EFFECTS OF THE MCA-GHANA PROGRAM FARMER TRAINING ON PRODUCTIVITY OF SMALLHOLDER MAIZE FARMERS IN THE KWAHU EAST DISTRICT OF GHANA

by

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A Thesis submitted to the Institute of Distance Learning, Kwame Nkrumah University of Science and Technology in partial fulfillment of the requirements for the degree of

COMMONWEALTH EXECUTIVE MASTERS OF BUSINESS ADMINISTRATION

SEPTEMBER 2012

DECLARATION

I hereby declare that this submission is my own work towards the Executive Masters of Business Administration and that, to the best to my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

This research report was initiated to evaluate effects of farmer training of the Millennium Challenge Account -Ghana program on productivity of smallholder maize farmers in the Kwahu East District. The Program which ran from 2007 to 2012 aimed at reducing poverty by raising farmer incomes through private sector-led, agribusiness development. The farmer training spanned August 2008 to October 2010 in the Kwahu East District. Since then no ex-post evaluation had been undertaken to assess the impact of the training in the District in terms of technology adoption, yields and incomes. Hence this study aimed to undertake such evaluation. The objectives of the study were to: find out how the training affected the technology adoption by farmers; determine yield outcomes and incomes of the farmers; examine the yields and incomes of farmers two years after the training relative to figures before the training; and identify the challenges to enhanced technology adoption, yields and incomes of farmers. Data were collected through a district survey of MiDA trained and non MiDA trained maize growers conducted in May 2012. A three-stage, randomized procedure was used to select a representative sample of 162 maize farmers. These farmers were questioned on their level of technology adoption, production costs, yields and revenues. The study revealed that in 2011 with regards to use of improved maize seed, close to 80% of trained farmers compared to less than 60% of non trained farmers adopted this technology. A significantly higher percentage, 71.1%, of the trained farmers adopted row spacing technique, while this is true for only 44.4 of non trained farmers provide evidence that the disseminated maize technologies have diffused satisfactorily among MiDA trained farmers. This is quite impressive, considering that maize in the district is grown mostly by small-scale farmers, many of whom live in isolated communities. These results show that MiDA made

good progress in achieving the objective of promoting the dissemination and adoption of improved maize technologies. Also in 2011 Return on Investment for the trained and untrained groups were 92.36 and 59.45 respectively, with a difference of 32.91 in favour of the former. In either year each group had production efficiency greater than one, indicating that each made profit. However in 2011 maize production was much more profitable and efficient for the trained group with production efficiency of 1.92, than the non trained group, whose efficiency was 1.59. Consequently the training has had a positive effect on the incomes of many rural smallholders throughout Kwahu East. The survey results show that enhanced productivity of the smallholders is challenged by the following factors: technology adoption challenges (i.e., costly to adopt, complex to adopt, lack of skills to adopt, lack of access to extension services and lack of production resources); yield challenges (i.e., unusual agro-climatic conditions, low soil fertility, lack of skills to adopt technology, lack of access to extension services, lack of production resources and pests and disease effect); and income challenges (i.e., unstable prices, unreliable market, post-harvest losses, lack of market information, and bad roads). What emerged from the findings suggests that in spite of the aforementioned challenges which continue to be the factors that explain why there is still a wide gap between the current best yield of 1200kg/acre among the smallholders and the achievable yield of 2400kg/acre, the impact from the training program had been positive as many of the beneficiary farmers have had significantly enhanced yields and incomes two years after the training program. It is hoped that the successes and challenges identified can serve as a source of knowledge that can potentially be used to inform and improve future intervention efforts, both within the district and in other parts of Ghana.

DEDICATION

This work is dedicated to the Triune God and my family.

ACKNOWLEDGEMENT

To the Lord God is the glory. I trust in Him and lean on His word in my ways and He keeps making my paths straight. I truly acknowledge and appreciate the goodness of His love.

My profound gratitude goes to Dr. John Adu Kumi, who supervised this work. His kind, encouraging and constructive supervision of this work has been highly commendable. I truly appreciate the contribution that all the Lecturers at the Koforidua Centre of the Institute of Distance Learning of the School of Graduate Studies have made towards my post-graduate education.

I am highly indebted to my family. My special love and gratitude go to Madam Benedicta Danso, Messrs. Isaac Bimpeh, George Danso, and Francis Bimpeh for the inputs they have made in my schooling and my life. I also greatly cherish the love and support offered me by Madam Joana Odei Acquaye and my siblings during the course of this research work. The Lord richly blesses them.

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LIST OF ABBREVIATIONS

ADRA	-	Adventist Development and Relief Agency
AEA	-	Agricultural Extension Agent
CDFO	-	Commercial Development of Farmer-Based Organization
CRI	-	Crop Research Institute
CYMMYT	-	International Maize and Wheat Improvement Center
FASDEP	-	Food and Agricultural Sector Development Policy
FBO	-	Farmer-Based Organization
GGDP	-	Ghana Grains Development Project
KSA	-	Knowledge, Skills and Abilities
MCA	-	Millennium Challenge Account
MCC	-	Millennium Challenge Corporation
MiDA	-	Millennium Development Authority
MV	-	Maize Variety
OA	-	Operational Area
SRID	-	Statistics Research and Information Directorate
TTSP	-	Training and Technical Service Provider

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The largest constituent of human resource of the agricultural sector in Ghana, is the over 60 per cent of the population, that make a living from the sector. High illiteracy among producers means a constant need for facilitating their access to information on new approaches, opportunities and policies. High incidence of poverty among farmers limits their ability to respond to opportunities either because of lack of capacity or because of their risk-aversion strategies (FASDEP II, 2009.)

According to MiDA (2008) it was against this background that the Millennium Challenge Account (MCA) – Ghana Compact was signed into being, between the Government of Ghana and the United States of America, on 1st August 2006. The Millennium Challenge Corporation's (MCC) funding of $547 million formed part of the MCA Assistance intended to positively transform the lives of the rural poor and catalyze long-standing economic progress. The five-year (2007-2012) program consisted of three projects: (i) Agriculture Project; (ii) Transportation Project; and (iii) Rural Services Project. The Compact aimed at reducing poverty by raising farmer incomes through private sector-led, agribusiness development. The program operated in 30 districts in the northern region, the central Afram Basin region and the southern horticultural belt in the southeastern region (each region, an Intervention Zone), where poverty rates were generally above 40 percent.

The Farmer and Enterprise Training in Commercial Agriculture was a component under the Agriculture Project of the Program. It was meant to accelerate the development of commercial skills and capacity among Farmer-Based Organizations (FBOs). The desired goal of the training was the evolution of a new type of farmer with a market oriented mind set who understands what the market demands and is willing and interested in adopting improved agricultural methods that enable him to produce high quality produce that meets the consumer demands of higher value markets. The net desired result is for increased profits, incomes and poverty reduction (ADRA Ghana, 2012).

Overall the Agriculture Project targeted to train, assist and support 1,200 FBOs and 60,000 farmers. The Afram Basin zone (which includes the Kwahu East District) had 600 FBOs, comprising about 30,000 farmers. The Farmer groups were assigned into training cohorts over a three year period (2008-2010). As a result all the groups were not trained at once, but by the end of the training program all the groups had been trained (op.cit.).

Some evidence of effects of training were reported by Friis-Hansen (2005) on the one hand, when he presented a paper on " Agricultural Development among poor Farmers in Soroti district, Uganda: Impact assessment of agricultural technology" at an impact assessment workshop at International Maize and Wheat Improvement Center (CYMMYT), Mexico, October, 2005.; and Dola (2010) on the other hand when he presented a study on "The Impact of Government initiated Training towards farmers in Malaysia" in the European Journal of Social Sciences, Vol 4, No. 2 (2010). In general, training programs can be costly investments, and so there is an ongoing debate regarding the profitability and suitability of farmer trainings, (University of Hannova, 2004). The most effective way of relating whether training has been effective or not is through evaluation. Training evaluation is a systematic

process of determining the impact of training program to the participants (Improving Training Quality, 11: 1991).

In light of this, any study that aims to evaluate the impact of the Farmer Training in Commercial Agriculture of the MCA – Ghana Program (which came to completion in February 2012) is commendable, since among other things, it provides a document which outlines the impact of the 'Training Program'; guides the design and delivery of future farmer training interventions; and provides information that will be useful regarding the ongoing debate on the profitability and suitability of farmer training in developing countries.

1.2 Statement of the Problem

The Millennium Development Authority (MiDA), implementer of the MCA – Ghana Program (February 2007 – February 2012), made a huge investment in the training of 1200 FBOs, comprising about 60,000 farmers nationwide. The Kwahu East District has 46 of such FBOs, comprising 1,310 farmers. The Farmer Training in Commercial Agriculture of the MCA-Ghana Program was meant to upgrade the knowledge and skills of the participating farmers. It was designed to enhance yields and incomes of mainly smallholder farmers. ADRA Ghana's terminal 'Monitoring and Evaluation Report', 2012, on the farmer training in the Afram Basin Zone outlined among other things the following issues and challenges:

1. Some farmers participated in the training mainly due to the incentives to benefit.
2. The handholding activities conducted by some Training and Technical Service Providers (TTSPs) were unsatisfactory, and hence established relations between the service providers and the farmers could not be well sustained.
3. The four (4) hour duration per training session was too long for adult learning.

4. Some farmers traveled several kilometers by foot to training venues to participate in training sessions

The desired goal of the training was to change the mindset of farmers and move them from “farming as a way of life” to farming as a business. To this end no ex-post evaluation had been undertaken to assess the impact of the training in the Kwahu East District in terms of technology adoption, yields and incomes. Hence this study aimed to evaluate the impact of the Farmer and Enterprise Training in Commercial Agriculture in the Kwahu East district in terms of technology adoption, yields and incomes.

1.3 Objectives of the Study

The main objective of this research is to evaluate the impact of the Farmer Training in Commercial Agriculture on the productivity of farmers in the Kwahu East district in terms of technology adoption, yields and incomes.

The specific objectives are:

1. To find out how the training affected the technology adoption by farmers.
2. To determine yield outcomes and incomes of the farmers.
3. To examine the yields and incomes of farmers two years after the training relative to figures before the training.
4. To identify the challenges to enhanced technology adoption, yields and incomes of farmers.

1.4 Research Objectives

1. To what extent has the training enhanced the level to which the farmers in Kwahu East are adopting improved technologies?

2. What were the yields and incomes of farmers in Kwahu East before and after the training?

3. What are the challenges to enhanced technology adoption, yields and incomes of farmers in Kwahu East?

1.5 Significance of the Study

The research is justified on the grounds that it:

1. Identifies the challenges to enhanced technology adoption, yields and incomes of farmers and seeks suggestions for improving the situations for the farmers.
2. Provides information that will be a useful contribution to the ongoing debate on the profitability and suitability of farmer training in developing countries.
3. Provides a document which outlines the impact of the Farmer Training component of the MCA-Ghana Program in the Kwahu East District, to show the worth of such training in Ghana.
4. The report serves as a guide to the design and delivery of future farmer training interventions.

1.6 Scope of the Study

The research is focused on:

1. An ex-post evaluation of the 'technical training component' of the Farmer and Enterprise Training in Commercial Agriculture on farmers in the Kwahu East district.
2. The MCA beneficiary farmers trained in 2009 within the Kwahu East district.
3. Trained smallholder farmers engaged in maize production in the Kwahu East District, who cultivated in the 2011 major production season.

1.7 Organization of the Study

The study is presented in five chapters. Chapter one deals with the introduction to the study comprising; background to the study, statement of the problem, objectives of the study, significance of the study and scope of the study. Chapter two is devoted to the review of literature most relevant to the study. Chapter three looks at the methodology of the study, whilst chapter four concentrates on the analysis discussion and representation and of results obtained. Chapter five is a summary of findings, conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter deals with review of literature most relevant to the study. The review concentrates on the concepts of evaluating farmer training and assessing productivity of smallholder maize farmers in Ghana. Key concepts reviewed include: adoption of improved production technologies; agricultural productivity; and training evaluation. The review also examines the challenges to enhanced technology adoption, yields and incomes of farmers.

2.2 Food and Agriculture in Ghana

Agriculture is the backbone of Ghana's economy. It accounts for approximately 40 percent of the country's gross domestic product, directly employs approximately 60-70 percent of the labor force, and generates more than 55 percent of foreign exchange earnings. Agriculture is predominantly practiced on smallholder, family-operated farms using rudimentary technology to produce about 80% of Ghana's total agricultural output. It is estimated that about 2.74 million households operate a farm or keep livestock. According to the 2000 census, 50.6% of the labour force, or 4.2 million people, are directly engaged in agriculture (FASDEP II, 2009).

The slow growth of agriculture in Ghana is due to a combination of factors that reduce farmers' incentives to invest and produce. Constraints of the sector are classified under: Human Resource and Management skills; Natural Resource Management;

Technology Development and Dissemination; Infrastructure; Market Access; Food Insecurity; and Irrigation Development and Management. The largest constituent of the human resource of the agricultural sector is the over 60 per cent of the population, including farmers, traders and processors that make a living from the sector. High illiteracy among producers means a constant need for facilitating their access to information on new approaches, opportunities and policies. High incidence of poverty among farmers limits their ability to respond to opportunities either because of lack of capacity or because of their risk-aversion strategies (op.cit).

2.3 The MCA-Ghana Program: Farmer and Enterprise Training in Commercial Agriculture Component

The program operated in 23 districts in the northern region, the central Afram Basin Zone and the southern horticultural belt in the southeastern region (each region, an Intervention Zone), where poverty rates were generally above 40 percent. In fact, in the northern region and parts of the Afram Basin region, the incidence of poverty in the rural population was as high as 90 percent, with incomes below $2 a day (MiDA, 2008).

The core of the training hinged on the use of a market led value chain approach that will enhance value addition by the actors in each crop value chain. The desired goal was the evolution of a new type of farmer with a market oriented mind set who understands what the market demands and is willing and interested in adopting improved agricultural methods that enable him to produce high quality produce that meets the consumer demands of higher value markets. The net desired result is for increased profits, incomes and poverty reduction. According to ADRA Ghana (2012), overall, in the Afram Basin Zone, training, assistance and support were provided to 600 FBOs comprising 30,000 farmers. These numbers of FBOs

and farmers constitute 50% of the entire Commercial Development of Farmer Based Organization (CDFO) target of 1,200 FBOs and 60,000 farmers.

ADRA Ghana (2012) noted that the FBO training which formed the core of the Commercial Development of Farmer based Organizations (CDFO) activity was preceded by a lot of preparatory activities. These included staff capacity building in various aspects of the CDFO activity through participation in workshops such as the TOT workshop for staff of MoFA and private extension providers, participation in external and local value chain workshops, Cold Storage operations workshop, and Technical and Training Service Providers (TTSPs) orientation workshops.

Training involves a series of activities carried out to provide farmers with knowledge and skills needed to improve their performance. Training is important when we have to provide farmers with the knowledge and skills they need to function successfully. Farmers may need training in technical areas in order to succeed in enterprises in which they are engaged. Competencies gained from training can shape attitudes and create commitment on the part of farmers (GTZ-MOAP/MOFA, 2009).

2.4 Adoption and Impacts of Improved Maize Production Technologies in Ghana

Morris, Tripp and Dankyi (2001) carried out a study and presented a report which summarizes the findings of a case study that focused on the adoption by Ghanaian farmers of improved maize production technologies developed through the Ghana Grains Development Project (GGDP). The overall objective of the case study was to assess the success of the GGDP in achieving its stated goals of developing improved maize production technologies and transferring those technologies to the farm level in order to improve the welfare of maize

producers and consumers. The following sub-sections highlight various sections of the report.

2.4.1 The Maize Economy of Ghana

Maize is Ghana's most important cereal crop. It is grown by the vast majority of rural households in all parts of the country except for the Sudan savannah zone of the far north. In Ghana maize is cultivated by both men and women, however, women frequently manage their own maize fields, contribute an important proportion of the overall labor requirements, and exercise complete discretion over the disposal of the harvest (GGDP, 2001).

The area annually planted to maize in Ghana currently averages about 650,000 hectares. Most of the maize grown in Ghana is cultivated in association with other crops, particularly in the coastal savannah and forest zones, so planting densities are generally low. Average grain yields of maize are correspondingly modest when expressed per unit land area, averaging less than 2 t/ha. Maize is the most widely consumed staple food in Ghana. An analysis based on 1987 data showed that maize and maize based foods accounted for 10.8% of household food expenditures by the poor, and 10.3% of food expenditures by all income groups (Boateng et al. 1990).

Maize in Ghana is consumed in a variety of forms. Many of these foods require considerable time and skill to prepare, and that explains why a significant proportion of all maize consumed in Ghana as human food is purchased from specialized food sellers as prepared food, rather than as grain. Prepared foods are particularly important in urban areas, but they are also important in rural areas (Alderman 1992). The extensive marketing of maize has important welfare implications because revenues from maize sales represent an important source of income for many households, even households that grow maize primarily to satisfy

their own consumption requirements. Nationwide, maize accounts for 16.8% of the revenues from crop sales earned by poor households and 18.5% of revenues from crop sales earned by "hardcore poor households" (Boateng et al. 1990).

2.4.2 Maize technology transfer

In addition to its research component, the Ghana Grains Development Project (GGDP) supported a number of activities designed to improve the transfer of improved technologies generated through the project to farmers. The strong emphasis on technology transfer issues was reflected in three types of activities:

(1) Building linkages between research and extension,

(2) Providing support to extension activities, and

(3) Strengthening seed production capacity.

2.4.3 Research-extension linkages

Great care was taken to ensure that GGDP research activities were closely linked to extension activities. An important contribution of the project was the development of an extensive network of adaptive experimentation that served both research and extension functions. Centrally planned and administered on-farm experiments were conducted jointly by researchers working with extension agents in every agro-ecological zone.

The extension agents who participated in the on-farm experimentation program often took responsibility for the demonstrations, providing important continuity and experience. Links between researchers and extension agents were further strengthened through annual National Maize and Cowpea Workshops, which brought researchers, extension agents, policymakers, and farmers into a forum where ideas and information could be shared.

2.4.4 Extension activities

In addition to involving extension agents directly in the research program, the GGDP sponsored a number of extension activities, some of which were quite innovative at the time. For example, regular planning meetings were held from the outset of the project to discuss strategies for transferring GGDP-generated technologies to farmers' fields. These planning meetings were attended by researchers, extension specialists, and, notably, by local farmers; in this respect, the meetings provided a vehicle for testing novel participatory research and extension methods.

2.4.5 Maize Yields in Ghana

Data from the Statistics, Research and Information Directorate (SRID) of the Ministry of Food and Agriculture (2010) indicates that maize yields in Ghana are currently very low at an average of 1.6 tonnes per hectare, whereas 4 or 5 tonnes per hectare should be achievable provided sufficient investment in inputs and improved practices are conducted by the farmer.

2.4.6 Agricultural productivity in relation to training of farmers

Agricultural productivity is a valid indicator of GGDP impacts because of the tremendous importance of agriculture in rural Ghana. Considering the large number of Ghanaians who grow maize, any technology that succeeds in increasing the productivity of resources devoted to maize production will bring about real income gains for the vast majority of the rural population by freeing up resources for use in other activities. To the extent that increases in productivity are translated into lower prices for maize, the income gains will also be passed on to urban dwellers.

The purpose of the GGDP was to generate and disseminate improved maize technology, so the obvious place to look for productivity gains is in maize fields. Empirically measuring changes in total factor productivity is difficult, so a simpler measure, partial factor productivity, was used in this study, specifically grain yield per unit land area. How have average maize yields in Ghana been affected by the GGDP? This relatively straightforward question turns out to be extremely difficult to answer. Ghanaian farmers themselves do not calculate maize yields, and they are rarely able to provide enumerators with the detailed area and production data needed to calculate yields in terms of standard measurement units. Under these circumstances, the only way to obtain accurate yield data is to go out and make crop yield cuts in farmers' fields, which is prohibitively expensive on a large scale. For this study, we adopted the approach of asking farmers to estimate how many bags of maize they would expect to harvest from their largest maize field using each of the following technology combinations (which are equivalent to experimental "treatments"):

(1) local variety without (2) local variety with fertilizer, fertilizer,

(3) former MV without (4) former MV with fertilizer, fertilizer,

(5) current MV without (6) current MV with fertilizer, fertilizer.

Farmers were asked to make estimates only for technology combinations they had actually used, so our results are based on farmers' direct experience. By making pair wise comparisons between each technology combination, we were able to calculate the percentage yield increase attributed by farmers to each technology or combination of technologies. In addition to focusing on productivity gains achieved under actual farming conditions (as opposed to experimental conditions), this approach allowed us to avoid the problem of

having to convert non-standard local measurement units for land and production into standard measurement units.

As expected, the yield response is greater in MVs than in local varieties. These results suggest that the GGDP-generated maize technologies have brought about significant productivity increases on farms where they have been adopted. Since the data on maize yield increases were based on farmer's estimates, rather than on direct measurements, we are reluctant to read too much into the actual figures. Nevertheless, the figures are plausible and consistent with experimental data. Another way to determine whether the GGDP has had a positive impact on agricultural productivity is simply to ask farmers if their maize yields have changed during the course of the project. This approach, admittedly, has its shortcomings, because yield changes attributable to the adoption of GGDP-generated technologies could have been confounded (enhanced or offset) by other factors, such as changes in agro-climatic conditions, cropping systems, agricultural support policies, economic incentives, and so forth.

2.4.7 Farmer incomes

Income is widely used as a welfare measure because it is strongly correlated with the capacity to acquire many things that are associated with an improved standard of living, such as food, clothing, shelter, health care, education, and recreation. Income gains are a valid indicator of GGDP impacts because the productivity gains attributable to the adoption of improved maize technologies logically should be reflected in income gains (either directly through increased sales of maize, or indirectly through increased earnings from resources that have been released from maize production).

How can income gains attributable to the GGDP be measured? In the absence of baseline data on farmers' maize marketing activities prior to the initiation of the project, we could think of no reliable way to measure income gains directly. Indirect methods based on farmers' recollections must be ruled out as too unreliable; when questioned about the distant past, few farmers are able to recall detailed information about amounts of maize they sold and the prices they received.

Lacking any approach to measure income gains directly, we simply asked farmers whether during the previous ten years they had noticed any changes in (1) the quantity of maize they produced each year, (2) the quantity of maize they sold each year, and (3) their total annual income from maize sales. In response to all three questions, more than half of the respondents indicated that they had noticed increases. Interestingly, the proportion of farmers reporting an increase in the quantity of maize sold was lower than the proportion of farmers reporting an increase in income from maize sales. This discrepancy can be explained by the fact that maize prices strengthened considerably during the past ten years, so that total income from maize sales could indeed have increased even if the physical quantity of maize sold remained the same or even decreased.

Farmers who reported increased income from maize sales were asked to describe how the additional income was spent. By far the most common reported use was to pay children's school fees. The next most common reported uses included purchasing building materials to expand or renovate the farmer's house, investing in merchandise for a family-owned retail trading business, and purchasing additional agricultural land. The additional income earned through maize farming (much of which presumably can be attributed to the adoption of

GGDP-generated technologies) for the most part seems to have been invested productively, rather than spent on short term consumption.

2.4.8 Factors affecting technology adoption

In addition to providing a detailed picture of the diffusion of improved maize technologies throughout Ghana, the data generated through the CRI/CIMMYT survey provide important insights about the many factors that can influence the adoption process. These factors may be divided into three general categories: (1) characteristics of the technology; (2) characteristics of the farming environment into which the technology is introduced; and (3) characteristics of the farmer making the adoption decision.

2.4.9 Characteristics of the technology

It has long been recognized that the rate and extent of adoption of any new technology are conditioned by the nature of the technology itself. Important characteristics that can encourage or discourage adoption include the complexity of the technology, its profitability, riskiness, compatibility with other technologies or practices, and divisibility. By themselves, these characteristics do not determine adoption; technologies that are simple, inexpensive, and risk-free may never be taken up, just as technologies that are complex, costly, or risky may find wide acceptance. But the characteristics of the technology do matter, and they deserve careful attention (GGDP, 2001). The three GGDP-generated maize technologies represented different levels of complexity. Maize Varieties (MVs) were probably the least complex technology, because adopting MVs required relatively few changes to the farmer's current practices. Plant configuration ranked next in terms of complexity, because in order to

adopt the row planting recommendation, farmers had to learn how to use planting ropes or sighting poles, and they had to know how to measure row and plant distances.

Fertilizer was undoubtedly the most complex technology; managing fertilizer efficiently involved learning the names of different products, their nutrient composition, correct application rates (based on field characteristics), optimal application schedules, and efficient application methods. Judging by complexity alone, one might have predicted that Ghanaian maize farmers would first adopt MVs, then row planting, and finally fertilizer. Past surveys suggest that this adoption sequence has in fact been common (Tripp et al. 1987; GGDP 1991).

The complexity of the technology is only one factor influencing adoption, however, and what actually happens in farmers' fields depends on many other particulars. Another important determinant of adoption is the expected profitability of the technology. Farmers naturally are interested in technologies that give higher returns to scarce factors of production (e.g., labor, cash, land, or some combination of these).

Of the three GGDP generated maize technologies, adopting fertilizer can potentially result in considerably higher yield increases than adopting MVs or row planting alone.9 But the higher yields that can potentially be achieved with fertilizer must be balanced against the higher cash costs associated with fertilizer use. In economic terms, although the *net benefits* associated with adopting fertilizer are often higher, the marginal rate of return to the additional investment required is not necessarily higher. MV use and row planting generate lower net benefits, but adopting MVs and planting in rows requires very little cash

investment, so the marginal rate of return to the additional investment required is extremely attractive.

Farmers also look at the risks involved in adopting a new technology. Several types of risk can be distinguished. Farmers may be convinced that the new technology works, but they may still be uncertain how it will perform on their own farms. This uncertainty can usually be allayed by observing the technology in a neighbor's field or in a nearby demonstration plot. Another type of risk relates to the technology's performance during periods of unusual climatic stress (e.g., drought), which may be more difficult to assess because such periods do not occur very often.

Research has shown that farmers often place a premium on stability, choosing technologies that perform satisfactorily under a wide range of conditions; instead of technologies that perform exceptionally well but only under favorable conditions. Tripp and Marfo (1997) reported that many farmers in southern Ghana were particularly attracted to some MVs because they matured earlier than local varieties and had a better chance of escaping drought. The short stature of these MVs also protected them from the threat posed by lodging. A third type of risk relates to the possibility of losing the investment made in an improved technology. This reduced the riskiness of the technologies by allowing farmers to adopt each recommendation progressively, in step-wise fashion.

2.4.10 Characteristics of the farming environment

A technology can be simple, profitable, relatively secure, compatible with farmers' current practices, and divisible; but that does not necessarily mean it will be adopted. Adoption decisions depend partly on the characteristics of the technology, but they depend also on the

environment in which farmers operate. GGDP (2001) asserted that important characteristics of the farming environment that can affect technology adoption include agro-climatic conditions, the nature of prevailing cropping systems, the degree of commercialization of the cropping enterprise, factor availabilities, farmers' knowledge and access to technical information, and the availability of physical inputs.

The most favorable areas for maize are concentrated in the transition zone and in parts of the Guinea savannah; these areas receive more solar radiation, feature lighter soils, and have fewer trees (which means land preparation is easier). Maize can be grown in forest areas, but agro-climatic factors are generally less favorable for maize production, and competition from tree crops is much greater. The observed differences in adoption rates between the forest zone and other zones stem in part from the generally lower profitability of maize in forest areas relative to alternative crops, especially cocoa.

Farmers who ridge their fields already plant in rows, so for them the GGDP-generated row planting recommendation has little relevance. In the southern part of the country, particularly in heavily forested regions, soil fertility is periodically replenished through a carefully managed bush fallow system. Farmers who have access to extensively fallowed land may not face soil nutrient deficiencies, so chemical fertilizer may have little relevance for them. Farmers' technology choices tend to be influenced by the degree to which the crop is marketed. Varietal selection criteria often vary depending on whether the harvest will be consumed at home or sold for cash. If maize is grown mostly to be eaten at home, consumption characteristics assume great importance (e.g., appearance, taste, smell, grain texture, ease of processing, storage quality).

But if maize is grown for sale as a cash crop, grain yield and market price tend to be the most important factors. The Ghanaian experience with MVs was quite revealing in this respect. In the north of Ghana, where a lot of maize is retained for home consumption, MVs were generally judged acceptable for food preparation. In the south, initially there were some concerns about the suitability of MVs for preparing local foods, and these concerns were sometimes reflected in lower market prices for MVs. The higher yield of the MVs offset this disadvantage, however, and despite the occasional price differential, MVs soon gained acceptance even among commercial farmers. Regardless of how attractive a new technology may be, it will probably not be adopted if adoption requires farmers to contribute additional factors of production that they do not have and cannot easily obtain.

Of the three GGDP generated maize technologies, the two that might have been affected by factor scarcities were row planting and fertilizer use, both of which require additional labor to adopt, and one of which (fertilizer use) requires a significant cash investment. Judging from the survey results, the labor constraint does not appear to have been binding; few farmers reported that they had not adopted the GGDP technologies because labor was unavailable. The capital constraint may have been more serious, however, with shortages of capital possibly discouraging fertilizer use.

Many of the survey farmers reported that they did not use fertilizer because they lacked the cash needed to purchase it. Since farmers cannot adopt improved technologies unless they have first heard about them, successful adoption is predicated on farmers having access to detailed and accurate technical information. Such information can reach farmers from various sources, but it is likely to reach them most rapidly (and with fewer errors) if there is a well functioning extension service in place. Regular contact with extension officers

clearly has been an important factor in explaining the adoption of all three GGDP-generated maize technologies. Extension resources are scarce in Ghana, and not all farmers have had equal contact. Finally, even if farmers know about a new technology, they cannot adopt it if adoption requires using an input that is unavailable. Two of three GGDP-generated maize technologies are based on physical inputs (MV seed and chemical fertilizer).

Although improved seed theoretically should be available from local inputs supply shops, in practice the seed industry is still very underdeveloped, particularly in more isolated areas. Many farmers manage to procure improved seed from extension officers, who frequently are able to provide seed samples as part of an extension program or sometimes sell seed on a commercial basis as a business sideline. Of course, once a particular MV has appeared in an area, local farmers can usually acquire farm-saved seed from early adopters. Obtaining fertilizer is generally more problematic because it is bulky and must be purchased each season. Fertilizer distribution was recently privatized in Ghana, but the number of agents continues to be constrained by low demand.

2.4.11 Characteristics of the farmer

Two farmers considering exactly the same technology and operating in the exact same farming environment can still end up making very different adoption decisions. A third set of factors that can affect the technology adoption process relates to farmers' personal circumstances, including ethnicity and culture, wealth, education, gender, and security of access to land. Ghana's maize farmers belong to a large number of different ethnic groups, each with its own language, customs, and forms of social organization. With respect to technology adoption, cultural factors frequently affect individuals' access to resources

(especially land, but also labor and capital), their obligations to contribute to different types of agricultural production activities, their ownership claims to crops harvested from communally cultivated fields, their access to external sources of information, and so forth (GGDP, 2001).

The vast majority of Ghana's maize farmers cultivates only a few hectares or less of maize and can accurately be characterized as small-scale farmers. Farmers with higher incomes generally enjoy advantages that facilitate adoption. For example, they may find it easier to make contacts with extension officers or to tap into other sources of technical information. Once they have heard about an improved technology, they may be better able to travel to distant towns in search of agricultural inputs. And, after they have located the inputs, they may experience less difficulty in raising the cash needed to purchase them.

Considering these and other advantages associated with wealth, it follows that the rate of technology adoption is slightly higher on larger farms (which presumably tend to be owned by wealthier farmers). Another farmer-related characteristic that can be important in the adoption process is the farmer's level of education. The survey results show that farmers who have adopted one or more of the GGDP-generated maize technologies have received more formal schooling than those who have not adopted. Since the adoption of improved technologies requires the acquisition and assimilation of new information, this result is perhaps not surprising.

Finally, the survey revealed differences in the extent to which some of the GGDP-generated maize technologies have been adopted by men and women. A number of gender-linked factors appear to be associated with these differences, including the farmer's access to

key resources (such as land, labor, and credit), contacts with the extension service, and level of education. Controlling for these factors, there is no difference in the rates at which men and women have adopted the GGDP-generated technologies. This suggests that the observed gender-linked differences in the rates of adoption are not attributable to inherent characteristics of the technologies themselves; rather the differences result from the fact that women in Ghana have less secure access than men to land, labor, and credit, enjoy relatively fewer contacts with the extension service, and receive less formal education.

2.4.12 Importance of complementary factors to adoption of improved maize technologies

As the GGDP experience illustrates, if improved technology is to make a meaningful impact at the farm level, it must be accompanied by at least three complementary factors: (1) an effective extension service, (2) an efficient inputs distribution system, and (3) appropriate economic incentives.

2.4.13 Extension Service

One distinguishing feature of the GGDP, and an important component of its eventual success, was its heavy emphasis on extension. Efforts to educate farmers about the potential benefits of the improved technologies began with the establishment of extensive networks for on-farm testing of MVs and crop management practices. The on-farm trials provided researchers with vital feedback about the performance of experimental technologies, while giving farmers an opportunity to observe the technologies and to learn about them. After the optimal technologies had been identified and approved for transfer to farmers, additional

effort was invested in devising recommendations that would be easy for farmers to assimilate and implement.

Finally, in an effort to see the technology transfer process through to a successful conclusion, the project included a strong extension component, under which thousands of government extension officers were taught about the recommendations. To further strengthen the GGDP extension effort, external agencies were invited to participate in the technology transfer process. The strong link between frequency of extension contacts and adoption of GGDP-generated maize technologies shows that extension continues to play a vital role in promoting adoption. In this respect, while the agencies that participated in the extension effort can justifiably claim partial credit for the widespread dissemination of GGDP maize technologies, there are grounds for concern about the adequacy of the extension effort. The survey results indicate that extension coverage is spotty in many areas and that important group of farmers, especially women, is regularly being missed. Furthermore, casual observation suggests that too many extension agents lack knowledge about the latest recommendations, indicating that the links between research and extension need to be strengthened.

2.4.14 Inputs delivery system

Two of the three GGDP maize technologies are based on the use of purchased inputs that farmers must acquire from external sources (improved MV seed and chemical fertilizer). These purchased inputs must be readily and reliably available if farmers are to adopt the technologies. Unfortunately, often they are not available. Ghana's recently privatized agricultural inputs supply system is struggling to establish itself, and seed and fertilizer

distribution outlets are still scarce in many areas. When questioned about their choice of variety, many maize farmers who still grow local varieties state that they have not switched to MVs because MV seed is not available. Since most farmers who have adopted MVs say that MVs significantly outperform local varieties (and relatively few farmers who try MVs subsequently abandon them), it seems likely that many more farmers in Ghana would adopt MVs if they had access to improved seed.

When asked why they do not use fertilizer, most farmers say that fertilizer is not needed to grow maize (implying that fertility levels in their maize fields are adequate) or that it is too expensive. This suggests that the problem is not availability, but low profitability. Although the price of fertilizer would be lower if a well-functioning fertilizer distribution system were in place, it is not clear that the cost reductions achieved by improving the efficiency of distribution would be great enough to overcome the profitability problem.

2.4.15 Economic incentives

Profitability considerations have also played an important role in influencing the uptake of GGDP technologies. MVs and row planting have been widely adopted in part because the additional costs associated with MV use and row planting are more than paid back by the additional revenue these technologies generate. Fertilizer has been adopted (or adopted and subsequently disadopted) at a much more modest rate, largely because the high cost of fertilizer is not returned in terms of incremental production.

The conclusion to be drawn from this experience is not that researchers must be clairvoyants to develop technologies that will stand the test of time, but that the success or failure of any technology depends to a large extent on its profitability—which in turn

depends on external economic forces beyond the influence of the researchers. In assessing the likely profitability of a new technology, it makes sense to consider possible future changes in economic incentives, but realistically it will never be possible to anticipate all possible changes. In this respect, even the most outstanding agricultural research programs owe at least part of their success to blind luck.

2.5 Farming as a Business: The Farmer as an Entrepreneur

Farming must be run as a profitable business if farmers are to stay sustainable and profitable. A business is an activity someone undertakes to produce something which is sold for a profit. Refusing to organize farming as a business leads to waste of time, effort, money and other resources used in farming. Farmers must have the attitude that they are in farming to operate as a business and to make profit. Farmers must behave as entrepreneurs or business persons who work actively to identify enterprises, plan, organize resources and produce what can be sold for a profit on a sustainable basis. Only by doing this will farmers become sustainable and profitable for the benefit of their members.

2.6 Defining Impact

What is seen as impact of farmers training really depends on the training objectives. What do training institutions initiatives attempt to achieve? Is it for the purpose of imparting knowledge, skills and abilities (KSAs) of farmers, or to enhance production capacity of farmers? Or do training institutions' roles include the concern for yield improvement, and to increase the income and productivity of farmers? (Dola and Noor, 2010).

Table 2.1 Examples of Immediate and Developmental Impacts to Farmers

Immediate	**Developmental**
Knowledge/skill acquisition	More cost- effective production
Technology know how	Innovation
Improve farm management	Improve harvesting
Yield increase	Poverty reduction
Productivity increase	Improved livelihood

Source: adapted from IPM Farmer Field Schools, Berg:2004

According to Dola and Noor (2010) although the purpose of these training providers has to do with providing opportunity for SKAs acquisition, the ultimate objective has been to make them better managers of their fields. Later, they can become better farm managers and trainers. Then, the training helps to increase farmers technological, educational, and social capabilities (Table 2.1).

2.7 Concept of Training Evaluation

The most effective way of relating whether training has been effective or not is through evaluation. Training evaluation is a systematic process of determining the impact of training program to the participants. As precisely defined: "Training evaluation is a systematic process of collecting and analyzing information for and about a training activity which can be

used for planning and guiding decision-making as well as for assessing the relevance and effectiveness of various training components. It is also to determine the immediate results of the activity." *(Improving Training Quality, 11:1991)*

Generally, organizations have been spending large amounts of money in providing training. However, many organizations do not really focus to determine its effectiveness, in particular, the application of the training content to the workplace or to assess the change in job behavior of the individuals. There are a number of benefits that can be drawn from training evaluation. To the trainees, it is important that training can bring beneficial results like acquiring new knowledge, skills and abilities for change in behavior and performance improvement. To training providers, training may mean improving workers' productivity and increasing their economic value, better quality of products produced and enhancing professionalism of individuals (op.cit).

2.8 Model of Training Evaluation

Dola and Noor (2010) carried out a Study on the Impact of Government Initiated Training towards Farmers in Malaysia and indicated that it **is** possible to divide evaluations of training impact into different levels (Table 2.2). The structure which follows is inspired by the work of Kirkpatrick (1979), who has been one of the leading academics in the field of training evaluation. Each successive level represents a more precise measurement of the effectiveness of the training programme, which also infers a more rigorous and time-consuming data-collection and analysis.

2.8.1 Reaction – Level 1 Evaluation

At Level 1 an evaluation focuses on the reaction to the training intervention. In other words, it measures how the participants reacted to a training programme. It looks at participants' satisfaction – i.e. did they like the presentations? Were the topics and materials relevant to their work? These types of questions are typically evaluated through a questionnaire handed out at the end of the training. A positive reaction is conducive to increased learning (Level 2) while a negative reaction is a hindrance to learning. The reaction is the least cost-intensive impact to measure and at the same time provides information that can be important as rough guidance for improving the training (op.cit).

Table 2.2 Types/Sequence of Training Evaluation

EVENT / INTERVENTION	**EVENT / INTERVENTION**
Level 1 -Training Event Evaluation -Assess Satisfaction of Trainees -Event Assessment Questionnaire -Completion of Training	**Level 2** -Skills/Knowledge Acquisition -Assess Change in Knowledge, Skills, Attitudes -Pre-Test/Post Test -Completion of Training
FOLLOW-UP	**IMPACT**
Level 3 -Skills/Knowledge Transfer -Assess Extent of Application of Skills/Knowledge to Job Related Activities -Survey : Interview and/or Questionnaires -3 months to 6 months	**Level 4** -Organizational Performance Change -Assess Organizational Change as a Result of Skills/Knowledge Transfer And Incorporation -Baseline Comparison 1-3 years

Source: Assessing Training Impact, Marcotte, *et. al*., (2002)

2.8.2 Learning – Level 2 Evaluation

At Level 2 the evaluation attempts to assess the extent to which the trainee has enhanced knowledge and/or improved skills or attitudes through the training course. There are various ways to assess the learning impact of training, including both formal and informal testing as well as self-assessments. If possible, trainees are assessed by comparing pretest and post-test results. However, to produce reliable result the tests oftentimes need to be very detailed, thus raising questions regarding the cost benefit of the exercise. For this reason evaluations of actual learning are carried out much less frequently than evaluations of reactions (op.cit.).

2.8.3 Behavioural Change – Level 3 Evaluations

Level 3 evaluations focus on the extent to which trainee behavior has in fact changed as a result of the training. It seeks to establish if newly acquired knowledge, skills or attitude are being applied in the working environment of the trainee. Often it will be difficult to predict when and exactly how a change in behavior will occur. As a result the decision son when and how to evaluate are highly important. There are also various methods to uncover behavioral changes including self-assessments, surveys and interviews of trainees, their managers and other interlocutors (op.cit.).

2.8.4 Results – Level 4 Evaluation

Level 4 evaluations attempt to assess the organizational results derived from the training– e.g. have there been increased productivity, improved quality, decreased costs, and reduced frequency of mistakes? While achieving such results is most often the overall goal of a training programme from an organizational perspective, Level 4 results are rarely assessed. It is almost impossible to determine results in financial terms in a humanitarian setting, and

such results are moreover hard to link directly with the specific training. A pragmatic and cost-efficient way of seeking to address actual results could be to establish behavioral changes and assess how they align with organizational priorities in regards to relevant competencies, skills and functions (op.cit.).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The main issues considered under methodology of the study are the study area, research design, population, sampling procedure, data collection and data analysis and presentation.

3.2 The Study Area

The study area is Kwahu East District. Kwahu East District Assembly is one of the twenty-one districts in the Eastern Region. The following sections are excerpts from the District Profile, 2012, compiled and prepared by the Kwahu East District Assembly.

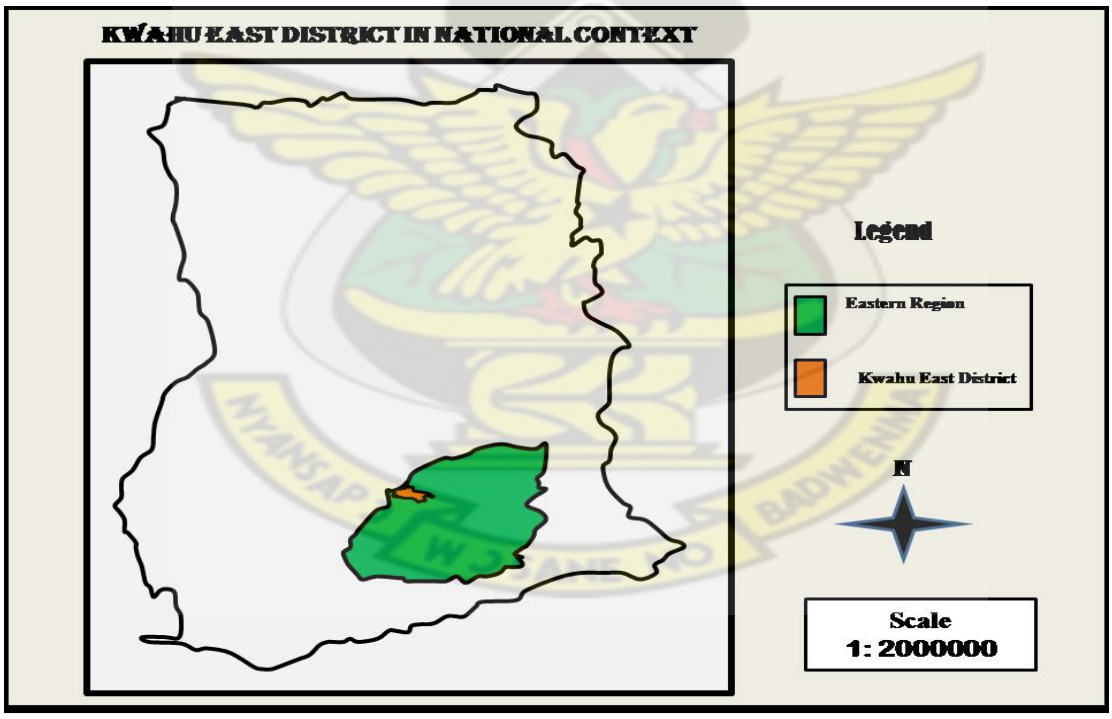

Figure 3.1 Kwahu East District in National Context

Source: District Profile, Kwahu East, 2011

3.3 Baseline Profile of the District

This section discusses the physical characteristics of Kwahu East District. The main physical features are the location and size, relief, rainfall and drainage, climate, vegetation and soil **(**District Profile, KEDA, 2011).

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3.3.1 Location and Size

The Legislative Instrument (L.I 1839) established the Kwahu East District Assembly on 29th February, 2008, with Abetifi as the District Capital. The District is situated on the northern part of the Eastern Region. It shares common boundaries with the Kwahu North District to the east, Kwahu South District to the south, Fanteakwa District to the south-east and Asante-Akim North of the Ashanti Region to the north. The total land size of the District is approximated to be about 860 square kilometers **(**District Profile, KEDA, 2011**)**.

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3.3.2 Climate and Rainfall

The district falls within the wet semi-equatorial climatic zone which experiences substantial amount of precipitation/rainfall. It experiences the double maxima rainfall pattern namely the major and minor rainy seasons which promotes active farming activities throughout the year. The major rainy season starts from April and ends in July. On the other hand, the minor rainy season starts from September, ending in October. Annual average rainfall is between 1580mm and 1780mm. Mean monthly temperature ranges from as high as 30^{o}c in the dry season but declines to about 26^{o}c in the wet season. It is worthy to note that the relatively

higher altitude has moderating influence on the local temperature **(**District Profile, KEDA, 2011).

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3.3.3 Relief and Drainage

The topography of the district is generally undulating. It is mountainous and interspersed with low lying plains to the west and the east. The mountainous terrain is rugged and characterised by the configuration of several summits and steep slopes of hard sandstone and quartzite ridges, mainly rock out-crop and scarps. Kwahu East is endowed with rich water resources which are capable of meeting the water needs of the entire population if consciously harnessed. The district is drained mainly by the Afram River which is a major tributary of the Volta River. Communities such as Kotoso, Sempoa, Asempaneye, Tokrom and Hyewohoden are well noted for their fishing activities. The farmlands along the Afram River are low-lying. This, coupled with the abundance of water from the lake, make these areas have the potential to support agricultural development, particularly irrigation farming. It could be a major source of irrigation for the production of vegetables all year round **(**District Profile, KEDA, 2011).

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3.3.4 Vegetation and Soils

The district falls within the semi-deciduous rainforest region leading to high degree of rainfall for crop cultivation and human use. The vegetation is mainly characterized by tall trees with evergreen undergrowth and abounds in economic trees. The vegetation is dense in terms of tree coverage with most trees shedding off their leaves in the dry season. Soils

belong to the forest ochrosols and consist of fine sand loams, concretional loams, non-gravel sandy clay loams and iron pan soils. These soils posses good chemical properties of clay and appreciable amount of humus, making them generally fertile for the production of both cash and food crops such as cocoa, coffee, almonds, plantain, cassava, yams, etc. The forest ochrosols support the cultivation of plantain and cassava at Asikam, Aduhima, Oframase, Miaso and others while the fertile sandy-loams around Akwasiho, Pepease, Kotoso and Kwahu Tafo support the growth of legumes and variety of vegetables **(**District Profile, KEDA, 2011).

3.4 Demographic Characteristics

This section gives the analysis of the population characteristic of the district. It also looks at factors influencing demography.

3.4.1 Population Size Growth

The 2000 National Population and Housing Census put the District's population at 67,498 with an intercensal growth rate of about 1.19%. The projected population for the year 2010 is therefore 76,603. Out of this figure, 51% are females with 49% males. The spatial distribution of population ranges from about 5000 in the urban settlements such as Abetifi, the District Capital, Nkwatia and Kwahu Tafo and about 2000 or less in the rural settlements. The District comprises eight Town/Area Councils and eighteen Electoral Areas with about 110 settlements **(**District Profile, KEDA, 2011).

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3.4.2 Population Density

The 2000 population figure yields a density of 89.5 persons per sq km slightly higher than the national density of 79.3 and the regional density of 89.5 persons per sq. km. With a projected population of 76,603 in 2010, the estimated Population density is 89.1 persons per sq. km. The spatial distribution of population in the district also emphasises the predominance of rural setting as only three of the 110 communities have populations exceeding the urban criterion of 5000 **(**District Profile, KEDA, 2011).

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3.4.3 Occupation Distribution

The predominant occupation in the District is subsistence agriculture employing 54.4% of the total labour force, Trade and Commerce employs 16.1%, production, transport 11.5%, professional, technical and related works constitute 13% while 4.2 % fall within the administrative and managerial sector and others being 0.9% **(**District Profile, KEDA, 2011).

3.5 Agriculture in the district

Agriculture is the major economic activity in terms of employment and rural income generation in the District. About 58 per cent of the working populations are engaged in this sector which constitutes the main source of household income in the district. There are three (3) prominent types of farming activities in the District. These are food cropping, livestock farming and cash cropping. The most predominant of these is food cropping with more than 78 per cent of the farmers in the District taking to this type. Livestock farming is carried out

on a limited scale employing only about 8 per cent of farmers whiles cash cropping also employs just about 14 per cent of the farming population **(**District Profile, KEDA, 2011).

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3.5.1 Land Tenure System

The land tenure arrangements include:

a. Owner occupancy, where the farmer is the owner of the land on which he/she works and provides all the necessary inputs for production.
b. Share tenancy – This is the "abunu" or the "abusa" share cropping system, where the owners lease the land to the farmer, and the farm produce shared equally (abunu) or a third goes to the landlord, while two-thirds goes to the tenant (abusa).

3.5.2 Plots and Farm Sizes

A greater percentage of the farmers have 2 or more farm plots with farm sizes ranging between 1 – 5 hectares. Such distribution of farm holdings in different places means farmers do not practice block farming. The small farm size constitutes a remarkable barrier to agriculture and makes efficient production difficult, as it does not encourage the establishment and maintenance of economic layout. Variation in the size of farms occupied by individual families at different stages in their life is also not provided for. It is, therefore, uneconomical to introduce the processes of agricultural innovations like mechanization, irrigation, etc on farms, which are small in size **(**District Profile, KEDA, 2011).

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3.5.3 Storage Facilities for postharvest preservation of food

The main types of storage facilities in use are the traditional barn, a few improved cribs and roof storage. Maize is the only grain with an elaborate storage system. Facilities for the storage of other farm produce are not available resulting in high post harvest losses. Processing as a means of conserving output is at a very low level and the traditional methods used are not efficient. These compel the farmers to sell their farm produce at low prices during the harvest **(**District Profile, KEDA, 2011).

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3.5.4 Marketing System

Urban-based middlemen within and outside the district undertake marketing of farm produce. Most of the farmers sell their produce at the nearest local market to these middlemen who in turn send them to other marketing centres especially Accra market for sale. The pricing of agricultural produce, which is determined by supply and demand but negotiated by the middlemen, is unfavourable to the farmers. Prices of farm produce are therefore, very low especially when there is a glut and serve as disincentive to the farmers. The poor roads to farming areas have also created for the farmers' limited access to the bigger markets, which can offer better price for their crops **(**District Profile, KEDA, 2011).

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3.5.5 Agric Mechanization

Agriculture mechanization is very low in the District. Farming is generally done on subsistence level as majority of the farmers do not have access to machinery for farming. Available mechanization equipments are few water pumps which are used to irrigate

vegetable farms at Abetifi and Pepease while Water Melon farmers at Kotoso also use irrigation pumps extensively. The use of Tractors for land preparation is virtually absent in the district even though there are vast low-lying grasslands that can be used for agric mechanisation. Investors are therefore needed to create a pool of farm implements for hiring as patronage is expected to be high **(**District Profile, KEDA, 2011).

3.5.6 Agricultural Extension Services

The main aim of the MOFA Extension Service in the district is to address the felt needs of the farmers and also to assist them to increase agricultural production through the transfer of improved production and post production technologies that would support better living standards. This is normally done through seminars and demonstrations. About 65% of farmers have access to extension services **(**District Profile, KEDA, 2011).

3.6 Methodology

3.6.1 Population

The Kwahu East District has forty-six (46) MiDA trained, crop producing FBOs, comprising, 2310 Farmers. There are 27 non-MiDA trained, crop producing FBOs, comprising 974 farmers. The farmer category includes:

i. MiDA trained farmers (treatment population).

ii. Non-MiDA trained farmers in communities where farmers were not trained (control population).

3.6.2 Sampling Technique

Sample Size: This is made up of 162 maize farmers from 27 FBOs. This comprises:

- 90 MiDA trained farmers (from 18 FBOs).
- 72 non-MiDA trained farmers (from 9 FBOs) in communities where farmers were not trained.

Sampling approach: It was important to draw a sample that would fairly represent the district population of maize farmers. The decision was made to use a three-stage, randomized sampling procedure. The three stages involved selection of (1) operational areas, (2) farmer-based organizations, and (3) maize farmers (Table 3.1). Given the resources available for the survey, it was feasible to interview approximately 162 maize farmers. These farmers were selected as follows:

Stage 1*:* The Kwahu East District is demarcated into nine (9) Agricultural Operational Areas. All the nine (9) agricultural operational areas in the district were selected. The advantage of using operational areas (OA) as sampling units is that each OA is approximately equal in size. This helps ensure that all farmers have an equal probability of being selected, which is not the case when sampling units consist of towns or villages of unequal size;

Stage 2*:* Within each of the 9 OAs, two (2) MiDA trained Farmer-Based Organizations (FBOs) were selected at random on the one hand, whereas one (1) Non MiDA trained Farmer-Based Organization (FBO) was selected at random on the other hand;

Stage 3*:* Compiled list of all farmers in the maize producing FBOs that were selected randomly from stage 2 were obtained from the District Agricultural Office at Abetifi. For the treatment population, five (5) farmers were selected at random from each selected MiDA trained FBO. For the control population eight (8) farmers were selected at random from each

selected Non MiDA trained FBO. The resultant sample size(s) can be considered to be fairly representative of the overall population of maize farmers in the district. Hence, the adoption, yield and income experience of the sample respondents can be extrapolated directly to the district level.

Table 3.1 Sampling Procedure, Farmer Training Survey, Kwahu East, 2012

Sampling Stage	Sampling Unit	Selection Criteria	MiDA Trained Farmers (Treatment Population)		Non MiDA Trained Farmers (Control Population)	
			Units at this level	Cumulative Units	Units at this level	Cumulative Units
1	Operational Area	Select all operational areas in the district	9	9	9	9
2	FBO	Randomly select from among operational areas in the district	2	18	1	9
3	Farmer	Randomly select from among each selected maize producing FBO	5	**90**	8	**72**

Source: Author's Computations, 2012

3.6.3 Data Collection Procedure and Research Instrument

Data on the farmer characteristics, production, technology adoption, yield and income among others were collected through a district survey of maize farmers. A one-day training activity was organized for nine survey enumerators. All the enumerators were Agricultural Extension Agents (AEAs) in the district with prior experience in survey work. The training activity included a discussion of the objectives of the survey, a detailed question-by-question review of the survey instrument, and instructional sessions on interviewing techniques. The survey

was carried out in May 2012. Interviews were conducted with the help of a formal questionnaire. When it was not possible to locate a farmer even after repeated visits, replacements were selected at random from the farmer list. After each interview was concluded, the completed questionnaire was reviewed by the student researcher for accuracy and completeness.

3.6.4 Research Design

The study is an ex-post evaluation of the impact of the Farmer Training in Commercial Agriculture on farmers in the Kwahu East district. It involves a latitudinal comparison between MiDA trained farmers (treatment population) and non-MiDA trained farmers (control population), two years after training. The methodology focuses on level 4 of the Kirkpatrick model of training evaluation. This enables the determination of the training effectiveness in terms of its benefit to the beneficiary farmers.

3.6.5 Data Analysis

Descriptive statistics was used to present and analyse data collected. Cost-revenue analysis was done to estimate and compare incomes. The procedure used by the Statistics, Research and Information Directorate (SRID, MoFA) in their publication on 'Estimated Returns on Investment in Selected Crops' (2010), was adopted and t-test technique was used to determine whether or not there were significant differences between the mean yields and incomes of the treatment and control groups.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents results of the analysed data and discusses them with the view to address the research objectives raised in chapter one, namely:

1. To what extent has the training enhanced the level to which the farmers in Kwahu East are adopting improved technologies?
2. What were the yields and incomes of farmers in Kwahu East before and after the training?
3. What are the challenges to enhanced technology adoption, yields and incomes of farmers in Kwahu East?

4.2. Demographic and Occupational Characteristics of Farmers

4.2.1 Distribution of Farmers

The questionnaires were actually administered to a total of 162 farmers, of which 90 of them were MiDA trained farmers, and 72 were Non MiDA trained farmers from communities where farmers were not trained. Aside information regarding their demography and occupation, data on the farming characteristics for the 2011 major production season was solicited from all the farmers. For both 2011 (impact year) and 2009 (baseline year) major production seasons data was collected particularly regarding the level of technology adoption, production costs, yields and revenues.

Table 4.1 Demography and Occupation of Farmers

Characteristics		MIDA Trained Farmers		Non MIDA Trained Farmers		Overall	
		Sampled Farmers					
		Freq	Percent	Freq	Percent	Freq	Percent
Gender	Male	56	61.5	38	53.5	94	58
	Female	35	38.5	33	46.5	68	42
Marital Status	Married	71	78	46	64.8	117	72.2
	Single	11	12.1	12	16.9	23	14.2
	Divorced /Separated	8	8.8	8	11.3	16	9.9
	Widowed	1	1.1	5	7	6	3.7
Age	Up to 30	7	7.7	10	14.1	17	10.5
	31 - 45	21	23.1	27	38	48	29.6
	46 - 60	44	48.4	27	38	71	43.8
	60+	19	20.9	7	9.9	26	16
Highest level of Education Completed	Illiterate/ None	17	18.7	19	26.8	36	22.2
	Primary	10	11	22	31	32	19.8
	Middle /JSS	52	57.1	20	28.2	72	44.4
	Secondary+	12	13.2	10	14.1	22	13.6
Farming as main occupation	Yes	81	89	61	85.9	142	87.7
	No	10	11	10	14.1	20	12.3
Other Occupation	Trader	31	34.1	14	19.7	45	27.8
	Salaried employee	5	5.5	7	9.9	12	7.4
	Artisan/Skilled craftsman	10	11	5	7	15	9.3
	Hired farm laborer	11	12.1	6	8.5	17	10.5
	Others	5	5.5	7	98	12	7.4
	None	26	28.6	32	45.1	58	35.8

Source: Author's Computations, 2012

4.2.2 Gender of Farmers

From a total of 72 respondents, 58% were male farmers whilst the remaining 42% were female farmers as shown in Table 4.1. For both MiDA trained and Non MiDA trained farmers the males were relatively more than the females. Data from the District Agricultural Office suggests that there are relatively more male than female farmers in Kwahu East. This probably stems from the fact that in the district, women do not enjoy easy access to land and other resources compared to men, so many women end up working in the fields of their husbands or male relatives.

4.2.3 Age of Farmers

About 60% of the respondents were beyond 45 years. This is consistent with the belief that majority of Ghanaian farmers are aged. The remaining 40 % can be said to be in their productive years as they are 45 or less (Table 4.1). This is encouraging and suggests that young adults and the mid-aged in the district are being attracted to take farming as their career. Another reason to explain why the youth are getting more engaged in farming is due to government interventions through various subsidies and credit incentives for farmers throughout the country. Farming as a business is demanding and hence requires energetic and resourceful efforts.

4.2.4 Educational Level of Farmers

As shown in Table 4.1, nearly 60% of the total respondents have had formal education at the middle/JSS level or beyond. Five out of every seven of the MiDA trained farmers, whereas two out of every five Non MiDA trained farmers are in that category. Also out of a total of 162 respondents, 126 have had formal education. This is a good development since a large

majority of such farmers are enlightened enough to contribute to enhance agricultural productivity in the district.

4.2.5 Marital Status of Farmers

Most of the respondents, 72.2%, were married (Table 4.1), while the remaining 27.8% are single, divorced/separated or widowed. Data from the District Agricultural Office suggests that on the average farm families had family sizes of three to five. The level of farm incomes should therefore be of importance to these farmers and the upkeep of their families.

4.2.6 Occupation of Respondents

Table 4.1 again presents data showing the importance of farming to the survey respondents. As many as 142 0ut of 162 farmers indicated that farming is their main occupation. In addition to farming, 45 of them were traders, 12 were salaried employees, 15 were artisans and 17 were hired labourers. Those who had no additional occupation were 58. In all nine operational areas, the majority of respondents indicated that agriculture is the main source of household income. This indeed reiterates the view that the level of farm incomes must be of relevance to such farmers.

4.3 Crop Production Data

4.3.1 Form of Land Acquisition and Acreages Cultivated

The land area available to each respondent (through ownership, rental, sharecropping, or other means) ranged from a low of 1.2 acres to a high of 10.4 acres. Only 19.1% were cultivating their own lands (Table 4.2). However, obtaining a piece of land for cropping does not really constitute a problem in the district. Although the vast majority of the farmers

indicated that farming was their main occupation, many of them were found to be cultivating on small-scale. 33.3% of them practiced small-scale farming on a plot of land, 2 or less acres, while 71% did farm on a plots of land less than 4 acres, as shown in Table 4.2.

Table 4.2 Farming Characteristics of Respondents

Characteristics		MIDA Trained Farmers		Non MIDA Trained Farmers		Overall	
		Sampled Farmers					
		Freq	Percent	Freq	Percent	Freq	Percent
Land Acquisition	Own land/purchased	15	16.5	16	22.5	31	19.1
	Family land	36	39.6	11	15.5	47	29
	Rented/leased	29	31.9	36	50.7	65	40.1
	Crop sharing	10	11	8	11.3	18	11.1
	Borrowed	1	1.1	0	0	1	0.6
Acreage Cultivated	Less than 2	25	27.5	29	40.8	54	33.3
	2 - 4	39	42.9	22	31	61	37.7
	4 - 6	15	16.5	13	18.3	28	17.3
	Beyond 6	12	13.2	7	9.9	19	11.7
Farming Method	Monocropping	28	30.8	25	35.2	53	32.7
	Intercropping	46	50.5	27	38	73	45.1
	Crop rotation	3	3.3	11	15.5	14	8.6
	Land rotation	4	4.4	2	2.8	6	3.7
	Mixed farming	10	11	6	8.5	16	9.9
Cropping Times per Year	Once	28	30.8	48	67.6	76	46.9
	Twice	63	69.2	23	32.4	85	53.1
Land Fertility	Lowly fertile	27	29.7	29	40.8	56	34.6
	Fertile	57	62.6	27	38.0	84	51.9
	Very fertile	7	7.7	15	21.1	22	13.6
		Number of Responses	% of Cases	Number of Responses	% of Cases	Number of Responses	% of Cases
Source of Capital	Equity/own	86	94.5	64	90.1	150	92.6
	Contract farming	6	6.6	14	19.7	20	12.3
	Money lenders	11	12.1	10	14.1	21	13
	Banks	8	8.8	9	12.7	17	10.5
	Relatives/friends	36	39.6	20	28.2	56	34.6

Source: Author's Computations, 2012

4.3.2 Farming Methods and Cropping Intensity

Cropping systems adopted in growing maize among the farmers in decreasing order of frequency were intercropping, monocropping, mixed farming, crop rotation, and land rotation (Table 4.2). Out of the 162 farmers, 53.1% cropped twice, while 46.9% cropped once within the 2011 cropping year. For MiDA trained farmers, as many as 69.2% of them cropped twice as compared to 32.4% for non MiDA trained farmers, in that production year. Maize in the district is usually intercropped with cassava, plantain, and/or cocoyam. Although some maize is consumed in the district, it is not a leading food staple and much of the crop is sold. Annual rainfall in the district usually averages about 1,500 mm; maize is planted both in the major rainy season (beginning in March) and in the minor rainy season (beginning in September).

4.3.3 Land Fertility

Table 4.2 again shows a distribution for land fertility. Farmers described the fertility of their lands depending on the years and intensity of cropping. Chemical fertilizers are mainly used to supplement soil fertility. On the average 100kg (2 bags) of NPK and 50kg (1 bag) of sulphate of ammonia are used per acre of land. Regular control of weeds which compete with the crops for nutrients is important for good growth. This was as much as possible practiced regularly and frequently by the MiDA trained farmers than their untrained colleagues in communities where training did not take place.

4.3.4 Sources of Capital

Sources of capital to the farmers in order of importance were equity capital, relatives and friends, money lenders, wholesale buyers, and banks (Table 4.). The farmers' main source of capital was equity capital. Quite a number of them borrow money from relatives and friends, or money lenders or banks with interest. Interest charges by money lenders were said to be so high, with some taking about 50% interest. As a result the farmers hardly borrow from them lately. The activity of NGOs or rural banks among them to offer loans with flexible terms and probably some technical assistance will greatly enhance their production and income levels. Majority of those interviewed held the view that, the prospect of maize farming could be high, and that farm incomes would increase significantly with adequate or higher capital.

4.4. Technology Adoption by Farmers

In evaluating the performance of any agricultural project, it is important to know the extent to which technologies generated and or disseminated by the project are adopted by the beneficiary farmers in particular and how these technologies have spread throughout the target population. It is also important to understand the factors that have influenced the adoption process. For this reason, adoption rates are a valid criterion for measuring the success of agricultural projects. This criterion was used by Morris et. al. (2001) in a study which assessed the adoption and impacts of improved maize production technologies in Ghana. The key stakeholders of Agricultural Project of the MCA-Ghana Program also evidently recognize the relevance of adoption rates.

Both projects focused on the adoption of three specific improved maize production technologies, namely: improved maize variety, improved fertilizer recommendations, and row planting recommendations. Although these three technologies were not the only ones disseminated, they were considered to be among the most important. In the case of the Agricultural Project of the MCA-Ghana Program, a beneficiary farmer is considered to be an adopter if they satisfactorily adopt 5 of the disseminated technologies, including, use of improved seed and adoption of row planting. Table 4.3 presents data on factors that are often associated with the adoption of improved maize production technologies. The data are presented in the form of a series of quantitative indicators that were calculated for both the treatment and control groups. Percentages were computed to determine the level of adoption between the two groups.

4.4.1 Impact of Training on Improved Maize Technology Adoption by Farmers

Table 4.3 shows the relationship between participating in the farmer training of the MCA-Ghana Program and its effect on technology adoption. Comparing adoption rates in 2009 for the two groups, it is obvious that generally there were relatively minimal differences in the rates of adoption. However in 2011, relatively higher percentages of MiDA trained farmers than non-trained farmers adopted and used improved techniques for land preparation, plant configuration, weed management, soil fertility management, pest and disease management, harvesting and post harvest management.

In 2011 it can be noticed that in terms of use of improved seed, close to 80% of trained farmers compared to less than 60% of non trained farmers adopted this technology. A

Table 4.3 Technology Adoption by MiDA Trained and Non MiDA Trained Farmers in Kwahu East District

Technology Indicators	Baseline Data (2009)		Impact Data (2011)	
	MiDA Trained Farmers (N=90)	NonMiDA Trained Farmers (N=72)	MiDA Trained Farmers (N=90)	Non MiDA Trained Farmers (N=72)
	% Adoption	% Adoption	% Adoption	% Adoption
Land Preparation				
1. Ploughing across the slope	53.3	52.8	78.9	55.6
2. Minimum Tillage	45.6	45.8	72.2	51.4
Planting				
3.Use of improved seed	51.1	51.4	78.9	58.3
4. Crop Spacing	34.4	34.7	71.1	44.4
Weed Management				
5.Timely weed control	46.7	45.8	65.5	50.0
6. Frequency of weed control	44.4	44.4	60.0	50.0
Soil Fertility Mgt.				
7.Appropriate use of fertilizer type	17.8	18.0	37.8	19.4
8. Adequacy of quantity of fertilizer applied	13.3	12.5	30.0	15.3
9.Appropriate timing of fertilizer application	16.7	16.7	30.0	19.4
Pest & Disease Mgt.				
10.Appropriateness of type of plant protection product applied	33.3	33.3	47.8	34.7
11.Adequacy of quantity of plant protection product applied	26.7	26.4	41.1	30.6
12.Appropriateness of timing of application of plant protection product	30.0	30.6	48.9	33.3
Timing Of Harvesting				
13. Appropriateness of timing of harvesting of the crop with regards to physiological growth stage	40.0	40.3	58.9	44.4
14.Appropriateness of timing of harvesting of the crop with regards to time of day for the crop	48.9	48.6	61.1	52.8
Post Harvest Mgt.				
15. Appropriateness of methods of shelling and drying	47.8	48.6	60.0	52.8
16. Use of appropriate storage chemicals	31.1	30.6	48.9	34.7
17.Use of appropriate storage structure	15.6	13.9	30.0	16.7

Source: Author's Computations, 2012

significantly higher percentage, 71.1%, of the trained farmers adopted row spacing technique, while this is true for only a 44.4 of non trained farmers. As for soil fertility management, less than half of the survey farmers for both groups, adopted the techniques involved. Nevertheless, higher numbers of the trained than non trained farmers practiced such improved techniques.

The data in Tables 4.3 provide evidence that the disseminated maize technologies have diffused satisfactorily among MiDA trained farmers. This is quite impressive, considering that maize in the district is grown mostly by small-scale farmers, many of whom live in isolated communities. These results show that MiDA made very good progress in achieving the objective of promoting the dissemination and adoption of improved maize technologies. Although these findings are encouraging, they do not provide grounds for complacency.

MiDA trained farmers had three times more contacts with extension officers especially from October 2009 to November 2010 than non-adopters. The difference is significant. This finding suggests that extension officers play a crucial role in educating farmers about the benefits of improved techniques.

4.5 Yield Outcomes and Incomes of Farmers

Simply knowing about adoption is not enough, because adoption is only a means to an end. The ultimate objective of the farmer training of the MCA-Ghana Program was to improve the yields and incomes of especially smallholder farmers in Ghana. In that context, it is necessary to look beyond the question of adoption and to consider effects or impacts on yield

and incomes. To be able to do this data was collected regarding production costs, yields and revenues for both 2011 (impact year) and 2009 (baseline year) major production seasons.

Yield outcomes and Income gains are valid indicators of agricultural productivity impacts because the productivity gains attributable to the adoption of improved maize technologies logically should be reflected in yields obtained and income gains (either directly through increased sales of maize, or indirectly through increased earnings from resources that have been released from maize production).

4.5.1 Cost-Revenue Analysis

Table 4.4 Cost-Revenue Analysis – Range Figures

Farmer Category	Production Cost/Acre (GHc)		Yield/Acre (Kg)		Revenue/Acre (GHc)		Net Revenue/Acre (GHc)	
	2009	2011	2009	2011	2009	2011	2009	2011
MiDA Trained Farmers	178.50 - 350.50	258.00 – 453.50	300.00 – 800.00	450.00 – 1200.00	240.00 – 640.00	382.50 – 1,020.00	61.50 - 289.50	124.50 – 566.50
Non MiDA Trained Farmers	172.50 – 344.50	251.00 – 446.50	300.00 – 800.00	340.00 - 1000.00	240.00 – 640.00	289.00 – 850.00	67.50 - 295.50	38.00 – 403.50

Source: Author's Computations, 2012

Tables 4.4 and 4.5 are summaries of the cost-revenue analysis for the crop enterprises of the two groups. Table 4.4 displays range figures, while table 4.5 displays mean figures. The mean figures (per acre of maize cultivation) were computed for the two groups to aid discussion and comparison. Refer to appendix 1 for detailed data on the cost-revenue

analysis. Comparing production cost, yield, revenue, profit, return on investment and production efficiency in 2009 for the two groups, it can mathematically be deduced that there was relatively minimal differences in the output and income indicators involved, however in 2012 the difference widened. For instance in 2009 the average maize yield per acre of production for the trained and untrained groups were 500kg and 490kg respectively, with a difference of 10kg in favour of the former. However in 2011 average yield for the trained and untrained groups were 800kg and 650kg respectively, with a difference of 150kg in favour of the former.

Table 4.5 Cost Revenue Analysis – Mean Figures

Farmer Category	Mean Production Cost/Acre (GHc)		Mean Yield/Acre (Kg)		Mean Revenue/Acre (GHc)		Mean Profit/Acre (GHc)		Return on Investment [(profit/cost)×100]		Production Efficiency (revenue/cost)	
	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011
MiDA Trained Farmers	269.50	353.50	500.00	800.00	400.00	680.00	138.50	326.50	48.42	92.36	1.48	1.92
Non MiDA Trained Farmers	263.50	346.50	490.00	650.00	392.00	552.50	128.50	286.00	48.77	59.45	1.49	1.59

Source: Author's Computations, 2012

Also, in 2009 return on investment (ROI) for the trained and untrained groups were 48.42 and 48.77 respectively, with a difference of 0.35 in favour of the latter. However in 2011 ROI for the trained and untrained groups were 92.36 and 59.45 respectively, with a difference of 32.91 in favour of the former. In either year each group had production

efficiency greater than one, indicating that each made profit. However in 2011 maize production was much more profitable and efficient for the trained group with production efficiency of 1.92, than the non trained group, whose efficiency was 1.59.

The farmer training of the MCA-Ghana Program has had a positive effect on the incomes of many rural smallholders throughout Kwahu East District. If rural incomes have increased largely because of the Program, how have the income gains benefited rural households? Most farmers who reported increased income from maize sales indicated that the additional income assisted in supporting the schooling of their children. The next most common reported uses included purchasing building materials to expand or renovate the farmer's house, investing in family-owned retail trading business, and purchasing or acquiring additional agricultural land. Generally the additional income earned through maize farming for the most part seems to have been invested productively.

4.5.2 Statistical Analysis of Relationship

Table 4.6 T-test of Means of Productivity Indicators (Paired Samples Test)

	MIDA Trained Farmers (N= 90)						Non MIDA Trained Farmers (N= 72)					
	2009		2011				2009		2011			
Item	**Mean**	**SD**	**Mean**	**SD**	**a-b**	**t-Value**	**Mean**	**SD**	**Mean**	**SD**	**a-b**	**t-Value**
Mean Production Cost per Acre (Ghc)	269.50	121.80	353.50	138.24	84.00**	-4.7308	263.50	121.80	346.50	138.24	83.00*	-4.1787
Mean Yield per Acre (kg)	500.00	353.55	800.00	424.26	300**	-6.0456	490.00	353.55	650.00	424.26	160*	-2.886
Mean Revenue per Acre (Ghc)	400.00	282.84	680.00	381.84	280**	-7.4278	392.00	282.84	552.50	381.84	160**	-3.3692
Mean Profit per Acre (Ghc)	138.50	161.04	326.50	243.60	188.00**	-9.1017	128.50	161.04	286.00	243.60	157.5*	-2.8457

Notes: a-b is the difference in the means of the various indicators.
*, and **: Significant at 0.05 and 0.01 level of significance respectively.
ns: not significant.
Source: Author's Computation, 2012

Table 4.7 T-test of Means of Productivity Indicators (Independent Samples Test)

	MIDA Trained Farmers (N= 90)		Non MIDA Trained Farmers (N= 72)			
	2011		2011			
Item	**Mean**	**SD**	**Mean**	**SD**	**a-b**	**t-Value**
Mean Production Cost per Acre (Ghc)	353.50	138.24	346.50	138.06	7ns	0.09
Mean Yield per Acre (kg)	800.00	424.26	650.00	378.12	150**	4.4458
Mean Revenue per Acre (Ghc)	680.00	381.84	552.00	327.55	127**	2.100
Mean Profit per Acre (Ghc)	326.05	175.09	286.00	153.37	40.5*	1.0499

Notes: a-b is the difference in the means of the various items.
*, and **: Significant at 0.05 and 0.01 level of significance respectively.
; ns: not significant
Source: Author's Computation, 2012

Tables 4.6 and 4.7, show the outcomes of t-test of means, indicating the level of difference within and between the productivity indicators of the two farmer groups. It can be seen from table 4.7 that there is no significant difference between the mean production costs for the two groups of farmers. It is however observed that there are significant differences in yields and revenues at 5%, and profit at 1% level of significance. The significant differences of these indicators for the two groups may be attributed to the effect of the farmer training of the Agriculture Project of the MCA-Ghana Program which has had to have had an influence on skills, knowledge and attitudes of the trained farmers.

4.6 Challenges to Technology Adoption, Yield outcomes and Incomes of Farmers

Table 4.8 outlines the challenges mentioned by the farmers (as those that affect adoption of technology, yield outcomes and income levels) and the associated frequencies and percent responses to each.

Table 4.8 Challenges to Enhanced Technology Adoption, Yield and Income

Challenges		MIDA Trained Farmers		Non MIDA Trained Farmers		Overall	
		Sampled Farmers					
		Number of Responses	% of Cases	Number of Responses	% of Cases	Number of Responses	% of Cases
Technology Adoption	Costly to adopt	72	80	45	63.4	117	72.7
	Complex to adopt	32	35.6	43	60.6	75	46.6
	Lack of skills to adopt	21	23.3	50	70.4	71	44.1
	Lack of access to extension services	18	20	29	40.8	47	29.2
	Lack of production resources(inputs)	70	77.8	43	60.6	113	70.2
Yield	Unusual agro-climate conditions	78	87.6	40	56.3	118	73.8
	Low soil/land fertility	40	44.9	24	33.8	64	40
	Lack of skills to adopt technology	19	21.3	48	67.6	67	41.9
	Lack of access to extension service	16	18	31	43.7	47	29.4
	Lack of production resources	63	70.8	39	54.9	102	63.8
	Pests and disease effect	46	51.7	20	28.2	66	41.3
Income	Unstable prices	79	87.8	54	78.3	133	83.6
	Unreliable market	72	80.0	45	65.2	117	73.6
	Post-harvest losses	43	47.8	53	76.8	96	60.4
	Lack of market information	37	41.1	44	63.8	81	50.9
	Poor/inaccessible roads	20	22.2	39	56.5	59	37.1

Source: Author's Computations, 2012

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter deals with the conclusions and recommendations of the study on effects of the MCA-Ghana program farmer training on productivity of smallholder maize farmers in the Kwahu East District.

5.2 Conclusions

This research report has presented findings of a recent study that evaluated the effects of farmer training of the MCA-Ghana program on productivity of smallholder maize farmers in the Kwahu East District. Data collected in May 2012 through a district survey of smallholder maize farmers show that knowledge disseminated and demonstrated through the training has diffused fairly well particularly among the beneficiary farmers in the district. Based on the evidence of the analysis presented, it is obvious that the project has succeeded in meeting its main objectives of raising productivity and increasing incomes among rural poor farmers in the district. Maize is produced and consumed throughout Ghana, so interventions that succeed in increasing the productivity of resources devoted to maize production were likely to have significant impacts.

It is fair to state that the success of the training intervention in the district can be partly attributed to the collaboration between the key players in the implementation process: MiDA, ADRA-Ghana, Contracted TTSPs, the District Agricultural Directorate and the Kwahu East District Assembly. These organizations interacted very satisfactorily throughout the duration of the project, allowing the particular strengths of each to be exploited and

ensuring that the product of the collaborative effort was far greater than the same organizations could have achieved by acting individually.

In summary, what emerged from the findings suggests that in spite of the aforementioned challenges which continue to be the factors that explain why there is still a wide gap between the current best yield of 1200kg/acre among the smallholders and the achievable yield of 2400kg/acre, the impact from the training program had been positive as many of the beneficiary farmers have had significantly enhanced yields and incomes two years after the training program. It is hoped that the successes and challenges identified can serve as a source of knowledge that can potentially be used to inform and improve future intervention efforts, both within the district and other parts of Ghana.

5.3 Recommendations

The author is of the opinion that measures can be taken to sustain the progress and gains made as outcomes of the project under review; to bridge the gap between the current yield levels and the achievable; and to enhance the current levels of income of smallholders in the district. To this effect the following are recommended:

1. Improved farming technologies and good agricultural practices espoused by the training intervention should be disseminated by means of radio to the benefit of other farmers.
2. The District Directorate of Food and Agriculture should sustain and enhance progress made through subsequent trainings and demonstration of new technologies to farmers.

3. Farmers should be encouraged to focus more on high yields and quality of produce rather than on production acreages to bridge the gap between actual yields and achievable yields.
4. Bulk purchase of inputs and sale of produce should be encouraged and promoted among farmer groups to benefit from economies of scale.
5. The District Directorate of Food and Agriculture should continue to promote the adoption of technologies through the establishment of demonstration plots and the use of on-farm trials.
6. MiDA trained farmers should be admonished to share knowledge gained on technology adoption and good agricultural practices with non trained farmers to enhance agricultural productivity in the district.
7. Farmers should be encouraged to construct improved storage structures to reduce post harvest losses.

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APPENDICES

APPENDIX 1A

Cost-Revenue Analysis for the Treatment Group; 2009 Major Production Season

Activity / Item	Quantity/ Frequency	Unit	Unit Cost (GH¢)	Total Cost (GH¢)
Hiring of Land	1	Acre	25.00	25.00
Land Preparation	1	Acre	28.00	28.00
Subtotal				**53.00**
Production Inputs				
Maize Seed	9	Kg	1.50	13.50
Fertilizer (NPK)	2	50kg bag	27.00	54.00
Sulphate of Ammonia	1	50kg bag	18.00	18.00
Atrazine	2	Litres	6.00	12.00
Actellic Super	1	Litres	6.00	6.00
Subtotal				**103.5**
Labour				
Row planting	1	Acre	10.00	10.00
Spraying of weeds	1	Acre	15.00	15.00
Fertilzer NPK application	2	50kg bag	5.00	10.00
Hand weeding	1	Acre	20.00	20.00
Sulphate of ammonia application	1	50kg bag	6.00	6.00
Harvesting/Bulking/Carting	1	Acre	25.00	25.00
Dehusking, Shelling	1	Acre	15.00	15.00
Bagging, Fumigation & Storage	12	Maxi bag	1	12.00
Subtotal				**113.00**
Total				**269.50**
	`			
REVENUE				
Yield (bags) / acre (100kg/bag)				5
Price (GH¢) / unit of produce				80.00
Total Revenue (GH¢)				**400.00**
Profit /Net Revenue (GH¢)				**138.50**
Return on Investment,%				48.42
Production efficiency				1.48

APPENDIX 1B

Cost-Revenue Analysis for the Control Group; 2009 Major Production Season

Activity / Item	Quantity/ Frequency	Unit	Unit Cost (GH¢)	Total Cost (GH¢)
Hiring of Land	1	Acre	25.00	25.00
Land Preparation	1	Acre	27.00	27.00
Subtotal				**52.00**
Production Inputs				
Maize Seed	9	Kg	1.50	13.50
Fertilizer (NPK)	2	50kg bag	27.00	54.00
Sulphate of Ammonia	1	50kg bag	18.00	18.00
Atrazine	2	Litres	6.00	12.00
Actellic Super	1	Litres	6.00	6.00
Subtotal				**103.5**
Labour				
Row planting	1	Acre	10.00	10.00
Spraying of weeds	1	Acre	15.00	15.00
Fertilzer NPK application	2	50kg bag	5.00	10.00
Hand weeding	1	Acre	20.00	20.00
Sulphate of ammonia application	1	50kg bag	6.00	6.00
Harvesting/Bulking/Carting	1	Acre	20.00	20.00
Dehusking, Shelling	1	Acre	15.00	15.00
Bagging, Fumigation & Storage	12	Maxi bag	1	12.00
Subtotal				**108.00**
Total				**263.50**
REVENUE				
Yield (bags) / acre (100kg/bag)				4.9
Price (GH¢) / unit of produce				80.00
Total Revenue (GH¢)				**392.00**
Profit /Net Revenue (GH¢)				**128.50**
Return on Investment,%				48.77
Production efficiency				1.49

APPENDIX 1C

Cost-Revenue Analysis for the Treatment Group; 2011 Major Production Season

Activity / Item	Quantity/ Frequency	Unit	Unit Cost (GH¢)	Total Cost (GH¢)
Hiring of Land	1	Acre	35.00	35.00
Land Preparation	1	Acre	45.00	45.00
Subtotal				**80.00**
Production Inputs				
Maize Seed	9	Kg	1.50	13.50
Fertilizer (NPK)	2	50kg bag	27.00	54.00
Sulphate of Ammonia	1	50kg bag	18.00	18.00
Atrazine	2	Litres	7.00	14.00
Actellic Super	1	Litres	7.00	7.00
Subtotal				**106.5**
Labour				
Row planting	1	Acre	15.00	15.00
Spraying of weeds	1	Acre	20.00	20.00
Fertilzer NPK application	2	50kg bag	8.00	16.00
Hand weeding	1	Acre	30.00	30.00
Sulphate of ammonia application	1	50kg bag	8.00	8.00
Harvesting/Bulking/Carting	1	Acre	35.00	35.00
Dehusking, Shelling	1	Acre	25.00	25.00
Bagging, Fumigation & Storage	12	Maxi bag	1.50	18.00
Subtotal				**167.00**
Total				**353.50**
REVENUE				
Yield (bags) / acre (100kg/bag)				8
Price (GH¢) / unit of produce				85.00
Total Revenue (GH¢)				**680.00**
Profit /Net Revenue (GH¢)				**326.50**
Return on Investment,%				92.36
Production efficiency				1.92

APPENDIX 1D

Cost-Revenue Analysis for the Control Group; 2011 Major Production Season

Activity / Item	Quantity/ Frequency	Unit	Unit Cost (GH¢)	Total Cost (GH¢)
Hiring of Land	1	Acre	30.00	30.00
Land Preparation	1	Acre	45.00	45.00
Subtotal				**75.00**
Production Inputs				
Maize Seed	9	Kg	1.50	13.50
Fertilizer (NPK)	2	50kg bag	27.00	54.00
Sulphate of Ammonia	1	50kg bag	18.00	18.00
Atrazine	2	Litres	7.00	14.00
Actellic Super	1	Litres	7.00	7.00
Subtotal				**106.5**
Labour				
Row planting	1	Acre	15.00	15.00
Spraying of weeds	1	Acre	20.00	20.00
Fertilzer NPK application	2	50kg bag	7.50	15.00
Hand weeding	1	Acre	30.00	30.00
Sulphate of ammonia application	1	50kg bag	7.00	7.00
Harvesting/Bulking/Carting	1	Acre	35.00	35.00
Dehusking, Shelling	1	Acre	25.00	25.00
Bagging, Fumigation & Storage	12	Maxi bag	1.50	18.00
Subtotal				**165.00**
Total				**346.50**
REVENUE				
Yield (bags) / acre (100kg/bag)				6.5
Price (GH¢) / unit of produce				85.00
Total Revenue (GH¢)				**552.50**
Profit /Net Revenue (GH¢)				**286.00**
Return on Investment,%				59.45
Production efficiency				1.59

APPENDIX 2

APPENDIX 2A

RESEARCH QUESTIONNAIRE

EVALUATING THE IMPACT OF FARMER TRAINING ON MAIZE PRODUCTIVITY IN KWAHU EAST DISTRICT

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COMMONWEALTH EXECUTIVE MASTERS IN BUSINESS ADMINISTRATION (CEMBA)

The purpose of this questionnaire is to evaluate the impact of MCA farmer training in Kwahu East District.

We invite you to participate in this study that aims to provide a document which outlines the impact of the training on farmer technology adoption, yield and income levels in the Kwahu East District.

We will need your socio-economic information, crop production data, the level to which you adopt technology, your yield and income levels and the challenges to your production and income levels.

Please be assured that the information you provide will be kept confidential. Your candid responses will be useful and greatly appreciated. We thank you for accepting to participate in this interview.

EMMANUEL BIMPEH
MAY 2012

QUESTIONNAIRE FOR MAIZE FARMERS

Below we ask a number of questions about you and your maize enterprise. The interviewer will read out each question to you for response, and then tick the response which, for you, is correct. If there is a line beside the question, we want the answer/information requested to be written in. Where there is a table, please fill in the table by providing the information requested.

A. SOCIO-ECONOMIC INFORMATION

Name of Respondent …….

Name of Farmer Based Organization……...

Community/Village…….

1. Sex of Respondent 1. Male [ ] 2. Female [ ]

2. State your age as at your latest birthday……..

   1. Up to 30 [ ] 3. 46 - 60
   2. 31 – 45 [ ] 4. Above 60

3. What is your highest level of education? ……

   1. Illiterate/None [ ] 3. Middle/JHS [ ]
   2. Primary [ ] 4. Secondary + [ ]

4. Marital status

   1. Married [ ] 3. Divorced / Separated [ ]
   2. Single [ ] 4. Widowed [ ]

5. Is farming your principal occupation? 1. Yes [ ] 2. No [ ]

6. What other occupation are you engaged in?
   1. Trader [ ] 4. Hired Farm Labourer [ ]
   2. Salaried employee [ ] 5. Others, (specify)……
   3. Artisan/Skilled Craftsman [ ]

B. CROP PRODUCTION INFORMATION

7. Form of land acquisition engaged in

1. Own land/Purchased [ ]
2. Family Land [ ]
3. Rented/Leased [ ]
4. Crop Sharing [ ]
5. Borrowed [ ]
6. Others, (specify)……

8. Acreage of cultivated land (Farm Size)

1). Less than 2 [ ]
2). 2-4 [ ]
3). 4-6 [ ]
4). Beyond 6 [ ]

9. Which of these farming methods is applicable to your situation?

1. Monocropping [ ]
2. Intercropping [ ]
3. Crop rotation [ ]
4. Land Rotation [ ]
5. Mixed farming [ ]
6. Others, (specify)……

10. How many times do you usually crop in a year? 1. Once [ ] 2. Twice [ ]

11. How fertile is the land or soil?

1. Lowly fertile [ ]
2. Fertile [ ]
3. Very fertile [ ]

C. CAPITAL

12. Source of capital (**Rank**)

1. Equity (own) [ ]
2. Contract farming [ ]
3. Money lenders [ ]
4. Banks [ ]
5. Relatives/Friends [ ].
6. Others, (specify)……

D. PRODUCTION COST PER ACRE

Please provide in the table below information regarding your cost of production.

	2009			2011		
Operation/ Item	Quantity/ Acre	Unit Cost /Acre (GHc)	Total cost / Acre (GHc)	Quantity/ Acre	Unit Cost /Acre (GHc)	Total cost / Acre(GHc)
A) **Land** 13.Hiring of Land 14.Land Preparation **Sub-total (A)** B**) Production Inputs** 15.Maize Seed 16.N.P.K 17.S.O.A 18.Weedicide 19.Chemical for treatment **Sub-total (B)**						

QUESTIONNAIRE FOR MAIZE FARMERS

	2009			2011		
Operation/ Item	Quantity/ Acre	Unit Cost /Acre (GHc)	Total cost / Acre (GHc)	Quantity/ Acre	Unit Cost /Acre (GHc)	Total cost / Acre(GHc)
C) **Labour**						
20.Row Planting						
21.Spraying of Weeds						
22.NPK Application						
23.Hand Weeding						
24.SOA Application						
25.Harvesting/Bulking/Carting						
26.Dehusking/Shelling						
27.Bagging/Fumigation/Storage						
Sub-total (C)						
Total						

E. YIELD AND REVENUE DATA

Please provide in the table below information regarding the yield and revenue of your crop enterprise.

2009			2011		
Yield (# 100kg bags/acre)	Unit price (GHc)	Revenue	Yield (# 100kg bags/acre)	Unit price (GHc)	Revenue
28.					

F. CHALLENGES

a).Technology Adoption

29. What technology adoption challenges do you face? (Rank)

1. Costly to adopt [ ]
2. Complex to adopt [ ]
3. Lack of skills to adopt [ ]
4. Lack of access to extension service [ ]
5. Lack of production resources (inputs) [ ]
6. Others, (specify)…….

b). **Yield**

30. What are the challenges to enhanced yields? (Rank)

1. Unusual agro-climatic conditions [ ]
2. Low soil/land fertility [ ]
3. Lack of skills to adopt technology [ ]
4. Lack of access to extension service [ ]
5. Lack of production resources [ ]
6. Pest and Disease effects [ ]
7. Others, (specify)…….

c). **Farmer Incomes**

31. What are the challenges to enhanced farmer incomes? (Rank)

1. Unstable prices [ ]
2. Unreliable market [ ]
3. Post-harvest losses [ ]
4. Lack of market information [ ]
5. Poor / inaccessible roads [ ]
6. Others, (specify)…….

G). STORAGE AND MARKETING

32. To whom or where do you sell your produce? (Rank)

1. Farm gate [ ]
2. Local Traders [ ]
3. Long distance traders [ ]
4. Market/Institutions [ ]
5. Exporters [ ]
6. Other, specify……..

33. What storage and marketing problems do you face? (Rank)

1. Storage facilities [ ]
2. Post-harvest Losses [ ]
3. Unstable market/prices [ ]
4. Transportation problems [ ]
5. Pest and diseases effects [ ]
6. Others, specify……

34. How do you store your produce?

1. Unimproved crib [ ]
2. Improved narrow crib [ ]
3. Fertilizer bags
4. Others, (specify)……

H). EXTENSION SERVICES

35. Do you have easy access to extension services?

1. Yes [ ]
2. No [ ]

36. Do you keep records? 1. Yes [ ] 2. No [ ]

37. What is your view about the prospect of your crop enterprise?

1. Uncertain [ ]
2. Low [ ]
3. Moderate [ ]
4. High [ ]

THANK YOU!

APPENDIX 2B

RESEARCH QUESTIONNAIRE

EVALUATING THE IMPACT OF FARMER TRAINING ON MAIZE PRODUCTIVITY IN KWAHU EAST DISTRICT

TECHNOLOGY ADOPTION ON MAIZE PRODUCTION

FARMER LEVEL DATA COLLECTION FORM –KWAHU EAST DISTRICT

Data Collection Start Date: **Date of Completion:**

Name of Farmer: **Name of Enumerator:**

Community:

Variety:

Major Technologies	Sub Technologies	Indicators	2009(Baseline)		2011(Impact)	
			Check as applicable	Scoring	Check as applicable	Scoring
1. Land Preparation	Conservation Tillage	i) Ploughing across the slope				
		ii)Minimum Tillage				
2. Soil and water conservation measures	Mulching	i)Inorganic / Plastic mulching				
3. Improved Planting materials	Use of Improved Seed	I) Use of Improved Seed				
		ii) Spacing(intra-row=40cm),(inter-row=80cm)				
		iii)# of plants/stand				
5. Weed management	Weed management (timeliness, frequency)	i) Timeliness of weed control				
		ii) Frequency of weed control				
6. Soil fertility management	Soil fertility maintenance	i) Appropriateness of type of fertilizer(NPK, Sulphate of Ammonia)				
		ii) Adequacy of quantity of fertilizer 2bags (100kg) -15-15-15 0r 20-20-0) for 1 acre of land.				
		iii) Appropriateness of timing of fertilizer application (at time of sowing or within two weeks of sowing –NPK, sulphate of Ammonia 4-5 weeks after sowing)				
7. Pest and Diseases management	Pest and Diseases management	i. Appropriateness of type of pest management or plant protection product applied to the type of crop				
		ii. Adequacy of quantity of plant protection products applied at a time				
		iii. Appropriateness of timing of the application of the				

Major Technologies	Sub Technologies	Indicators	2009(Baseline)		2011(Impact)	
			Check as applicable	Scoring	Check as applicable	Scoring
		management practice with regards to time of day.				
		iv. Appropriateness of timing of application of plant protection product with regards to the physiological growth stage of the crop				
		v. Appropriateness of timing of application of management practice or plant protection product with regards to harvesting or marketing of the crop				
8. Harvesting	1. Timing of Harvesting	i. Appropriateness of timing of harvesting of the crop with regards to physiological growth stage of the crop (use of maturity index)				
		ii. Appropriateness of timing of harvesting of the crop with regards to time of day for the crop				
9. Post Harvest II. Durables	1. Handling (i.e gathering / transportation)	i) Appropriateness of timing of carting from harvested fields				
	2. Primary processing (shelling / threshing and drying)	ii)Appropriateness of threshing or improved threshing methods (use of manual or mechanized shellers, threshers and tarpaulins				
	3. Storage	iii) Improved drying methods to achieve grain moisture level acceptable for the crop (maize = 10-12 %)				
		iv) Sorting produce				
		v) Grading produce				
		v) Use of appropriate storage chemicals				
		vi) Use of appropriate storage structure with good ventilation & pallets (i.e. improved cribs/ mud silos/ warehouse)				