that residual is statistically significant, we prefer to use 2SLS since the result gives evidence that show the suspected variable was endogenous.
In addition, the post estimation Durbin-Wu-Hausman endogeneity test suggests that, the null hypothesis which says quantity of sesame marketed is exogenous was not rejected. This again confirms exogeneity of the suspected variable, thus the final estimation is possible through truncated regression method rather than through instrumental variable estimation.

However, as we have done in the previous sections, we should carry out statistical tests for the proposed regressors before using these variables in the final estimation. Accordingly, we carried out tests of multicollinearity (both for continuous and discrete variables) by applying VIF and contingency coefficient (CC) techniques (see below).

<table>
<thead>
<tr>
<th>Table 4.12: VIF test result for continuous regressors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>MRKTPRICE</td>
</tr>
<tr>
<td>DSTMRKT</td>
</tr>
<tr>
<td>QUANTTY</td>
</tr>
<tr>
<td>Mean VIF</td>
</tr>
</tbody>
</table>

Source: survey result, 2012

<table>
<thead>
<tr>
<th>Table 4.13: Contingency coefficient test for discrete regressor variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MNTHT 2MNTH 3MNTH COOP MRKTRD BROKER MRKTINFO</td>
</tr>
<tr>
<td>1MNTH</td>
</tr>
<tr>
<td>2MNTH</td>
</tr>
<tr>
<td>3MNTH</td>
</tr>
<tr>
<td>COOP</td>
</tr>
<tr>
<td>MRKTRD</td>
</tr>
<tr>
<td>BROKER</td>
</tr>
<tr>
<td>MRKTINFO</td>
</tr>
</tbody>
</table>

Source: survey result, 2012

As one can observe, we obtained from both table 4.13 and 4.14 that, there is no serious linear correlation among the proposed explanatory variables, which can cause a multicollinearity problems. Therefore, all the proposed variables were included in the final regression. We use the corrected – robust t-ratio since we suspect heteroskedasticity problem, which is commonly arise
in a cross sectional data. As noted in Verbeek (2004) if we use the robust standard error, the resulting test statistics are appropriate, whether or not the errors have a constant variance (Verbeek, 2004). After all, ten variables entered the final regression and the estimated coefficients of these variables are reported in the Table 4.15.

Out of the included explanatory variables, seven (8) variables were found with statistically significant coefficients. Out of these significant variables, the coefficients of four variables were found with positive signs, implying direct correlation of these variables with the dependent variable. In contrast four significant variables were found to have a negative signs, indicating the inverse relationship between these regressors and the dependent variable.

Turning to individual explanatory variables, the quantity of sesame marketed (QUANTTY) has a positive and significant effect on the derived income from sesame sale in the study area, ceteris paribus. This outcome is expected and logical, since there is positive relationship between quantity supplied and income generated. This result indicates that, the amount of sesame marketed is one among the major factors determining the amount of income earned from sesame sale in the study area.
Table 4.14: Factors affecting income earned from sesame sale in the study area

| VARIABLES                                      | COEFFICIENTS | ROBUST S.E. | P>|z| |
|------------------------------------------------|--------------|-------------|-----|
| Quantity of sesame marketed (QUANTTY)         | 1363.60***   | 57.59       | 0.000 |
| Access to market information (MKTINFO)        | 119.96       | 105.56      | 0.256 |
| Selling time:                                 |              |             |     |
| 1 month after harvest (ONEMNTH)               | -286.54***   | 79.20       | 0.000 |
| 2 months after harvest (TWOMNTH)              | -286.58***   | 86.88       | 0.001 |
| 3 months later after harvest (THREMTNH)       | -519.55***   | 129.92      | 0.000 |
| Selling channels (BROKERS)                    | 243.62***    | 73.92       | 0.001 |
| To whom sesame sold (Buyers)                  |              |             |     |
| Cooperatives (COOP)                           | 124.44*      | 64.06       | 0.052 |
| Traders at market (MRKTRAD)                   | 26.18        | 72.12       | 0.717 |
| Sesame market price (MRKTPRICE)               | 87.93***     | 25.46       | 0.001 |
| Distance to market (DSTMRKT)                  | -2.32***     | 0.68        | 0.001 |
| CONSTANT                                      | 319.30       | 143.57      | 0.026 |
| /sigma                                        | 295.10       | 26.79       | 0.000 |

Number of obs = 91  Wald chi2(9) =1963.80  Prob > chi2 = 0.0000
Log pseudolikelihood = -646.66

*, **** indicates the statistical significance of the coefficients at 10% and 1% probability levels, respectively

Source: Survey result, 2012

We also obtained result that confirms direct relationship between income generated and the price of the commodity at markets. The positive and significant coefficient obtained for this variable, highlights the evidence that show the sesame price and the received income are positively correlated. The result is also statistically significant at 1 percent significance level. The descriptive survey result reveals that, sampled farmers receives different price levels for their sesame produce, hence the market price importantly determines their level of income could be derived from sesame sale.
The next significant variable in determining the income earned from sesame sale is “DSTMRKT” which represents traveling time to the nearest market place. Negative sign coefficient was obtained for this variable from the regression result, giving evidence that show the income earned from sesame has inversely affected by the longer walking hour from households home to the nearest market place the sale their sesame produce. This implies longer travelling time negatively affects smallholder farmer’s income. The outcome is expected because, distance from market centers affects the price of the crop, hence producer farmers prefer to sale at local area to local traders at lower prices. In addition, distance from market is one of the transaction cost related problems, which is common in rural areas where access to transportations is non-existence, the problem is serious. Thus, the actual distance between farmers’ home and the nearest market place is one of the determinant factors in influencing the amount of income earned from sesame sale in the study area, other things being constant.

Furthermore, the estimated coefficients for dummy variables indicating sesame selling periods (ONEMNTH, TWOMNTH and THREMNTH) shows the inverse correlation between selling sesame in latter months after harvest and the income earned. These are dummy variables we constructed to identify how the difference in sesame selling time can affect the income of farmers which could be derived from the sale. Accordingly, we constructed five dummy variables including: IMMIDIATE (to refer farmers have sold their sesame produce immediately after harvest), ONEMNTH (to refer farmers have sold their produce one month latter after harvest), TWOMNTH (which represent farmers waits for two months after harvest and sold their sesame produce), THREEMNTH (to refer they sold their produce three months latter after harvest) and LATTER (which refers to farmers have sold their produce after four months and later). In this case, the first variable (IMMIDIATE) was considered as the reference dummy
variable for comparison purpose and the rest of four dummy variables were included in the model regression. However, the dummy variable represented by “LATTER” was omitted from the regression (by default), because we have no any observation for this dummy variable. For the remaining three variables, we obtained negative sign coefficients which imply selling sesame at one month and later after harvest results in less income from sesame sale, when compared to income earned from selling it immediately after harvest. The coefficients of all these dummy variables were found with significant results.

As one can observe from the regression result (Table 4.15), the difference in the amount of income earned from sesame sale increases as farmers sale at latter periods which reduces the income. For example, the estimated coefficient for variable “ONEMNTH” is only negative 286.58, but the estimated coefficient for variable “THREMNTH” is negative 519.55. This indicates that, selling sesame one month later after harvest results in less income when compared to selling immediately after harvest, keeping the effects of other variables at zero. However, those farmers who sold their sesame produce three months later generate less income than those farmers who have sold their produce immediately after harvest, ceteris paribus. These all results, gives evidence that show sesame selling time explains and determines the income farmers derive.

Next, we discuss how the type of sesame buyer (to whom sell) affects farmers’ income from the sale. These dummy variables are represented by as “LOCTRAD” to refer the household sold the produce to traders at their area (local traders), “COOP” to refer the household sold to local cooperatives, and “MRKTRAD” representing the household sold to traders at markets. This is considered since different buyers can provide different prices, hence affects the farmers income. In this case, “LOCTRAD” was used as a reference dummy variable and the remaining two variables COOP and MRKTRAD were used as additional regressors. The estimated coefficients

11 The estimated coefficients are in Ethiopian Birr.
for these variables shows that selling to cooperatives and traders at markets results in more income from sesame sale when compared to selling to local traders, ceteris paribus. However, only the result from one variable was found to have a significant impact, giving evidence that shows the difference in income earned from the two types of buyers (local traders and cooperatives) is significant. This result suggests that farmers secure better income from being selling to local cooperatives which indicate cooperatives are an important institutional innovation in encouraging smallholder farmers to produce cash crops, in which it provides better incentive for their participation.
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1. Summary

Agriculture in Ethiopia continues to be the leading sector, and in turn smallholder agriculture sub-sector continues to dominate this sector. As a result, commercialization of smallholder farms has been viewed by the government of Ethiopia as the major source of agricultural growth in the country. A recorded literature suggests that one form of smallholder farmers’ commercialization is through production of cash crops and cash crops are conceivable to be the major source of export revenue and contribute to livelihoods diversification and poverty alleviation by directly increasing the farm household's income earning potential. This is possible only if there is active participation of smallholder farmer’s in production and marketing of such crops. Here, the key effort should focus on identifying those factors that explain and stand to determine farmers’ decision to participate in the field.

The principal objective of this study is to identify and analyze the determinants of farmers' participation in sesame production and marketing in Diga Wereda. Sesame is one among the major export products of Ethiopia, on which the livelihood of hundreds of thousands of farmers depends in different areas of the country including Diga. Using data collected from 120 households; drawn from Diga woreda farming system, the current study analyzed factors affecting smallholder farmers’ participation in production and marketing of sesame in this area. A two-stage sampling was used to select households. In the first stage, four peasant associations were randomly selected out of the 21 PAs (Kebeles) found in the woreda. Taking a list of households in the selected PAs, 30 households were selected from each PAs by using a simple random sampling technique in the second stage.
Out of the total 120 sampled household heads, 91 of them were found to be participated in sesame production in the survey year while the remaining 29 household heads were not participated. Using descriptive and econometric analysis methods, the current study identifies household specific and external factors that stand to limit smallholder farmers from producing sesame in the study area.

Survey result from descriptive statistics revealed that the major source of income for sampled farmers was on-farm activities and sesame is the major cash crop primarily produced for market in Diga Wereda. However, there are a number of challenging problems to produce the crop and to actively participate in its marketing in this area. In relation to the sesame production decision and its production processes, the sampled farmers have listed and complained about a number of sesame production related problems. Among the listed problems the major one includes: lack of improved sesame seed varieties, different sesame diseases and pest infestations, and rainfall related problems. In addition, lack of land preparation equipments is one of the major factors putting smallholder farmers in the area in a low position to cultivate larger areas of land under sesame, which also results in low sesame crop yield.

The three specific research objectives were achieved through different econometric model estimations. Accordingly the probit analysis method was employed to identify the determinants of participation in sesame production in the study area. Eleven variables were hypothesized to explain probability participation decision and used to estimate the probit model. The estimated coefficients of six variables included in this model were found to have a significant impact on the likelihood of participating in the production of sesame. These variables include: the number of active working family members (FAMLAB), household’s landholding size (FARMSZE),
number of oxen owned (OXEN), traveling time from farmers home to extension service centers (DSTEXTN), access to credit service (CREDIT) and access to the whole year family food (FOOD). The results from the probit model regression revealed that two variables were significant at less than 1 percent probability level and five variables were significant at less than 5 per cent probability level. Out of these significant variables, the coefficients of six variables were positive, indicating positive effects of these variables on the likelihood of producing sesame in the study area.

Similarly, after taking account of the sample selection bias, we analyzed factors affecting the level of sesame production participation in the second double hurdle model estimation by using the truncated regression. Eight variables were entered the final estimation. From this regression, we obtained positive and significant coefficients for five of the included potential variables. These significant variables include: the number of active family labour (FAMLAB), number of oxen owned (OXEN), access to credit service (CREDIT), productivity of sesame crop (PRDVTY), and household’s experience in sesame farming (EXPERNCE). Three variables were significant at 1 percent probability level while the remaining two variables were significant at 5 percent significance level. One important point here is that, three variables are influential and significant both in influencing farmer’s decision probability to produce sesame and their level of participation, in the study area. These variables includes: number of working in family (FAMLAB), access to credit service (CREDIT) and the number of oxen owned (OXEN). This implies that, these household specific assets and access are the major factors in determining smallholder farmers’ participation status in sesame production in Diga Wereda.
Finally, after testing for endogeneity and other statistical problems, we executed the truncated regression technique to analyze factors that are expected to influence and explain the income smallholder farmers are earning from sesame sale in the study area. Ten variables (three continuous and seven discrete) were considered and entered this model regression. Majority (eight) of these variables were found with significant coefficients. The coefficients of four variables, out of the significant variables, were found with negative sign indicating inversely correlated to the dependent variable. However, four significant variables have positive signs, showing the positive association between these variables and the considered dependent variable. The significant variables in this case includes: the quantity of sesame marketed (QUANTTY), sesame market price (MRKTPRICE), traveling time to the nearest market centers (DSTMRKT), access to market information (MRKTINFO), sesame selling time (ONEMNTH, TWOMNTH and THREMNTH), and selling to local cooperatives (COOP). This regression result revealed that, four variables were significant at less than 1 percent probability level, two variables at less than less than 5 percent and 1 variable at less than 10 percent probability level. In this study, the conclusion and policy recommendations were given based only on the statistically significant variables.

5.2. Conclusions

Sesame is the major cash crop for smallholders in Diga Wereda. And there is a potential arable land for further production in the Wereda. Productivity (crop yield) in this area (2.53 quintal per hectare) was found to be far below the national average (7.25 quintal per hectare) in 2011/2012 production year. The production technique was still dominated by traditional means (more 95 percent of sampled farmers use oxen and donkey for land preparation, the remaining use traditional equipments like hand hoe) which put farmers in this area far below other sesame
producing areas like Humera and Metema, at least in using modern technology for sesame production. Lack of improved seed, lack of awareness about the importance of sesame in the area and lack of knowledge and capacity to use fertilizer for sesame production are the other major factors resulting in low productivity of the crop in the study area. This discourages farmers to produce sesame, despite the available potential and opportunities. Fear of crop failure due to unexpected rains and existence of different sesame diseases (which currently become a common problem in the Wereda), were also found as the major determinant factor in limiting smallholder farmers from producing sesame in the area.

In addition, from the probit model regression, we observed that number of family labour, number of oxen owned, the size of farmland owned, family food availability and access to credit service influences the decision probability of farmers to produce sesame in the study area, positively and significantly. We also obtained that, distance to agricultural extension service centers decreases the likelihood of farmers to produce sesame and its impact was found to be statistically significant. This result suggests that, household specific characteristics and asset endowments are the major determining factors for smallholder farmers to produce sesame in the study area. Therefore, individual household specific factors matters for different level participation status of smallholder farmers in sesame production in the area, which results them in differently responding to the available potential and opportunities. In addition, access to rural credit service was found to be a significant factor, both in participation decision and the level of sesame production participation in the study area. This implies that credit availability is one of the key institutional factors that determine farmer’s decision status in same production in Diga Wereda.
This is because sesame production requires high working capital by easing the liquidity constraints of smallholder farmers.

In addition, the number of family labour and the number of oxen owned significantly influences sesame production participating (both decision to produce and how much to produce) in the study area. This is because sesame production is a labour intensive and oxen ownership is the major means of land preparation for the crop production, hence these two variables were found to be the major determinant factors both in decision to produce the crop and the extent of production participation. These two variables are also household specific factors in determining smallholder farmers’ participation status in sesame production in the study area.

Furthermore, from the truncated regression result, we highlighted that although the income farmers generate from sesame sale increases with the amount of sesame marketed, the relationship was found to be not a one-to-one. That is, in addition to the quantity of sesame marketed, other factors explain and determine significantly the amount of income earned from sesame sale in the study area. Accordingly variables such as market price of sesame produce, the channels through which farmer’s sale their sesame produce, the usual selling time, distance to the nearest market and access to market information were found to be the major and the significant ones. One possible conclusion from this result is that, time at which farmers will sale their sesame produce matter in generating better income from sesame. Thus, it is better for farmers to sell their sesame produce before two months after harvest, the survey result reveals. The type of sesame collectors or traders who buys sesame from farmers also matters for variations in income earned from sesame sell. Cooperatives are found to be the major channel for farmers to secure better income from sesame produce in the study area. This is because cooperatives are believed
to pay better price and provides other market related information; hence those farmers who have sold their produce to local cooperatives were found to generate better income than others. Access to market information was also found to be an important factor in securing better income from sesame sells for smallholders. This is because sesame is one of the international crops in which its price is linked to international markets; hence market information is necessary and significantly determines the level of income farmers derives.

5.3. Main Recommendations and Policy Implications

Sesame seed is currently becomes an important agricultural export commodity for Ethiopia. However, its production is significantly dominated by smallholder farmers and is limited to selected areas in the country due to limited availability of agro-ecological zones for its production and productivity. Therefore, to promote and encourage smallholder farmers in production of this export potential crop, a number of improvements are required. Based on the findings of the study, the following points need to be considered as possible recommendations.

Sampled farmers complained about lack of improved sesame seed varieties in the area. In this regard, farmers require immediate intervention and support. Therefore, providing improved sesame variety that properly fit the agro-ecology of Diga Wereda is one possible solution. In addition to this, smallholder farmers have complained about the crop failures at different stages due to sesame diseases, rainfall related problems, soil acidity and cracks, and pest infestation problems. This requires research and development works in the area to sustainably solve these problems. Furthermore, sampled farmers have also complained about lack of awareness and capacity to use fertilizer for sesame production. Therefore, building smallholder farmers’
knowledge how to use fertilizer for sesame production is another necessary recommendation from the current study.

Furthermore, the findings of this study suggests that institutional services like producer cooperatives and credits are the key factors in influencing both farmers decision to participate in sesame production and the level of production participation. This is so because sesame production entails high working capital throughout its production processes. Thus availability of credit service can help to facilitate farmers to participate in its production and to produce a significant amount. Broadening and expanding sources of such institutional service is another possible recommendation from the present study, if active participation of smallholder farmers is required in sesame production and marketing in the study area. In this regard, contract farming activities and experiences are importantly needed to facilitate farmer’s participation and to make conducive environment for these marginalized farmers. As different literatures suggests, contract farming practices are important through different ways in smallholder commercialization through cash crops, especially by solving the liquidity constraint for farmers, by increasing the quality of product produced and in reducing transaction costs. Thus, developing the contract farming practices is another important recommendation from the current study. And as sesame is a smallholder crop; which is produced by a number of farmers at very remote and hardly transported places, infrastructure investments are also needed and recommended to encourage farmers in production of such high value-export potentials crops in the country.
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Annex A: Survey Questionnaire

“Analysis of Smallholder Farmer’s Participation in Production and Marketing of Export potential Crops: The Case of Sesame Crop in Diga District, Eastern Wollega Zone of Oromia Regional State”

Prepared by: Geremew Kefyalew Gobena, Addis Ababa University – School of Economics

Purpose: This questionnaire is prepared to collect data pertaining to production and market participation of smallholder farmers in Diga, East Wollega Zone of Oromia regional state. It will provide a major input for my master’s thesis and it is purely conducted for academic purposes. Therefore, the respondent is kindly requested to provide his/her valid responses to the sets of questions included in the questionnaires. All your responses remain confidential. We thank you in advance for your cooperation.

Woreda/District _________________________________
Peasant association/Sub-district /Kebele_________________________
Got _________________________________
Date of interview _________________________________

A. Household Head Demographic Characteristics

1. Sex: 1=male 0=female

2. Age (in years) ________________

3. Educational level of hh head (in years of schooling) ________________

4. Number of total family members ______________________

5. Number of active household members aged between 15 and 64 years fulltime on farm activity ________________
<table>
<thead>
<tr>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
</tr>
<tr>
<td>0-15</td>
</tr>
<tr>
<td>15-64</td>
</tr>
<tr>
<td>65 and above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of active family members</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
</tr>
<tr>
<td>15-64</td>
</tr>
<tr>
<td>65 and above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of non-active family members</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
</tr>
<tr>
<td>15-64</td>
</tr>
<tr>
<td>65 and above</td>
</tr>
</tbody>
</table>

6. Is your family labour adequate for farm activities? 1= Yes 2 = No

7. Total amount of hired labor for the production year (2003/04) ------------------------

8. Total land holding size (in hectare) _______________________________

9. Land size suitable for sesame production ___________________ (in hectare)

10. Did you involve in land renting activity in 2011/2012 production year? 1=Yes 2= No

11. If your answer to question #10 is “Yes”, are you:

   1 = Rented out  2 = Rented in

B. Source of Household Income

1. From where did you get income you used to cover all family expenditures?
   1=crop sales 2=livestock sales 3=remittances 4=credit 5= labour sale
   6=others (please specify---------------------------------------------)

2. Would you rank your income sources from major to minor (use the above code): 1st= ______ 2nd= ______ 3rd= ______ 4th= ______ 5th= ______

3. Would you list the major 5 crops you grow currently?

<table>
<thead>
<tr>
<th>Type of crop</th>
<th>Area cultivated (ha)</th>
<th>Quantity produced(qntl)</th>
<th>Quantity sold(quintal)</th>
<th>Price per quintal</th>
<th>Value sold (in Birr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td>3</td>
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<tr>
<td>4</td>
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<td></td>
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<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Livestock ownership

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Cows</th>
<th>Oxen</th>
<th>donkeys</th>
<th>Mules</th>
<th>Sheep</th>
<th>Goats</th>
<th>Poultry</th>
<th>Heifers</th>
</tr>
</thead>
<tbody>
<tr>
<td>N owned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you planned to sell in 2004 E.C?</td>
<td>1= Yes</td>
<td>1= Yes</td>
<td>1= Yes</td>
<td>1= Yes</td>
<td>1= Yes</td>
<td>1= Yes</td>
<td>1= Yes</td>
<td>1= Yes</td>
</tr>
<tr>
<td></td>
<td>2=No</td>
<td>2=No</td>
<td>2=No</td>
<td>2=No</td>
<td>2=No</td>
<td>2=No</td>
<td>2=No</td>
<td>2=No</td>
</tr>
</tbody>
</table>

5. If you get income from sale of crop productions, which crop type you used to sell in the market - most of the time?
1 = food crops  2 = cereals  3 = vegetables  4 = cash crops  5 = fruits

6. Would you rank these crops according to primary crop income sources from major to minor (use the above code)

1st = _____  2nd = _____  3rd = _____  4th = _____  5th = ________

7. What are the major crops produced for market (cash crops) you grow in your area?
1 = --------------  2 = --------------  3 = --------------  4 = --------------  5 = --------------

8. Would you list these according to your level of production participation:

1st = -------------  2nd = ----------------

3rd = --------------  4th = -------------  5th = ----------------

9. Are you a member of any rural cooperatives?  1 = Yes  2 = No

10. Do you have access to credit/loan?  1 = Yes  2 = No

11. Do you participate in non-farm income generating activities?  1 = Yes  2 = No

12. Do you produce sufficient food for your family for the whole year?  1 = Yes  2 = No

13. Traveling time from home settlement to extension services ☐☐☐☐☐ (in minutes)

14. Traveling time from home to farm places ☐☐☐☐☐ (in minutes)

15. Traveling time from home to nearby markets ☐☐☐☐☐ (in minutes)

16. Traveling time from home to nearby rural weather road ☐☐☐☐☐ (in minutes)

17. Do you have production/marketing contracts for any agricultural products with any organization?  1 = Yes  2 = No

18. If you have contract, for what?

1 = cash crops  2 = food crops  3 = livestock  4 = other (specify ____________ )

19. Did you receive advisory services on sesame production?  1 = Yes  2 = No

21. What direction had the farm gate price of sesame shown in these two years? 
   1= increased  2 = decreased  3= remain the sesame

22. Was there any sesame crop failure in any of these years? 1 = Yes 2 = No

23. If yes, what are the sources of such failures? (multiple answers are possible)
   1 = sesame disease  2 = pest infestations  3= long/short rain
   4 = other (specify____________________________)

24. Did you participate in the production of sesame in 2003/2004 (E.C) cropping season? 
   1= Yes 2= No
   (If your answer to Q#24 is “No”, skip to question #37)

25. Land size allocated for sesame in 2011/2012 cropping season______ (in hectare)

26. Which means of land preparation methods you used for sesame production: 
   1= own oxen/donkey 2 = rented oxen/donkey 3 = traditional instruments 4= rented tractors

27. Type of sesame seed used:
   1= traditional 2 = improved

28. From where did you get the seed?
   1= own production  2=Market  3= cooperatives  4 = agricultural offices
   5 =buyer contractor  6 = other (specify____________________________)

29. Amount of sesame seed used as input per hectare ____________ (quantity)

30. Amount of sesame seed used as input per hectare ____________ (in birr)

31. Did you use fertilizer for sesame production? 1= Yes 2 = No

32. If your answer to question #31 is” No”, what is the reason?
   1=No need  2=Not available
   3=No potential to purchase  4=others (specify__________
33. The land you used for sesame production in 2011/2012 production year was:
   1 = fresh land                                             2 = land used for sorghum last year
   3 = land used for maize previous year       4 = land used for Niger seed previous year
   5 = land used for other crop in previous year

34. Are you producing sesame for continuous years in the same land?
   1 = Yes   2 = No

35. If your answer for question #34 is “No” what is the reason?
   1 = due to decrease in productivity  2 = cannot grow sesame  3 = other__________

36. What do you think to be done to improve productivity of sesame?

37. If your answer to question #24 is “No”, what are the main reasons that limit you from production of sesame?

<table>
<thead>
<tr>
<th>s.no</th>
<th>Possible reasons</th>
<th>1=serious problem</th>
<th>2=Minor problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decreased productivity of sesame from year to year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lack of improved sesame seeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fear of crop failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Shortage of land</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Poor soil fertility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Fear of market related problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Lack of awareness about its importance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Shortage of input supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Fear of food shortages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Other unlisted problems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
C. Marketing Aspects:

1. Quantity of sesame produced in 2004 E.C ___________ (in quintal)
2. Quantity of sesame marketed ____________ (in quintal)
3. Quantity of sesame consumed _____________
4. Quantity of sesame saved for seed ______________
5. Time of sale:
   1= immediately after harvest  2= after a month  3= after two months
   4= after three months  5= after four months  6 = after five months/later
6. On which month you usually prefer to sell your sesame produce?
   1=December  2=January  3=February  4=March  5=April  6=May  7=others
7. How did you sale your sesame produce?
   1= directly to the purchaser/traders  2= through brokers  3= others
8. Where did you sell mostly your sesame produce?
   1= local buyers (collectors)  2= Cooperatives  3= traders at primary market
   4= others
9. From whom you get better price? 1= local collectors  2= cooperatives
   3= traders at primary market  4= others (specify____________________________)
10. Is there any problems created by any marketing agents? 1= Yes 2 = No
11. If your answer to question #10 is “Yes”, the problems are:
    1= weight/scale cheating  2= Limit client  3= Charge high brokers price 4= other
12. Did you face difficulty in finding sesame buyers? 1 = Yes 2 = No
13. If your answer to question #12 is “Yes”, is it due to: 1 = inaccessibility of market  2= low price offer 3= lack of price information 4= other

14. Who set your selling price?

1 = yourself  2=market  3= Buyers  4= negotiations  5 =other _____________

15. Did you know the nearby market price before you transport to your sesame to market?  
1=Yes 2= No

16. Did you know Addis Ababa market price before you sold your sesame? 1=Yes 2=No

17. What is the price of sesame per kilogram in your local? ________________

18. What is the price of sesame per Kilogram at nearby market? ________________

19. Do you have a transport access to the nearest market?  1= yes  2= No

20. How did you transport your sesame produce from home to market places?

1 = head/back loading  2= pack animals  3 = Vehicles  4 = other (________)

21. Do you have access to market information?  1= Yes  2= No

22. From where did you get market information?

1= local traders  2= neighbor  3= cooperatives  4=media  5= other___________

23. Are you confident enough in your buyer?  1=Yes  2=No

24. What are the major costs you incur in selling your sesame?

1. Transportation cost__________________________ (birr per quintal)

2. Packaging Cost_____________________________ (birr per quintal)
3. Threshing and cleaning cost____________________ (birr per quintal)

4. Costs while waiting at the market _______________ (birr per quintal)

5. Others ________________________________ (birr per quintal)

25. Have you ever had any marketing contracts with commercial buyers of sesame?
   
   1 = Yes  
   2 = No

26. What is the amount of total income you earned from sesame produce?
   
   1. 2003 E.C_______________  2. 2004 E.C ______________

27. What is the farm gate price of sesame per kilogram last year-2003 E.C? ________(in birr)

28. Did you considered this price when you decide to produce sesame in 2003/2004 E.C crop season?  
   
   1 = Yes  
   2 = No

29. What is your prediction about the coming year sesame price? 1= increase
   
   2= decrease  3=remain constant 4 = no idea

30. If you have any comment please list here:_________________________________
Key Informant Interview with Agriculture and rural development experts

Prepared by: Geremew Kefyalew Gobena, Addis Ababa University- Post Graduate school

Purpose: This questionnaire is prepared to collect data pertaining to production and market participation of small scale farmers in Diga, East Wollega Zone of Oromia. It will provide a major input for a master’s thesis research purely conducted for academic purpose. Therefore, the respondent is kindly requested to provide us his/her valid responses to the sets of questions included in the questionnaires. All your responses remain confidential.

We thank you in advance for your cooperation.

A. Personal background

1. What is your job responsibility?

2. How long have you served in this sub-district/tabia and in what capacity?

B. Production, Marketing, and Farm Characteristics

1. What is the primary means of livelihoods for the people in this District/Tabia/sub-District?

2. What are the main food and cash crops grown in this District/Tabia/sub-district and why?

3. What services and assistance do the farmers get from your office?

4. What efforts are done to integrate the smallholder farmers with the market? What are the challenges and opportunities at their disposal?

5. What are the major non-farm activities farmers in your District/Tabia/sub-district mainly engaged in?

6. How many hectare of land is potentially suitable for production of sesame in your zone/Wereda/Tabia?

7. What portion of land is allocated for the production of sesame currently?

8. Who is the primary buyer of the commodity from the farmers?

9. Are there any marketing cooperatives in this District/Tabia/sub-district?

10. If so, is sesame product traded through these coop
### Annex B: Tobit regression Result

<table>
<thead>
<tr>
<th>SESPROD11</th>
<th>Coef.</th>
<th>R.S.E.</th>
<th>t</th>
<th>P&gt;t</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LANDCULT</td>
<td>1.824435</td>
<td>.2511336</td>
<td>7.26</td>
<td>0.000</td>
<td>1.324941, 2.32393</td>
</tr>
<tr>
<td>FAMLAB</td>
<td>0.0835053</td>
<td>.0575917</td>
<td>1.45</td>
<td>0.151</td>
<td>-.0310423, .1980528</td>
</tr>
<tr>
<td>CREDIT</td>
<td>0.0928168</td>
<td>.1249004</td>
<td>0.74</td>
<td>0.460</td>
<td>-.1556051, .3412387</td>
</tr>
<tr>
<td>EDCN</td>
<td>0.0222199</td>
<td>.0234204</td>
<td>0.95</td>
<td>0.346</td>
<td>-.0688022, .0243624</td>
</tr>
<tr>
<td>SEX</td>
<td>-0.3604582</td>
<td>.1688886</td>
<td>-2.13</td>
<td>0.036</td>
<td>-0.6963708, -0.0245457</td>
</tr>
<tr>
<td>PRODTTY</td>
<td>0.3412021</td>
<td>.0739731</td>
<td>4.61</td>
<td>0.000</td>
<td>0.1940726, 0.4883315</td>
</tr>
<tr>
<td>EXPERNCE</td>
<td>0.2954474</td>
<td>.116648</td>
<td>2.53</td>
<td>0.013</td>
<td>0.0634393, 0.5274556</td>
</tr>
<tr>
<td>OXEN</td>
<td>0.0302356</td>
<td>.0481351</td>
<td>0.63</td>
<td>0.532</td>
<td>-.0655032, 0.1259743</td>
</tr>
<tr>
<td>cons</td>
<td>0.8704543</td>
<td>.2374148</td>
<td>3.67</td>
<td>0.000</td>
<td>-1.342663, 0.3982458</td>
</tr>
<tr>
<td>/sigma</td>
<td>0.5419139</td>
<td>.0617221</td>
<td></td>
<td></td>
<td>0.4191512, 0.6646766</td>
</tr>
</tbody>
</table>

Number of obs = 91

F(8, 83) = 23.19  Prob > F = 0.0000
Log pseudolikelihood = -73.37242  Pseudo $R^2$ = 0.4601

Obs. summary:

- 29 left-censored observations at zero value of SESPROD11
- 91 uncensored observations
- 0 right-censored observations