WATERMELON (Citrullus lanatus) VALUE CHAIN AND SMALLHOLDER LIVELIHOOD IMPROVEMENT IN THE UPPER EAST REGION OF GHANA

BY

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DECLARATION

I, Mohammed Bukari the writer of this thesis titled "**WATERMELON (Citrullus lanatus) VALUE CHAIN AND SMALLHOLDER LIVELIHOOD IMPROVEMENT IN THE UPPER EAST REGION OF GHANA.**

" do hereby declare that except for various forms of assistance reference to other people's work which has been duly cited and acknowledged, this dissertation is the result of my own original work produced under supervision and that has never been presented in part or whole for the award of any degree in this university or elsewhere.

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DEDICATION

This work is dedicated to my eldest sister, Mrs. Mariama Bukari for first taking me to school. I also dedicate the work to my loving wife and my two kids for allowing me to leave home and come to school to learn. I had unflinching support.

ABSTRACT

The study was conducted among one hundred and thirty (130) participants; 120 farmers and 10 buyers. The purpose of the study is to examine the production of watermelon as a high value crop in contributing to livelihood of smallholder farmers in the Bawku West District (BWD) in the Upper East Region (U/E/R) of Ghana. Specifically, the study sought to achieve the following objectives: to determine the relationship between personal characteristics of smallholders and level of participation in watermelon production, to determine the linkages and strengths among actors in watermelon production and to examine the contribution of watermelon to household income of smallholders. The study reveals that all the buyers were women and 97% of the producers were men indicating a male dominance in cultivating the crop. Overwhelming majority (73%) producers did not have formal education. Average household size was found to be 13, which is higher than the 6.1 recorded in the 2010 census data. In order of hierarchy, the livelihoods of famers were crop farming, livestock farming, fishing and trading. Family labour was the leading source of farm labour at 32.5% followed by hired labour at 31.7%. The production volume of watermelon was found to be declining from an average of 17 donkey carts in 2009 to 12.2 in 2013. This was attributed to low access to markets.55.8% and 30% of producers indicated incomes from watermelon cultivation formed very significant and significant portions house hold incomes respectively.

The study revealed that personal characteristics of smallholders such sex had no influence access to service providers and farm size. Formal educational and marital status of respondents did not have influence on farm sizes of watermelon farmers. The study established that generally, weak relationship exist between watermelon farmers and other value chain actors such as MoFA, financial institutions, input dealers and buyers.

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ACRONYMS

ARPN : Asian Research Publishing Network

BMA : Bawku Municipal Assembly

BWD : Bawku West District.

DADU : District Agricultural Development Unit

DFID : Department for International Development.

FAO : Food and Agricultural Organisation of the United Nations.

FI : Financial Institution

GSSP : Ghana Strategy Support Programme

HH : House Hold

ID : Input Dealers

IFAD : International Fund for Agricultural Development

IFPRI : International Food Policy Research Institute.

MoFA : Ministry of Food and Agriculture

NGO : Non-Governmental Organisation.

PHC : Population and Housing Census

RADU : Regional Agricultural Development Unit

SPSS : Statistical Package for the Social Sciences

SSA : Sub-Saharan Africa.

CHAPTER ONE

INTRODUCTION

1.0. Introduction

This chapter focuses on what the research is about and its scope. It looks at the justification, objectives and limitations of the study.

1.1. Background

Poverty and food insecurity remain a common plaque among smallholder farmers in Africa. In Ghana, the poverty figures consistently shows the poorest regions to be Upper West, Upper East and Northern Region in order of severity As a coping mechanism against risk of crop failure, small holders engage in mix cropping in the same field or divide the field among multiple crops if they engage in mono cropping. Farmers in the study area grow cereals such as maize, rice, sorghum and millet. They also grow legumes such as groundnut, cowpea, soyabean and bambara beans. Vegetables such as watermelon, okro, pepper, onion, cabbage and tomatoes are also cultivated in the area. All these crops contribute in one way or the other to poverty reduction and food security among smallholder farmers in the Upper East Region. The potential of these crops, particularly the vegetables in alleviating poverty and food insecurity differs; making it necessary to put more emphasis on the ones that have comparative advantage to generate income and contribute to income and food security.

From my personal observation and working with farmers in the area, watermelon does seem to have a comparative advantage in terms of contributing to income and food security, more so for people living around water bodies who could engage in

both wet and dry season cultivation of watermelon. Watermelon (Citrullus lanatus) is an annual fruit vegetable that thrives well in Tropical and Sub-Tropical Africa, requiring a lot of sun-shine and high temperature over 25˚c for optimum growth. It matures between 80-100 days after planting depending on the variety. Yield averages 25-30Ton/Ha. Fruit weight averages between 4.5kg-11kg/fruit.

Many farmers living around the White Volta, dams and streams engage in the cultivation of watermelon mainly for cash. It is also relished as food by children and adults at large and it is said to be very nourishing. In addition, watermelon has demand locally in the cities and urban areas. Its demand goes up during certain festivities and periods like Ramadan (Muslim fasting) when Muslims eat a lot of fruits in the mornings and evenings. The crop is relatively easy to cultivate and can easily be done by both men and women. It requires less fertilizer to grow and when established requires less watering for it to survive, grow and produce. The Climate of region is also suitable for the crop.

1.2. Research Problem

A review of the annual reports of the Ministry of Food and Agriculture (MoFA) over the years reveals that watermelon is not listed as one of priority crops to be given attention in the Upper East Region. Yield data as well as number of farmers engaged in its production are difficult to find. Rather, vegetables such as tomato and onion are captured as priority crops. However, watermelon production has become wide spread in the area and has a very high potential as a cash crop among farmers in the Upper East Region and as such when promoted could contribute significantly to the fight against poverty and food insecurity. It study would provide information as basis

for development organisations interested in rural development to make decisions on which crops to promote. The government institutions responsible for local agricultural planning and development are Regional Agricultural Development Unit (RADU) and the District Agricultural Development Unit (DADU). The institutions determine which crops are priority crops for income and food security for the local area. Recognising and promoting crops with potential could improve their productivity and hence promote incomes of farmers. Sufficient information is required to take decisions on which crops to promote. Watermelon is a non-traditional crop and its cultivation is seen to be increasing among many farmers in the study area. However, there is currently no empirical data on the contribution of the crop to income and food security for cultivators of the crop in the region. This study is an attempt to assess the potential of watermelon value chain in improving the livelihoods of smallholder farmers and make.

1.3. Research questions

1. Do personal characteristics of farmers affect their participation in the value chain of watermelon?
2. How does watermelon cultivation contribute to income security of smallholder farmers?
3. What kind of relationship exists between various actors of watermelon value chain in the Bawku West District?

1.4. Research hypothesis

1. Watermelon industry does not contribute to income security of smallholder farmers.
2. There is no relationship between personal characteristic of farmers and their participation in the value chain of watermelon

1.5. Research Objectives

1. To determine whether there is a relationship between characteristics of smallholders and their level of participation in watermelon production.
2. To determine the linkages and strengths among actors in the watermelon value chain.
3. To examine the contribution of watermelon production to the household income of smallholders.

1.6.Justification of the study

The livelihood of smallholder farmers is dependent on diverse sources from agricultural and non-agricultural related activities. Climate change resulting in changes in rainfall pattern and increasing demand for fruits and vegetables especially for urban dwellers are factors that affect farmers' decision to cultivate certain crops. Sufficient information is required by service providers such as MoFA on which crops gives better returns to farmers. This study would provide enough bases to promote the value chain of such crops. The information would also be beneficial in deciding which livelihood activity of farmers should be given priority in the study area since resources are scarce. There is currently no data on the contribution of watermelon to livelihoods of smallholders in the study area. The study is aimed at gathering data

mainly from farmers and buyers to determine the contribution of watermelon to income security and the nature of value chain of the crop in the study area. The result of the study would provide some basis for development agents to plan and prioritise support services to meet the needs of farmers.

1.7. Scope of the study

The study looks at the livelihood sources of smallholder farmers involved in watermelon production. It looks at the actors involved in the watermelon value chain and the level of relationship that exist between actors. The study determined the contribution of watermelon production to household livelihoods of smallholders. Questionnaires were administered to watermelon farmers and marketers in Bawku West District of the Upper East Region.

1.8. Limitation of the study

During the field data collection, some of the respondents were absent during the scheduled time with enumerators. This necessitated re-scheduling of meetings resulting in more time and cost than expected. Most respondents were not also willing to leave their farm work to stay at home and so enumerators had to follow-up to their farms to interview them. Another limitation of the study is my in ability to gather data on production figures of watermelon in the region from official sources because such data did not exist with MoFA.

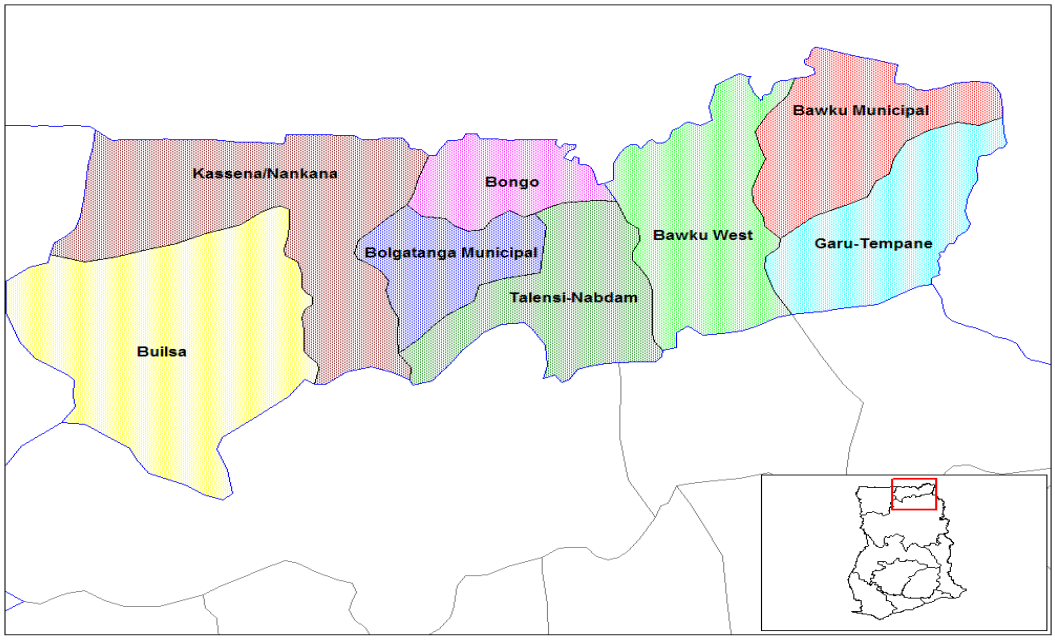
1.9. Demographic characteristics

According to Blench (2006) The Upper East Region has some of the highest rural population densities of any region of Ghana. The total population of the region is

1,046,545 made up of 506,405 male and 540,140 female. The average household size in the region is 5.8.

Majority of the population, 826,899 people representing 79.01% live in rural areas whilst only 20.99% live in urban areas (Ghana Statistical Service, 2012). The Upper East Region has the least population growth rate at 1.2% in Ghana whilst the Greater Accra and Central Regions have the highest population growth rate of 3.1% (Ghana statistical service, 2010). The average house size of the Upper East Regions is 5.8 and is the third highest in the country after Northern Region (7.7) and Upper West Region (6.2). Map showing the various districts in the Upper East Region is shown in figure 3.1

Figure 1: Map of U/E/R indicating districts in the region



1.10. Soil and vegetation

The soil in the Region is basically "upland soil" mainly developed from granite rocks. The soils are shallow, low in organic matter content and predominantly course textured. Valley areas have soils ranging from sandy loam to salty clays. The valleys have more natural fertility but are generally difficult to tilt and are often prone to seasonal waterlogging and floods. The main means of drainage of water is by the white and Red volta and Sissili rivers. The natural vegetation is that of the savannah woodland characterised by short scattered drought-resistant trees and grass that gets burnt by bushfire or scorched by the sun during the long dry season. Human interference with ecology is significant. The climate is characterized by one rainy season from May/June to September/October. The mean annual rainfall during this period is between 800 mm and 1100 mm. The rainfall is erratic spatially and in duration. There is a long spell of dry season from November to mid-February, characterized by cold, dry and dusty harmattan winds. Temperatures during this

period can be as low as 14 degrees centigrade at night, but can go to more than 35 degrees centigrade during the daytime. Humidity is, however, very low making the daytime high temperature less uncomfortable. The most common economic trees are the sheanut, dawadawa, boabab and acacia.

1.11. Major crops and livestock

The main staples grown the area are cereal such as millet, sorghum, maize and rice. Legumes such as cowpea, soya, groundnut and bambara beans are also cultivated. Vegetables such tomatoes, onion, cabbage, watermelon are cultivated mainly for cash. Rain-fed agriculture is predominant method of farming although irrigation farming is practiced in areas where the facility exists.

Various animals are also kept by the people. These animals include cattle, sheep, goats, donkeys, pigs, fowls, guinea fowls, and ducks.

CHAPTER TWO

CONCEPTUAL FRAME WORK AND LITERATURE REVIEW

2.0 Introduction

This chapter looks at the main ideas constituting the conceptual frame of this study. Literature review on concepts such as smallholders, livelihoods activities of smallholders and commodity value chains are explored in this chapter.

2.1 Theoretical perspectives

Poverty and food insecurity continues to plague smallholder famers in the Upper East Region. Agriculture remains the most potent means of alleviating the poverty of over 70% of farmers who are classified as poor and 60% as very poor in the region. Since the primary occupation of the people is farming, it would be more beneficial that efforts at alleviating poverty, improving income and food security should be directed at agriculture as a catalyst for growth. There is a relationship between growth in agriculture and poverty reduction. High growth in agricultural productivity supported early development in countries like Japan, United States and Western Europe and later in China, Korea Republic and Taiwan. Analysis by IFAD and IFPRI cited in Cleaver (2012) indicates a clear correlation between developing countries with the largest reduction in poverty rates and incidence of undernourishment and those with the most rapid agricultural growth. The analysis indicates that 1% increase in agricultural growth leads to 2.7% increase in incomes of people in the lowest three income groups in developing countries. Investing in agriculture is 2.5 to 3 times more effective in increasing incomes of the poor than in non-agricultural investments. When farmers make enough income from farming they can invest in other livelihood ventures such as trading and artisanship to create more wealth. Empirical data

generated locally is required to help MoFA and other development agencies to identify and focus on the crops with high potential for income and food security in the region to support faster development and reverse the trend of underdevelopment and poverty among smallholder farmers. Thapa (2009) observed that smallholder famers have the potential to raise their incomes by switching from grain-based production system to high- value agriculture.

2.2. Description of conceptual framework

The conceptual framework is a way of linking all the aspects of the research and situates the study within prior study and theory in the proposed study topic. It also identifies the phenomena the researcher proposed to analyse and justification for the study. School of Education and Human development (2012) content that the term conceptual framework has two elements:

1. "Conceptual" which refers to the theoretical and conceptual assumptions underpinnings to be given attention in the study.
2. "Framework" which has the function of putting boundaries and providing points and attachments for ideas, relationships, categories and data sets.

The main premise of my conceptual framework for the study is anchored on better understanding of the livelihood sources of smallholders by local development organizations like MoFA for enhanced planning and appropriate support systems towards improving livelihood efforts of farmers especially smallholders.

The basic components of the framework for the study are the following:

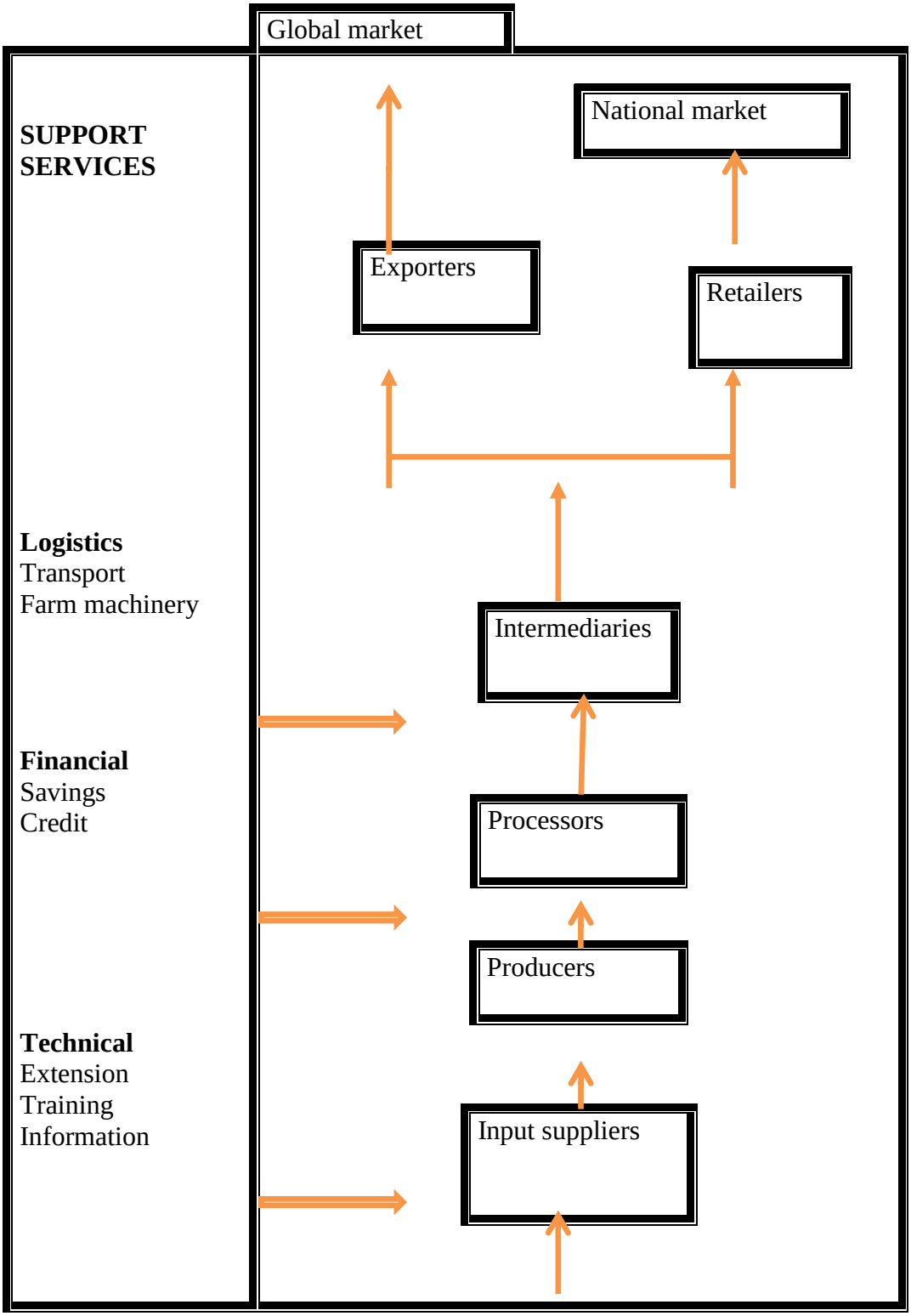
1. Concept of smallholders; who are they and how are they identified?
2. Livelihood activities of smallholders and ranking of livelihood options

3. The contribution of watermelon to livelihoods of farmers
4. Production Resources of smallholders
5. Personal characteristics of respondents and how this affects their participation in watermelon value chain.
6. Value chain actors involved in watermelon crop and their relationships.

Commodity value chain would normally involve vertical as well as horizontal relationships among actors. Input dealers would be linked vertically with farmers. Farmers could also be linked with other farmers participating in other value chains horizontally. Strong relationships among the actors should result in positive outcomes such as:

1. Secured markets and increased sales
2. Profits leading to income security
3. Enhanced ability by producers to reinvest leading to increased production.
4. Increased access to financial and technical services.
5. Increased access to information by all actors.

Figure 2: value chain conceptual framework



2.3. Concept of smallholders

Majority of rural dwellers in Ghana depend on agriculture in various degrees for their livelihood. On the average, 56.2% of Ghana's population lives in rural areas. Moreover, it is also estimated that 57.6% of land classified as agricultural land in Ghana is said to be under cultivation (MOFA, 2011). Despite increasing urbanization, Africa is still predominantly a rural continent with over 60% of its population living in rural areas (Wiggins, 2009). Smallholders engage in diverse activities to earn their livelihoods. They engage in multiple crop production, rearing of different species of livestock and also engage in off farm activities. According to Dixon, Taniguchi, Wattenbach, & Tanyer-Abur (2004), smallholders as a group still dominate most farming systems of developing countries and on the positive side, account for majority of rural employment, most food production and significant export earnings

Different indicators are often used in identifying smallholders. Chamberlin (2007) used landholdings, wealth, market orientation, and levels of vulnerability to risk in identifying smallholders. In terms of landholdings, the Ministry of Food and Agriculture (MoFA) classified farmers with less than 2ha of landholding as smallholders. In terms of wealth, The Ghana Poverty and Social Impact Analysis (PSIA) classifies farmers into five categories which are large scale commercial farmers, small scale commercial farmers, semi-commercial farmers, non-poor complex diverse risk prone farmers and poor complex diverse risk prone farmers. With this categorization, apart from the first two; large scale and small scale commercial farmers, the rest are classified as being smallholders. Nyateng and Seini (2000) cited in Chamberlin (2007 p. 13) stated that "over 90% of the Ghana's food

production is derived from holdings of 3ha or less." The distribution of landholdings varies across the various regions in Ghana. Table 2.1 gives the breakdown of landholdings in the ten (10) regions of Ghana.

Table 2. 1 Distribution of landholding sizes in Ha

Region	< 0.5	0.5-1.0	1-2	2-3	3-4	4-5	>5
Western	15%	15%	23%	18%	8%	8%	13%
Central	10%	17%	22%	17%	9%	8%	18%
Greater Accra	17%	14%	21%	15%	7%	7%	19%
Eastern	27%	18%	21%	14%	5%	5%	10%
Volta	23%	22%	28%	14%	4%	5%	5%
Ashanti	3%	6%	16%	23%	10%	14%	30%
Brong Ahafo	9%	20%	34%	12%	4%	5%	17%
Northern	7%	11%	29%	26%	10%	8%	10%
Upper East	31%	19%	19%	11%	7%	5%	9%
Upper West	15%	10%	18%	18%	8%	10%	21%
National average	16%	15%	22%	17%	7%	8%	16%

Source: Chamberlin, 2007.

It is indicative from the table that on regional basis, majority of farmers (31%) with landholdings of < 0.5ha are from the Upper East Region.

Since land size is fixed, the use to which the land is put makes the difference. Therefore, the kinds of crops that are cultivated and breed of livestock that can give better returns on investment to smallholders should be the pivot of effort for development organizations. Emphasis should be put on high value crops such as fruits and vegetables which are cheaper to produce and though labour intensive has the potential to generate higher incomes for smallholder farmers. The smallholders have

the potential to raise incomes by switching from grain-based production systems to high –value agriculture. However, farmers need to work in value chain to enhance linkages with input and output markets to minimize risk associated with high value, perishable crops such as fruits and vegetables.

2.4. Food and income insecurity among smallholders

The population of Sub Sahara Africa (SSA) is said to be poorer than other regions and falling further behind. Whilst other regions have managed to reduce the number of the absolute poor, in SSA the number of the poor has steadily grown (Livingston, G.,Schonberger, S.,& Delaney, S. 2011) Given that agriculture creates jobs, generates income, produces food and contributes to social stability, the sector is important in the development of Sub-Saharan Africa and expanding it judiciously can pave the way to the future where Africa can feed itself and the world (Schaffnit-Chatterjee, 2014) It is often said that the green revolution that saw Asia develop its agricultural sector and brought about significant increase in food production has bypassed Africa. Moreover, with the current growth rate in population exceeding growth rate in agriculture in Africa, the problem of food insecurity is expected to aggravate. Between the year 2000 and 2010, the population of Africa compared to the rest of the world moves from 13% to 15% (FAO, 2012). According to Schaffnit-Chatterjee (2014) around 25% of the population in SSS are undernourished and that this has declined less compared to other regions in the last two decades. In order to ensure food security, the current annual growth rate of agriculture of less than 3% should be stepped up to the range of between 4-7% annually.

2.5 Challenges of smallholder farmers

Farmers face many challenges in cultivating crops and rearing livestock. Smallholders are more disadvantaged because of limited resources which limit their ability to use technology that requires capital investment and are also incapable of expanding farms to take advantage of increased produce prices. According to Seini, Jones, Tambi, and Odularu (2011 p.8), some of the factors militating against agricultural development in Africa include, inadequate investment in agriculture; limited access to credit by smallholder farmers; high cost and unavailability of inputs such as fertilizers and improved seeds; inadequate use of modern technologies; inefficient agricultural input markets; and the absence of conducive policy environment. Smallholders have the potential to contribute to food and income security if the right support services and policy environment are available. Wiggins (2009.p11) states the following five conditions under which smallholder farmer development is possible.

1. A favourable investment climate for farming creating level playing field. Farmers are able to access inputs, finance and sell their produce on neutral terms without exorbitant domestic tax and being able to compete in the market with cheap imported produce as well as being able to export to markets were price depressing policies exist.
2. Investment in public goods that support agricultural development such as in agricultural research, extension, rural roads, health care and some cases irrigation and power supply.
3. Development of institutions to allocate and protect property rights, facilitate trade, reduce risk and to facilitate collective action.

4. Existence of demand which is transmitted to the farm gate.
5. Farmers conserving land, water and other natural resources so that physical production can be sustained.

In order to overcome these challenges, a number of interventions have been put in place including government subsidizing inputs such as fertilizer and seed of maize and rice to enable farmers boost the use of these inputs and thereby increase production. Increased agricultural production could be achieved through intensification of agriculture. Low external input intensification and high external input intensification are two path ways to achieving increased agricultural production. Though both intensification methods have achieved successes in various degrees in increasing agricultural production particularly the green revolution in Asia that employed high external input use, their contribution to environmental sustainability are not the same. Where shortage of land cannot be overcome by migration, lack of access to external inputs implies that only increased use of labour and skills offers a way out. Where some arable land does exist, in Sub-Saharan Africa and Latin America, more than 70% suffer from soil and terrain constraints (FAO, 2011).

The term low-input agriculture has been defined as a production activity that uses synthetic fertilizers or pesticide below rates commonly recommended by extension service. It does not mean elimination of these materials and yields are maintained through greater emphasis on cultural practices, integrated pest management, and utilization of on-farm resources. That is why promotion of value chains for high value crops such as fruits and horticultural crops for smallholder farmers would inure to

their benefit. According to Wegner and Zwart (2011) high external input agriculture refers to a system of production that is characterized by high inputs of capital and intensive usage of technologies (modern machines) and chemicals per land area without taking into account environmental externalities whilst low external input intensification agriculture is associated with low input capital but is more labour-intensive relative to the area of land farmed and focuses on maintaining the long-term ecological health of farmland.

It is important to look at the issue of agricultural intensification more closely because of the strategic importance of the agricultural sector in the economics of developing countries. It is the sector that employs the majority of rural people and would continue to be for several decades to come. The intensification should be sustainable so that future generations could benefit from agriculture. The environment should be protected and enhanced by the kind of intensification practiced. Generally, input use in Africa is lower compared to the rest of world. The ability to afford and use agricultural inputs is even lower for smallholders in Sub-Sahara Africa where it is estimated that only 3% of global fertilizer use occurs. Despite government of Ghana subsidies of up to 21% and 36% on fertilizer and seed respectfully for the 2013 season, affordability remains a key challenge to farmers in the Upper East Region of Ghana. Farm profits are marginal making it difficult for smallholder farmers to acquire the requisite quantities of fertilizer and seed. In addition, input dealers also manipulate the input market to the disadvantage of farmers. Moreover, smuggling of inputs particularly fertilizer across the border to neighbouring Burkina Faso and Togo by traders, further send inputs beyond the reach of the smallholder farmers. Druilhe and Barreiro-Hurle (2012) observed two major sources of constraint limiting the use

of inputs by farmers in Sub-Saharan Africa which are profitability and affordability. Table 2.2 provide further explanation on factors constituting profitability and affordability.

Table 2.2 Profitability and affordability issues affecting external input use

Profitability (low marginal returns in quantity and value)	Affordability (high marginal cost)
Lack of knowledge in fertilizer use.	Lack of physical access to inputs.
Fertilizer availability at wrong time	High transport cost
Poor soil fertility	Market power with retailers
Lack of adequate fertilizer for particular soils and crop.	Lack of credit
Impact of climate	
Lack of crop insurance	
Limited access to ready market Low output prices	
Volatility of output markets	

Source: Druilhe and Barreiro-Hurle (2012)

Food insecurity, low incomes and poverty is vicious cycle that plaque the majority of smallholder farmers. If agriculture which is primary occupation of these people is to contribute to uplifting them from this problem, agricultural intensification should suit the needs of smallholder farmers by being affordable and at the same time enhancing soil fertility and protecting the environment.

Increasing agricultural productivity is crucial, both to meet growing demand for food and to offset the climate change yield losses projected in many developing countries. The mounting pressure to increase food security, respond to climate change challenges and halt biodiversity decline have prompted an intense debate on which approach to production could bring better results. There is the option of intensification of agriculture for which there is agreement among experts in agriculture but one form of intensification cannot be uniformly prescribed for all categories of farmers and for all soil and climatic types. Some school of thought is of view that alternatives to high input use should be sought to better serve the needs of poor, small scale farmers. Leeuwis (2004 p.4) observed that "farming that relies on high external input does not seem to be the most feasible development model for many of the rural poor as it is notoriously difficult for them to acquire necessary inputs".

Some of the challenges facing agriculture require dynamic planning at local level to identify and promote agricultural livelihood options that best support smallholders to achieve sustainable incomes and improved food security. High value crops with little requirements for external inputs such as watermelon and other vegetables could contribute to achieving food and income security for smallholder farmers.

2.6 Concept of livelihoods

Chambers & Conway (1991) defines livelihoods as comprising people, their capabilities and their means of living including food, income and assets. Smallholders engage in a number of activities that contribute to their wellbeing and for that matter their livelihoods. These activities include agriculture (crops and livestock), trading, wage labour (on-farm and off-farm), pottery, carving and weaving. Smallholders do

multiple livelihoods activities mostly at subsistence level. Livelihoods therefore is said to be the means, activities and entitlements by which people make a living. Farrington, Carney, Ashley, and Turton (1999) observed that the concept of sustainable livelihoods comprises two basic principles which are humane centeredness and holism. The humane centeredness means that people are put in the centre of development by:

1. Analysing of people's livelihoods and how these have been changing over time.
2. Fully involving people and helping them achieve their own livelihood goals.
3. Analysing different institutional and policy implications on lives of peoples and how these can improve the livelihood agenda of the poor. Holistic principle in the other hand emphasizes the identification of livelihood related opportunities and constraints in all livelihood activities of people. Specifically, the following ideas are components of holism in sustainable livelihoods.

1. Recognizing and understanding multiple influences on people's lives and relationships that exist between these sources of influence.
2. Recognizing various actors in the livelihoods of people such as private actors, community based actors and government agencies, departments and ministries.
3. Seeking to achieve multiple livelihoods outcomes which are determined and negotiated by people themselves.

Identifying and understanding the sources of livelihood of smallholder farmers is fundamental in development interventions to support farmers come out of poverty. For extension officers, this entails continuously monitoring the potentials of the various crops that farmers cultivate to see which crops could bring more income.

2.7 Concept of agricultural commodity value chains

The actors involved in the production, transportation, procession and marketing of an agricultural product are normally referred to value chain actors. Their activities link up to ensure final delivery of the particular product to the market. Marking markets work better for the poor (2008) defined value chain broadly as a complex range of activities implemented by various actors such as primary producers, processors, traders and service providers to bring a raw material through a chain to the sale of the final product; it does not look at the activities implemented by a single actor but rather includes all the backward and forward linkages until the level in which the raw material produced is linked to the final consumer. Jaffee, Siegel and Andrews (2008 p.6) defined agricultural value chain as "encompassing all the input supply, production, post-harvest, storage, processing, marketing and distribution, food service and consumption along the "farm to fork" continuum for a given product be it consumed fresh or processed including external enabling environment". Furthermore, Hellin and Meijer (2006) also asserted that commodity value chain refer to the full range of activities required to bring a product or service from conception through the different phases of production (involving a combination of physical transformation and input from various producer services), delivery to final consumer and final disposal after use. This definition looks at commodity value beyond the final consumer and includes disposal of by- products and waste. Bockel and Tallec (2005) define chain of production as a group of agents that contribute directly to the production, transformation and the delivery to the final market of a single crop or livestock product.

Agricultural commodity value chains results in many benefits for the value chain actors. Barnes (2004) mentioned that commodity value chains result in three benefits for the actors and these are improved product quality, increase system efficiency and development of differentiated products such as preferred crop variety.

2.8 Origin and Domestication of Watermelon

Watermelon (Citrullus lanatus) is thought to have originated in southern Africa because it is found growing wild throughout the area, and reaches maximum diversity there and has been cultivated in Africa for over 4,000 years (Wehner, n.d). The crop has since been developed by scientist in many different ways to increase yield potential and taste. In its wild form before domestication, the plant has undesirable characteristics such as late maturing, small fruit size, hard white flesh and bitter fruit. Watermelon varieties fall into three broad classes based on how scientists develop the seed: open-pollinated, F1 hybrid, and triploid or seedless. Watermelons are also grouped according to fruit shape, rind colour or pattern, and size (Boyhan,Granberry & Kelley, 2000). Watermelon is a native crop of the dry areas in Tropical and Sub-tropical Africa.

The crop has many nutritional benefits to human beings and less labour intensive in its cultivation. The nutritional benefits of the crop have been well documented. "Watermelon is relished by many people across the globe as fresh fruit. This is because watermelon is known to be low in calories but highly nutritious and thirst quenching, it also contains vitamin C and A in the form of disease fighting beta-carotene. Lycopene and beta-carotene work in conjunction with other plant chemical not found in vitamins/mineral supplements. Potassium is also available in it which is

believed to help in control of blood pressure and possibly prevent stroke" (Adekunle, Fatunbi, Adisa, and Adeyemi, n.d). Lilly and Rengasamy (2013)also observed that watermelon acts as natural moisturizer on the human skin, good source of potassium for healthy heart, good source of lycopene, vitamin A and acts as antioxidant which help the body fight diseases such as oral, lung and prostate cancer.

2.9 Varieties of watermelon cultivated

There many different watermelon varieties cultivated all over the world. The most common varieties of watermelon are sugar baby and Chaliston grey. Sugar baby has dark green rind colour, round in shape and takes between 75 to 85 days to mature. Chaliston grey has yellow rind colour, oblong in shape and takes between 85 to 95 days to mature. Watermelons are classified based on the shape and whether they are seeded or seedless type. In the study area, the most common variety grown are the chaliston grey type which the locals called "waa or golle"meaning the "oblong shape" and round types which the locals called "gbila" meaning the round type.

2.10 Conclusion

This chapter reviewed the main ideas constituting the conceptual framework of the research. High value crops have a higher potential for improving smallholder livelihoods. Watermelon, a fruit vegetable has the potential to contribute to livelihoods where value chain approach is adopted. The concept of smallholder farmers was reviewed and what constitutes livelihoods was also examined in this chapter. Commodity value chains were examined as well as challenges smallholder farmers' face in their farm business.

CHAPTER THREE

METHODOLOGY

3.0. Introduction

This chapter highlights the methodology adopted in this study. It also looks at information concerning the study area such as vegetation and demographic characteristics.

3.1. The study area

The Upper East Region is located in the north-eastern corner of Ghana and lies between longitude 0° and 1° west, and latitudes 10° 30′N and 11°N. It is bordered to the north by Burkina Faso, to the east by the Republic of Togo, to the west by Upper West Region and the south by Northern Region. The land is relatively flat with a few hills to the East and southeast. The region is divided into thirteen (13) districts, each district being headed by a chief executive. The total land area is about 8,842 sq km, which translates into 2.7 per cent of the total land area of the country

3.2. Research Design

Collis & Hussey (2003) defined research methodology as the overall approaches to the research and covers aspects such as why certain data is collected, what data is collected, where the data is collected, how the data is collected and how the data is analysed. According to Neville (2007), research methods however, "refer to specific tools used to collect and analysed data. These tools include questionnaire, interview checklist and data analysis software."

The research design however, describes what specially is to be done concerning the research and how it would be done. In order to prepare a suitable description of the

population, it is essential to distinguish between the population for which the results are ideally required, the desired target population and the population which is actually studied (Rose, 2005). According to Saunders. Lewis, &Thornhill, (2009) the problem statement, the research question and the research objectives call for specific research design. The research design addresses issues such as the purpose of the research, the location of the study, type of investigation, the extent of researcher's interference, time horizon of the study and unit of analysis (Sekaran&Bougie, 2010) cited in Khalid, Hilman & Kumar (2012).

This study employs survey research design using structured questionnaire, administered on face-to face basis to two actors in the watermelon value chain. These are household head or household head representative engaged in watermelon production and buyers and sellers of watermelon.

The terms quantitative and qualitative research refer to the type of data generated in the research process. Quantitative research produces data in the form of numbers whilst qualitative researches tend to produce data that are stated in prose or textual form (Garbarino & Holland, 2009). The difference also lies in the degree of flexibility. Quantitative methods are fairly inflexible such as in survey and closed ended questions. A combination of both quantitative and qualitative methods was adopted in the study. Combining the two methods was appropriate for the study to enable the researcher obtain information from participants using both closed ended and open questions. Proper sampling in quantitative survey allows for the measurement of many subjects reactions to a set of questions and because each of questions have limited set of answers, the results could be compared and analysed

statistically. The results could also be generalized to a larger population within known limits of error. Qualitative methods provide the context against which to fully understand those results. They capture what participants have to say in their own words and describe in detail their own experiences. In short, quantitative methods are standardized, systematically obtaining succinct responses from as many as possible respondents. Qualitative methods however, provides greater richness and more detailed information (Warwick and Lininger, 1975; Patton, 1986) cited in SEEP-AIMS(2000 p.1)

3.3. Population of the study

The population of the study would comprise smallholder farmers engaged in the cultivation of watermelon in the Bawku West District of the Upper East Region..

3.4. Sampling procedure and sample size

There are eleven (11) communities in the study district where watermelon is produced. Four communities were randomly selected for the survey. Total of one hundred and thirty (130) persons were interviewed comprising one hundred and twenty (120) farmers; 30 per community and ten (10) marketers. The buyers were identified using snow ball sampling method. This method was used because the researcher has no access to prior list of buyers and therefore interviewed one buyer who in turn directed the researcher to another buyer.

Sample size is critical in generating usable survey results. It is also very important to obtain a representative sample. A sample is a subset or some part of a large population. Sampling involves using some portion of a population to make conclusions about the whole population. Obtaining a representative sample is more

useful in survey process than the sample size since a bigger sample size which is not representative may be costly and ineffective. National Oceanic and Atmospheric Administration (2007) indicates the following as critical for sampling:

1.There is much greater benefit in obtaining a representative sample than in obtaining an exceedingly large sample.

2. Given enough time, contacts and resources to be more rigorous about a sampling scheme, the researcher should strive for responses that possess 95% confidence level.

3. Determining an adequate sample size is best determined by someone professionally trained in survey techniques.

In a survey, since the whole population is not studied, the representation of the population the researcher chooses to study is the sample population. The sampling method adopted in this study is multi-stage sampling, purposive sampling and simple random sampling. Purposive sampling was adopted to select seven (7) districts out of thirteen (13) in the Upper East Region where watermelon is cultivated. Simple random sampling was used to select one district for the study. Eleven (11) communities out of forty one (41) were purposively selected in the District in which watermelon is cultivated. Simple random sampling was used to select four communities for the study. The sampling process used is indicated in table 3.1.

Table 3. 1 sampling procedure used for the study

Sampled district	Communities cultivating watermelon	Sampled communities	Number of farmers cultivating watermelon	Sampled farmers
Bawku West District.	Salpiiga Golmata, Tampulogu, Koburi Yarigu, Timonde Zangbeyiri Galaka Sakpari Kupela	Sakpari Timonde Yarigu Salpiiga	*120* *120* *120* *120*	*30* *30* *30* *30*

Source: Field survey data, 2014.

3.5. Questionnaire design and pre-testing

There are two sets of questionnaire used for this study. One for farmers and the other for marketers. Closed ended questions as well as open ended ones were used. Pre-testing of the questionnaire was done with students on campus. This resulted in fine tuning and improving the wording and quality of the questionnaire for filed survey.

3.6. Data collection

Questionnaires were administered to farmers and marketers to collect primary data. Secondary data was also obtained from MoFA Upper East Regional office for this study. Personal interaction with farmers and marketers of watermelon and conditions

under which women sell the fruits in the market provided much better qualitative perspective for the study.

3.7. Data management

Coding was done on the questionnaire and all responses entered into Statistical Product and Service Solutions (SPSS) software for analysis. A coding frame was developed under the various topics in the questionnaire in which responses were given. The codes were given values. For open ended questions, the questionnaire was each read and the responses entered under the appropriate code. The same responses in each category were then counted. The responses were then summarized in form of frequency tables where applicable as well as cross tabulation of variables.

3.8. Data analysis

The data collected was analysed using SPSS (version 20) software. The results obtained both in quantitative and qualitative forms were presented in the form of percentages, frequencies and charts to determine quantities and relationships.

3.9. Concepts, information and sources of information

The variable to be investigated in this research, the kinds of information, the sources of such information and methods used to solicit information is presented in table 3.2 below.

Table 3. 2 ***Concepts, information and sources of information.***

Concepts	Information required	Source of information	Method used to gather information
Questionnaire	- Age of respondent - Gender - Formal educational level - Marital status - Numbers of years in production - Number of people in house hold	Watermelon farmers	
Socio–economic characteristics of marketer.	- Gender of buyers - Educational levels - Number of years in business.	Marketers of watermelon	Questionnaire.
Sources of supply of watermelon. livelihoods sources of respondents	-sources of livelihoods - types of crops and livestock produced - ranking of sources of livelihoods	Farmers	Questionnaire
Farm resources used.	-Types of farm Resources used -Sources of farm resources	Farmers	Questionnaire
Marketing avenues	- Sources of markets for watermelon - Sorting methods for marketing	Farmer marketers	Questionnaire Observation
Incomes from watermelon sales	- Cost involved in cultivating watermelon - Quantities harvested - Incomes from sales	Farmers	questionnaire

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter focuses on the analysis of data collected and the discussion thereof. The analysis seeks to answer the objectives of the research which are as follows; to determine the relationship between personal characteristics of smallholders and level of participation in watermelon production, to identify the key actors in the watermelon value chain, to determine the linkages and strengths among actors in the watermelon production and to examine the contribution of watermelon production to the livelihoods of smallholders.

4.1 Demographic characteristics of respondents

The first set of the analysis of my research focuses on the demographics of respondents such as age, sex and educational level and how this relates to their participation in watermelon value chain.

4.1.1 Gender of respondent

The analyses indicate that all ten (10) buyers interviewed were female. Meaning women have dominance when it comes to buying and selling of watermelon. Personal observation by the researcher and interaction with traders in markets where the interviews took place indicated all those engaged the trading of watermelon were women. However, when it comes to farming, the study showed that majority (96.7%) of respondents was male and only 3.3 % female. This also indicated male dominance in farming of watermelon (see Table 4.1). The administration of the questionnaire was on household basis and this may also explain the male dominance

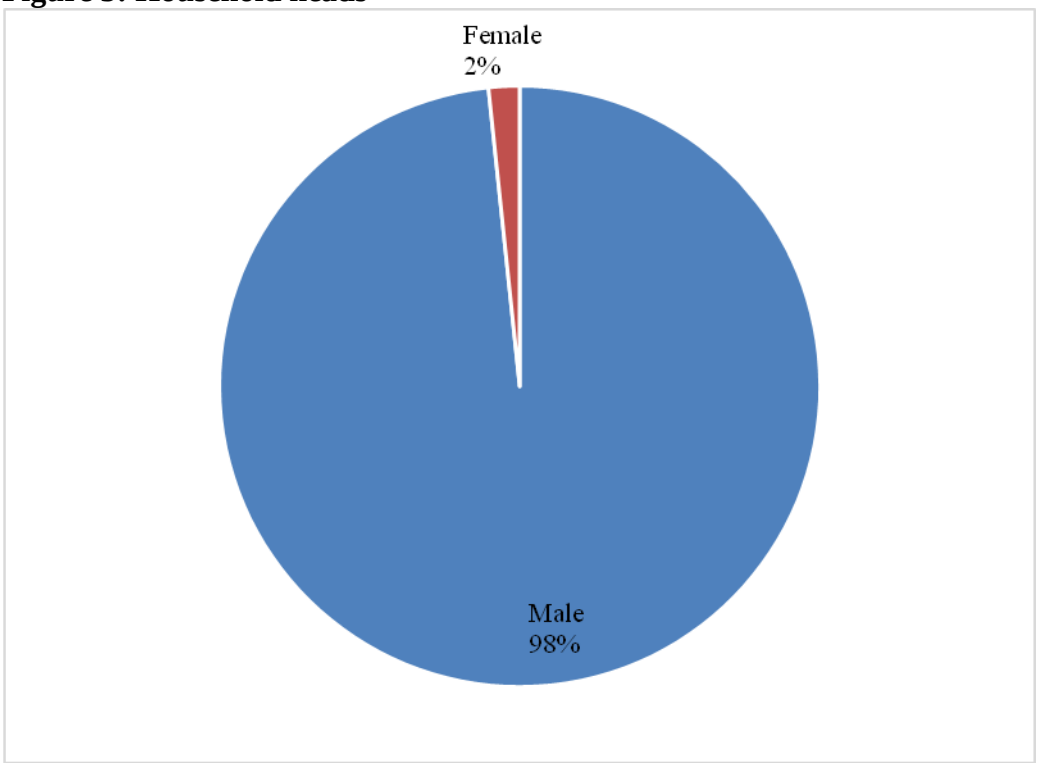
since most house households in the study area were male headed. Only two (2%) of households were headed by females (see Figure 4.1).

Table 4. 1: Sex of respondents (farmers)

Sex	Frequency	percentage
Female	4	3.3
Male	117	96.7

Source: Field survey, 2014

Figure 3: Household heads



Source: Field survey, 2014

The results of the study was consistent with similar study carried out by Adeboye, Olajidi-Taiwo, Adebisi-Adelani and Badmus (2011), that found that 94.5% of watermelon farmers in Oyo state in Nigeria were men.

4.1.2 Age distribution of respondents

The analyses indicated that 65.8% of the farmers were aged between 18 to 45 years, the mean age being 41.4 years and oldest farmer being 76 years. It can be deduced from the study that majority of the farmers are youthful and would therefore be ready for innovations particularly those requiring physical labour since they are youthful. The youthful nature of majority respondents could be advantageous in the production of watermelon since according to the study, family labour was reportedly the predominant form of farm labour.

4.1.3 Formal educational level of respondents

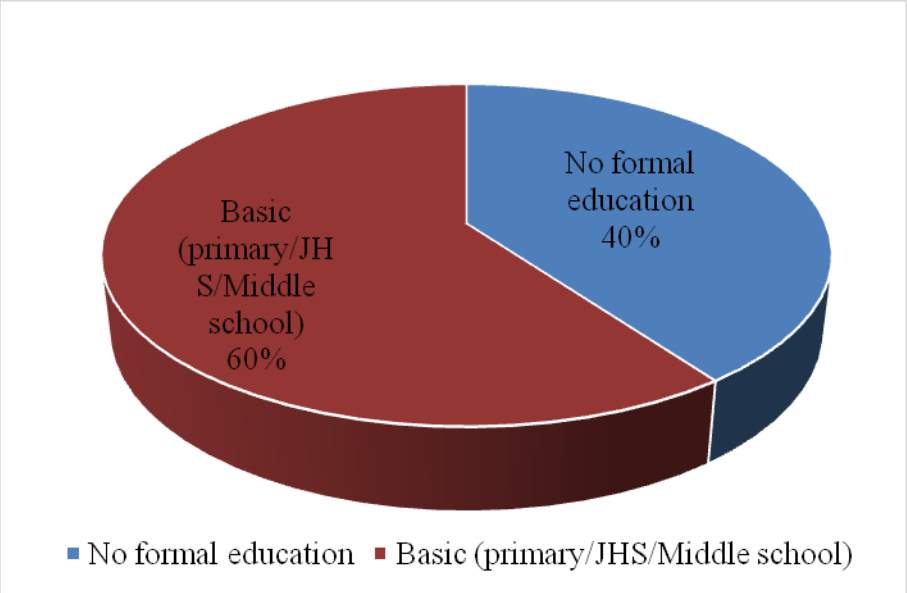
Over 73% of farmers had no formal education at all. 20% did not progress beyond the elementary level and 2 farmers representing 1.7% had tertiary education (see Table 4.2). The low educational level of respondents was found to be in contrast with Adeboye et al. (2011) who presented educational status of watermelon farmers at 83% and only 17% with no formal education in his study in Oyo State, Nigeria. The low level of formal education among farmers has a reflection in general low literacy levels in the Study district. The analysis revealed that a higher percentage (60%) of the buyers had attained elementary education compared to the farmers (see Figure 4.2). However, none of the buyers interviewed went beyond the elementary school reflecting the general trend of females who drop out of school as they climb the educational ladder in the region.

Table 4. 2: Formal educational level of farmers

Formal educational level	Frequency	Percentage
No formal education	88	73.3
Basic (primary/JHS/Middle school)		20
Secondary (SSS/Vocational/technical)	6	5
Tertiary (college/university/polytechnic)	2	1.7
Total	120	100

Source: Field survey, 2014

Figure 4: Formal educational level of buyers.



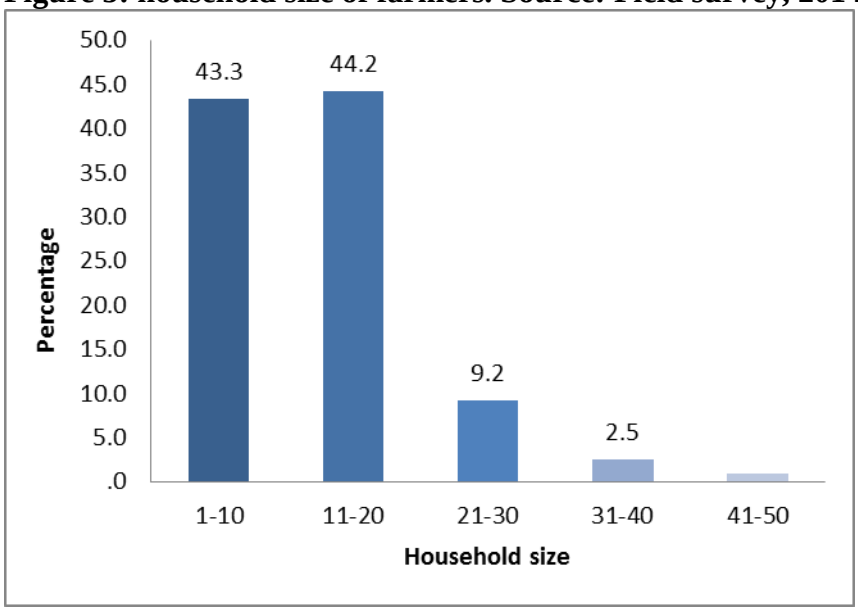
Source: Field survey, 2014.

4.1.4 Household size of respondents

The analysis of the one hundred and twenty (120) household heads indicated that the minimum house hold size was 2 persons and the maximum was 46. The mean

household size was 13. This figure is in sharp contrast with general household size reported by the Ghana statistics department. Ghana statistical service (2012) indicated that the average household size in the Bawku West District (BWD) to be 6.1. Majority of the household sizes fell in the range of 11-20 persons (44.2%) and 43.3% had their house hold sizes in the range of 1-10 persons (see Figure 4.3).

Figure 5: household size of farmers. Source: Field survey, 2014



4.1.5 Number of years in watermelon production and marketing

The study indicates that respondents had many years of experience in the cultivation as well as marketing of watermelon. Over half of the farmers (50.83%) have been cultivating the crop for more than five years. Eighty (80%) of the buyers also indicated that they have been in the business for between 1 to 5 years. The table 4.3 shows the number of years farmers and buyers have been in watermelon business.

Table 4. 3: Experience in watermelon production and marketing

Years	Freq.(farmers)	Percentage	Freq.(buyers)	percentage
1-5	26	21.7	8	80
6-10	61	50.8	0	0
11-15	23	19.2	0	0
16-20	9	7.5	2	20
21-25	1	0.8	0	0
Total	120	100	10	100

Source:Field survey, 2014.

4.1.6 Major sources of livelihoods for farmers

The study indicates that majority of the respondents do not engage in livelihood activities outside agriculture. Only one respondent reported trading as his most important livelihood activity and no respondent was a salaried worker. Crop farming was the most important source of livelihoods followed by livestock rearing and fishing. Table 4.4 indicates the livelihood sources of farmers ranked in order of importance.

Table 4. 4: Ranking of livelihoods sources of farmers.

Source of Livelihood	1st most important		2nd most important		3rd most important		4th most important		5th most important	
	Count	%	Count	%	Count	%	Count	%	Count	%
Crop farming	107	89.2	13	10.8	0	0	0	0	0	0
Livestock rearing	11	9.4	101	86.3	5	4.3	0	0	0	0
Fishing	0	0	1	2.7	10	27	13	35.1	13	35.1
Trading	1	2.8	1	2.8	22	61.1	3	8.3	9	25
Salary	0	0	0	0	1	50	1	50	0	0
Artisan	0	0	2	5.3	14	36.8	14	36.8	8	21.1

Source :Field data,2014

Farmers cultivated different crops aside watermelon and kept many species of livestock and poultry at the same time. Crops like cereal, legumes and vegetables are cultivated by one farmer and who also engages in rearing ruminants, non-ruminants and poultry. The predominant cereals cultivated were maize, early millet; sorghum and rice (see Table 4.5). This they do in most cases on smallholder basis but as the saying goes they become "jack of all trade and master of none". There is need to understand the farming system of smallholders and to plan with them on particular services they would require to improve their production practices. The predominant animals kept by respondents in the study also include goats, sheep, cattle, donkeys and pigs (see Table 4.6). In addition poultry such as fowls, guinea fowls and ducks were also kept by farmers (seeTables4.7) indicate the various crops, livestock and poultry kept by respondents.

Table 4. 5: **Type of crops cultivated by farmers**

Crops cultivated	Freq.	%
Earl Millet	103	85.8
Rice	93	77.5
Maize	118	98.3
Sorghum	99	82.5
Soya	97	80.8
Groundnut	91	75.8
Cowpea	119	99.2
Bambara	50	41.7
Tomato	50	41.7
Okra	48	40
Onion	29	24.2
Cassava	1	0.8
Pepper	2	1.7
Sweet potato	1	0.8
Sesame	1	0.8

Source : Field survey,2014

Table 4. 6: Type of livestock kept by farmers.

Livestock kept	frequency	%
Sheep	94	78.3
Goats	114	95
Cattle	79	65.8
Pigs	31	25.8
Donkey	69	57.5
Dogs	5	4.2
Cats	1	0.8

Source: Field survey, 2014

Table 4. 7: Type of poultry kept by farmers.

Poultry kept	Yes	
	Freq.	%
Fowls	118	98.3
Guinea fowls	118	98.3
Duck	33	27.5
Turkey	5	4.2
Pigeons	14	11.7
Doves	1	0.8

Source: Field survey, 2014

4.1.7 Size of farm holdings

The average farm size of respondents allocated for cultivation of watermelon was 2.2 acre. The least farm size was 0.5 acre, and the largest was 7 acres. The farm size that occurred most frequently (mode) was 2 acres with a frequency of 47. One respondent had up to 7 acres of watermelon farm. The farm sizes indicated was consistent with smallholder farmers who are generally said to have landholdings of less than 2 ha. Table 4.6 shows the distribution of land holdings of farmers.

Table 4. 8: Distribution of watermelon farm sizes.

Farm size (acres)	Frequency	Percentage
0.5	4	3.3
1	25	20.8
1.5	7	5.8
2	47	39.2
2.5	9	7.5
3	13	10.8
4	6	5
4.5	1	0.8
5	5	4.2
6	2	1.7
7	1	0.8
Total	120	100

Source: Field survey, 2014.

4.1.8 Farm resources used by farmers and source of farm resource

The study indicated that most respondents used farm resources such as improved seed, fertilizer, insecticides, and farm labour and extension service. Improved seed refers to the purchase of certified seed from seed dealers for planting. Over ninety per cent of respondents indicated the use of improved seed and fertilizers (see Table 4.7). The wide spread use of improved seed and fertilizer among respondents is a good sign as these practices are considered as part of good agricultural practices that contribute to good yield and therefore profits. However, one respondent and two respondents reported they did not use improved seed and fertilizers respectfully. Credit, however, appeared as the least (5.8%) farm resource used by respondents. This was due to the fact many of respondents did not have direct transactions with financial institutions and therefore could not access credit. The main source of inputs (seed, fertilizer herbicide and insecticide) was from the market (see Table 4.8).

Interestingly, credit is gotten from friends and not from financial institutions. Farmers reported receiving extension service mainly from MoFA and the case of the use of herbicides for weed control, up to seventy (70) respondents did not use this resource but rather use manual means for weed control.

Table 4. 9: Farm resources used for watermelon production

Farm resource used	Freq.	%
Improved seed	119	99.2
Fertilizer	118	98.3
Insecticide	120	100
Herbicide	50	41.7
Credit	7	5.8
Land	120	100
Labour	101	84.2
Water	82	68.3
Extension service	51	42.5

Source: Field survey, 2014

Table 4. 10: Sources of farm resources

Farm resource	MoFA		Self		Market		Friends		FI/NGO	
	Count	%	Count	%	Count	%	Count	%	Count	%
seed	4	3.3	2	1.7	114	95	0	0	0	0
Fertilizer	1	0.8	1	0.8	114	95	4	3.3	0	0
Insecticide	1	0.8	1	0.8	117	98	0	0	1	0.8
Herbicide	1	2	0	0	48	96	1	2	0	0
Credit	0	0	0	0	0	0	6	86	0	0
Land	0	0	98	81.7	0	0	22	18.3	0	0
Labour	0	0	66	65	0	0	35	35	0	0
Water	0	0	67	82	0	0	15	18	0	0
Extension service	36	70.6	9	17.6	0	0	6	11.8	0	0

Source: Field survey, 2014

4.2.0 Relationship between farmers and other value chain actors

The effectiveness of any crop value chain depends on the availability and mutual collaboration among the value chain actors or necessary service providers. The service providers identified in this study are MoFA, input dealers, financial institutions, buyers and NGOs that provide technical, financial and marketing services depending on the roles of the particular service provider. (See Table 4.9). The relationship of the farmers with service providers was based a multiple response choices such that a respondent can have relationship with more than one service provider. It was discovered from the responses that farmers had relationship with some of these service providers. Out of 120 respondents, 4.2% had relationship with financial institutions. Almost half (49.2%) of respondents had relationship with MoFA and 94.2% had relationship with buyers.

However, the strength of relationship between farmers and these service providers was found to vary. For instance out of 95 respondents who ranked their relationship with MoFA, 6 (6.3%) respondents indicated very strong relationship and 18 (18.9%) indicated very weak relationship. None of the farmers indicated “very strong” and “strong” relationship with financial institutions and NGOs. Details on level of relationship between farmers and service provide are indicated in Table 4.11

Table 4. 11: Service providers for farmers

Service providers	Responses		Percentage of Cases
	N	%	
MoFA	59	22.7	49.2
Financial Institution	5	1.9	4.2
Input dealers	79	30.4	65.8
Buyers	113	43.5	94.2
NGOs	4	1.5	3.3
Total	*260	100	216.7

Source: Field survey, 2014 * multiple responses

Table 4. 12: Ranking of farmers' relationship with service providers

Other actors	Very strong		Strong		No relationship		Weak		Very weak		Total
	Count	%	Count	%	Count	%	Count	%	Count	%	
MoFA	6	6.3	16	16.8	37	38.9	18	18.9	18	18.9	95
Input dealers	10	11.2	65	73	14	15.7	0	0	0	0	89
Financial institutions	0	0	0	0	22	36.7	9	15	29	48.3	60
NGO	0	0	0	0	10	17.5	39	68.4	8	14	57
Buyers	70	61.4	18	15.8	4	3.5	22	19.3	0	0	114

Source: Field survey, 2014

4.3 Relationship between buyers and other value chain actors

The study set out to determine the relationship that exists between buyers and other value chain actors. Ninety (90) % of the buyers said they had "strong" and "very strong" relationship with farmers. This strong bond between farmers and farmers was achieved through regular phone calls to communicate on marketing of watermelon. Although up to sixty (60) % of respondents said they had relationship with financial institutions (FI), they did not take loans. They however, do savings with these

financial institutions. No buyer indicated any relationship with MoFA (see Table 4.11) Depending on strength of relationship and trust that existed between buyers and farmers, payments for farmers produce were made in full, in part or on credit at point of purchase. The current relationship as it exists between buyers, MoFA and financial institutions indicate low interaction and weak relationship between these actors and therefore require some strengthening.

Table 4. 13: **Rating of relationship between buyers and other value chain actors**.

Other actors	Rank in order of strength									
	Very strong		Strong		No relationship		Weak		Very weak	
	Count	%	Count	%	Count	%	Count	%	Count	%
Farmers	5	50	4	40	1	10	0	0	0	0
MoFA	0	0	0	0	6	60	3	30	1	10
Financial Institutions	2	20	2	20	4	40	1	10	1	10

Source: Field survey, 2014.

4.4 Cropping systems of farmers

The results of the study indicated that over eighty of farmers practice sole cropping of watermelon and few (11.7%) practice mixed cropping. The crops intercropped with watermelon are maize, cowpea and okro. Farmers gave varied reasons for intercropping and these reasons include economic use of land, for security against crop failure, to diversify income sources and to roast and eat maize whilst they work on watermelon farm.

4.4.1 Methods used by farmers to carry out cultural practices

The predominant method used by farmers (65%) in land preparation is by use of drought animals (bullocks and donkeys). Tractor use among farmers was found to be low at 16.7%. Direct planting is most preferred by farmers. Only 0.8% of farmers say they nurse the watermelon seed before transplanting out on the field. Manual method (hoeing)was found be the most predominant method by which farmers carry out weeding with only 0.8% reporting use of weedicide to control weeds. Pesticide use was found be very high (95.8%) among farmers in controlling field pest. Few farmers (4.2%) reported the use of organic extract for control of field pest. Chemical fertilizer use among farmers was found to be high (98.3%) with only 1.7% using organic matter to fertilize the soil. The table 4.14 summarizes the cultural practices and methods used to carry it out.

Table 4. 14: Cultural practice and methods used in watermelon production

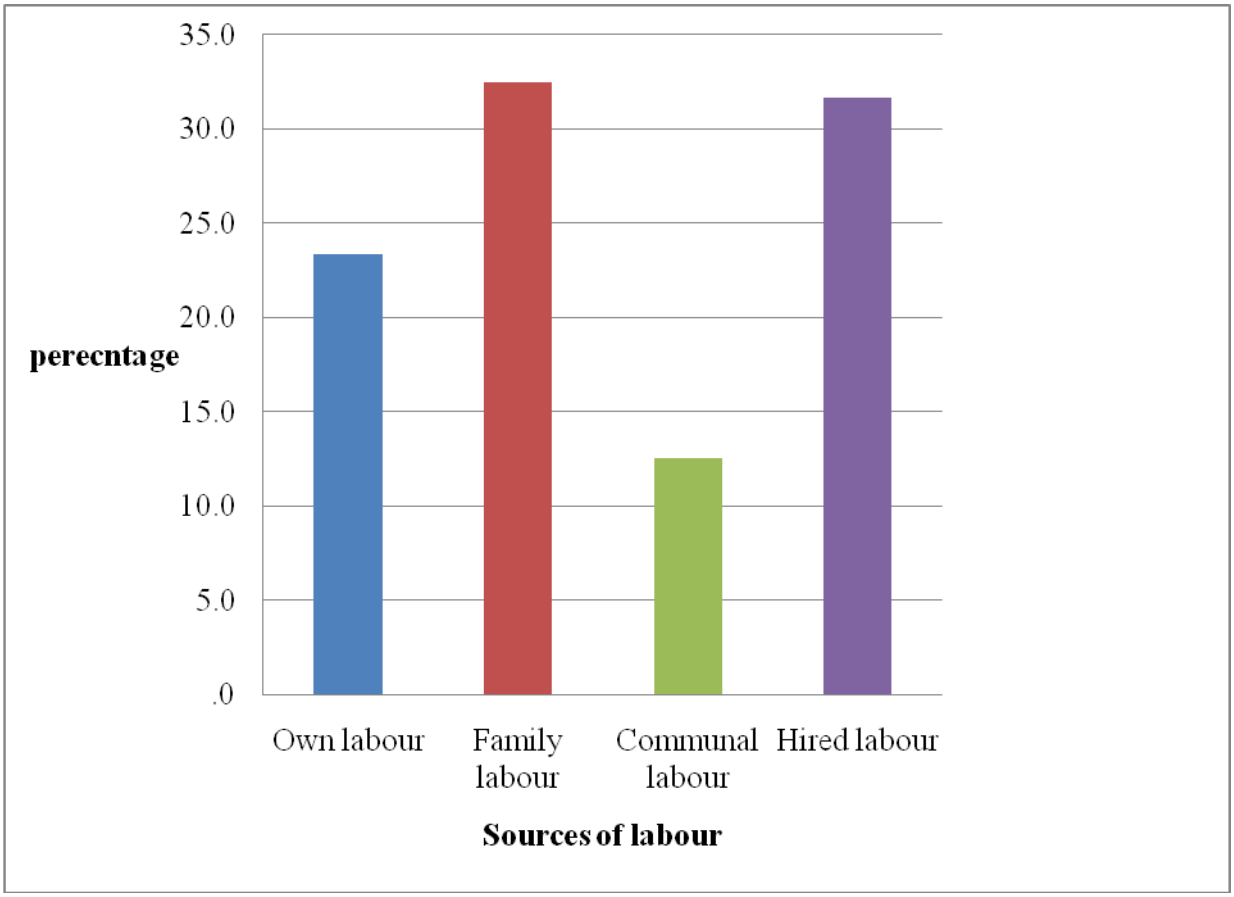
Cultural practice	Method used	Frequency	Percentage
Land preparation	Use of tractor	20	16.7
	Use of bullock	77	64.2
	Use of donkey	1	0.8
	Use of weedicide	20	16.7
	Use of hoe (manual)	2	1.7
	Total	120	100
Seeding	Direct seeding	119	99.2
	Transplanting	1	0.8
	Total	120	100
Weeding	Hoeing	119	99.2
	Use of weedicide	1	0.8
	Total	120	100
Pest control	Use of organic extract	5	4.2
	Use of pesticide	115	95.8
	Total	120	100
Fertilization	Use of Organic fertilizer	2	1.7
	Chemical fertilizer	118	98.3
	Total	120	100

Source: Field survey, 2014.

4.4.2 Sources of farm labour

Four sources of farm labour were identified in the study. These are family labour, self-labour, communal labour and hired labour. More farmers (32.5%) use family labour followed by hired labour (31.7%). Communal labour was found to be the least source of farm labour. Farm labour and inputs constitute significant portion of total cost for watermelon production. According to Lin (2006), labour and fertilizer contributed 37% and 30% respectively to the cost of watermelon production. Figure 4.4 indicates the various sources of farm labour.

Figure 6: Sources of farm labour .Source: Field survey, 2014



4.4.3 Production trend of watermelon among respondents

As part of the study, an assessment was made of the production, sale and household consumption of watermelon. The study sought to identify the production trend of the crop among respondents for the past five years. The study discovered that the mean production of watermelon (measured in donkey carts) dropped from 17 to 12.2 donkey carts per farmer from 2009 to 2013 (see Table 4.13) indicating a reduction in total production volume.. Farmers mentioned challenges that accounted for the reduction including marketing challenges. The study also revealed that few farmers (0.8 %) consume up to 1% of watermelon harvested and sell the rest. An equal percentage of farmers consume 50% of fruits harvested. Majority (65%) of farmers

consume between 5-20% of harvested fruits and sell the rest. Farmers use loads of donkey carts, motor king and KIA trucks as measure of quantity of harvest.

Table 4. 15: Trend in watermelon production (in donkey carts)

Season	Minimum	Maximum	Mean
This season (2013)	1	67	12.2
The season before (2012)	0.5	100	12.4
Two seasons ago (2011)	1	160	16
Three seasons ago (2010)	0.5	165	15.9
Four seasons ago (2009)	2	170	17

Source: Field survey, 2014

4.4.4 Post-harvest practices of farmers

After harvest, the fruits are sorted out based on size and sold in single or in heaps of 65 fruits. The price for a heap is determined based on factors such as fruit size, level of maturity, fruit quality and taste. The study also revealed that the fruits are sold either at the farm gate or are sent to the local market. The analysis of responses based on multiple choice responses indicated that 54.8% of respondents sold their watermelon at local markets whilst 45.2% indicated they sold their harvest at farm-gate (see Table 4.14).

Table 4. 16: Places of selling watermelon produce.

Place	Responses	
	Frequency	%
Local market	91	54.8
On-farm	75	45.2
Total	*166	100

Source: Field survey, 2014. *multiple responses

Ninety (90) % of buyers also indicated that they travel to locations outside their business centres to purchase their stock of watermelon. They mentioned places like Zebila, Bazua, and Bawku as major supply areas. They indicated that at certain times of the year, they travel as far as Techiman in the Brong Ahafo Region to purchase their stock (see Table 4.15). The analyses also revealed that eight (8) out of ten (10) buyers got their supplies direct from the farmers whilst two (2) of them got theirs from other traders. In addition it was discovered that ninety per cent (90%) of the buyers indicated that they got sufficient supply from their supply sources. One buyer indicated that her supply was insufficient and would therefore wish to be linked to other supply sources that could supply her two donkey carts load of watermelon every week. It also came out clearly that eighty (80%) of the buyers had information about availability of the watermelon produce from farmers through phone calls. Farmers use mobile phones to call buyers to inform them of stock availability

Table 4. 17: Locations where buyers got their stock.

Watermelon Markets	Responses	
	Frequency	%
Bawku	5	16.1
Binduri	1	3.2
Zebila	10	32.2
Bazua	7	22.6
Walewale	4	12.9
Wundua	1	3.2
Techiman	3	9.7
Total	31	100

Source: Field survey, 2014

4.4.5 Challenges faced by buyers

The respondents of the study who are buyers mentioned a number of challenges in their business. The key challenges negatively affecting their business are, perishing of fruits (60%), stealing of fruits (50%) and livestock such as pigs and cattle eating fruits in the market. It is important to high light these challenges because the strength of the value chain commodity is dependent on the off takers or buyers of that commodity. Understanding and finding solutions to these challenges would go a long way to boost production. Table 4.16 shows the challenges faced by respondents.

Table 4. 18: Challenges faced by buyers.

Challenges of watermelon business	Responses	
	Frequency	%
Stealing of fruits	5	19.2
Perishing of fruits	6	23.1
Pigs or Livestock eat fruits	4	15.4
Insufficient capital to expand business	3	11.5
Risk of accident during transport	1	3.8
Lack of customers	1	3.8
Inability to determine maturity level of fruits before buying.	1	3.8
Competition from other traders	1	3.8
No profit from sales	2	7.7
No fruits all year round to buy	2	7.7
Total	26	100

Source: Field survey, 2014

4.4.6 Production challenges faced by farmers

Farmers mentioned a number of challenges they encounter in the watermelon value chain. The challenges are categorized into two; those encountered on the field and those challenges encountered during marketing. Majority (89.2%) reported

incidences of pest and diseases as major challenges. Moreover, over fifty per cent (50.8%) and 24.2% mentioned access to inputs and financial services respectfully as major challenges. Some marketing challenges farmers faced include poor prices, buyers purchasing on credit and language barrier during price negotiation.

4.5 Income farmers make from sale of watermelon

Majority (90.8%) of the farmers surveyed indicated that they planted watermelon once in a year and only a handful of respondents who had access to water in the dry season planted twice in a year. In terms of incomes generated by farmers, over 40% had incomes in the range of GHC 500.00 annually. Few (5%) of the farmers are able to make incomes above GHC 2000.00. The minimum income generated was GHC40.00 and maximum income was GHC10, 000.00. The details of incomes generated by farmers are indicated in table 4.17

Table 4. 19: Income made from watermelon farms.

Income (GH¢)	Frequency	%
1-500	50	41.7
501-1000	42	35
1001-2000	22	18.3
2001-5000	4	3.3
5001-10000	2	1.7
Total	120	100

Source: Field survey, 2014

4.5.1 Contribution of watermelon to household income of farmers

The study sought to establish the significance of the incomes generated from cultivating watermelon to household incomes. More than half (55.8%) of farmers gave a rating of “very significant “which means that they consider the incomes from

watermelon very significant part of total household income. In addition, over 30% of farmers surveyed also stated that they consider the incomes from watermelon as significant part of household incomes (Table 4.18). This underscores the potential of the crop in improving income and food security among smallholders. Over 50% of farmers asserted strongly that without incomes they generate from watermelon, "life would be difficult to live" (Table 4.19).

Table 4. 20: Contribution of watermelon income to household (HH) income.

Contribution	Frequency	Percentage
Very significant	67	55.8
Significant	37	30.8
Not sure	2	1.7
Insignificant	14	11.7
Total	120	100

Source: Field survey, 2014

Table 4. 21: Without income from watermelon sales, life would be difficult to live.

Response	Frequency	Percentage
Strongly agree	61	50.8
Agree	31	25.8
Not sure	5	4.2
Disagree	18	15
Strongly disagree	5	4.2
Total	120	100

Source: Field survey, 2014

4.5.2 Comparison between watermelon and other crops to income security

Since farmers cultivate multiple crops, the study sought to establish the potential of watermelon in contributing to farmers' income security as compared to other crops they cultivate. Majority of respondents (71.7%) were of the view that watermelon had more potential in contributing to their income security compared to other crops they cultivated. The study established that watermelon farmers view the crop having advantage over other crops in terms of ready market, income potential, ease of production and profitability. (See table 4.20).This further underscored the high potential of the crop from farmers' point of view.

Table 4. 22: Comparing watermelon to other crops cultivated.

Parameter	Other major crops		Watermelon	
	Count	%	Count	%
Ready market	15	12.5	105	87.5
Income	28	23.3	92	76.7
Ease of production	8	6.7	112	93.3
Profitability	29	24.2	91	75.8

Source: Field survey, 2014

4.6 Personal characteristics of farmers and value chain participation

The research sought to establish whether personal characteristics such as age, sex, marital status and educational level of respondents have influence on respondent's participation in the watermelon value chain.

4.6.1 Distribution of gender of respondents by farm size

The analysis of the data indicated that the majority of respondents (66%) had farm sizes ranging from 0.5-2 acres. All the four women among the respondents fell within this range and so did seventy-nine (79) out of hundred and sixteen (116) of the male respondents (Table 4.21) Only one woman had farm sixe up to 2 acres whilst up to thirty –nine male respondents (33.6%) had between 2.5 to 7 acres. There is an indication from the study therefore that sex of farmers engaged in watermelon production does not have an influence on size of farm as male farmers had bigger farm sizes.

Table 4. 23*:* Distribution of sex of respondents by farm size.

Size of farm (acre)	Frequency		Total
	Male	Female	
0.5	4	0	4
1	22	3	25
1.5	7	0	7
2	46	1	47
2.5	9	0	9
3	13	0	13
4	6	0	6
4.5	1	0	1
5	5	0	5
6	2	0	2
7	1	0	1
Total	116	4	120

Source: Field survey, 2014

4.6. Distribution of sex of respondents and access to service providers

The study sought to establish whether sex of respondents had any effect on their ability to get services from MoFA which responsible for extension service, financial institutions (FI) responsible for financial services, input dealers (ID) and buyers responsible for marketing services. From the analysis, female farmers did not have

direct contact with service providers such as MoFA, financial institution s and buyers. (Table 4.22). However, all the four women farmers said they had relationship with input dealers for the purchase of seed, fertilizer or pesticide. It could be concluded from the study that sex of respondents does not have influence on farmers access to service providers.

Table 4. 24: sex of respondents and access to service providers

Service provision	Frequency		
	Male	Female	Total
MoFA	59	0	59
Financial Institution	2	0	2
Input dealers	28	4	32
Buyers	27	0	27
Total	116	4	120

Source: Field survey, 2014

4.6.3 Distribution of marital status of respondents and size of farm

Since majority of the respondents were married -112 out of 120 respondents said they were married, the study sought to draw a relationship between marital status of respondents and farm holdings of farmers. The minimum farm holding is 0.5acre and maximum is 7acre. (Table 4.25). The analysis indicated that there a fair distribution of farm holdings among married and unmarried farmers. It is shown from the table 4.25 below that one hundred and twelve (112) out of one hundred and twenty (120) respondents were married. Over sixty -eight per cent (68.8%) of the married have between 0.5 to 2 acres whilst 75% of those not married also have farm sizes between

0.5 and 2 acres. It can be deduced from the analysis that marital status of respondents did not have influence on farm sizes of respondents.

Table 4. 25: **Distribution of marital status of respondents and farm sizes**

Size of watermelon farm	Frequency		Total
	Married	Not married	
0.5	3	1	4
1	21	4	25
1.5	7	0	7
2	46	1	47
2.5	8	1	9
3	13	0	13
4	6	0	6
4.5	1	0	1
5	4	1	5
6	2	0	2
7	1	0	1
Total	112	8	120

Source: Field survey, 2014

4.6.4 Distribution of marital status of respondents and access to service providers

Majority of the respondents were married -112 out of 120 respondents said they were married and only 8 were unmarried. The study sought to establish whether marital status of respondents have any bearing on their access to service providers such as MoFA, financial institutions, input dealers and buyers. The analysis indicated that Fifty –nine (59) married respondents said they had relationship with MoFA and all

eight unmarried respondents indicated they have no relationship with MoFA (Table 4.24). However, four unmarried respondents had relationship with ID, three had relationship with buyers and one had a relationship with FI. One could conclude from the analysis that marital status of respondents did not influence on access to service providers.

Table 4. 26: Distribution of marital status of respondents and access to services

Service providers	Frequency		Total
	Married	Not married	
MoFA	59	0	59
Financial Institution	1	1	2
Input dealers	28	4	32
Buyers	24	3	27
Total	112	8	120

.

Source: Field survey, 2014

4.6.5 Distribution of farm size and educational level of respondents

The study sought to establish whether there is a relationship between educational level of respondents and farm sizes. The analysis indicates that 88(73.3%) of the respondents have no formal education. 24(20%) attended elementary (primary, junior high and middle) school, 6(5%) had secondary (senior high, technical and vocational) education and only 2(1%) went up the educational ladder to the tertiary (university, polytechnic and colleges) level. It is instructive from the analysis that those farmers who had farm sizes above 5acre have no formal educational (Table 4.25).Also up eighty (80) farmers who had no formal education had farm sizes between 0.5-2acre.

The two respondents who had tertiary education had 2acres and 2.5acres of farm size. It could therefore be deduced from the analysis that educational level of respondents did not influence farm sizes they cultivate.

Table 4. 27: Distribution of farm size and educational level of respondents

Size of farm	Frequency				Total
	No formal education	Basic	Secondary	Tertiary	
0.5	3	0	1	0	4
1	20	5	0	0	25
1.5	4	3	0	0	7
2	36	8	2	1	47
2.5	5	2	1	1	9
3	10	3	0	0	13
4	2	2	2	0	6
4.5	0	1	0	0	1
5	5	0	0	0	5
6	2	0	0	0	2
7	1	0	0	0	1
Total	88	24	6	2	120

Source: Field survey, 2014

4.6.6 Educational level of respondents and access to services providers.

Level of formal education is one of the personal characteristics of respondents for this study. This part of the analysis sought to draw a relationship between educational levels and access to services. The analysis indicates that 73.3% of the respondents

have no formal education. 20% attended elementary school, 5% had secondary education and only 1% went up the educational ladder to the tertiary level. Out of total 59 respondents who benefited extension service from MoFA, 47 had no formal education whilst 12 beneficiaries had various levels of education. Financial institutions provided the least service to farmers with only two farmers accessing service from financial institutions. The breakdown of the two farmers who had services from financial institutions is that one had formal education and the other one had no formal education. One could conclude from the analysis that educational status of respondents did not have influence on access to service providers.

Table 4. 28: Educational level of respondents and access to service providers.

Service providers	Frequency				Total
	No formal education	Basic	Secondary	Tertiary	
MoFA	47	9	2	1	59
Financial (Institution	1	0	1	0	2
Input dealers	21	9	2	0	32
Buyers	19	6	1	1	27
Total	88	24	6	2	120

Source: Field survey, 2014

4.6.7 Distribution of sex of farmers and significance of watermelon to household incomes

The majority of the responds were men, 117 respondents (97%) and 3 females (3%).The analysis indicated 66 male respondents and 1 female said they considered contribution of incomes from watermelon to household incomes as "very important ".It was also established from the study that 34 male respondents and 3 female respondents (see Table 4.27) indicated that they considered incomes from watermelon as "important" to their household incomes. It can be concluded from the study therefore that sex of respondents does not have influence on the value farmers placed on the contribution of incomes from watermelon production to overall household incomes. Both sexes considered incomes from watermelon equally important.

Table 4. 29: sex of respondents and significance of watermelon to household income

significance of watermelon to household income	Frequency		Total
	Male	Female	
Very significant	66	1	67
Significant	34	3	37
Not sure	2	0	2
Insignificant	14	0	14
Total	116	4	120

Source: Field survey, 2014

To further probe whether sex of respondents had influence on the level of contribution of watermelon to house hold incomes of farmers, an analysis was carried out on farmers response on the statement that "without incomes from

watermelon, life would be difficult to live". Sixty males and one female respondent agreed "very strongly "to the statement. Twenty-eight (28) male and three (3) female respondents agreed "strongly" (see Table 4.28). Meaning over seventy-six (76.7%) per cent of respondents considered that without incomes from watermelon, live would indeed be difficult for them. The sex disaggregation of respondents in this category also indicated that male respondents were eighty-eight (75.9%) and all four female respondents. This implied that both sexes regard highly incomes from cultivation of watermelon. Sex of farmers does not influence how they rank the importance of watermelon to their incomes.

Table 4. 30: sex of respondents and level of agreement on statement "without income from watermelon, life would be difficult to live".

Without income from watermelon sales, life would be difficult to live	Sex of respondents		Total
	Male	Female	
Strongly agree	60	1	61
Agree	28	3	31
Not sure	5	0	5
Disagree	18	0	18
Strongly disagree	5	0	5
Total	116	4	120

Source: Field survey, 2014

4.6.8 Educational level of respondents and contribution of watermelon to their incomes

The study sought to establish whether there is a relationship between educational level of respondents and contribution of watermelon income to hose hold income.

The analysis indicates that 88 (73.3%) of the respondents have no formal education. 24 (20%) attended elementary school and only 2 (1.7%) went up the educational ladder to the tertiary level. Out of the 67 respondents who see the contribution of watermelon income to house hold income as "very important", 51, had no formal education, 11, had elementary education, 3 had secondary education and 2 had tertiary education (See Table 4.31.) The study therefore reveals that educational level of respondents does not have influence on the contribution of watermelon to their household income.

Table 4. 31 : Educational level of respondents and contribution of watermelon to household income

Contribution of watermelon to household income	Frequency				Total
	No formal education	Basic	Secondary	Tertiary	
Very significant	51	11	3	2	67
Significant	26	8	3	0	37
Not sure	1	1	0	0	2
Insignificant	10	4	0	0	14
Total	88	24	6	2	120

Source: Field survey, 2014

To further investigate whether educational level of respondents had influence on the level of contribution of watermelon to house hold incomes of farmers ,an analysis was carried out on farmers' level of agreement on the statement that "without the income form watermelon, life would difficult to live". (See Table 4.32).

Table 4. 32: Educational level of respondents and level of agreement on statement "without income from watermelon, life would be difficult to live"

Without income from watermelon sales, life would be difficult to live	Frequency				Total
	No formal education	Basic	Secondary	Tertiary	
Strongly agree	48	8	3	2	61
Agree	24	6	1	0	31
Not all	4	1	0	0	5
Disagree	11	6	1	0	18
Strongly disagree	1	3	1	0	5
Total	88	24	6	2	120

Source: Field survey, 2014

CHAPTER FIVE

SUMMARY, DISCUSSION, CONCLUSION AND RECOMMENDATION

5.0 Introduction

The purpose of the study is to examine the potential of watermelon as a high value crop to income security of smallholder farmers in the Bawku West District (BWD) in the Upper East Region (U/E/R) of Ghana. Specifically, the study sought to achieve the following objectives:

1. To determine whether there is a relationship between characteristics of smallholders and their level of participation in watermelon production.
2. To determine the linkages and strengths among actors in the watermelon value chain.
3. To examine the contribution of watermelon production to the household income of smallholders.

5.1 Summary

The study revealed that all the buyers were women and 97% of the producers were men indicating male dominance in cultivating watermelon in the study area. Overwhelming majority (73%) of producers did not have formal education and 40% of buyers did not have formal education. Average house hold size was found to be 13, which is higher than the 6.1 recorded in the 2010 census data. The crop was found to be cultivated by respondents during the past 15 years with average land holdings of 2.21 acres. In order of hierarchy, the study found out that livelihoods sources of famers were crop farming, livestock farming, fishing and trading. The least used farm

resource identified in the study was credit which interestingly was obtained from friends but not from financial institutions. Family labour was the leading source of farm labour by 32.5% followed by hired labour by 31.7%. Family labour was most used probably because of the relatively large average household size of thirteen persons per household. The production volume of watermelon was found to be declining from an average of 17 donkey carts per farmer in 2009 to 12.2 donkey carts per farmer in 2013. This was attributed to certain challenges such low access to markets, incidence of pest and diseases and poor prices. However, with 90% of buyers indicating that they travel outside the study area to buy watermelon, it is possible to link farmers and these buyers together to enhance markets for farmers and hence boost production.

With regards to the issue of contribution of watermelon income to household income of farmers, 55.8% and 30% of respondents indicated incomes from watermelon cultivation formed “very significant” and “significant” portions their household incomes respectively. Meaning, an aggregate of 85% of respondents consider incomes they earn from watermelon production annually as important component of total household incomes.

The analysis of the findings of the study does not support the initial hypothesis of study which proposes that :(a) there is no relationship between personal characteristics of farmers and their participation in watermelon production. (b) Watermelon industry does not contribute to household income security of smallholders.

5.2 Conclusion and Recommendation

The study revealed that watermelon cultivation contributes significantly to house hold incomes of farmers and therefore could potentially serve as a pathway to reducing food and income security. The relationship between the key value chain actors was found to be weak. This relationship could be strengthened. It is recommended that MoFA could a play a facilitating role at local level to promote the value chain.

Pesticide use was common among the farmers; 98.3% use chemical fertilizer and 95.8% use pesticide. In addition, 89.2% of farmers identified pest and diseases as production challenges. These chemicals are expensive and could reduce profits Significantly and could also affect food safety of these fruits. It recommended that further research be conducted on organic extracts that could control pest. Available technologies on organic extracts should be promoted and made accessible for farmers.

Animal traction was found to be predominant means of land preparation as against tractor use. This practice should be maintained and promoted to help conserve the soils for sustainable land use.

The challenges faced by buyers such as stealing of fruits and destruction of fruits by livestock in the market could be addressed by the local District assembly. Market stalls should be provided to provide security for the women who sell the fruits at unprotected locations.

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APPENDICES

Appendix I: Questionnaire for buyers

Sir/Madam, I am a student of the University of Ghana conducting a survey on Assessing the contribution of watermelon value chain to income security of value chain actors as part of my academic work. The responses you give to the questions would be analyzed and used for academic work. The results would also be shared with MOFA and this would be useful in providing better service to all actors in the watermelon value chain
June/2014. Thank You

To be administered to marketers .
DEMOGRAPHIC INFORMATION OF RESPONDENTS.

1. Name:…….
2. Sex of respondent: 1. Male [ ] 2. Female [ ]
3. Phone number of respondent……..
4. Highest formal educational level of respondent
   1. No formal education [ ] 2. Basic (primary/JHS/Middle school) [ ]
   3. Secondary (SSS/Vocational/technical) [ ]
   4.Tertiary (college/university/polytechnic) [ ]
5. How long have you been in the business of buying and selling watermelon (in years):……..

RELATIONSHIP WITH OTHER ACTORS IN THE VALUE CHAIN OF WATERMELON.

6. Kindly indicate where you get the supply ofwatermelons from?

1. Individual farmers [ ] 2. Group of farmers [ ]
3. From the market [ ] 4. From other traders []

7. Do you travel to buy watermelons?
   1. Yes [ ] 2. No [ ]
8. If yes, kindly mention the district(s) or market(s) where you buy your watermelon from.

   …….

   ……..

9. Do you get enough from where you get your supply from for your business?
   1. Yes [ ] 2. No [ ]
10. If no to question 9, would you like to be linked to other sources of supply?
    1. Yes [ ] 2. No [ ]
11. If yes to question 10, could you estimate the quantity and time frame you may require?

Quantity	period
	1. Every day [ ] 2. Every week [ ] 3. Every two weeks [ ] 4. Every month [ ]

12. How do you sortout the watermelon fruit before buying?
    1.ByWeight [ ] 2. By Size [ ] 3.Level of Maturity [ ]4. By Taste [ ] 5.By Color [ ] 6. Others specify……
13. Where do you get information about the source of supply of watermelon?

1. From other traders [ ]2. From friends [ ] 3.Radio [ ] MoFA [ ] 5. From farmers [ ]

14. How do you pay for the produce you purchase?

    1. Full payment before you take produce [ ] 2. Part payment [ ] 3. Credit (buy and pay latter) [ ]
    4. Use bank cheque

15. Do you have relationship with the following service providers in the watermelon value chain?

Service providers	**Relationship**	
	YES	**NO**
Farmers		
MoFA		
Financial institutions		

16. How would you rate your relationship with the service providers?

Service provider	**Rank in order of strength (1= very strong,2 = strong, 3=no relationship at all, 4=weak 5= very week**				
	1	**2**	**3**	**4**	**5**
Farmers					
MoFA					
Financial institution					

17. what challenges do you face in your business?

1. ……..

2……..

3…….

4……..

18 what do you propose as solutions to the challenges?

1……

2……

3……

Appendix ii: Questionnaires for farmers

Sir/Madam, I am a student of the University of Ghana conducting a survey on Assessing the contribution of watermelon value chain to income security of smallholder farmers in Bawku West District, Zebila as part of my academic work. The responses you give to the questions would be analyzed and used for academic work. The results would also be shared with MOFA and this would be useful in providing better service to farmers.

THANK YOU

BUKARI MOHAMMED

MA STUDENT, UNIVERSITY OF GHANA.

To be administered to household head or household representative.
Interviewer's name……Date…….
Name of District……..Name of community…….
DEMOGRAPHIC INFORMATION OF RESPONDENTS.
OBJECTIVE 1:. To determine the relationship of personal characteristics of smallholders and level of participation in watermelon value chain.

1. Name of respondent:……..
2. Sex of respondent: 1. Male [ ] 2.Female[ ]
3. Age of respondent (in years): …….
4. Marital status of respondents: 1. Married [ ] 2. Not married [ ]
5. Highest Formal educational level of respondent

1. No formal education [ ] 2. Basic (primary/JHS/Middle school) [ ]
3. Secondary (SSS/Vocational/technical) [4. Tertiary (college/university/polytechnic) [ ]

6. Number of people in household ……
7. Who is the head of the household? 1. Male [ ] 2. Female [ ]

8. Number of years into watermelon production……

PRODUCTION FACTORS.

9. What are your sources of livelihoods? Rank in order of importance. 1=1st most important, 2 =2nd most important, 3= 3rd most important (in that order)

Source of livelihood	Rank				
	1	2	3	4	5
Crop farming					
Livestock rearing					
fishing					
trading					
salary					
*artisan					

*artisan (tailor, mason, carpenter, hairdresser, fitter, barber, welder, sprayer, electrician etc)

10. if you do crops or livestock or both, please tick where appropriate the type of crop or livestock you engage in.

Crops	Yes	No	Livestock	Yes	No	Poultry	Yes	No
Earl Millet			Sheep			Fowls		
Rice			Goats			Guinea fowls		
Maize			Cattle			Duck		
Sorghum			Pigs			Turkey		
Soya			Donkey			Others (list)		
Groundnut			Others (list)					
Cowpea								
Bambara								
Tomato								
Kora								
Others (list)								

11. What is the size of your watermelon farm? (acres)……..
12. Do you use the following farm resources for watermelon production?

Farm resource	**use**		**If yes, indicate by ticking the appropriate source(s)**					
	Yes	***No***	***MoFA***	***self***	***market***	***Friends***	***Financial institution***	***NGO***
Improved seed								
Fertilizer								
Insecticide								
Herbicide								
Credit								
Land								
Labour								
Water								
Extension service								

13. Which of the following service providers provide services for your watermelon production?Tick all that apply

1. MoFA [] 2.FinancialInstitutions [] 3.Input dealers [ ] 4. Buyers [ ] 5. NGOs [ ]

14. How would you rank your relationship with the service providers?

Service provider	**Rank in order of strength (1= very strong,2 = strong, 3=neutral, 4=weak 5= very weak**				
	1=Very strong	**2=Strong**	**3=Neutral**	**4=Weak**	**5=Very weak**
MoFA					
Input dealers					
Financial institution					
NGO					
Buyers					

15. How do you carry out the following cultural practice in producing watermelon? **Please tick where appropriate.**

16.

Cultural practice	**Method used**
Land preparation	1. Use of tractor [ ] 2. Use of bullock [] 3. Use of donkey [ ] 4.Use of weedicide [ ]5. Use of hoe (manaual) [ ]
Seeding/planting	1.Directseeding [ ] 2. Transplanting [ ]
Weeding	3. Hoeing [ ] 2. Use of weedicide
Pest control	1.Use of organic extract [ ] 2. Use of pesticide [ ] 3.Others (specify)
Fertilization	1.Use of Organic fertilizer[ ] 2. chemical fertilizer [ ]

17. What is your source of labour for your watermelon farm?
    1.Own labour [ ] 2. Family labour [ ] 3. Communal labour [ ] 4. Hired labour [**]**
18. What do you use the watermelon you produce for, after harvest?

Use of produce	**Percentage of total harvest %**
Consumption [ ]	Percentage of harvest you consume……
Sale [ ]	Percentage of harvest you sale……..

19. If you sell, where do you sell your produce? Tick all that apply
    1. Local market [ ] 2. Traders. [ ] 3. Others (specify)
20. If you sell, how do you sale it?
    1. In singles [ ] 2. In multiples
21. If in multiples, please indicate the unit of measure.
    1. By numbers (heap) [ ] 2. In containers [ ] 3.In donkey carts [ ] 4. In truck loads [ ]

    5. Others(specify)……

    21. How do you sort out the watermelon fruits for sale?
    1. by weight [ ] 2. By size [ ] 3. Color [ ] 4. By taste [ ]

    5. others (specify) ……..

22. Do you know the name of varieties of watermelon you produce?
    1.Yes [ ] 2. No [ ]

23. If yes, please kindly state the reasons for cultivating the varieties you cultivate.

Variety	**Reasons**
1.	1.preference by customers [ ]2. Early maturity [ ] 3. Easy to handle [] 4. Bigger size [ ] 5. Taste [ ] 6. Others (specify)……
2.	1.Preference by customers [ ]2. Early maturity [ ] 3. Easy to handle [ ] 4. Bigger size [ ] 5. Taste [ ] 6.Others (specify)……
3.	1.Preference by customers [ ]2. Early maturity [ ] 3. Easy to handle [ ] 4. Bigger size [ ] 5. Taste [ ] 6. Others (specify)……
4	1.Preference by customers [ ]2. Early maturity [ ] 3. Easy to handle [ ] 4. Bigger size [ ] 5. Taste [ ] 6. Others (specify)……..

24. Over the last 5 years, could you provide information on the quantity of fruits of watermelon you produced from your farm?

Year	**Quantity (in donkey carts or motor king)**
This season. (2013)	
The season before. (2012)	
Two seasons ago.(2011)	
Three seasons ago. (2010)	
Four seasons ago. (2009)	

25. With regards to watermelon, what cropping system do you practice?
    1.Solecropping [ ] 2. Intercropping [ ]
26. If you intercrop, what crops do you intercrop with watermelon?

    1……

    2……..

    3……
27. If you intercrop, what are your reasons for intercropping?

1……
2……
3……..

28. How many times do you cultivate watermelon in a year?……
29. How much income (GHC) do you make from your watermelon farm? GHC……

30. How much is your cost in terms of the following (in acres)?

VARIABLE COST ITEM	**COST (GHC)**
SEED	
FERTILIZER	
CHEMICALS	
HIRED LABOUR	
IRRIGATION FEE	
TOTAL	

31. How do you consider the contribution of income from watermelon production to your household income?
    1. Very significant [ ] 2. significant [ ]3. Not sure [ ] 4. Insignificant [ ] 5. Very insignificant [ ]
32. Without the income from the sales of watermelon, life would be difficult to live.
    Tick all that apply.
    1.Strongly agree [ ] 2 . Agree [ ]3. Not sure [ ] 4. Disagree [ ]5. Strongly disagree [ ]

33. Comparing watermelon to other crops you produce, which do you think has more potential in contributing to your income security?
    1. Watermelon[ ] 2. Other crops[ ]
34. With regards to the following parameters, how would you rank watermelon to the other crops you cultivate? **Tick where appropriate**

Parameter	Other major crops	Watermelon
a Ready market		
b income		
C Ease of production		
d. profitability		

35. What other reasons do you consider in cultivating watermelons?

    1……..

    2……..

    3……..

36. What are major problems do you encounter in production of watermelon?
    1. Pest and diseases[ ] 2.Access to inputs [ ]3.Access to credit [ ]
    4. Access to extension advisory services[ ] 5.Access to water [ ]

    6. Others (specify)……

37. What problems do you encounter in sales (marketing) of watermelon?

    1. Bargaining power [] 2. Language barrier with buyer [ ]3. Buyers buying on credit [ ]
4. Poor price [ ]5. No buyers at all [ ]Others (specify)…….

38. What general suggestions to you make for improving the production and marketing of watermelon?

    1……..

    2……

    3……..