Mekelle University

College of Business and Economics

Department of Cooperative Studies

Exploring Fruit Market Potential of Tigray, Northern Ethiopia

By:

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Submitted in Partial Fulfillment of the Requirements for the Award of Master of Arts Degree in Cooperative Marketing

Principal Advisor: Abebe Ejigu (Asst. Professor)

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EXPLORING FRUIT MARKET POTENTIAL OF TIGRAY, NORTHEN ETHIOPIA

A Thesis submitted to the Department of Cooperative Studies

In Partial Fulfilment of the Requirement for the Degree of Master of Art in Cooperative Marketing

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Mekelle University

DECLARATION

This is to certify that this thesis entitled "**Exploring Fruit Market Potential of Tigray, Northern Ethiopia**" submitted in partial fulfilment of the requirements for the award of the degree of MA., in cooperative marketing the College of Business and Economics, Mekelle University, through the Department of cooperative studies, done by Mr.Yikunoamlak Teklebirhan,Id.No.013/PGS/01is an authentic work carried out by him under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Name of the student Yikunoamlak Teklebirhan Signature & date _____

Name of the supervisor Abebe Ejigu Signature & date _____

DEDICATION

I dedicate this piece of work to all who assist me to accomplish this work.

STATEMENT OF THE AUTHOR

I hereby declare that, this work is my own finding and all those source materials used in this study were duly acknowledged by the author under each part. This thesis has been submitted to Mekelle University, Business and Economics College impartial fulfilment for the requirement of MA degree in cooperative Marketing. One copy of the Thesis is submitted to university library to make it easily available for researcher and user as of the university library rules and regulation for borrowing and use.

Besides, this thesis work is not allowed to be submitted to any institutions wherever it is as accreditation for requirements of any qualifications. However, brief quotations are permitted without special request from the author or university provided that work is duly acknowledged.

BIOGRAPHICAL SKETCH

The author was born on June, 1981 in Tigray National regional state, Southern zone of Tigray; Korem He attended his Primary and Secondary school at Korem town. He Joined then Mekelle University on 2003/2004 academic year and completed his undergraduate studies with Business Management Degree in July, 2006.

Before and after graduation he was employed at Mekelle University as research assistant for Belgian and Ethiopian PHD students and currently he is working at MU-IUC project with the same position. One year after graduation of BA degree in Management he joined the School of Graduate Studies at Mekelle University in 2008/2009 academic year to pursue his post graduate studies in the field of Cooperative Marketing.

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List of Acronyms

ADLI	Agricultural Development Led Industrialization
CSA	Central Statistics Agency
DA	Development Agent
DESCI	Dedebit Saving and Credit Institution
EHDA	Ethiopian Horticultural Development Agency
EHPEA	Ethiopian Horticulture Producers and Exporters Association
FAO	Food and Agriculture Organization
FFV	Fresh Fruit and Vegetable
FTC	Farmers Training Centre
GDP	Gross Domestic Product
Ha.	Hectare
Hrs.	Hours
KM	kilometre
m.a.s.l	meters above sea level
mm	mill meter
MoARD	Ministry of Agriculture and Rural Development
NGO	Non Governmental Organization
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
No	Number
OARD	Office of Agriculture and rural development
PASDEP	Plan for Accelerated and Sustained Development to End poverty
REST	Relief Society of Tigray
STDEV	Standard Deviation
SNNPR	Southern Nation and Nationality of people Region
SPSS	Statistical Package for Social Science
SIDA	Swedish International Development Cooperation Agency
TFF	Tigray Fruit Forum
VIF	Variance Inflation Factors

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Abstract

To improve the livelihood of farmers, different agricultural interventions have been done under federal and regional Governments. The current government has given more emphasis on improving agricultural productivity in the past decades by supplying new agricultural inputs and technologies, new agricultural system and extension services thereby improve the livelihood of farmers and to increase the GDP of the country. Under the sub sector of agricultural activities, horticulture contributes a significant amount to the livelihood of farmers. This research is conducted on fruit market potentials of Tigray region with the objectives of identifying the potentials of fruit for market and identifying major problems and opportunities in fruit production and marketing, identifying the major type of fruits that are produced in Tigray, to assess the fruit market channel in the region and to assess the income contribution of fruit at household economy. To accomplish this study both primary and secondary sources of data were used. Primary data were collected from sample farmer respondents using structured questionnaire. The farmers (producers) sampled in this study were those who are engaged in fruit production and marketing. A total of 274 samples were selected in these sample districts. Data analysis was carried out using descriptive statistics and econometric model. As the result of the descriptive statistics revealed that among the total sample 42.34%, 41.30% and 10.6% of respondents have an experience on fruit growing 1 to 5 years 6 to 10 years and 11 to 15years respectively. The remaining 4.1 and 1.5 % of the respondents have an experience of 16 to 20 and more than 20 years. In regard to fruit production and marketing poetical of the producer the result shows that out of the total sample producers, 183 (65.6 %) of them produce orange an average fruit amount of 460.9kg and 129 (47.1%) and 125 (45.62%) Produce Guava and Banana with the amount of 407.4kg and 221 kg respectively. Furthermore, of the total sample 16 (5.8%) sample respondents produce apple an average amount of 66.7 kg. From the total amount of fruit production farmers supply to the market is 85%.The result also revelled that 37.38% of the average household income is from fruits. Therefore, as fruit contributes more in the households' livelihood, improving the quality and, productivity and the market situations are among the important intervention areas by the development agents and other partners.

CHAPTER ONE

INTRODUCTION

1.1Background of the study

Ethiopia is situated in the Tropics, but as a result of the significant altitude differences, it is possible to distinguish different climatic zones: such as a temperate zone (>2400 m.a.s.l.) with average day temperatures between 0 – 16 °c.; a sub-tropical zone (1500 – 24000 m.a.s.l.) with average day temperatures of 16 – 20 °c; a tropical / arid zone (< 1500 m.a.s.l.) with average day temperatures of 27 °c or higher (EHDA, 2011); and a country with a surface area of 1.2 million square kilometres of which approximately 45% is arable (Tsegay, 2010).

Due to this, agro-ecologically diverse and many parts of the country are suitable for growing temperate, sub-tropical or tropical fruits. Substantial areas in the southern and south-western parts of the country receive sufficient rainfall to support fruit production adapted to the respective climatic conditions. In addition, there are also many rivers and streams which could be used to grow various fruits (Kahsay et al., 2008).

Like most sub Saharan African countries, Ethiopian economy is dominated by the agricultural sector. The Ethiopian economy depends to a large extent on the agricultural sector which accounts for nearly 50% of the Gross Domestic Product (GDP), employing more than 80% work force and more than 50% of export items (Frank, 2007). In general, the agricultural sector consists of numerous scattered small farmers at subsistence level and relatively few commercial producers and exporters. As part of agricultural sector, fruit and vegetable cultivation is certainly not a new activity in Ethiopia as the production of horticultural crops has been undertaken for decades. In addition, there are numerous small producers growing a small range of vegetables for the local and regional export market. Of the total land under cultivation fruit and vegetable cultivation (including potatoes and other roots and tuber crops) in Ethiopia amounts to around 800 thousand hectare; this is around 5% of cultivable lands (Frank, 2007).

Out of the total land area, 60 % is suitable for production of fruits, vegetable, cereals and other agriculture products. Nearly 4.3 million hectares of land has access to irrigation, however, only

4.4 % is currently in use; even though the out put is not satisfactory, the country has good opportunities from this sub sector (MoARD, 2007). As report of CSA (2008) shows in Ethiopia of the arable land, more than 47 thousand hectares are under fruit crops. Bananas contributed about 60.56% of the fruit crop area followed by Mangoes that contributed 12.61% of the area. Nearly 3.5 million quintals of fruits was produced in the country. Bananas, papaya, mangoes and orange took up 55.32%, 12.53%, 12.78% and 8.35% of the fruit production, respectively (CSA, 2008). The major fruits and vegetables growing areas of the country are East Hararghe (eastern part of the country), East Shewa (Central Ethiopia in Oromia Regional State West Shewa (central Ethiopia in Oromia Regional State Arsi (central Ethiopia in Oromia Regional State), particularly in the Awash River Gamo Goffa (Southern Nations, Nationalities and Peoples Regional State), particularly Woliata and Sidama zones, are good producers of banana, avocado, pineapple, papaya and other types of fruits and vegetables in various districts. Whereas, Dire Dawa and Harari (eastern Ethiopia) and lastly Amhara and Tigary regions are the least fruit and vegetable producers (Sisay, 2004 as cited Rolien and Jager, 2007).

Current agricultural policy of regional state of Tigray in line with national agricultural policy called agricultural development led industrialization (ADLI), various efforts are under way to implement it. To attain these, Tigray regional state government and non government organization are using different means on water harvesting mechanisms to improve the crop productivity such as constructions of earth micro dams, river diversions, deep and shallow hand- dug wells and low cost labour intensive rain water harvesting ponds are implemented to enhance agricultural production and productivity through irrigation since the year 2002 (kassa etal , 2009).

ADLI, Policy with its focus on the development of smallholder agriculture as critical to transforming Ethiopia's agrarian economy into a modern one through deeper linkages between agriculture and industry (Eyob T. 2007).

The overall impact of smallholders' engagement in horticulture production would primarily manifest through improvement in living condition of the rural communities in terms of better income, better housing, better health, access to education and food security (Tilaye ,2010).

Currently, production level of fruit crops is increasing gradually in the region. Farmers become interested to produce fruits in their garden, small and large farms. Use of fresh and processed fruits increased considerably. The demand for improved planting materials and production technologies is growing at alarming rate. In the earlier times, fruit crops were found only at the gate of hospitals. These days one can witness the change by observing the fresh fruit and juice shops mushroomed in big towns, cities and even rural districts at every corner. Consumption demand for fruits (especially exotic species) is certainly keeping pace and probably out-striping the increase in supply and consumers are willing to pay whatever they are asked for the available products (kassa et al ,2009).

1.2 Statement of the Problem

According to Sisay (2004) among the Ethiopian regions; Amhara and Tigary are the least fruit and vegetable producer regions. Especially, in Tigray region fruit and vegetable production is less compared to other regions. For the past decades most fruits are 'imported' from other region in the country. Currently, the government of Ethiopia is providing due emphasis on irrigation; and adoption of new agricultural technology as a result, the region has shown progress in fruit production and farmers are trying to supply fruit to the market but their contribution is insignificant in satisfying the existing fruit demand in the region.

Due to the fact that the fruit production in the region is very low, identifying those factors that impede fruits production, productivity and market potentials in the region will enable to come up with valuable information to policy makers and other stakeholders. To fill this gap, investigating the overall potential of fruit market in the region is essential for further development of fruit production and market. Hence, the current research aimed to access opportunities and challenge of fruit production and marketing in the region.

1.3. Objectives of the Study

General objective

The general objective of the study was to assess the potential of fruit for market and to assess the livelihood contribution of fruit income to the rural households.

Specific objectives:

- To identify major problems and opportunities in fruit production and marketing.
- To investigate the potential of fruit production in the region
- To identify the major type of fruits that are produced in Tigray
- To assess the fruit market channels in the region
- To assess the income contribution of fruit to the rural household economy

1.4 Research questions

1. What are the major constraints and opportunities in fruit production and marketing in the region?
2. What does the demand and supply of fruits look like in the region?
3. How is fruit marketing chain in the region organized?
4. What is the impact of fruit production in the rural household livelihood?
5. Why is fruit production low in the region?
6. What are the marketing channels and market arrangement for those who produce and supply to the market?

1.5. Scope of the Study

The area coverage of the study was under Giba catchment by selecting three districts and one district out of the catchment. Giba catchment is one of the biggest catchment in the region which covered 7 districts and it is a tributary to Tekeze River. This catchment is a representative of all agro ecology of the region. Under this catchment Kilteawlalo, Degua Temben and Kola tembain were selected; the fourth district is selected out of the catchment which is found in the southern part of Tigray, Alemata district. In addition to this, Mekelle city is under the study area to see the fruit market, market channel, demand and supply of fruit. A household survey was conducted on these four districts. From each district one to three kebeles (the lowest local administration) were selected. The study emphasized on general fruit market potential of Tigray region by assessing

the opportunities and challenges of fruit production, demand and supply of fruit market, to assess the chain of fruit market, and trends of fruit production and marketing of farmers. Hence, the results of the study are delimited to this area and other areas whose agro ecological zone is similar to these study areas.

1.6. Significance of the Study

The study collected important information on fruit market potential of Tigray and come up with recommended results. The result of this research would be very useful for different stakeholders such as farmers, traders, governmental policy makers and non governmental sectors who are engaged in fruit production and market development. In addition, this study will be used as a source material for further study**.**

1.7. Limitation of the study

Due to the difference on fruit coverage of each district the sample of each district is not proportional.

CHAPTER TWO

Review of Literature

2.1 Definition Of terms

Fruit

According to Marjorie *(2009)* fruit is defined as unprocessed plant produce which is used for human consumption. Based on the fruit test, hardness, softness, agro ecology and other reason, fruit can be divided as follows and the difference is made between the following kinds of fruits:

Pome fruits: apples, pears, quinces, etc., Drupes: apricots, cherries, peaches, plums, damsons, Mirabelle's, green gages, etc.; Soft fruit (berries): blackberries, strawberries, blueberries, raspberries, blackcurrants, gooseberries, grapes, etc, Citrus fruit: grapefruits, mandarin oranges, Clementine's, oranges, lemons, etc; Exotic fruits: pineapples, bananas, dates, figs, avocadoes, etc. **Hard-shelled fruit**: sweet chestnuts, peanuts, hazelnuts, coconuts, almonds, Brazil nuts, pistachios, walnuts, etc. and Dessert fruit, fruit intended for preserves or cooking, fruit from ecological cultivation.

- Dessert fruit is fruit which, when supplied to consumers, is clean and ripe and normally developed in shape, colour and internal properties and free of blemishes that affect its value for consumption.

- Fruit intended for preserves or cooking is fruit that cannot meet or no longer meets the demands made on dessert fruit but which is suitable for cooking, drying and for other methods of preserving or usage. It may have external blemishes, may not be fully ripe or may be slightly over-ripe, be slightly affected in terms of freshness and storage qualities, slightly shrunk and slightly devalued by unsuitable or excessive storage or by transport damage. Fruit from ecological cultivation may have small external blemishes (Marjorie, *2009).*

Marketing: Marketing is the business function that identifies unfulfilled needs and wants, defines and measures their magnitude and potential profitability, determines which target markets the organization can best serve, decides on appropriate products, services, and programs to serve these chosen markets, and calls upon everyone in the organization to think and serve the customer (Kotler, 2003).

Marketing channel: it is a network of organizations that are involved, through upstream and downstream linkages, in different processes and activities that produce value in the form of products and services in the hands of the ultimate customer (Christopher, 1998).

Demand: it is the rate at which consumers want to buy a product. Economic theory holds that demand consists of two factors: *taste* and *ability to buy*. Taste, which is the desire for a good, determines the willingness to buy the good at a specific price. Ability to buy means that to buy a good at specific price, an individual must possess sufficient wealth or income (Whelan and Msefer, 1996).

Supply: supply is defined as how much of a good or service is offered at each price (Whelan and Msefer, 1996). Buyers and sellers react in opposite ways to a change in price. When price increases, the willingness and ability of sellers to offer goods will increase, while the willingness and ability of buyers to purchase goods will decrease.

2.2 Overview of Fruit sector

Of the total land area of 111.5 million hectares of the country, 66% is estimated to be suitable for agriculture. Of these, 16.5 million hectares is covered by cereals and about 500,000 hectares of land covered by fruits and vegetables (*MoARD 2005).*

2.1. Land cultivated by Fruits in regions in the year 2005-2008 / hectares

S. N	Region	Avocado	Mango	Banana	Lemon	Orange	Papaya	Guava	Pineapple	Total
1	Amhara	26	100	422	300	505	290	109	_	1752
2	SNNP	2571	1987	18864	231	1009	906	142	110	25820
3	Oromia	640	2885	8790	156	1418	1381	727	30	16027
4	Somalia	9	57	85	78	88	14	9	-	340
5	Harari	_	629	_	462	47	_	55	13	1206
6	Benshangul Gumze	_	115	9	_	_	12	115	_	251
7	Tigray	_	_	9	32	31	21	21	25	108
8	Dire Dawa	_	19	4	_	_	36	5	_	64
9	Afar	_	_	45	_	_	21	_	_	66

Source: MoARD (2005)

According to the above table the amount of fruit cultivated in the year 2005 to 2008 at national level, SNNP and Oromia took the highest share with 56.58% and 35.1% respectively of the total cultivated land. Moreover the remaining, 8.32% of the total cultivated land of fruit was covered by other regions; among this Tigray's share is only 0.24% compared to SNNPR and Oromia the amount is very insignificant.

2.3 Fruits sector progress in Ethiopia

Ethiopia has a potential of irrigable area of 3.5 million hectare with net irrigation area of about 1.61 million hectare, of which currently only 4.6 % is utilized (Amer, M.H. 2002, as cited in Kahsay et al,). Despite this potential, however, the area under fruits is very small and mainly smallholder based. According to the Ministry of Agriculture and Rural development (MoARD, 2005), there are about 3 million farmers involved in fruit production with a total area of about 43,500 hectare and producing about 261,000 tons annually(Kahsay et al, 2008).

The policy of the government until recently was also focusing mostly on increased grain production while fruit development was marginalised. Although the number of trained manpower in the area of horticulture was also very small, efforts are underway to increase the number of graduates. The government realised this gap and has created a more enabling environment for the private sector by developing the PASDEP (Plan for Accelerated and Sustained Development to End Poverty). This policy encourages privatization of state enterprises, promotion of commercial production and exports, in which the horticulture sector is a major component. Recently again the horticulture sub-sector has been receiving more attention within the Ministry of Agriculture and Rural Development and is now elevated from a small unit/section to a level of agency. The major limiting factors for the poor performance of the fruit sub-sector are many, including an inefficiently organised system for the production and supply of improved fruit varieties/cultivars (Aithal, and Wangila, 2006).

2.4 Export of Fresh Fruits

Among the Sub Saharan African countries, South Africa, Kenya, Cote d'Ivoire, and Zimbabwe are the leading horticulture exporters. These four countries account for about 86 percent of the fruit and vegetable exports from the region (World Bank, 2004).

Ethiopia's top five horticultural export partner countries in the year 2008/09 were China, Germany, Netherlands, Switzerland and Saudi Arabia. Ethiopia's import partner countries were China, Saudi Arabia, India, Italy and UAE. In the 2009/10 annual budget year, Ethiopia earned around 2 billion US dollars from the export sector among which agriculture constitutes around

80%. The main exportable agricultural products were Coffee, Pulses, oils seeds & spices, Chat and Horticulture produces (Tsegay, 2010). The main fruits exported are citrus, bananas and mangoes. Around 85% of the fruits are exported to Djibouti. The second market destination is the Emirates (EHDA, 2011).

Production and exports of fresh fruits have shown modest growth. The principal types of fruits for which significant volumes are recorded are bananas, oranges and other citrus fruits (tangerines, Clementine's, Satsuma, lemons, mangoes, avocado, and papaya). In terms of volume, domestic production is dominated by papayas (31% in 2003), mangoes (22%), followed by avocado and banana (11 % each). Overall, production growth has experienced only 1 percent growth per annum over the last decade, with a decline in per capita terms. Fresh fruit exports represent overall a very small share of domestic production. Thus, in 2002, exports of the 5 major products represented only 1.24% of domestic production viewed by product; however, the extent of commercialization varies considerably with 26 percent and 12 percent of tangerine/Clementine and orange production going to export, respectively, compared to only 1 percent of bananas. Thus, in contrast to domestic production, the relative importance of different products in total fresh fruit exports changes significantly, with citrus exports dominating in both quantity and value terms. In terms of export values in 2001, orange export earnings represented 63 percent of total earnings (World Bank, 2004).

Table 2.2.Fruit and vegetable export performance (2002 to 2009/2010)

Year	Exported volume(MT)	Exported value('000)	Average value (USD) per ton
2002/03 (1995)	25.3	9.6	397.4
2003/04 (1996)	28.452	6.87	397.4
2004/05 (1997)	37.645	15.971	424.2
2005/06 (1998)	35.294	14.071	398.7
2006/07 (1999)	41.028	16.373	399.1
2007/08 (2000	41.117	18.526	450.5
2008/09 (2001)	44.3	20	451.5
2009/10 (2002)	63,14	30	475.1

Source: EHDA, 2011

The European market for citrus fruits is very competitive and dominated by Israel, Morocco, and South Africa. These results suggest that Ethiopia's opportunities for fruit exports may lie in finding alternative niche products which is best suited to its agro-climatic potential. Second, from a cost consideration, as will be explored in subsequent sections, citrus fruits would not be a strategic priority for a landlocked and large country such as Ethiopia given their bulk. That is, the transport of citrus is largely the transport of water and, as such, erodes Ethiopia's competitive advantage in comparison with the market leaders identified above who are competing on sea rather than inland freight, given their geographic location (ibid).

2.5 Empirical Evidence on Marketing of Fruits and Vegetables

According to kent (2006) in his study on Estimating Market Potential Check-List stated that estimating the market or market potential for a new business or business expansion is critical indetermining the economic feasibility of a venture. Estimating the market potential will determine if the market is large enough to support your businesses. This check-list will address a number of questions that need to be answered before an estimate can be calculated. The cheak listes for estmataing the market potecial are What type of customer will buy the product or service?,Where are these customers located?,How many potential customers are there?,How often do they consume or use it?,What is the Competition?,What are people paying?,What is the Potential for the Market to Develop?and What is my share of the Market?.

As study conducted by Bezabih and Hadera (2007) revealed, the major constraints of marketing of fruit and vegetable includes lack of markets to absorb the production, low price for the products, middlemen dominated marketing system, lack of marketing institutions safeguarding farmers' interest and rights over their marketable produces (e.g. cooperatives), lack of coordination among producers to increase their bargaining power, poor product handling and packaging, imperfect pricing system, lack of transparency in market information system mainly in the export market They added also that, horticulture production is affected by pests, drought, and shortage of fertilizer and price of fuel for pumping. Being the production is seasonal and price is inversely related to supply, that is, at a season when they produce more price will be charged less. Besides they indicated that, farmers bargaining power being low and lack of alternative market outlet become challenges to farmers to market their output. In addition on their study, the main opportunity for increasing horticulture production are increasing market integration, the culture of intensive crop production, farmers are becoming aware about production technologies and improved inputs and the government policy and development strategy.

In addtion the study condacted by Rolien and André (2009)on there study on Business opportunities in the Ethiopian fruit and vegetable stated that from the major challenges of FFV market are non constant supply of fruit and vegetable with limited quantities and high variation in quality, Limited knowledge and availability of the proper varieties with respect to local climatic

conditions and consumer demand, Low quality of locally produced packaging material, Limited capacity of appropriate cold storage capacity, Limited technical know how for production and handling high quality fruit and vegetable for export markets, Limited research and extension programs focused on the export oriented fruit and vegetable sector, moreover Ethiopia has a beneficial climate for growing a wide range of fruits and vegetables throughout the year , having good soil and water conditions , Facilitating government policies, Land lease costs are low and labor is relatively inexpensive and productive, favorable geographical location, Increasing in Demand are from the major opportunities for this sector.

As well as Tassew (2007) in his study on Econometric analyses of horticultural production and marketing in Central and Eastern Ethiopia In attaining the shift in household resource use from subsistence towards commercial agriculture, the role of well functioning markets is substantial. Particularly under the absence of cooling and storage facilities, markets for horticultural products need special attention due to the perishable nature of these products. The level of transmission and accessibility of market price information could affect the bargaining position of horticultural producing farmers. Besides the bargaining position, the availability of alternative market outlets can also influence farmers' production plans.

According to World Bank (2004), there were at least three supply chains existing for horticulture products in Ethiopia. These are domestic, regional and European supply chain depending on the destination market and type of product. In the case of domestically traded fruits and vegetables, the supply chain involves supply from the large state-owned commercial farms, such as Upper Awash, Horticulture Development Enterprise, Metahara Sugar, and North Omo Agricultural Development Enterprise to Etfruit, the state-owned distribution enterprise. The Ethiopian Fruit and Vegetable Marketing Enterprise (Etfruit) was established in 1980 under the former Ministry of State Farms Development, the Horticulture Development Corporation with the aim of serving as a marketing organ for all state owned horticulture farms. Although 90 percent of its procurement is from state farms, Etfruit is also supplied by small private farms. In terms of its own distribution, Etfruit has developed its distribution canters and branches and is today present in 10 major towns of the country, where it supplies 40 percent of its supply and in the city of Addis Ababa, where Etfruit has three main branches, twenty-one retail shops and thirty mobile

shops strategically placed to render efficient service. Etfruit distributes to both wholesale outlets (75 percent) and its own retail units (25 percent).

In the case of exports to the region (Djibouti, Sudan), the supply chain extends from smallholder producers to private exporters in a more informal fashion. This market is generally bulky fruits such as bananas, papayas, and pineapples, quality standards are not strictly enforced nor are the products highly perishable.

Finally, in the case of exports to the European market, where food safety and product quality issues are paramount, and the supply chain is somewhat complex. It involves the state farms who export directly to Europe, as well as private exporters with their vertically integrated commercial farms, as well as private exporters who export supplies from smallholders. In addition, the private commercial farms also work with out grower schemes for a proportion of their produce. Finally, Etfruit is also still a direct exporter although it is no longer a monopoly exporter, as in the past.

Hence, this study will try to investigate on market potential of fruits in Tigray by considering production, market supply, supply constraints, market demand of fruits, level of farmers participation in fruit market and marketing chain of fruits in the study area;

CHAPTER THREE

Data and research methodology

3.1 Description of the study area

Location

The National Regional State of Tigray is one of the Sates of the Federal Democratic Republic of Ethiopia and the total area of the region is about 53638 square kilometres. Tigray is located in the northern part of Ethiopia. It borders the state of Eritrea in the north, the Sudan Republic in the west, Amhara Region in the South and Afar Region in the East. Tigray is divided in to 6 administrative zones and it has 47 districts and nearly 800 tabias.

Demographic features

According to CSA (2008) the total population of the region is estimated about 4,316,988 and out of this 3,472,948 population live in the rural area and the reaming 844,040 in the urban area. This shows that nearly 80% of the total population live in the rural area and the reaming 20 % live in the urban.

Economy

The economy of Tigray is almost entirely agricultural with small holder cultivation of cereals and pulses mainly characterized by subsistence farming mixed with livestock rearing. Oxen are the only source of traction power and among the main indicators of poverty and inequalities among farmers. Ownership of oxen is very crucial as the land has to be ploughed many times and crops sown at the right time. Agriculture is almost wholly dependent on the Kiremt rains (from June to September) with very few areas in the south getting short Belg rains (between February and April). Out of the potential irrigable land of about 300,000 hectares, only 4600 hectares is under irrigation (Chekol, 2008).

Land use productivity

The average size of land available to a four-person household is about 0.5 hectares, too small to support the family on agricultural production alone. The average production of cereals, the major agricultural out put is 5-7 quintals (10 quintals = 1 ton) per household in the drought prone areas and this level of staple cereal production can only feed a family only for 5-8 months a year at best (Chekol, 2008).

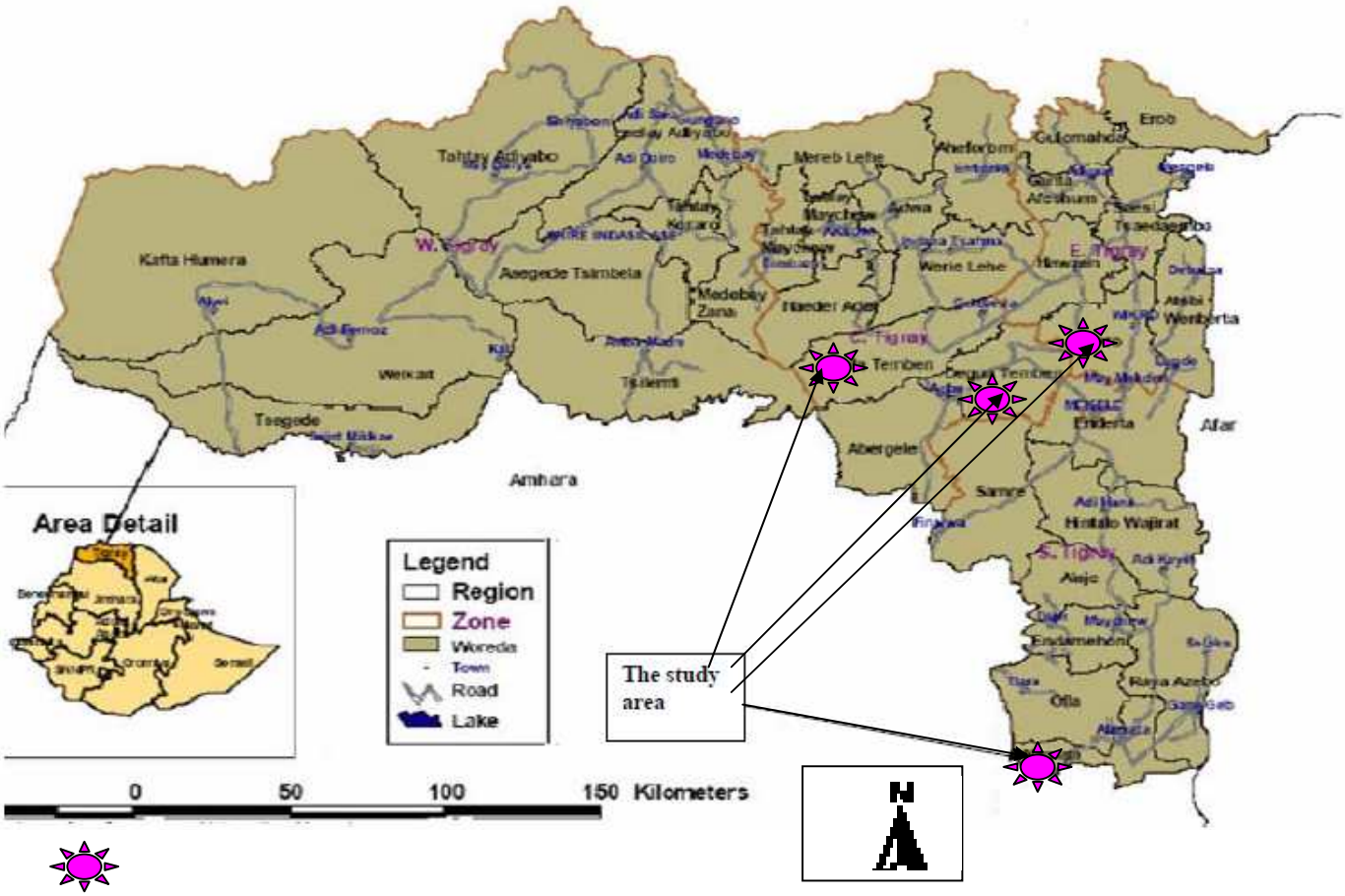
Topography and climate

The topography of Tigray contains the three main traditional divisions of arable: the *kolla* – lowlands (c1400-1800 meters above sea level) with relatively low rainfall and high temperatures; the *woina dega* – middle highlands (c1800-2400 m.a.s.l.) with medium rainfall and medium temperatures; *dega* – highlands (c2400-3400 m.a.s.l.) with somewhat higher Rainfall and cooler temperatures. Most of the eastern half of Tigray has a single rainy season (*meher*) giving a length of growing period (LGP) for crops of less than 120 days duration. The south has the shorter *belg* rains too, bringing the LGP up to 200+ days, favouring both short and long-cycle crops and even allowing two harvests on the same field, e.g. teff followed by chickpeas. The western lowlands have a single rainy season, which is appreciably longer that that of the east, favouring long cycle crops, especially sorghum (MoARD, 2009).

There are high mountainous areas especially in the south and the northeast, with one southern peak at 3925 meters. The typical agro-ecology for much of the rest of Tigray is middle highland, whether as undulating plain or hillier terrain favourable to a large mix of crop types, varying in emphasis according to localized conditions of exact elevation, soils and rainfall. The food crops include the preferred but expensive teff, sorghum of different species, wheat, barley, finger millet, and field peas, and chickpeas. Wild cactus is an important and spreading resource as both fruit for human consumption and fodder for cattle (MoARD, 2009).

The study was done on Four Zones of Tigray region by selecting four districts in regard to their fruit potentials. The district's are named Alemata (southern zone), kilte-Awlalo, (Eastern zone), Degua Temben (South -eastern zone), and Kola Temben (Central zone).

Figur3.1.Map of Tigray Region



District 1 (Alemata)

Alemata district is one of the study area that characterized by bimodal rainfall with an average annual rain fall of 663 mm and the average annual temperature of 29.7 ^{0}C with the Maximum and 14.6 ^{0}C the minimum averaging 22.2 ^{0}C . The dominant crops produced in the district are mostly cereals, pulses and oil seeds, of the cereals sorghum, teff, and maize takes the largest portion of production (Adugna, 2006). Raya Azebo and Alemata district have the most potential belt for the development of exportable fruits, vegetables, herbs and spices (EHDA, 2011). The

major types of horticultural crops growing in the district are onion, tomato, green pepper from vegetables and papaya, banana, avocado, guava and lemon from fruits.

To maximize the production of fruit, one fruit nursery was established since 1985E.C, and in the past years the nursery is propagating different fruit tree such as guava, orange, avocado, mango, papaya and lemon. Currently the nursery propagates total of 25,000 mango seedling supported by FAO and OARD of the District, 2011. Total population of the district is 75,318 with a total of 23,362 Household Head which mean an average family size of 3.22.

District 2 (Kilte Awlealo)

The second study area is Kilte Awlealo situated some 45 km south of Mekelle in 14° of south and 40° east. Temperature of the district is 17 -23 °c and annual rain fall is 300-450mm. Altitudinal range of the district is 1900 -2460 meter. Number of house hold in the district is 22,142 and the total population of the district is 111,546 male 54,545 and female 57,001.The total area of the district is 105,758ha Cultivated land 21,620.he out of this 170he Irrigated land, Area closer 44,134ha, Hill and gulley 28,073.13 and Grazing land 7930.85 and Average land holding size at house hold level is 0.6ha (OARD of the District, 2011). The district is known in honey production and good in irrigation activities with a total of 170ha of land is cultivated. The major crop growing are cereals such as wheat, barley, maize and from legumes grass pea. The fruit coverage of the district is 12,304ha of land with a total beneficiary of 12,304(Male 10381 and Female1923). The main fruit type growing are Guava, Avocado, orange, and mango. To improve the fruit production two fruit nurseries establish in the year 2010.

District 3: (Kola Temben)

The third study area is Kola Temben: Total population of the district is 148,282 (male73, 873 and female 74,409) Projected from 1999 E.C. From this a total of 30388(male 23197 and female 7191) are house hold head with an average family size of 4.88. Altitudinal range of the district is Kola 58% W/degua 41% and Degua 1% with the range of 1400 to 2400 metre. Average rain fall and temperature is 500 to 800 mm and 25 to 30 ^{0}C respectively. As the majority of the area is dominated by kola (low land) Maize, T*aff*, and Millet are the most common crop growing in the district. The fruit coverage of the district is estimated 180 ha of land with a total of 4500 farmers are producing different type of fruit. The type fruit growing in the district are orange, mango,

avocado, papaya, citron, guava and lemon. The orange production in the district is the highest production and different traders supply to different market places. In 1985 E.C RSET office begins to introduce and distribute different type of fruit tree to the district. Before, the office is started to distribute some farmers producing few type of fruit and such us citron and lemon. To maximize the fruit production in the district one fruit nursery site was establish in 2002. Currently the nursery propagates a total of 2000 seedling of avocado and mango.

District.4 (Degua Temben)

The fourth Study area is Degua Temben which is found 50km west of Mekelle, capital city of Tigray region. The district is situated at an altitude of 2650 m and the average annual rainfall is 778 mm, concentrated in a few months (Jan Nyssen et al, 2003)**.** Economic activity of the district is integrated rain fed annual crop and livestock production. Pulses and cereals are the major crops (Segers, 2010). From the major cereals and pulses wheat & h*anfets* (a mixture of wheat and barley), lentil and Faba bean area the most dominant crop growing in the district. White honey is one of sources of income for many farmers. Regarding to the fruit production as the area is dominated by a highland, one of the high land fruit, Apple is found in some sub-district and cactus growing and supply to the market in bulk from June to August (OARD of the District, 2011). Cactus has so far been neglected. But it is a very useful plant; It can be used as food, fodder for animal and it prevents soil erosion. This should be promoted (FAO, 2009).

Average arable land size estimates for Tigray, ranging from 0.5 to 1 ha per household, are indeed below estimates for the country as a whole (Jayne et al., 2003) the district has a total of 19,472ha cultivated land with average land holding size of 0.6 ha. The total population of the district is estimated 119,202 with a total of 24,565 house hold head which mean an average family size 4.85.

3.2 Sampling Method

3.2.1 Data collection and source of data

Data was collected from primary and secondary sources. Primary data sources incorporate the fruit market potential, production trend, contribution of fruit for livelihood and factors that affects the fruit income. In addition to this information related productions constraint and fruit market

chain was collected. Besides, secondary data were collected on the population of the districts, average land size, fruit nursery and irrigation amount and other relevant information.

3.2.2 Primary source

Household surveys were administered in four zones of the region by selecting 4 districts. Two days training was given to 14 data enumerators and May, 24 to June 05, 2011 the data was collected. Primary data were collected from sample farmer respondents using structured questionnaire. The questionnaires were tested on selected respondents before full scale survey and on the basis of the results necessary modifications were done. In addition to this primary data collection method stated so far, focus group discussion were held with fruit producing farmers on fruit market chain, constraints faced market chain and opportunities.

3.2.3 Secondary source

Secondary source of information were collected from relevant documents of regional Bureau of agriculture, Federal and regional report documents, CSA, publications, policy documents and other relevant documents.

3.2.4 Sampling

Determining sampling is a complex task and involves much clarity with regard to the balance between the resource obtained and number or accuracy or information obtained. Sampling is one the very important aspect of marketing research .From a general perspective sampling it involves selecting relatively sample number of elements(characteristics) from a large defined group of element and expecting the information gathered from the small group of element will provide accurate judgment about the large group of the population (paurav, 2008).

3.2.4.1 Sampling method

Producers

Table 3.1 Total number of fruit producers in the district and sample size

zone	District	Tabia (sub district)	Sample from each tabia	Percent	Total sample	Percent
Southern	Alemata	Gerjalea	35	12.77	80	21.53
		Timuga	12	4.38		
		Selam nkalsi	12	4.38		
Eastern	KilteAwlealo	Genfel	28	10.22	59	29.2
		Adi kisandik	20	7.3		
		Abreha Weatsebeha	32	11.68		
South-eastern	Kola Temben	Adiha	123	44.89	123	44.89
Central	Dega Temben	Seret	12	4.38	12	4.38
Total			274	100	274	100

The farmers (producers) sampled in this study were those who are engaged on fruit production and marketing. To select the sample size multistage sampling was employed. In the first stage from the four zones four districts were selected purposively on their potential of production and marketing of fruits. Following from each district a number of 1 to 3 tabias (the smallest administrative unit) was selected based on the potential of fruit production. Based on this a total sample of 123 was taken from Kola Temben district. The district is one of the potential areas of fruit production and the tabia selected was Adha. From the list of 250 fruit producer of Adha tabia by selecting randomly an (odd numbers) of 125(50%) sample households was selected and among thus two respondent were not replied the questionnaire and a total of 123 sample respondents ended selected at this tabia.The remaining 3 district as the number of producers was

few in number and manageable by using census method a total of 59, 80 and 12 sample of households were taken from Alemata, kilteawmalo and Degua Temben districts respectively.

Trader's sample

Traders for interview were selected randomly and asked using checklists. The total number of sample traders was 42 of which 12 and 30 are wholesalers and retailers (shop and super markets[1]) respectively. To be specific from the total number of 12 wholesalers were selected from Kilte Awlealo (Wikro), Alemata and Mekelle city2, 2and 8 respectively. And retailers sample were taken from each district Alemata, kilteAwlealo and kola temben 4 sample traders in each and Degua Temben and Mekelle 2 and 16 samples respectively.

3.3 Method of Data Analysis

3.3.1 Descriptive Analysis

Following, the completion of the data collection, data were coded and entered in to statistical package for social science (SPSS version 16) computer software and analyzed and presented in a descriptive way. Moreover, a multiple linear regression model was used to test factors contributing for rural households' income. This procedure is described below.

3.3.2 **Econometrics** Analysis

Multiple Liner Regression Model was used to identify factors influencing the fruit income of the respondent. Data was analyzed by using STATA software Version 10 through the model specified below.

Model specified

$$Y= \beta 0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \ldots + \beta_n X_{ni} + U_i \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

Y - Is the value of the dependent variable (Fruit income of Household?)

[1] *(For this research shop and supper markets are taken as retailers)*

β0 – the intercept that show the average effect on Y if all variables excluded from the model

The parameters β_1, β_2 … βn are the regression coefficients of parameters

i= the i^{th} observation

ε - The total error of prediction (residual).

X_i= f(Sex of House hold head , type of education, Active Family member, size of irrigation land , Village distance from district market. to make it clear based on Gujarati (2004); the model had been rewritten as follows containing both quantitative and qualitative explanatory variables.

Yi= βo+ β1(GEN)Xi+ β2(EDU)Xi+ β3(ACT)Xi+ β4(ACT)Xi +…+ βn Dnxni + Ui...(2)

Where,

GEN=Gender of the House Hold head

ED= Education

AFM= Active family member

D4…Dn = Dummy variables where 1 for existence and 0 non-existence

It is statistically advisable to figure out the existence of multi collinearity problem between continues explanatory variables and degree of associations among the discrete variables prior of running the model. Multicollinearity refers to the existence of more than one exact linear relationship among explanatory variables, and collinearity refers to the existence of a single linear relationship. The issue of multicollinarity may arise due to fact that explanatory variables may have highly liner relationship. Prior to application of the econometrics model to make inference about the variables, all hypothesized variables were tested for existence of multicollinearity problem. The existence of multicollinearity may result in, smaller t-value, the estimated regression coefficient to have wrong sign and high R^2 value. Moreover, it may cause large variance and standard error with wider confidence interval deviation which means the coefficients cannot be estimated with great precision or accuracy (Gujarati, 2004). In this study, to detect the existence of multicollinearity among the continuous explanatory variables, variance inflation factors (VIF) technique was used (Gujarati, 2004). Thus, the VIF can be stated as,

$$\textbf{VIF (Xi)} = \frac{1}{1 - R_i^2}$$

Where;

$R_i^2 =$ It is the multiple correlation coefficients between Xi and other explanatory variables.

The largest the value of R_i^2 will result into higher value of VIF (Xi) which cause higher collinareatiy among the variables. Most of the time as a rule of thumb for continuous variables values of VIF greater than 10 are taken as a signal for the existence of multicollinearity in the model. In the same manner; to test existence of collinearity (degree of association) among dummy variables, contingency coefficient (CC) was computed for each dummy variable. According to Healy (1994), if the value of contingency coefficient is greater than 0.75, the dummy variables have collinearity. The formula used to calculate contingency coefficient look like the following

$$\textbf{CC} = \sqrt{\frac{X^2}{N + X^2}}$$

Where;

CC = contingency coefficient

N= is total sample size

X^2= Chi-square of random variable

3.3.3 Definitions of variables

In identifying the variables that affect the fruit income of farmers the following explanatory and dependent variable are stated.

Dependent variable

Fruit income of the respondent': This indicates the amount of money received from the fruit sold measured in terms of money. It is continuous dependent variable.

Independent (explanatory) variables

1. **Gender of house hold head (GEH): this is** dummy variables, male score one and zero otherwise. The Assumption is the male headed House hold can do more in the effort of agricultural activities to increase fruit production and supply to the market. Hence, it is assumed that male headed house hold can generate more fruit income than the female.

2. **Educational level of members (EDU):** This is a discrete variable and indicates the number of years that the farmers attend formal education. Hence, it is treated as discrete variable where,"1" represent illiterates, 2 Adult education/religious"3" represent 1st cycle,"1" and "4" represent primary 2nd cycle 5 to 8 ''5'' high school '6''high school grade 9 to 10 . '7'' preparatory '8''vocational/collage It is assumed that, as the number of years of fruit produce , attended formal education become high, their access to new agricultural input and market information become more, hence farmers with the high level educations generate more income than less educated one.

3. **Active Family Member (ACT):** this refers Active Family member of house hold have positive influence on fruit production, in farm management and marketing (transporting of fruit, sealing and market information) all these can do with the family member actively participating. Having more Active family member have positive influence in fruit income since more manpower will be available to be used for fruit production.

4. **Farming Experience (FEX)** this is the number of years farmers engaged in Agriculture Activities, the assumption is the more experience that the farmers have on Agriculture the more productive in fruit production. It is assumed to influence positively fruit income of farmers.

5. **Size of Irrigated land (SIL)** this is continues variable, size of irrigated land is Amount of land size Access to water resource. the assumption is the more the size of irrigated land the

probability of plating more fruit tree is high and production amount also increase highly, hence if the production is increase the fruit income also increase this also have a positive influence.

6. **Village distance from district to market (VDT)** this is continues variable which the distance of fruit produce to the district market have an influence on fruit market. The assumption is if producers are far from the district market they couldn't get market access and information this have a negative influence on fruit production and income. Besides, it influences farmers income negatively due to long distance fruits may spoil out before it reaches the market. Hence, these variables affect the income of farmers negatively.

7. **Total Number Of fruit tree under production (TNT)** this is continues variable which total number of fruit tree under production means the amount of fruit tree provide fruit on specific period of time. The assumption is if the amount of fruit under production is high the amount of income also increase, hence the number of fruit tree positively influence the income.

8. **Experience on fruit supply (EXS)** this is continues variable which is years of farmers experience on supplying fruit. The assumption is the more they experience on fruit supply the more they experience in market information, channel and searching good market and price. Hence, the experience on fruit supply has a positive influence on fruit income.

9. **Total Livestock unit (TLU)** this is the amount livestock under the house hold. The assumption is the more they have livestock they can use pack animals for transporting fruit to the market and using manure at the filed as natural fertilize to increase the product . Hence reducing the renting cost of pack animal and adding manure to the farmers filed increase the productivities. Thus; this can have positive influence on the level of income to be generated from fruits.

3.4.4 Operational Definition of Concepts

Fruit income : In this study fruit income is generate from different fruit trees such as banana , orange ,, guava , avocado , mango , Apple citron , lemon and cactus fruit type.

CHAPTER FOUR

Result and discussion

The result and discussion of the thesis is categorized in to production and marketing and it also includes the findings from both farmers and Traders.

This part of the thesis presents the findings and discussion by using SPSS and STATA software version 10 to analyze the factors of fruit income at household level. Presented in this part includes descriptive statistics like mean, standard deviations, simple percentage, frequency, table's and figures significant level were used to show the findings of the study.

4.1 Production

4.1.1 Respondents' demographic and farm characteristics

Table 4.1 Respondent's demographic

List	Description	**Frequency**	**Percent**
Sex			
	Male	240	87.6
	Female	34	12. 4
Total		274	100
Education level			
	Illiterate	125	45.62
	Adult education/religious	53	19.34
	Primary 1st cycle (grade 1-4)	33	12.04
	Primary 2nd cycle (grade 5-8)	36	13.14
	High school (grade 9-10)	22	8.03
	Preparatory/vocational	1	0.36
	College education	4	1.46
Total		274	**100**

Cnt.

	List		
	Family size	Active Family Member	Farming experience
Statistic			
Mean	5. 98	2. 93	25. 3
STDEV	(2.16)	(1. 35)	14. 1

Source, Survey result, 2011

The age of the respondents ranged from 18 to 81 years with a mean of 48. 7. Moreover, out of the total sample respondents, 240(87.6 %), 34(12.4%) were male and female respectively. Hence, it is implied that fruit production is predominated by male headed households. The family size ranged from 1 to 13.While the average family size and active labour forces were 5.98 and 2.93 respectively. In relation to the experience of farmers in farming business is differ among unit of analysis. In line with this the average farming experience is 25.3 with a minimum and maximum of 2 year and 61 years respectively. Farmers with the higher age have higher farming experiences. As depicted in table above 45.62% of the sample respondents were illiterate, 19.3% able to read and write, 12.4% grade 1-4 13.1% grade 5-8, 8.5 % grade 9-10 and the remaining 0.4 and 1.5 % attended Preparatory and collage level respectively.

4.1.2Farm Characteristics

Table**4.2** .Farm Characteristics

Type of land	Land size in ha	percent
Fertile		
Mean	.2618	25.64
Moderate		
Mean	. 2669	26.14
Less fertile		
Mean	. 42062	48.22
Total average land size	1. 0039	100

Source, Survey result, 2011

As Kaajes (2009) indicated all arable land in the villages were categorized as *regwid* (fertile), *machelay* (intermediate) or *reqiq* (infertile), according to the indigenous soil fertility classification. It was then divided in plots (or in some cases in sets of two plots) of equal value,

with the value an aggregate of land quality and size. Next, all plots were distributed in two or three rounds, depending on the village.

As current study result shows, most of farmers in the study areas have a land in more than two parcels (plot). As the above table depict, from the total sample of respondent 164 (25.64%), 182(26.14%), and 222 (48.22%) farmers have a fertile, intermediate and infertile land respectively. This implies that the average land of the study area is dominated by infertile and intimidator soil types this need artificial and natural fertilizer to improve the quality of soil as well to improve the crop productivity.

Table**4.3**.Land holding and size of land

Land size in ha	**frequency**	**percent**
<0.5	54	196
0.51 to 1	113	41.1
1.1 to 1.5	78	28.4
1.51 to 2	26	9.45
2.1 to 2.5	3	1.1
>1	1	0.4
Mean	1 ha	
Stadv	0.47	
Maxim	3.25	
Min	0	

Source, Survey result, 2011

As Chekol (2008) stated, in the Tigray region the average size of land available to a four-person household is about 0.5 hectares, too small to support the family on agricultural production alone. The average land of the respondents in four study areas were 1 hectare with the average house hold size of nearly 6 (5.98). The maximum and minimum land holding by the sample respondents were 3.25 and 0 hectare respectively. Furthermore, those farmers who don't have land are included in the list of the sample due to this farmers produce and involved in the fruit market by renting in land from other farmers. From the total sample respondent 272(99.27%) farms land owned and the reaming 2(0.73%) farmers are land less this implies that if farmers engaged on fruit production the possibility of having their own land is very high.

Land rent in and renting out

Land rental simply adds an extra layer of rights to a piece of farmland at certain specific period. More specifically, a tenant is entitled to cultivate a field in exchange for paying a fee or a share of the harvest, or both, to the land owner or borrower (Kaajes, 2009).

Table**4.4**.Land Rent in and Out

Statistics	Rent in	Rent out	backyard (Own)
	Sample size 121	sample size29	sample sizes 185
Mean	0.6761	0 .5752	0.3093
Stadv	0.5811	0 .4040	0.1933

Source, Survey result, 2011

As table above portray the average farm size of 0.68 ha was rented in by sample respondents far with standard deviations of 0.58 ha among the sample households. Besides, 0.58 ha with standard deviations of 0.4 ha between sample units were rented out. As farmers indicated the major reason behind rent in or renting out their land is total number of oxen they have, man power (active family members), distance of farm land and household income are the major ones. In the year 2010 out of the total respondent 121 (44.16%) had rent in land from farmers and 29 (10.58%) had rent out their land to others.

Backyard

Backyard is the land owned by the farmers near to their homestead this is mostly the first round of farmers land at the time of land distribution. Of the total sample respondent 185(67.5) have a backyard near by their homestead. This is due to when land was distributed; to farmers the basic parameter was taken distributing land to farmers near by the homestead. This helps farmers to be more productive and minimize the distance and other related costs. In regard to this If water is available; for a better management farmer's preference for fruit production is near by their home or at back yard.

4.1.3 Access to irrigation

According to Bryant (2009), Tigray region has a potential of 3220 km² (322000 hectares) having access to irrigation and currently (in 2011) according to BoARD the number has increased to(350,000 hectare with the actual use of 125,000 hectare). Irrigation is very crucial for fruit production. This is due to the fact that the nature of perennial tree (fruit tree) need more water after the rainy season. However, the means of irrigation differs. The study discloses that all respondents have the access to irrigation water for their fruit farms. As the survey result shows from the total respondent 186 (67.88%) use river, 61(22.26%) hand dag wall and 27(9.85%) use pond and dam diversion. This shows those farmers involved in fruit production have possibility of getting any one of the above irrigation system. These in turn can have significant impact on farmers' production of fruits and supply to the market.

Table **4.5** size of land Access to irrigation for fruit tree

size of land in ha	Alemata	Kilte Awlealo	kola Temben	Degau temben	Total	Percentage
	Frequency					
<0,25 ha	29	59	58	12	158	57.66
0,25 to 0,5ha	18	21	65		104	37.96
0,51 to 0,75 ha	10				10	3.65
0,751to 1ha	1				1	0.36
<1ha	1				1	0.36
					274	100
Min	0.01	0.01	0.01	0.05		
max	2.25	0.5	0.5	0.25		
Mean	0.275	0.24	0.22	0.2		

Source, Survey result, 2011

As depicted on the above table an average size of irrigated land used for fruit production is 0. 275 hectares while, the maximum and minimum size of irrigated land was 0.01 and 2.25 hectares respectively. Moreover, 158 (57.66%), 104(37.96%) and 12(4.38%) of sample farmers have irrigated land size of <0.25 ha, >0.251to $\leq$0.5 ha and >0.51 ha. This implies that majority of sample respondent have mini orchard for fruit production. In relation to the total arable land of the total sample respondent (who engaged on fruit production) around 27% of sample respondents' lands were cover by fruits trees.

4.1.4Fruit tree distribution and productivity

Table.4.6 Fruit tree distribution and productivity

S/N	Type of Fruit Tree	District								Total producers[2]	Average fruit tree	% Fruit producer Based on fruit type	No of fruit tree under production	% of fruit tree under production
		Alemata		Kilte Awlealo		Kola Temben		Degua Temben						
		No farmers	Average fruit No	No farmers	Average Fruit No	No farmers	Average fruit No	No farmers	Average fruit No					
1	Banana	42	23.9	26	10.11	81	51.72	5	10.8	154	24.13	56.2	13.86	10.8
2	Orange	39	25.97	72	10.11	121	41.18	2	3	234	24.09	85.4	9.23	38.31
3	Guava	27	8	70	71.98	58	4.89	5	5.4	160	22.57	58.39	19.56	86.66
4	Papaya	47	278.63	33	51.72	40	2.85	3	3.33	123	93.72	44.89	50.17	53.53
5	Avocado	18	16.72	42	4.52	22	4.4	2	3	84	7.16	30.66	1.07	14.94
6	Mango	36	25.94	41	7.7	68	8.36	1	4	146	11.5	53.28	3.81	33.13
7	Apple	0	0	15	6.27	2	4	12	95.66	29	26.48	10.58	10.87	41.05
8	Lemon	39	5.57	15	2.27	91	3	3	2	148	3.21	54.01	2.72	84.74
9	Citron	18	78.3	22	3.64	32	2.87	6	6	78	5.09	28.47	3.47	68.17

Source, Survey result, 2011

Fruit tree distribution

A few number of sample respondents have single fruit tree but most of them grow 2-5 different type of fruit tree. As the above table shows out of the total sample producers, 234 (85.4 %) farmers grow orange, 160(58.39%) and 153 (55.84%) framers engaged on Guava and Banana respectively. Furthermore, of the total sample (9.85%) farmers engaged in apple which is the least in terms of coverage due to agro ecological factor (Apple grows in the high altitudes) and introduced recently in Tigray region than other fruit types which is almost 8 years ago.

[2] *This is the total number of producers in specific fruit type*

Moreover, based on the average number of fruit trees Kola Temben takes the lion's share (51 and 41 average trees of Banana and Orange respectively) compare to other remaining districts in terms of average fruit trees of Banana and Orange. Furthermore, Guava, Papaya and Apple were dominantly planted in Kilte Awlealo, Alemata and Degua Temben respectively. Based on the discussions with district agricultural office experts, the main reason behind these fruit type becomes dominant in these study area was having large size of fruit land ,good agro ecology suitable for specific fruit type, and fruit nursery near by the sites.

Productivity

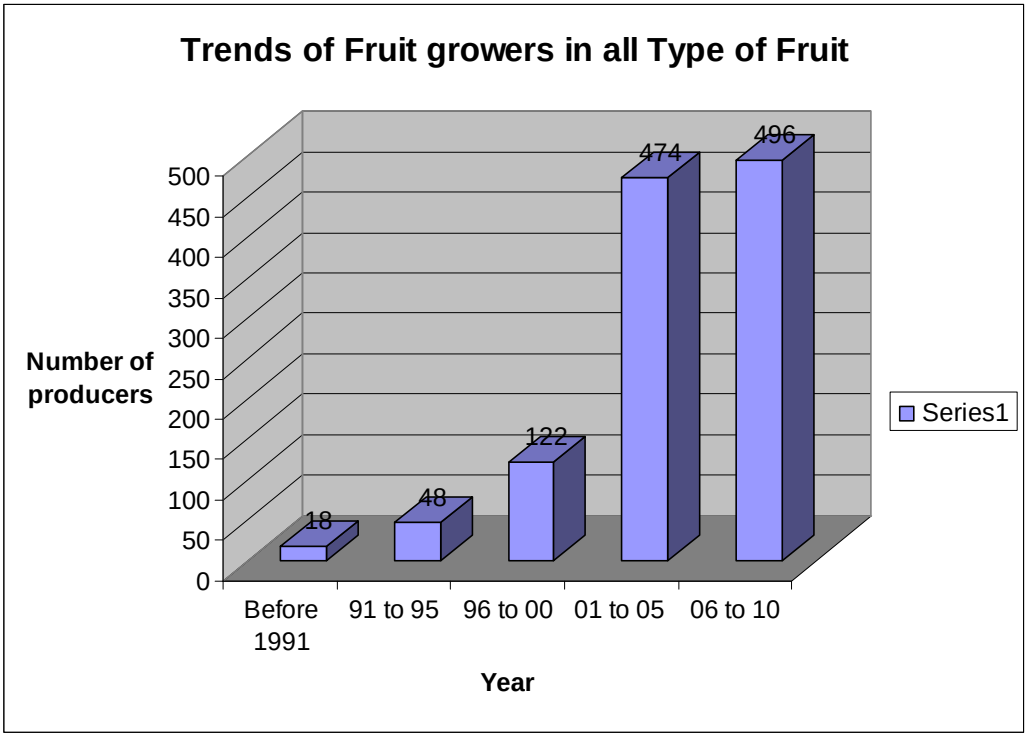
Among the fruit type Banana, Papaya, Guava, Lemon and Citron fruit trees are with the majority of more than 50% in production this is due to the nature of fruit tree can provide fruit with in few years or Fruit tree can be aged and matured to give fruit. Whereas the remain fruit type such as Orange, Avocado, Mango and Apple trees in the farmers filed are productive at less than 50% this is due more fruit trees are cultivated in the past two three years and the type of fruit tree in production year takes longer compare to other fruit tree type.

Of the total number of fruit trees cultivated in the farmers filed 53 % fruit tree are under production and the remaining (47 %) of fruit trees are not matured to produce. This portrays that almost half of the fruit trees are not aged ones and planted in the past one to three years ago. Moreover, this implies that by considering other factors like drought and disease influence kept constant, the fruit trees production will increase by 40 to 45 % in the coming three to four years.

4.1.5 Fruit Producer, Production trend and farmers experience

For the past decades Tigray is known in the production of cactus fruit and in some low land areas lemons and citrus fruit was grown rather than any fruit type. This is due to less water resources, lack of awareness about the fruits grown in Tigray region, shortage of fruit nursery sites and the shortage of improved fruit seedling distribution are the major reasons. After the year of reform since 1991 as the policy of Agriculture was changed and give more attention to agricultural sector to improve agricultural production and productivities; expansion of irrigation and new technology input were introduced from that on wards. Beginning from this era different fruits production in the region increased in number of producers and type of fruit trees as well.

Figure 4.1 Trend of Fruit Growers in all Type of Fruit



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Source, Survey result, 2011

As depicted on the above figure the number of fruit growers highly increased after the year 1991**.** Especially in the past ten years the fruit growers and the type of fruit trees planted by households were increased. The maximum and minimum type fruit grown by sample respondents was 8 and 1 respectively and most of the respondents have a fruit tree type in a range of 2 to 5.

More over among the total sample 42.83 %, 40.93% and 10.53% of respondents have an experience on fruit growing 1 to 5 years 6 to 10 years and 11 to 15% years respectively. The remaining 4.1 and 1.5 % of the respondent have an experience 16 to 20 and more than 20 years. This clearly shows that and implies the fruit sector in the region and number of farmers increase in the past 10 years.

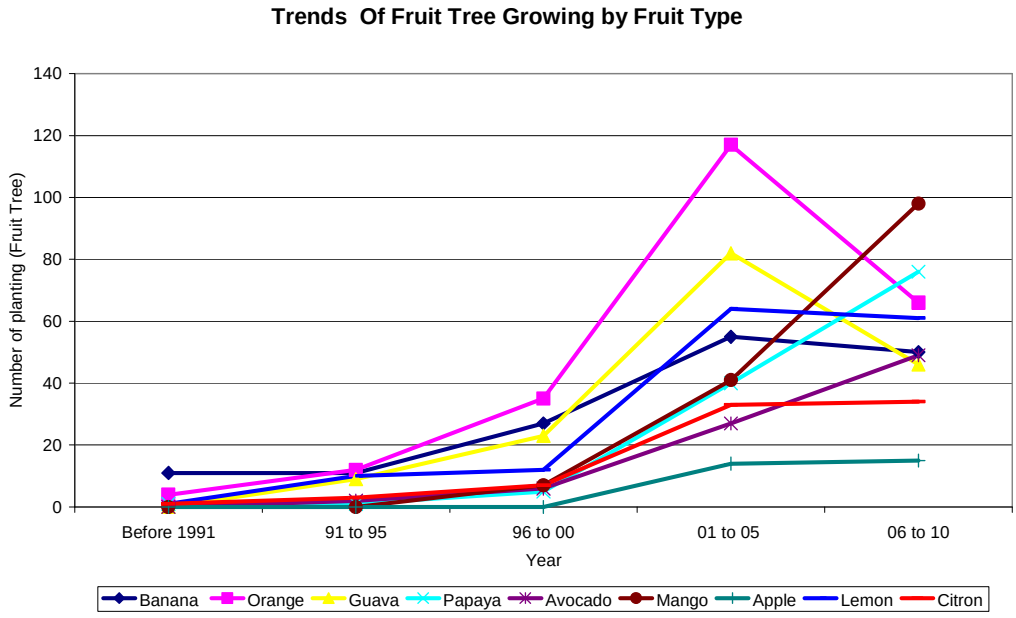
4.1.6 Trend of fruit production in the study area

Table4.7 Type of fruit and trend of fruit tree growers/producers

Type of fruit tree	Production Year					
	Before 1991	**91 to 95**	**96 to 00**	**01 to 05**	**06 to 10**	**Total**
Banana	11	11	27	55	50	154
Orange	4	12	35	117	66	234
Guava	0	9	23	82	46	160
Papaya	1	1	5	40	76	123
Avocado	0	2	6	27	49	84
Mango	0	0	7	41	98	146
Apple	0	0	0	15	16	31
Lemon	1	10	12	64	61	148
Citron	1	3	7	33	34	78
Total	18	48	122	474[3]	496[4]	

Source: Survey result, 2011

Figure 4.2. Trends of fruit tree growing by fruit type



Source: Survey result, 2011

3&4 The total sample respondent of this study was 274 while the No of 474 and 496 indicates that number of farmers cultivated different fruit tree in the same or different years for example if farmers cultivated banana and orange in the same or different year it was count as two.

As the figure above shows Apple, Mango and Avocado fruit tree types were introduced in the recent year in the famers' field; while the remaining fruit types were introduced in the past ten to twenty years. But the trend was very low compared to the past five years. When we see trends of fruits planted in the past five years, it shows remarkable progress i.e. 3.69%, 9.85%, 25.05% and 97.53% at interval of five years respectively. This show as the trend of fruit grower are reach almost in the optimal point as the % difference in the year 2001 -2005 and 2006-2010 shows it is only 2.43%. In addition to the above figures respondents were asked how the trend of fruit is. Accordingly, 94.53% replied that there is an increase in the trend; 2.55% and 2.92% responded there were decreases and no change respectively implying that the number of fruit trees as well as fruit productivities are increasing highly at increasing trends.

4.1.7 Farm site of fruit tree

Table 4.8.Farm site of fruit tree

Farm site of fruit tree		statistics
Description	Frequency	percentage
on Farm	201	73.36
Homestead	65	23.72
Both on homestead and Farm	8	2.92
Total	274	100

Source, Survey result, 2011

As it is depicted from the above table, from the total sample respondents 201(73.36%), 65(23.72%) and 8(2.92%) grow the fruit tree on the farm (on site), on homestead and on both on home stead and farms respectively. The primary reason why farmers have their fruit farm either in home stead or in farm is the availability of water and land. In addition to this, soil type, fruit tree management (guarding, watering, raking, protecting and harvesting) were also among the second reasons. For several reasons most farmers need to grow fruit tree at homestead or backyard and from the total sample respondents, the size of 0.3 hectare which is 30% total arable land found in homestead but due to problem of water and the reasons mentioned above the majority of farmers are growing the fruit tree at farm.

4.1.8 Source of Fruit tree and fruit Nursery in Tigray

Table4.9 Source of Fruit tree and fruit Nursery in Tigray

Source of the Tree	Frequency	Percent
Agriculture Office	211	77.01
REST	21	7.66
Action Aid	3	1.09
Own Sources*[5]	5	1.82
From all the Above source	34	12.41
Total	274	100

Source, Survey result, 2011

According to BoARD (2011) in Tigray a total of 30 fruit nursery were established in different districts. Among these three fruit nursery were established before 10 years whereas the remaining were establish in the past three years.

Each sample district has fruit nursery to propagate and distribute fruit trees. Out of this the nursery site of Alemta district relatively old and start to propagation fruit tree since in 1991. All the rest nursery sites were established in the past two/ three years and most of them didn't start supplying/distributing fruit tree to farmers. However, there is no well established fruit nursery to distribute fruit seedling. BoARD is supplying fruit tree by importing from the southern part of Ethiopia such as, Upper Awash, Melkassa and around Arbaminch. A shortage of fruit nursery in the region is one of the production constraints in this sector. To fill this gap non governmental organizations like REST, FAO and Action aid are participating in establishing fruits nursery and supplying fruit tree.

In line with this fact, survey result discloses that the majority of sample respondents replied that their sources of fruit tree/seedling were BoARD, which accounts77% and the remaining 33% is from NGOs and from farmers own sources.

[5]*Own source mean farmers can propagate by themselves or have the access of seedling out of the above source*

4.1.9 Inter cropping with vegetable

Among the total fruit producers/growers 144(52.5% of respondent used intercrop vegetable with fruit production. This inter cropping is depending on the fruit nature and size of the fruit tree. This is good opportunity to farmers to maximize the household income.

4.1.10 **Cactus Fruit production and marketing**

In Northern Ethiopia where cactus is covers around 30000 hectares growing wild with no management. The only notable case of its utilization in Ethiopia is the use of fresh fruit as human food and also cladodes at times drought. Recently, carmine cochineal has been introduced. In other countries like Kenya, Zimbabwe and Tanzania, much is not known and practiced by way of cactus utilization. Cactus do have an ecological role in combating desertification and therefore need to be integrated into soil and water conservation practices as well as for numerous other products like beverages, vegetarian dishes, drugs, cosmetics, etc. Cactus also provides shelter for wildlife species in arid environments.

Cactus plant has high potential as commercial crop that it can be processed so easily and it has potential international market to be source of foreign currency for the country. The experience of Latin America countries including Mexico shows that cactus could be used as a major economic crop for foreign currency earnings.

The cactus plant (Beles) grows profusely in Ethiopia and has adapted perfectly to the arid zones of the country characterised by droughty conditions, erratic rainfall, and poor soils subject to erosion. It thus contributes in times of drought, serving as a life-saving crop to both humans and animals. Beles has become the major income and food source for about four months of the year (May - August) and it is very much part of the culture and livelihood of the people in spite of the limited uses. Today it is fully integrated into the landscape of the highlands. Cactus pear has become the dominant plant in many areas. Despite being an alien plant that is able to spread aggressively without the presence of any natural enemies, it is accepted now as an integral part of people's environment and food security.(Ali Nefzaouieti,2010)

Due to the difficulty counting cactus fruit tree it is not include to analyzed together with other fruit type.

Cactus fruit in most part of Tigray commonly grown as wild fruit. Now a day farmers Grow in their homestead or near by there farm. Among the total sample respondent 42(15.32%) have cactus fruit near by their homestead. From these total cactus producers 25 have matured (under production) cactus plant. Of these only 17 farmers supply to the market and 8 used for home consumption.

From the sample respondent, like other fruit type farmers generate income from the cactus fruit with the maximum and minimum of 2500 and 200 birr respectively. This shows that cactus can be one of the income sources of farmers.

4.1.11 Production Constraint

The major fruit production constraint in the sample respondent is pest and disease, theft, birds (bird attack /damaging the fruit), water shortage, and shortage of quality fruit seedling distribution. Among these pest and disease took the lion share, i.e., 173(42.6 %). This is the problem of the majority of fruit producers. However, agricultural products are more susceptible for these. There are many possibilities to treat the pest and disease by applying different chemicals. But in the case of fruit production except few farmers applying chemical to avoid the pest and disease majority of the producers didn't apply any chemical or medication. This is because they don't know the type of insects and disease, lack of knowledge to buy chemical in the shop and less attention of district ARD office in providing these chemicals. Next to this, theft is also one of the production constrain which was replied by 108(26.6%) respondents. this is due to the fact that the majority of the fruit producer (73.36%) located far from their fruit farm site.

At the pick period of production farmers were guarding their farm on the day and night time, and this creates additional production cost to producers. Moreover, water shortage, birds damage and lack of improved seedling were also identified by 51 (12.5%), 62(15.2%) and 12(3%) respondents respectively. How ever the expansion of irrigation as wall excavation of hand dag show significant progress till the problem of water is one of the production problems. To solve these problems, producers irrigate their fruit by bringing water through donkey and human power. The last production problem is shortage of improved fruit seedling and this is a problem

in such fruit tree Varity. Some varieties of fruit trees are less productive, less tasty and vulnerable for disease, due to this few numbers of farmers avoiding such from their farm.

4.1.12 Production Opportunity

Governmental and non governmental organization support playing a vital role on fruit production and productivity different sectors providing training and fruit tree, expanding the water harvest mechanism, establishment of nursery sites , providing extension support and expansion of farmers training centre FTC and others are the major opportunities to this sector . As the study indicates that all fruit producers have the access of irrigation from the diversion of river and dams, from hand dag walls, pond and other mechanisms this is due to endless effort of Government and non Governmental organizations to maximize the irrigation potential and horticultural productivity in the region. .in addition to this from the total of producer framers 248(90.5%) have the access extension service training, and getting different support from government and non governmental sectors this results on the development of fruit production and productivities.

Having different agro ecology of the region results farmers producing different type of fruits. As the study shows that all sample district take the lion share on specific fruit product such as Alemata district is dominantly grow a fruit type of papaya, Kilteawlalo, Kola Temben and Degua Temben also highly cultivated and produce a fruit type of Guava, Orange and Apple respectively this is due to the difference in agro ecology and one of the production opportunity for farmers in producing a variety of fruit

Different research reviled that labour force is an important factor for agricultural products .As the study shows that the average family size and active labour forces were 5.98 and 2.93 respectively. This is a good opportunity to farmers to produce fruit with adequate labour force

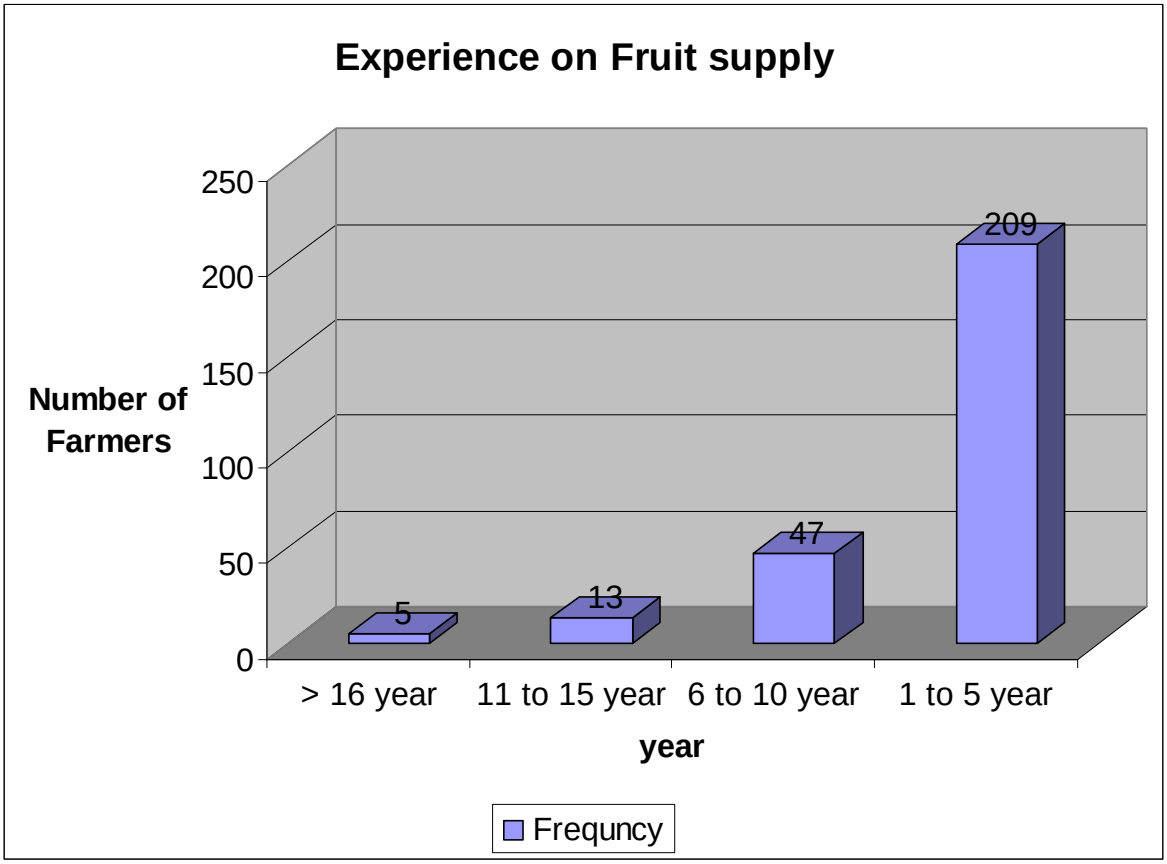
4.2. Marketing

Marketing is a societal process by which individuals and groups obtain what they need and want through creating, offering, and freely exchanging products and services of value with others.(Kotler, 2003).

4.2.1 Supply of fruit to the market and Farmers' experience

Production and marketing are two faces of a coin. As fruit production showing progress in the region in the past 15 to 20 years, farmers involvement in marketing to supply the fruit also increase. Based on the survey result farmers experience on fruit production and experience of fruit supply to the market is highly correlated.

Figure 4.3.Experience on fruit Supply



Source, Survey result, 2011

From the total of sample respondents, farmers with an eexperience on supply of fruit to the market with more than 16 years are only 5(1.8%). Whereas, in farmers with an experience of 11 to 15 years, and 6 to 10 years are 13(4.7%) and 47(17.15%).Moreover in the past five years total number of fruit producers 209(76.3%) involved in fruit market. This shows that majority of the respondents have an experience on fruit supply less than five years

4.2.2 Fruit production and Market Potential

Table 4.10 Quantity of Fruit production and supply

Type of Fruit Tree	District								total no of producer	Average fruit produce in total (kg)	Average Amount of fruit supply to the market	% of supply of fruit to market
	Alemata		Kilte Awlealo		Kola Temben		Degua Temben					
	No. Producer	Average fruit production in (kg)	No. Producer	Average fruit produced in (kg)	No. Producer	Average fruit produced n (kg)	No. Producer	Average fruit produced in (kg)				
Banana	25	280,4	20	50,2	78	250,6	2	47,5	125	221,2	188,4	85,2
Orange	15	219	57	246,7	109	614,1	2	25	183	460,9	415,2	90,1
Guava	16	184,1	69	635,5	39	138,5	5	72,8	129	407,4	333,7	81,9
Papaya	42	1107,9	23	64,4	19	35,1	1	30	85	573	522,3	91,1
Avocado			11	61,5	5	109	2	31	18	71,3	55,7	78,2
Mango	8	193,1	11	34,7	14	56,1	1	25	34	80,5	64,6	80,2
Apple			4	53			12	71,25	16	66,7	59,7	89,5
Lemons	25	346,2	6	70	61	173,35	1	30	93	216,4	194	91,9
Citron	8	142,5	9	49	18	72,9	4	71	39	81,5	66	81

Source, Survey result, 2011

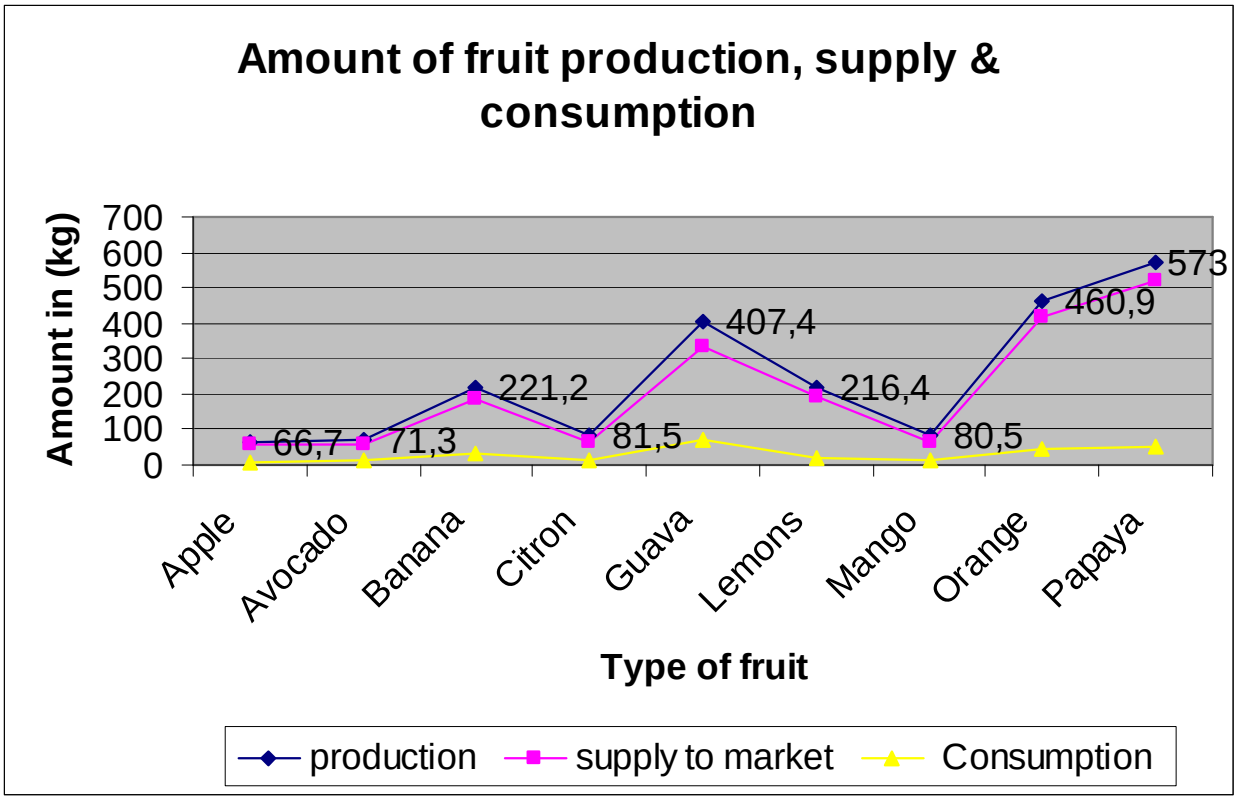
As the table above indicates, out of the total sample producers, 183 (65.6 %) of them produce orange an average fruit amount of 460.9kg and 129 (47.1%) and 125 (45.62%) Produce Guava and Banana with the amount of 407.4kg and 221 kg respectively. Furthermore, of the total sample 16 (5.8%) sample respondents produce apple an average amount of 66.7 kg.

Moreover, based on average amount of fruit production in kilogram Alemta has lion's share on papaya, lemon, banana, mango and citrus fruit with an Average amount of 1107.9kg, 346.2kg, 280kg, 193kg and 142.5 produced respectively. This shows that Alemata district is a poetical area for more type of fruit and quantity of fruit production compared to other remaining districts. Furthermore, orange and Avocado produced with the amount of 614.1 kg in kola Temben, Guava

and apple were also dominantly produced in Kilte Awlealo and Degua Temben with the amount of 635kg and 71kg respectively. This implies that the poetical of fruit production on fruit type is differ from different agro ecology zone

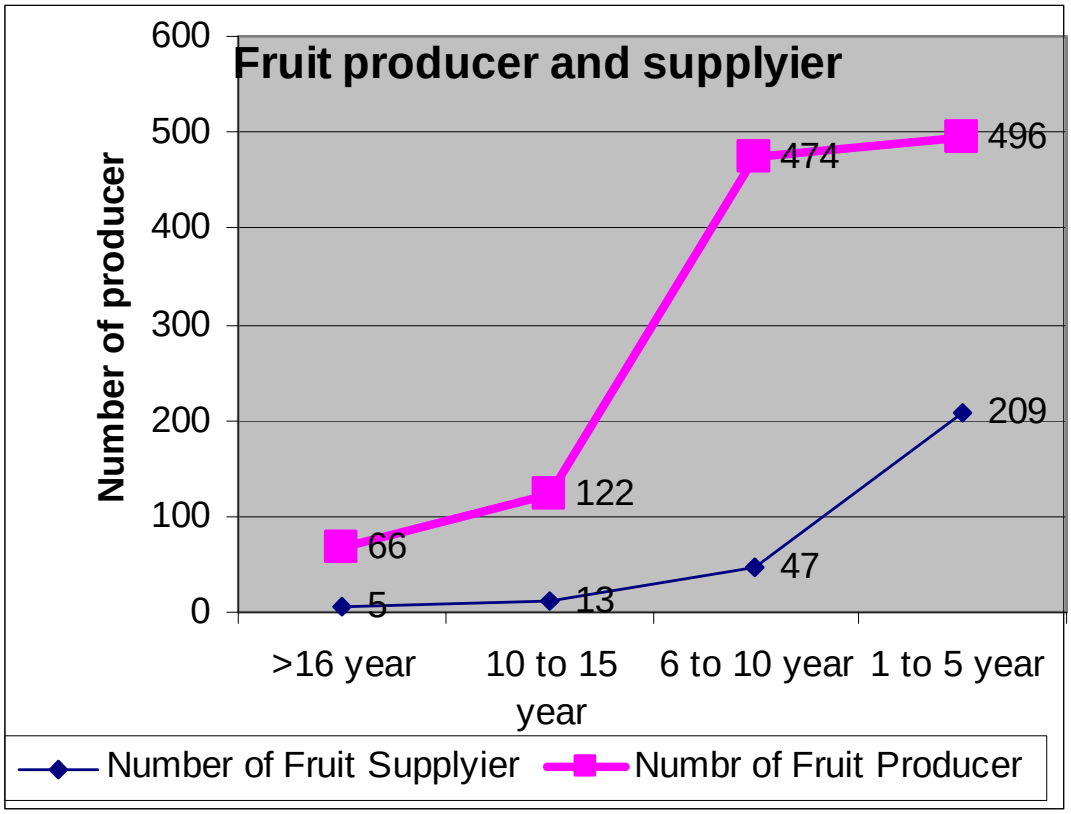
Figure 4.4.Amount of Fruit Production, supply and consumption

Amount of Fruit Production, Supply and Consumption



From the total amount of fruit production, 85% is supplied to market and the remaining 15% is used for home consumption, providing fruit to some neighbours and relatives as a present and few amount of fruit damaged at the time of transport. As the survey result shows the amount of production, supply and home consumption of fruit is positively correlated the more they produce the more will be consumed.

Figure 4.5. Fruit Producer and Supplier[6]



Source, Survey result, 2011

As the figure above shows, farmers experience on fruit production and fruit supplier to the market is highly correlated. The number of farmers engaged in fruit production before 16 years was 66 in number and out of these only 5 farmers were supplying to the market. The same to this in the past 11 to 15 and 6 to 10 year the number of producer was 122 and 474 and supplier 13 and 47 respectively. Moreover, the number of producers engaged in fruit production and supplier of fruits in past 5 years was 496 and 209 respectively. However, the numbers of producers are almost reaching on the optimal point where as the number of fruit suppliers still increase highly. This implies the number of fruit supplier in the coming years may increase highly.

[6]*In the figure Number of producer indicate that Number of farmers has involves in cultivating different fruit type with in the same or different period. For example if a farmer cultivates banana and orange in different years it was counted as two.*

4.2.3 Fruit market out let

Table.4.11.Fruit market out let

Description	Frequency	percentage
Open market/spot market	224	81.75
Contracts	9	3.28
Open market/spot market & Contracts	35	12.77
Open market/spot market & Cooperatives	4	1.46
Open market/spot market, Contract & Cooperatives	2	0.73
Total	274	100

Source, Survey result, 2011

Most (81.75%) of the fruits producers in the study areas sold their fruits in spot market while, 12.77% sold their fruits through spot market and contract. Only insignificant percents (0.73%) of the respondents sold their fruits towards cooperatives. This implies that there is no well organized fruit cooperative in the sample district. In Tigray region there is no fruit cooperative legally established under the bureau of cooperative. The only multi purpose cooperative is buying farmer's fruit (orange) in kola Temben since 2010.

4.2.3. Methods /Ways of selling the Fruit and market Channel

Table4.12 Methods /Ways of selling Fruit

Ways of selling the Fruit	Frequency	Percentage
To individual at Filed	128	22.94
To individual at market	185	33.15
To cooperatives	10	1.79
To retailers at field	95	17.03
To retailers at district market	124	22.22
To super markets	1	0.18
To Juice houses	9	1.61
Mekelle market	6	1,08
Total	558	100

Source, Survey result, 2011

Majority of fruit producers sold their fruit to individual at filed, to individual at market and retailers at district market, In addition farmers collaborate and rent the car or harvest on the same time and invite traders to come to their farm land. In addition to this selling the fruit through contract is insignificant. This implies the amount of fruit production is less in quantity.

Among the total sample respondent most (33.15%) of farmers sold their fruits to individuals at market while 22.94% of them sell their fruits at filed and 22.22% and 17.03% to retailers at the district market and to retailers at field respectively. the remaining insignificant 4.64% of producers sell their product to supper market, to juice house and at city of Mekelle. This implies that farmers have the possibility of selling their product to different individuals and traders in different market out lets .This is good opportunity to gain the bargaining power of fruit producers. In other way this different market out let indicates that the potential of fruit production at farmers field is very less in amounts.When the production amount is in bulk the possibility of selling to individuals are decrease and farmers need to sell there product to wholesales cooperatives or retailers

4.2.4Fruit Market channel

Channel-1 Farmer –Consumer = 56.09%

Channel-2 Farmer – Retailer –Consumers = 39.25%

Channel-3 Farmer – Cooperative – Wholesaler – Retailer – Consumer= 1.79%

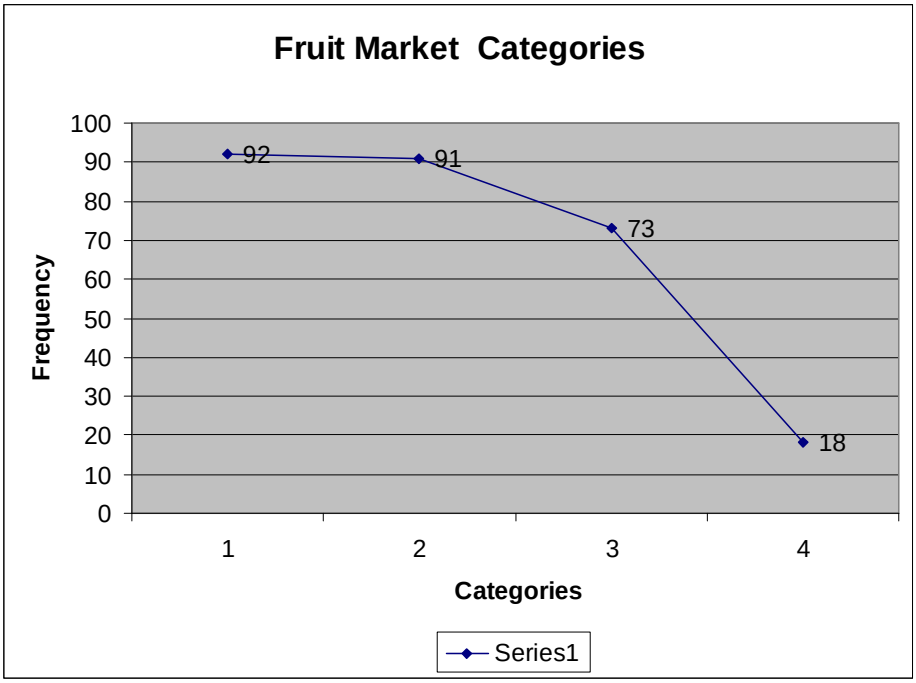
Channel-4 Farmer – juice house – Consumers= 1.25%

Channel-5 Farmer – super market – Consumers= 1.61%

Based on the survey result majority of (56.09 %and 39.25%) the producers use channel 1and 2 of producer to consumers and producers –retailers-consumers respectively. Whereas the remaining 4.65% of the sample use channel 3 to 5 listed in the above. This implies that majority of farmers used the first channel due to the reason that they produced a very small amount of fruit to satisfy the retailers need and some by direct contact with final consumers they search a better price .In addition to this in four sample districts there were no fruit cooperatives for buying the farmers product except the multi purpose cooperative of Adiha (Kola Temben District).

4.2.5 Market categories

Figure4.6.Markecategories



Source, Survey result, 2011

As the above figure shows, from the total sample respondent's majority of (92, 91 and 73) the respondents have the opportunity for selling their products at one, two and three outlets respectively. This implies that 66% of the respondents have the possibility of selling in more than one outlet.

4.2.6 Means of Transport

Table4.13.Means of Transport

Ways of transport	Frequency	Percentage
On foot	40	14.60
On foot & Pack Animals	91	33.21
On foot , Pack Animals& Vehicle	28	10.22
On foot & Vehicle	14	5.11
Pack Animals	64	23.36
Pack Animals & Vehicle	17	6.20
Vehicle	10	3.65
Other*[7]	10	3.65
Total	274	100

Source, Survey result, 2011

Of the total of the sample respondent the majority of the fruit producer (150(54.7%) used more than two methods of transport. From this 91(33.2%),17(6.2%)and 28(10.2%) used the combination of foot & Pack Animals, Pack Animals & Vehicle and foot , Pack Animals& Vehicle respectively. More over the remaining 114(41.6%) used only one means of transport which is 40(14.6%), 64(23.36) and 10(3.65%) used on foot, Pack Animals, Vehicle respectively

[7]* *These do not use transport; fruit producers sold their fruit product at their home or at farm.*

and the remaining 10(3.65%) didn't use any means of transport; they only sold their fruit production at field.

This diversified means of transport shows that the amount of fruit production among the sample households is varying .When farmers produce more in both fruit type and quantity of production they used more means of transport; whereas the production amount and the fruit type are few in number, the means of transport also gets fewer. In addition to this, the distance of farm to district market is also affected the means of transport.

Those farmers near to the district market commonly used either pack animal or foot whereas the distance of farm land to the district market is far the probability of using more means of transport is also more. In addition to this, the means of transport is an indicator for the potentials of fruit producer (quantity of production) from the total sample of respondents only 10(3.65%) used purely the means of vehicle transport; this is due to the production amount is high and difficult to manage by foot or pack animals.

. 4.2.7 Time to reach District Market

Table4.14.Time to reach District Market

	Time to reach district Market				
District	< 1hr	1to 2 hr	2:01 to 3 hr	>3hr	Total Sample
Alemata	8	45	6	0	59
Kilte Awlealo	36	21	21	2	80
Kola Temben	0	0	27	96	123
Degua Temben	0	8	4	0	12
Total	44	74	58	98	274
percentage	16,06	27,01	21,17	35,77	100

Source, Survey result, 2011

Of the sample farmers, 35.77% of them travel more than three (3) hours to reach the district market; while16.06% of them only need to travel less than one hour. From the sample district, Alemata, Kilte Awlealo and Degua Temben have the shortest distance to the district market

which is from the total respondent of each district 53(89.8%), 57(71.25%) and 8(66.6) of respondents walk a distance between one and two hours. whereas Kola Temben district 27(21.95%) of samples walk in between two to three hours while the remaining 96(78.05%) of the total respondent walk more than 3 hours.

This implies that farmers in kola Temben district need to exert their effort, time, cost and resources in travelling long distance in search for market for their fruits products.

4.2.8 Loss or damaged of fruit

Table4.15.Loss or damaged of fruit tree

Loss / damage of Fruit		Frequency	Percentage
Have you ever Loss or Damaged of fruit	Yes	117	42.70
	No	157	57.30
		274	100
Reason for loss / damage			
	Problem of package	33	28.21
	Long Distance	55	47.01
	Long Distance & problem of package	29	24.79
Total		117	100

Source, Survey result, 2011

As the table above indicates, 42.70% of sample respondents loss/damage of fruits occur due to the long distances (47.01%) they need to travel to reach the market while 28.21% as result of packaging problems. This implies that as the farmers travel more distance from their homestead in search of market, they will incur loss/ damage of fruits that may cause less amounts of income to be generated from their outputs. In addition to this the cause for loss or damage is the type of material used to pack while transporting their fruit to the market.

4.2.9Fruit Packaging

Table4.16 Fruit Packaging

Packing material to transport fruit	Frequency	Percentage
Chiret (sisal sack type)	187	40;22
Kefer / kuna /[8]	53	11.4
Basket	69	14.84
Box /Gabia	14	3.01
Plastic box / bucket	101	21.72
Caret	41	8.82
Total	465	100

Source, Survey result, 2011

Figure 4.7 Fruit Packaging mechanisms

[9]Source own Picture

[8] *Kefer is a local material it made from Special grass and farmers use for different purpose.*

[9] *The pictures are made at Aby Adi , H:selam and mekell from the district market of Kola Temben , Degua Temben and at mekelle suppere market respectivly the pictures of imported apple fruit taken for the comparisum how fruit is packing.*

Producers use different packing material to pack fruit at the time of transport and storage. Sample respondents indicated that chiret (sisal sack type), plastic box /bucket and kefer /kuna were used by 40.22%, 21.72% and 11.4% respondents respectively. Whereas the remaining sample respondent used cart and Gabia/wood box. This implies that the majority of fruits producer supply small amount of fruit in the market.

4.2.10 **Fruit Storage Mechanism**

As the nature of fruit is perishable and farmers lack well organized ventilated storage facility most farmers need to sell their fruit product one day after the harvest. And some farmers used open ventilated room to store for three to four days.

4.2.11 **Standard and grading**

Table4.17.Standard and grading

Description		Frequency	Percentage
Do you grade your fruit product?	No	23	8.39
	yes	251	91.61
		274	100
How do you Grade?	Quality[10]	127	46.35
	Size	25	9.12
	Both Quality and size	92	33.58
Total		274	100

Source, Survey result, 2011

Among the total sample producer majority of 251(91.61%) grading their product based on size and quality this is good to builds confidence and trust in the marketing for traders and consumers.

[10] *For this research Quality mean for products of fruit which is imperishable, well ripe, and timely harvested (fresh fruit)*

4.2.12 Unit of Measure

Table 4.18.Unit of Measure for selling the fruit

Unit of Measure	Frequency	Percentage
Kilo gram	112	40.88
Pieces	43	15.69
other measurements *[11]	8	2.92
Kilo gram and pieces	93	33.94
Kilo gram and other measurements	7	2.5
Pieces & different measurements	6	2.9
All measurements	5	1.2
Total	274	100

Source, Survey result, 2011

*A*s the survey result shows only 41% of the sample respondents sell their fruits in kilogram where as the remaining 59% sold their fruit product on piece, both in kilogram and pieces and other measurements. The common fruit type farmers sold in pieces is (Citron, papaya, lemons) this is due to the difficulty to measure in kilogram. In addition to this, the unit of measure to sell the fruits type is highly depend on the volume of fruit supplying to the market. That is, if the volume of fruit present to the market is high the probability of selling in kilogram is also high whereas the volume of fruits presents to the market is sold in pieces.

4.2.13 Fruit Price

Table4.19.Features of fruit Price

Degree of Price Flexibility	Frequency	Percentage
Fixed	8	2.2
Flexible	265	96.2
Unpredictable	1	0.6
Total	274	100

Source, Survey result, 2011

[11] *Other measurements are units of measurements farmers used to sell their fruit with out measuring by kilogram or in piece/ in number rather than selling their product as a whole of certain materials like bucket, box, or other local materials.*

The typical natures of horticultural products (fruits) are highly seasonal and perishable. With out having a cold room fruit can not be stored for longer days at farmers' field. One or two days after the harvest, producers bring their fruit product to the market. At the pick period of product most farmers supply their fruit to the market and the price goes very low, while the product to end(final)harvest the price of any fruit product is go up . Among the total of sample who were asked about the degree of price flexibility, the majority of 265(96.7%) replied that fruit price is flexible.

Table4.20.Price setting of fruit production

Methods of Price setting for fruit	Frequency	percentage
set price independently(sealer/producers)	61	22.26
Buyer sets the price	6	2.19
Negotiation	166	60.58
Seller and buyer	1	0.36
Seller and Negotiation	40	14.60
Total	274	100

Source, Survey result, 2011

As the survey result revealed, price of fruit production is set by producers, buyers and by negotiation among fruit producer and buyer. Negotiation took the lion share from the methods of price setting which is 166(60%) of the sample. and the price set by Producers 61(22.26%) and the remain 18% of sample set the price with the combination of the above price setting methods. This method of pricing indicates that the price flexible on fruit market.

4.2.14 Marketing constraint and coping mechanisms

Table4.21.Marketing constraint

Marketing constraint	Frequency	Percentage
Lack of demand/market	43	10.36
Lack of market information	38	9.16
Low price	169	40.72
Product perish ability	11	2.65
Lake of storage	37	8.92
Lack of transport	109	26.27
Cheating on balance/units of measure	8	1.93
TOTAL	415	100

Source, Survey result, 2011

Though the amount of fruit supply to the market is very low due to the nature of fruit price, majority of the respondents faced problem on low price of fruit, lack of transport and lack of demand with amount of 169(40.72%), 109(26.27%) and 43(10.36%) respectively. and the remaining few percent of the sample face a problem on lack of demand, products perishability and cheating on balance while measuring the fruit at the time of selling. To avoid the problem of the low pricing, some farmers sold their fruit product on contract base (which is oral agreement) sending their product to the city market rather than district market. In addition to this to reduce problem of transport, majority of the producers sold their fruit at field to local traders and used their own and rent pack animal to transport the fruit to the district market. However farmers sold their fruit at field to local traders to reduce the transport problem they faced; problem of low price selling the actual market price this implies that the problem of transport leads to farmers to sell their product at lower price. In all sampling district there is no well established store for fruit storage .Especially some orange and papaya producers in Kola Temben and Alemata district respectively they face with storage of fruit in the town after transporting the fruit from the place of production. These also lead farmers to sell their product for the cheapest price. To solve this problem orange producer of Kola Temben district rent a house at the town of Abyadi for shortage

period of time till the pick period of the production will end. Few producers of fruit faced product pershablity before and after to reach the market, this is due to some fruits damaged at the time of transport and some with the problem of less demand at the market. To solve this problem farmer used strong packing material to transports like Gabia (wood box) and looking the demand of the fruit before they sold and sold on time.

4.2.15. Opportunities for Fruit Market

Government support: To solve marketing problems on different agricultural products government and non governmental organization play significant role on establishing cooperatives and providing a promotion service in regional and federal exhibitions and workshops. According the experts of ARDO of kola Temben and Alemata District to promote orange and papaya respectively the office participate on different workshop and exhibitions to promote farmers product this is good opportunity to farmers to sell there product in different market

Increasing in Demand and Price: As continues increment on population and there purchasing power results on increasing on the demand of fruit and eating habit. In relation to this Like other agricultural products the price of fruit is increase highly from time to time this is good opportunities to farmers to have a better income from this sector.

Different Agro ecology: Due to the difference in agro ecology farmers can produce different type of fruit this is good opportunity to producer farmers to have good market share on specific product

4.3 Access to Service

4.3.1 Extension service and agricultural training

To improve agricultural production and productivities Farmers Training Centre (FTC) were built nearby farmers Village, in each sub district (tabia). Besides, in each tabia one FTC with a minimum of three DA's to help with the profession of crop production and horticulture, animal production and natural resources. Among the total sampled respondent 248(90.5 %) has an access of getting assistant from DA's. In addition to this different NGOs and BoARD experts give training on Horticultural and other agricultural Activities.

4.3.1 Access to credit

Credit is important to strength the financial capacity of producers/Farmers to buy and introduce new Agricultural technology and input, such as water pump, tridle pump, seed and fertilize , buying oxen and other Agricultural input The main credit Association for Farmers to have the credit Access, DESCI play an important role. In each district of the region a minimum of one DESCI branch exists to provide credit service to farmers. Through collaboration with Agriculture and Rural Development office of each district credit access is provide to farmers. Among the total sample respondent 107 (39%) get Access of credit in the 2010/11production Year.

4.3.1 Access to Infrastructure

In the study areas the study found that the quality of road is bad and difficult to truck. Though the road conditions is difficult for transpirations, all sample Tabia have access of weather roads, especially at (Tabia Selam Nikalsi and Gerrgal) Alemata District And (Adha Tabia) Kola Temben district, at the pick period of fruit production truck can go till the end of farmers field . Of all sample district Adiha tabia is far in distance, it is 30 km far from the centre of the district if trucks are not available farmers use Pack animal to transport their Fruit production to the district market. All sample tabia have access to wireless and mobile telephone services. In relation to bank service in the centre of all districts there is one Government Bank and in Kilteawlealo district center there is one privet Bank. However there is commercial banks in all sample district centre, most farmers get Access credit and saving service on DESCI.

4.3.2 Market Information

Market information is crucial to producers to sell the product for a better price. As sample respondents indicated that the major source of markets information for fruit markets were Producers /farmer, traders and others sources at 70%, 21% and 9% respectively.

4.3.3 Source of market information

Table 4.22.Source of information

Source of information	Frequency	percent
Government /OARD/*	24	6.92
Cooperatives	1	0.29
Radio	3	0.86
Buyers/trader	73	21.04
Sellers /producers /farmer	246	70.89
Total	347	100

Source, Survey result, 2011

Source of market information is vital to farmers to have a better price on their agricultural product, increase their bargaining power and reduced the production cost. As the result of survey it shows majority of producer farmers 246(70.89%) got the information on fruit seller / producer. the remain 73(21.04%) and 24(6.92%) got the access of information from trader and government (agricultural and marketing Experts) more over insignificant present of the respondent have the access of information from media /radio and cooperative

4.4 Fruit income

Table.4.23 Distribution of farmers based on their fruit income level

	Statistic					
Income categories	Frequency	Percentage	Mean	STDEV	Max	Min
<1000	81	29.56	3428.95	4522.76	31800	50
1001 to 5000	136	49.64				
5001 to 10000	38	13.87				
10001 to 15000	13	4.74				
>20000	6	2.19				
	274	100				

Source, Survey result, 2011

As one depict from above table, 136(49.64%) and 81(29%) of respondent have an annul income from fruit ranging from1001 to 5000 and less than < 1000 birr respectively and remaining 29(6,93) sample respondent have an income from the combination of the above categories ranging 10001 to > 20000 Birr . The mean and standard deviation of the fruits income among the sample is 3428.95 and 4522.76 respectively, the average mean is less than the standard deviations. The amount of fruit production and of supply is the factors behind immense variation among samples that makes the standard deviation above the average mean.

4.4.1 Contribution of Fruit on livelihood income

Table4.24.Contribution of Fruit on livelihood income

	Income Type					
Statistics	Off farm	Livestock	Animal product	Grain and vegetable	Fruit	Total
Average income	964.11	1930,53	478.56	2372.83	3428.95	9174.98
STDEV	2190.05	3142.78	2005.5	5227.46	4522.76	
Max	20304	33250	22540	39700	31800	
Min	0	0	0	0	50	
percentage	10.51	21.04	5.22	25.86	37.38	100

Source, Survey result, 2011

As the survey result revealed, among the income types that sample farmers obtain fruit income over shines other sources.37.38%, 25.86% and 21.04%, of the total income Fruit, (grain and vegetable) and livestock products respectively. Moreover off-farm and income from animal

products share the minimum amount to the house hold income level. Mainly the off farm activities of the respondents were daily labour, food for work and sealing local drink and natural resource, whereas milk, butter, honey, egg, skin & hides and renting animals are from Animal production .This implies that, even though the size of lands covered by fruit is only 30% of the total land size, the income generated from it is higher than the income of grain and vegetables. But farmers can not cover all the lands by fruit tree due to the shortage of water, distance of land from home stead and soil type. Though, the income generated from fruits to the House hold farmers' income is high and need to plant more fruit trees, shortages of water, the type of soil and land distance from homestead limited the farmers to expand fruits farm size.

4.5 Results of Econometric Analysis

To identify the factors influencing the fruit income and to test its significant level liner regeration model was used. To analyze this STATA soft wear version 10 was used and the results are discus below.

Table4.25 Correlation

	Income	GEN	EDU	ACT	FFX	LAND	VDT	TNT	EXS	TLU
Income	1.0000									
GEN	0.0859	1.0000								
EDU	0.1525	0.2566	1.0000							
ACT	0.1009	0.2025	-0.0457	1.0000						
FFX	-0.0892	0.1351	-0.3894	0.1860	1.0000					
LAND	0.2977	0.1285	0.1791	0.1234	-0.0378	1.0000				
VDT	-0.0100	-0.0195	0.0304	-0.1761	0.0381	-0.0879	1.0000			
TNT	0.4370	0.0703	0.2056	-0.0026	-0.0601	0.5706	-0.1733	1.0000		
EXS	-0.0235	-0.1383	-0.0565	0.0822	0.1097	-0.0392	0.0020	-0.0260	1.0000	
TLU	0.2956	0.1194	-0.0069	0.1101	-0.0710	0.1485	-0.1126	0.1563	-0.0371	1.0000
Lnincome	0.7591	0.0574	0.1305	0.1197	-0.1113	0.2679	0.0612	0.3243	0.0765	0.2025

Source: Own computations, 2011

As the above correlation matrix table depicted, there is no significant correlation among the independent variables that treats' multicolliniarity problem while running the model.

Table4.26 Effects of explanatory variables on dependent variables and its significant level

Income	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GEN	58.72869	570.9172	0.10	0.918	-1065.461	1182.919
EDU	153.6843	209.3685	0.73	0.464	-258.582	565.9507
ACT	356.9208 **	174.5295	2.05	0.042	13.25573	700.5858
FFX	-16.88837	14.92427	-1.13	0.259	-46.27566	12.49892
VDT	38.96139**	23.60022	1.65	0.100	-7.50967	85.43245
TNT	9.334146*	1.777791	5.25	0.000	5.833507	12.83478
EXS	-5.0483	46.17722	-0.11	0.913	-95.97562	85.87902
TLU	9.588777 **	5.268501	1.82	0.070	-.7854006	19.96296
cons	201.2874	1114.738	0.18	0.857	-1993.737	2396.312

Number of obs = 270

F (8, 261) = 11.95**

R-squared = 0.2680

Adj R-squared = 0.2456

Source: Own computations, 2011

*** And * represents level of significant at 1%, and 10%.*

To identify the factor that influence the fruit income and its significant level, multiple liner regression model was used.

After multicolinarty problem was checked and size of fruit land was cancelled this is due to high degree of collinearity problems on fruit size of land and Fruit tree. Among these variable, sex of

the household head is (Dummy) variables and among the remaining seven variables one is discrete and six of them are continues variables.

Based on statistical analysis done using STATA; of the total of eight explanatory variables entered in the model three variables were found to be significant in influencing the fruit income. These explanatory variables are number of fruit tree under production, active family member and discussed below.

1 **Total no Fruit under Production (TNT):** is significant at 1% (at probability of p= 0.000) level. As it hypothesized the number of fruit tree under production is highly significant in the house hold fruit income. This shows that as farmers have one additional number Fruit tree their fruit income level will increase by 9.33 Birr.

2. **Active Family Member (ACT)** as it was hypothesized as farmers have more active family member the income generated from fruit would be high. As the result shows when the number of Active family number increased by one equivalent unit fruit income increase by 356.92 Birr at probability of 10 % at (P= 0.042) level of significant.

3. **Total Livestock unit (TTL)** the total livestock unit of the house hold was found to be significantly influence the income of fruit to the farmers. It is significant at 10% (p = 0.070).The result shows that as the number of livestock owned by farmers increase by one equivalent unit of TLU the amount of fruit income of the farmer increase by 9.58 Birr.

4. **Village Distance to District Market (VDT)** village distance to district market influence positively the fruit income. How ever it was not expected sign. This implies that as the distance the farmers travel in one trip increase by one kilometer, there income will increase by Birr 38.96 and it is significant at 10% significance level. The possible reason for positive sign could be Access to transport, Access to information and other variables like production amount.

4.6 Result and discussion with Traders

4.6.1 Trader's demography

Table.4.27 Trader's demography

		Sample district					
	Sex	Kilte Awlealo	Alemata	kola temben	Degua Temben	Mekelle	Total
Wholesalers	Male	2	2	0	0	8	12
	Female	0	0	0	0	0	0
	Percentage	16,67	16,67	0	0	66,67	100
Retailer	Male	2	3	3	2	10	20
	Female	2	1	1		6	10
	Percentage	13,33	13,33	13,33	6,67	53,33	100

Source: Own computations, 2011

Out of 30 fruit retailers 20(66.6%) male and 10(33.3) female respondents are involved in the sample and while 100% of the wholesaler fruit traders are male.

Among the sample district Kola Temben and KilteAwlealo have no fruit wholesaler's traders rather than seasonal traders at the time of peak period of production. In addition to the sample district taken fruit market at farmer's level Mekelle city is also included

4.6.2 Traders Experience in Fruit Market

Table4.28.Traders Experience in Fruit Market

Categories	experience in year	Frequency	percentage
Wholesalers	1 to 5	9	75
	6 to 10	2	16.67
	> 10	1	8.33
		12	100
Rattlers	1 to 5	23	76.67
	6 to 10	7	23.33
Total		30	100

Source: Own survey result, 2011

As the above table depict from the total sample respondent majority 9(75%) and 23(76.7%) of wholesaler and retailer have an experience in fruit market 1 to 5 years, whereas the remaining 3(25%) and 7(23.3%) are involve in the market more than 6 years. This implies that majority of the fruit trader have no longer experience in fruit market and in the past five years the number of fruit trader increases.

4.6.3 Source of Fruit

Source of Fruit Supply for Wholesalers

The source of fruit for wholesalers mainly categorized in to two which is farmers in the region and traders and farmers out side the region.

Inside the region

Districts such as Kola Temben, and Edega Hamus (Gunda gundo) produce and contribute to the regional market in orange and lemon production, Alemata and Tekeze valley also one of the source of papaya and banana products respectively.

Based on the interview with traders, from the total sample of 12 wholesalers only four sample respondents have the source of fruit in the region. This implies that the production amount in the

region did not satisfy the wholesalers; as four sample respondents explain the source in the region is very few in amount and majority (around 90%) of fruit is imported out of the region.

Out side the region

Based on the information of wholesalers, the main source of fruit for wholesalers are farmers, traders, or cooperatives in south part of Ethiopia and Oromia region in the specific places of Awash, Metehara, Melkasa, Assosa, Awasa ,Arbaminch and some traders in Adiss Abeba. Based on wholesalers information the fruit type imported out of the region is orange, banana, avocado, mango and pineapple. This shows that the other type of fruit either it imported by supermarkets or produce in the region.

Source of Fruit Supply for Retailers

In this research supper market and shops are taken as the sample retailers. Based on the information of retailers the major source of fruit for retailers are wholesalers in the region. Beside to this, for few type of fruit like Guava, papaya , Apple ,lemon , and citron fruits are from farmers or local traders in the region whereas a type of fruit such as banana , orange , avocado mango, pineapple are from wholesalers of the region and in especial case most supper markets imported apple, grapevine and plum fruit from Addis.

4.6.4 Fruit Storage Mechanism for traders

Due to the nature of fruit that it is perishable in most case wholesalers sold their fruit to their customers immediately when it arrived from the source.

Basically the customers' of wholesalers are juice house, supper market and retailers shop. As wholesalers information the maximum of storage of fruit in their store is 5 days except banana fruit. In the case of banana most traders put in their store for more than two weeks in closed and high room temperature. In this case to give more heat to the banana on closed room they put fire with smock till the banana will ripe.

4.6.5 Type of fruit found regularly in the market

However fruits are highly seasonal due to agro ecology and variety difference the same type of fruit harvest and found in the market in different period or season. For example in the case of orange in tigray the Gunda Gundo type of orange harvest on the period of October to December whereas as orange type of Kola Temben harvest (the pick period) is June to September the same to this banana production have different harvesting seasons. This Varity and agro ecology difference is good opportunity to the fruit market and to be availed in the market based on trader's information the type of fruit regularly found in the market is banana and orange.

4.6.6 Fruit Demand and Supply

However to identify the supply and demand of fruit need separate study in this research to identify the highlight of fruit demand and supply 42 traders were interviewed.

Table4.29.demand and supply of Fruit

Demand	what is demand supply of fruit		
	Categories	Frequency	Percentage
	Low	2	4.76
	Medium	6	14.29
	High	34	80.95
		42	100
Supply	Low	18	45.24
	Medium	17	38.10
	High	7	16.67
		42	100

Source: Own computations, 2011

Based on the interview with traders, to know the demand of fruit in the region from the total sample respondent majority 34 (81%), 6(14.29%), and 2 (4.76%) replied with high, medium and low respectively whereas the supply of the fruit in the market is 18 (42.9), 17(38.10) and 7(16.67) replied high, medium and low respectively. This shows that the amount of fruit for supply to the

market is less than the demand. This is good opportunity to the producer farmers in the region. In addition to this based on the fruit type 100% of the respondent said the demand of the fruit type (banana and orange) have the highest on the traders and final consumers.

4.6.7 Market information

The source of market information for both traders (wholesale and retailers) is traders and farmers. Wholesalers found fruit market information on the source of fruit they bought, that is, farmers and traders and traders also from wholesales and farmers.

4.6.8 Fruit traders and Marketing constraint

The major problem for many fruit wholesalers is mainly transport. As wholesalers information from the source of fruit to the final destination it takes 4 to 5 days of transport. Some times when the trucks are delaying in any problem except banana all products of fruits are either wilting or perished. In addition to this, price variability is other problem of the traders, from the pick period till end of the harvest price in increase and changed two to three times. Moreover few wholesalers also faced a problem of cheating in the ordered fruits, most of trade communication and financial transaction is made by phone and banking. In rare case after the order is made by somebody to the fruit supplier, if trucks are Brocken before to reach the destination of the ordered fruit will sell to other traders.

4.6.9 Fruit Brand name

However all fruits have their own scientific name fruits called by wholesaler and retailers by adding the local name. The typical example for this is orange, traders can identified the orange by calling Metehara orange , Gunda Gundo orange , Abyadi orange and etc....

Gunda Gundo Orange

The Gunda Gundo orange, the only variety which is Cultivated in the region and it has high demand on consumers. As few numbers of wholesalers explained this orange variety good in size, Attractive colour and very tasty. Based on fruit traders this orange variety ranked first from all orange type cultivated in Ethiopian. This orange variety introduce to the market with its own brad name. This is an indicator that there is good possibility to grow such good Varity of fruit in the region.

CHAPTER FIVE

CONCLUSION & RECOMMENDATIONS

5.1 CONCLUSION

To improve livelihood of farmers, different agricultural activities were done under federal and regional governments. Due to the current government more emphasis has been given on agricultural product and productive in the past decades by introducing new agricultural inputs and technologies, new agricultural system and extension services. Under the sub sector of agricultural activities horticulture take important share to the livelihood of farmers.

This study attempted to identify the potentials of fruit production in Tigray region, livelihood contribution of the fruit, constraints of production and marketing, to identify type of fruit dominantly grown in the region and marketing performance. To achieve this, a total of 274 fruit producing farmers were involved in the study. To be more representative, four different zones, four districts and eight villages were involved in this study.

As the result of descriptive statistic among the total sample 42.34%, 41.30% and 10.6% of respondents have an experience on fruit growing 1 to 5 years 6 to 10 years and 11 to 15years respectively. The research finding shows that the fruit producers increase highly in the past 10 years. Though the increment in the region is promising compare to other region the coverage of fruit is insignificant. In addition to this except papaya which is 93.72 average fruit tree number the reaming average fruit type found at house hold level are less than 26 trees. Among the total number of fruit tree 53% is productive and the remaining 47 % is not matured to produce fruit.

As the result it shows, out of the total sample producers 183 (65.6 %) of them produce Orange an average fruit amount of 460,9kg and 129 (47.1%) and 125 (45.62%) produce Guava and Banana with the amount of 407.4kg and 221 kg respectively. Furthermore, of the total sample 16 (5.8%) sample respondents produce Apple an average amount of 66.7 kg. In relation to the average size of land cultivated under fruit, 0.27ha this amount of fruit is good and in the coming year it will

expect to increase the production as well the income of fruit by more than 40%. This is due to more trees are planted in the past years and will be matured to give fruits in the coming years.

The major fruit production and marketing constraint in the sample respondent is pest and disease, theft, birds (bird attack /damaging the fruit), water shortage, shortage of quality fruit seedling distribution transportation, low pricing are among the majors. Pest and disease took the lion share of 173(42.6 %) from the production constraint, this is the problem of majority fruit producers. As the research finding shows most of problems exist at the pick period of production.

From the total sample respondent 136(49.64%) and 81(29%) of respondent have an annul income from fruit ranging from1001 to 5000 and less than < 1000 birr respectively and remaining 29(6.93) sample respondent have an income from the combination of the above categories ranging 10001 to > 20000 Birr. The mean and standard deviation of the fruits income among the sample is 3428.95 and 4522.76 respectively, the average mean is less than the standard deviations. The amount of fruit production and supply is the factors behind immense variation among samples that makes the standard deviation above the average mean.

As the survey result revealed among the income types that sample farmers obtain fruit income over shine of others sources. 37.38%. Though the size of lands covered by fruit is only 27% of the total land size, the income generated from this is higher than the income of grain and vegetables. Though, the income generated from fruits to the house hold farmers' income is high, due to shortages of water, the type of soil and land distance from homestead limited the farmers to expand fruits farm size.

Based on the survey result the majority of 55.09 %and 39.25% of the producers use a marketing channel of (Farmer –Consumer) and (Farmer – Retailer –Consumers) This implies that Majority of farmers used the channel of (Farmer –Consumer) this is due to they produced a very small amount of fruit and they don't provide amount of fruit that satisfy the retailers need. In addition to this in four sample district there is no fruit cooperative for buying the farmers product except the multi purpose cooperative of Adiha (Kola Temben District) this indicates that there is no more production to satisfying amount of fruit to traders. As the research finding the reason why there is no fruit cooperative in the region is due to the amount of fruit produce is low and till farmers not faced a strong demand problem in the market.

As the research finding the amount of fruit for supply to the market is less than the demand. This is good opportunity to the producer farmers in the region. In addition to the demand of fruit based on fruit type 100% of the respondent Said the demand for (banana and orange) have higher than other fruit type. How ever the amount of fruit supply to the market is very low due to the nature of fruit price majority of the respondent faced a problem on low price of fruit, lack of transport and lack of demand at the pick production period.

Based on the econometric analysis to identify factors influencing the fruit income multiple linear regression models were employed using STATA software. The model result shows that Total no Fruit Under Production , Active Family Member, Total Livestock unit and distance to district market are significant at 1%,10%,10%and10% respectively.

5.2 RECOMMENDATIONS

- To maximize the fruit coverage, market potential and production, availability of water resource is an important factor. Unlike crop production fruit need more water for longer time. Currently farmers use different irrigation types for their fruit tree but shortage of water is typical problem of this sector, to be more productive and highly potential on fruit production and market different water harvesting mechanism would be done by different stockholders. As BoARD stated the irrigation potential increases in the region for the past two years only by 9%. This is very few amounts to improve the fruit productivity. Selective improved fruit seedling is an important factor for the potentials of fruit market. Fruit distributers should provide tested and improved Variety to maximize the potential. Governmental and non-governmental organization should extend their support in expanding distribution of selected and disease resistant fruit seedlings to farmers.

- Disease and pests are the major fruit production constraints in the farmer's field. Most farmers don't know the type and cause of different diseases and pests and its application of different protection of chemicals. Providing training in identifying type and causes' of diseases and pests ,application of chemicals and how to treat is vital in reducing the problem, so different stakeholders taking in to consideration this to maximize the fruit production .

- To minimize the demand and low pricing problem at the pick production period farmers organized and searching other market rather than their district. Moreover for the transportation problem if farmers collaborate to sell there product at ones, it is possible to organize trucks to load products of more farmers. In addition to this district and tabia administrators give emphasis on maintain the weathered to be suitable for truck.

- As the discussion with wholesalers, around 90% of the total source of fruit is out of the region and as the result of the study shows still there is a shortage of supply. This is good opportunity to local farmers to produce more and satisfy the regional market by supplying additional amount of fruit till the current supply and demand gap will be solved

- Currently there is no any cooperative specializing in fruit marketing. However, the study shows that there will be an increase in fruit production in the coming years that require organized effort to be excreted for storage and marketing of fruits. Hence, establishing fruit marketing cooperatives are among the recommendations the regional and district rural development offices need to think of.

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Appendix

.1.VIF of Continuous Explanatory Variables

Variables	VIF
EDU	1.41
ACT	1.2
FFX	1.34
VDT	1.08
TNT	1.11
EXS	1.05
TLU	1.07

Source: Computed from survey, 2011

.2.Tropical Livestock Unit (TLU) equivalent conversion factors

Animal Category	Conversion Factor	Animal Category	Conversion Factor
Calf	0.25	Donkey (young)	0.35
Weaned Calf	0.34	Donkey (adult)	0.70
Heifer	0.75	Horse	1.10
Ox and Cow	1.00	Camel	1.25
Sheep and Goat (young)	0.06	Chicken	0.013
Sheep and Goat (adult)	0.13		

Source: Strock et al. (1991)

.3.Checklist for fruit survey (BoARD and traders)

1.BoARD

1. wereda ----------
2. total population of the wereda ----------
3. What is the total arable land of the werda?
4. What is the total irrigated land?
5. What is the total fruit coverage of the werda?
6. What are the total beneficiary/ fruit producers?
7. What are the main fruit type produce in your wereda?
8. Is there fruit nursery in your wereda?
9. If yes what types of fruits propagate and distribute to farmers?
10. What is the role of your office in fruit market, market information and post harvest handling?
11. How do fruit producers distribute/sale fruit?
12. Are there fruit cooperatives?
13. Are there contractual agreements between fruit producers and any wholesaler or retailer within or outside the woreda?
14. Are there complaints on lack of demand for fruit?
15. Any conflict between buyers and sellers in terms of quality, failure to settle payments(contarcts)
16. What are the main constraints on the production and
17. What are the constraints on the marketing of fruit?
18. any additional on fruit production and marketing remarks

2 Traders, supermarket

1. Gender ----------
2. wereda----------
3. When did you start fruit business /selling fruit?

4. Type of business :
    a. retailer ,
    b. wholesaler
5. where is the source of fruit /supply
    a. famers from wereda
    b. retailers from the woreda
    c. wholesales from wereda
    d. farmers out of wereda /region specify the wereda/region
    e. traders out of wereda /region specify the wereda/region
    f. other
6. supply of fruit from source
    a. high
    b. medium
    c. low
7. demand of fruit
    a. high
    b. medium
    c. low
8. what are the common fruits you buy for the market?
9. What are the common fruits you sold?
10. How do you store your fruits?
11. Which type of fruit can be found regularly in your shop?
12. What are the common problems in buying fruit (quality, storage or any other)?
13. Where did you get market information about fruit?
14. How do you settled payment (immediate, credit, advance payment)
15. any additional remark about Apple

.4.Questionnaire on fruit Market Potential in Tigray

No.	Item	Description
1	Name of the enumerator	
2	Woreda Code 1. Alamata 3. Kola Tembain 2. Kilte Awlalo 4. Dega Temben	Code _____
3	Tabia Name 1. Gergale 5. Adi kisandik 2. Timuga 6.Abreha Weatsebeha 3. selam nkalsi 7. Adiha 4. Genfel 8. seret	Code _____
4	Kushet Name	_____
5	Complete name of the household head	
6	The sex of the Household Head **0=Female 1=Male**	Code _____
7	Does the household head read and write **0=no 1=yes**	Code _____
8	Type of education of the household head 1. illiterate 2. adult education/religious 3. Primary first cycle(grade 1-4) 4. primary 2nd cycle (grade 5-8) 5. high school (grade 9-10) 6. preparatory/vocational (11-12/10+1-+2) 7. college/university education	Code _____
9	Household size	_____
10	Active Family Members (18-65)	_____
11	How many of the household members participate in farming	_____
12	How many years of farming experience do you have	_____
13	Access to irrigation **0=no 1=yes**	Code _____
14	Irrigated land size of the household (Tsimad, 1 Tsimad=1/4 hectare)	_____ hectare
15	Kushet's Distance from Mekelle	_____kms
16	Kushet's Distance from Woreda market	_____ kms
17	Kushet's Distance from Asphalt road	_____ kms
18	Average transport cost per person to Mekelle	
19	Average transport cost per quintal to Mekelle	
20	Average transport cost per person to Woreda market	
21	Average transport cost per quintal to Woreda market	
22	Date of interview DD/MM/YYYY	
23	Household Code	_____

April 2011, Mekelle

SECTION 1: Household Characteristics

Table 1.1 Household Characteristics

1. Household member code	***2.List the names of the household members*** ***Names***	***3.The relationship of the HH head and the member*** ***0=self/head*** ***1=husband/wife*** ***2=son/daughter*** ***3=father/mother*** ***4=father/mother in-law*** ***5=grandmother/father*** ***6=grandson/daughter*** ***7=son/daughter in-law*** ***8=nephew/niece*** ***9=aunt/uncle*** ***10=brother/sister*** ***11=other relative*** ***12=non-relative*** ***Code***	***4.Sex of the household member*** ***0=Female*** ***1=Male*** ***Code***	***5.What is the age of the household*** ***Years***	***6.Active in farming*** ***0=No*** ***1=yes*** ***code***	***7. Do the household member read and write, if yes, fill q. 8.*** ***0. No*** ***1.Yes***	***8. How many years of formal schooling have been completed by the household members?*** ***years***
1							

Section 2: Land holding and plot characteristics

1. Does the household have any land with holding/use rights? 0= no 1= Yes , if no go to Question 3
2. what is the size and quality of the land (in tsimad; **four Tsimdi is equal to one hectare)**
    1. Fertile (regid) _____ Tsimdi
    2. Moderately Fertile_____ Tsimdi
    3. Not Fertile (rekik) _____ Tsimdi
    4. Total land Holding _____ Tsimdi
3. Did you rent in land in the (kiremti) season of 2002 E.C? 0= No 1=yes
4. If your answer for Q.no. 3 is yes how much was the size of the land you rented in 2002 E.C? _____ Tsimdi
5. Did you rent out land in (kiremti) season of 2002 E.C 0= No 1=yes
6. If your answer for Q.no. 3 is yes how much was the size of the land you rented out? _____ Tsimdi
7. Do you have a backyard land 0= No 1=yes
1. If yes, how much is its size _____ Tsimdi

Table 2.2. Source and distance of water for human use, livestock and irrigation

Water source	Distance from homestead in walking In minutes	Use of water	Means of accessing water for each type of use	Way of sharing water among community	Availability of water in months After rainy season
Code a		**Code b**	**Code c**	**Code d**	**Code e**
1					
2					
3					
4					

code

Code a	Code b	Code c	Code d	Code e
1=spring 2= river 3=wall with pump 4=Wall with out pump 5= pond 6=dam 7=other(specify)	1=drinking (human) 2=drinking (livestock) 3=Other domestic use 4=irrigation	1=pipe 2= motor pump 3= human power 4=animal power 5=gravity 6=other _____	1=own 2= free any time 3= turn by turn 4= any other _____	1= throughout year 2= up to 3 month 3= up to 4 month 4= up to 5 month 5= up to 6 month 6=any other, specify _____

Section 3 Questions related to production and marketing

3.1 productions

3.1.1 What are the types of fruit tree you planted in your farm land?

No.	types of fruit tree	Total number of trees	How many of these trees are under production	When did you plant for the first time	Where did you plant? 1 .Backyard 2. farm
1	Banana				
2	Orange				
3	papaya				
4	Avocado				
5	Mango				
6	Apple				
7	lemons				
8	(Tirunigo / citrus)				
9	Cactus				
10	Guava				
	Other ,specify----------				

3.2.2 What are the expected amounts of fruits to be harvested from the fruit trees you have?

No.	Types of fruit tree	Amount of fruit in kg you produce (expect) in 2003 E.C.	Amount of fruit you present to the market in kilograms in 2003 E.C.	How much money have you received from each fruit type you planted in 2003 E.C.	How much money do you expect to receive from each fruit tree you planted every year	Do you practice intercropping under the fruit trees?0=no, yes=1
1	Banana					
2	Orange					
3	papaya					
4	Avocado					
5	Mango					
6	Apple					
7	lemons					
8	(Tirunigo / citrus)					
9	Cactus					
10	Guava					
	Other ,specify----------					

11. Where do you plant the fruit trees?
    1) On farm
    2) Homestead
    3) Other, specify----------

12. Why did you plant the trees there?
    1. availability of water
    2. Land size
    3. Due to distance to market
    4. Due to the reason that fruit is high value
    5. More suitable for weather condition
    6. Suitable for the soil type
    7. Availability of fruit seedling
    8. Other, specify _____

13. What is the trend of fruit production since the time you start?
    1. Increase
    2. No change
    3. Decrease

14. Where is the source of fruit trees /seedling?
    1. ARDO (Agricultural and Rural Development Office)
    2. REST (Relief Society of Tigray)office

3. Action Aid
4. Cooperatives
5. Others ,Specify _____

15. What are the constraints you have ever encountered in fruit production?
    1. Pest and diseases
    2. Water shortage
    3. Birds (damaging the fruit)
    4. Theft
    5. Others ,specify _____
16. What coping strategies do you practice to overcome the problem listed above?
    1. Use of pesticides
    2. caring water from river near by the house
    3. Change to other crop production
    4. Guarding the fruit at the time of ripening
    5. Other, _____

3.2 Questions related to Fruit Market

17. How long have you been in fruit supply to the market (since when) _____ years
18. How do you sell fruit?
    1. Open market/spot market

    2. Contracts

    3. Cooperatives

    4. Others, specify

19. What is the means of transport?
    1. On foot 2. Pack Animals

    3. Vehicle 4. Others, specify _____

20. How much time does it take to reach the district market? _____hours(60 minutes= 1hr) in walking
21. Have you ever faced loss / damage of fruit during transport? 0=no 1=yes
22. if yes what was the reason_____
    1. problem of package
    2. Long Distance
    3. other, _____
23. What is your packing material while you transport your fruit to the market?
    1. Chiret
    2. Kefer / kuna
    3. Basket
    4. Box /Gabia
    5. Plastic box bucket
    6. caret
    7. Other, specify _____
24. How do you store your fruits in your house?
    1. Sacks 2. Chiret 3. Open/ventilated store 4. Common ventilated cooperative store
    5. Other, specify _____
25. Do you grade your fruit before supplying to the market? 0= no 1=yes

26. if yes based on what did you grade your fruit
    1. quality
    2. size
    3. other ,specify _____
27. How frequent did you sale your fruit?
    1. daily
    2. every three days
    3. every week (weekly market)
    4. other, specify _____
28. To whom did you sale your fruit?
    1. To individual at field
    2. To individual at market
    3. To cooperatives
    4. to retailers at field
    5. To retailers at district market
    6. to super markets
    7. to juice houses
    8. at Mekelle market
    9. other , specify _____
29. what is the unit of measure for selling your fruit
    1. Selling in kilogram 2. Selling in number (pieces) 3. other, specify _____
30. Have you ever taken back unsold fruit to your home? 0=no 1=yes
31. If yes, what do you do with this un sold fruit?_____
    1. Consume at home
    2. Use it as gift
    3. Use it as natural fertilizer
    4. Others _____
32. How do you set prices?
    1. I set price independently

    2. The buyer sets the price

    3. Negotiation

    4. Minimum price set by the district office

    5. Others, specify _____

33. what is the degree of price flexibility in the market
    1. Fixed 2. Flexible 3. Unpredictable

34. What are the constraints you have ever encountered in fruit marketing?
    1. Lack of demand/market
    2. Lack of market information
    3. Low price
    4. Product perishablity
    5. Lake of storage
    6. Lack of transport
    7. Cheating on balance/units of measure
    8. Other ,specify_____
35. What coping strategies do you practice to overcome the problem listed above?

1. Contracting with buyers
2. Forming cooperative
3. Build an open air store to reduce spoilage
4. Consume at home
5. Reduce production and shift to other crops
6. Other, specify _____

36. Have you ever sold fruit on contract base? 0=no 1=yes
37. If you sell on contract, with whom have you signed contract?
    1. Traders 2. Juice houses 3. Super market 4. other, specify _____
38. If you sell on contract, what was the kind of agreement you made with your buyer?
    1. oral Agreement
    2. written Agreement
39. If you sale fruit on contract, who did organize the transport?
    1. yourself
    2. buyer
40. What was the mode of payment while selling fruit?
    1. Immediate payment
    2. Advance payment
    3. Credit
    4. In kind
    5. Other, specify_____
41. Is the mode of payment a problem? 0=no 1=yes
42. If yes, do you face credit sales uncollected? 0=no 1=yes
43. If yes how much money did remain uncollected in the last 12 months? _____ birr
44. Where did you get market information?
    1. Government /ARDO/
    2. Cooperatives
    3. Radio
    4. Buyers
    5. Sellers
    6. Other ,specify _____
45. Did you give fruit to some one / relatives as present? 0=no 1=yes
46. if yes how much was the estimated amount in the last 6 months (in kg)_____

Section 4: Household Income from Fruit

4.1 Income from the sales of fruit from Ginbot, 2002 to Miazia 2003

No.	types of fruit tree	harvested in kg	Amount for the market in kg	Average price per kg	Annual income
1	Banana				
2	Orange				
3	papaya				
4	Avocado				
5	Mango				
6	Apple				
7	lemons				
8	Tiringo (citrus)				
9	Cactus				
10	Guava				
	Other ,specify				
	Annual income from fruit production				

4.2 incomes from the sales of other farm Activity in the past one year (Ginbot, 2002 to Miazia ***crop and vegetable income (own and rented land)***

Parcel name	Parcel size (in Tsimidi)	Parcel distance from Homestead minutes	Is the Parcel irrigated?0=no 1 =yes	Slop of the parcel 1=Maida 2=Daget 3=Gedel 4=other	Type of crop harvested (crop code below)	Amount harvested in kg (1 quintal =100kg or 1 chiret=50 kg) during Belg season	Amount of crops or vegetables for market in kg during Belg	Value of crops and vegetables for the market in Birr during Belg	Amount harvested in kg (1 quintal =100kg or 1 chiret=50 kg) during kiremt season	Amount of crops or vegetables for market in kg during kiremit	Value of crops and vegetables for the market in Birr during kiremit

Crop code:

1=white teff 9=Horse bean (bakela) 17=Sinar 25= Onion

2=Black and mixed teff 10=Linseed(Telba) 18=Field Peas 26=Garlic 33=Potato

3=Barely 11=sesame (Selit) 19=Haricot beans (Boleke) 27=Cabbage 34= Karia

4=Wheat 12=Lentils(Misir) 20=Fenugreek (Abish) 28=Spinach (quosta) 35=Sugarcane

5=karkata 13=Cheack peas (Shinbra) 21=Rice 29=Lettuce 36=Berbere

6=Sorghum 14= Cow peas (Ater) 22=Nueg 30=Tikil Gomen 37= Ird

7= Zengada 15=Dokoko 23=Pop corn 31=Carrot 38=Gesho

8=Oats (Aja) 16=Guaya (Vetch) 24=Dagussa 32= Tomato 39= Ginger 40=_____

4.3 incomes from off farm activity in the past one year

S/N	Source	Number of people engaged	Number of days they engaged	Average Income per working day	Total annual income from off farm
1.	Wage				
2.	Selling local drink ((tirif tirah)				
3.	Petty trading (tirif tirah)				
4.	Selling fire wood				
5.	Handicraft				
6.	Herding				
7.	Food for work				
8.	Remittance				
9.	Pension				
10.	Idir				
11.	Other income				

Table 5.4 Livestock assets currently and before 5 years

1.Animal code	***2.Type of Animal***	***3. How many of these do you own currently?*** ***Number***	***4.What is the value of livestock if sold today*** ***Birr***	***5. How many livestock did you own before 5 years?*** ***Number***
1	Beef cattle			
2	Dairy cattle(hybrid)			
3	Dairy cattle(local)			
4	Calf			
5	Heifer			
6	Oxen			
7	Bull			
8	Donkey			
9	Mule			
10	Horse			
11	Camel			
12	Goats			
13	Sheep			
14	Chicken			
15	Modern beehive			
16	Traditional beehive			
17	Intermediate beehive			
18	Other, specify			

5.6 Input used in own and rented land

Inputs used	how many kilograms of inputs did use in the last 12 months?	What was the total cost of input used in the last 12 months?	how many kilograms of inputs did use 5 years before?
Fertilizer			
Selected seed/seed			
Manure			
Pesticide			
Herbicide			

5.7 Rent income from land

Name the plot you rented to other persons Name	Plot area (in hectare)1 tsimad =1/4 hectare Amt	Type of contract 1=fixed2=share crop3=other Code	If fixed rent, what is the amount in birr? Birr	If share crop, what is the percentage? %	How much income did you get from the rented land? If it is share cropping, what was the income received from selling the received crop from each plot?
Total Income					

5.8 Income from livestock selling in the last 12 months

Code	Livestock product type	How many did you sell in the last 12 months? Number	What was the total value in Birr received from the sales made in the last 12 months?
1	Beef cattle		
2	Dairy cattle		
3	Calf		
4	Heifer		
5	Oxen		
6	Bull		
7	Donkey		
8	Mule		
9	Horse		
10	Camel		
11	Goats		
12	Sheep		
13	Chicken		
14	Traditional bee hive		
15	Modern beehive		
	Total Income		

5.9 Income from livestock products

Code	Livestock product type	Unit of measurement 1=liter 2=kilogram 3=minlik 4= tanika 5= Birr/day 6=birr/hour 7=number/unit	How much of these products were produced in the last 12 months?	What would be the total value in Birr if it sold in the same period	How much of these products were sold in the last 12 months	What was the total value in Birr received from the sales made in the last 12 months	How much of these products are in stock?	What will be the total value of stock if sold at present?
1	Honey							
2	Milk							
3	Butter							
4	Skins							
5	Hides							
6	Eggs							
7	Renting out donkey							
8	Renting out horse							
9	Renting out oxen							
10	Renting out mule							
11	Renting out camel							

5.10 Other non-agricultural income for the last 12 months

Income code	2. Type of income	***Amount of money received in the last 12 months***
1	Food for work	
2	Cash for work	
3	Selling of any other natural resources like incense, wiled fruit	
5	Income from Idir/other NGOs	
6	Remittance	
7	Credit from DECSI, or any other lender	
8	Others, specify	

SECTION 6: Support Obtained related to fruit production and marketing

1. Did you get any type of support? 0. No 1. Yes
2. From whom did you get support 1. Government 2. NGO 3. Cooperative 4. Buyer/client 5. Any other, specify _____

Type of support

No.	Type of support	1. Whether or not you have got any one of these supports?0. No 1 yes
1	Training	
2	Credit	
3	Input and technology	
4	Veterinary	
5	Fruit seedling and post harvest support	
6	Quality control	
7	Transportation	
8	Specialized storage	
9	Business and financial mgt support	
10	Market access	
11	Other	

12. Did you actively participate in the local administration? 0. No 1. Yes

13. If yes what was your area of involvement?

1. Abomay 0. No 1. Yes
2. Fana tena 0. No 1. Yes
3. Farmer association 0. No 1. Yes
4. Member of social court 0. No 1. Yes
5. Local security 0. No 1. Yes
6. Political membership 0. No 1. Yes
7. Member of the perish council/Sebeka gubaia 0. No 1. Yes
8. Other, specify _____

14. What was the trend of fruit sales since your beginning of fruit production?

1. drastically decrease
2. decrease
3. no change
4. increase
5. sharp increase

15. What does the trend of your income from fruit since the beginning of production?

1. drastically decrease
2. decrease
3. no change
4. increase
5. sharp increase