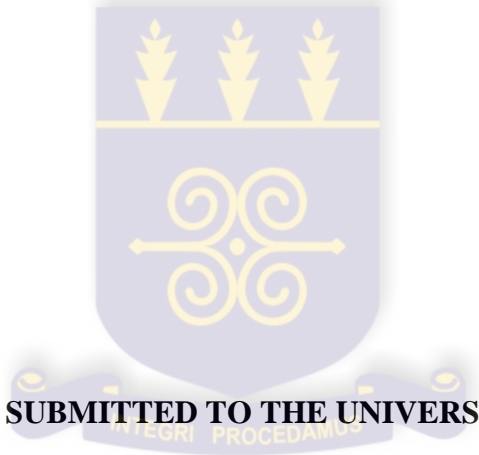


**DISSEMINATION OF INFORMATION ON GENETICALLY MODIFIED CROP
TECHNOLOGY TO FARMERS: A CASE STUDY OF THE OPEN FORUM ON
AGRICULTURAL BIOTECHNOLOGY'S EDUCATIONAL CAMPAIGN IN THE GA
SOUTH MUNICIPALITY**

BY

JOSEPH OPOKU GAKPO



**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON
IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MA
COMMUNICATION STUDIES DEGREE.**

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DECLARATION

I, Joseph Opoku Gakpo declare that this is an original work I have undertaken under the supervision of Ms. Sarah Akrofi-Quarcoo at the Department of Communication Studies, University of Ghana, Legon. Except for references to other people's work which have been duly acknowledged, this dissertation is a result of my own research work.

.....

Joseph Opoku Gakpo

Date.....

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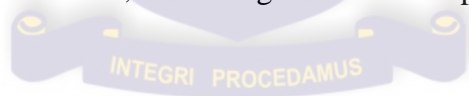
Ms. Sarah Akrofi-Quarcoo

Date.....



ABSTRACT

The government of Ghana has begun processes to introduce Genetically Modified foods (GM foods) into the country's food chain despite opposition by some civil society groups. In 2011, parliament passed the Biosafety Act, 2011 to permit the testing, production and commercialisation of GM crops in the country. The Council for Scientific and Industrial Research is undertaking confined field trials of some GM foods as part of approval procedures before government will give the green light for the local production of GM foods. The council has also rolled out an educational campaign under the Open Forum on Agricultural Biotechnology (OFAB) Project to educate farmers on the technology. Several other educational campaigns are ongoing through both mass media and inter personal means to sensitise farmers on the technology. This study in the Ga South Municipality of the Greater Accra region sought to find out how information on GM foods is disseminated among farmers there. The study investigated farmers' knowledge on GM foods, their opinions in relation to the economic, health and environmental outcomes of GM foods, as well as their sources of information on the technology. The Diffusion of Innovation Theory and the Two Step Flow Theory were the theoretical frameworks that guided the work. The study surveyed 120 farmers. The findings suggest farmers have low level of knowledge on GM foods. Majority of the farmers also believe GM foods are bad and will damage the environment and human health. The study also found that radio is farmers' most dominant source of information on GM foods. Interestingly although the farmers acknowledge GM foods have the potential to increase yield and productivity on the farm, majority of them said they are not ready to grow GM seeds on their farms. The study recommended that OFAB adopts more use of the mass media particularly community radio stations in communicating with farmers, and strengthen their interpersonal campaign.



DEDICATION

I dedicate this work to my family especially Benjamin Nii Dornu Quansah and Nancy Owusua, and my colleagues at Joy FM newsroom.



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LIST OF ABBREVIATIONS

GM Foods – Genetically Modified Foods

OFAB – Open forum on Agricultural Biotechnology

CSIR – Council for Scientific and Industrial Research



CHAPTER ONE

INTRODUCTION

1.0 Background

Genetically Modified Foods (GM Foods) are defined as foods whose genetic materials have been altered through the artificial introduction of foreign substances (Dhan-Prakash, Verma, Bhatia and Tiwary, 2011). In the production of GM Foods, foreign genes responsible for specific traits of socio-economic importance are isolated in the laboratory and transferred into the crop which is to be improved. When the newly improved crops produce offspring, they will carry the foreign trait that has been introduced. This is contrary to the traditional means scientists have used for several years to enhance the productivity of crops. The old process of introducing foreign genes was done naturally on the field by allowing crops within particular species to mate. But this new technology gives scientists the ability to introduce genes from different species into crops. GM Food technology is used to change the genetic makeup of cells and move genes across species boundaries to produce novel organisms (Gyau, Voss, Spiller, and Enneking, 2009). For example, genes can be introduced from bacteria into maize to create genetically modified maize.

Despite opposition by some Civil Society Groups, the government of Ghana has rolled out an elaborate process that will culminate in the introduction of Genetically Modified foods (GM foods) into the country's food chain soon. In 2011, Parliament passed the Biosafety Act, 2011 to permit the testing, production and commercialisation of GM crops in the country. The Biosafety Act (2011), Act 831 establishes the National Biosafety Authority. The authority has the responsibility to ensure adequate protection and safety when it comes to the application of

genetic modification to foods, so human health and the environment are not adversely affected (Amofah, 2014).

The Council for Scientific and Industrial Research (CSIR) is the government agency championing the introduction of GM crops into the country. CSIR is currently conducting confined field trials of GM cotton, rice and cowpea as part of regulatory procedures before they are allowed onto the market (www.ofabafrika.org, 2014). The council currently runs an educational campaign known as the Open Forum on Agricultural Biotechnology (OFAB) to educate farmers across the country on GM foods. The production of GM foods is expected to help reduce the destruction of farms by pests and diseases, cut down on the use of chemicals, reduce labour cost, and help the country produce more nutritious foods. According to Zakaria, Adam, and Abujaja (2011), Ghana is adopting the technology to improve agricultural production and increase farmers' income.

1.1 Controversy over GM Foods

All over the world, discussions on GM foods continue to remain a controversial issue (Tadesse, 2008). Despite all the benefits of genetic modification technology proclaimed by many biotechnology companies, the controversy surrounding its application to food production persists in many countries (Chen and Chern, 2002). Ghana is no exception. Onyango, Govindasamy, Hallman, Jang, and Puduri (2004) observes that the discussion on GM foods has split the public into two. On one side of the debate are the supporters of the technology, who emphasise its importance to mankind, assuring it will ensure improved supply of food, feed, and medicine, as well as reduce insecticide usage on the farm and cut down on labour cost. The proponents argue

that producing GM foods is the only way to ensure the world's future food security because climate change and urbanisation is making it more difficult to feed an increasing world population (Yengoh, Armah and Onuamah, 2012). They say the technology will play an important role in increasing production, income and efficient use of resources for the economic development of particularly developing countries (Tadesse, 2008).

On the other side are opponents of the technology who argue that GM food production is an interference of nature and may have unknown and disastrous consequences on human health (Nelson, 2001). They say the development of GM crop varieties pose a wide range of new legal, ethical and economic questions in agricultural production. There is a growing body of literature on the socio-economic, health and environmental impacts of GM foods which questions whether they provide any extraordinary benefits over traditionally produced crops as has been claimed by pro GM food campaigners (Azadi and Ho, 2009). Increasing trends linking organ diseases (like thyroid and liver cancer, hypertension, acute kidney diseases, diabetes, and autism) with the consumption of GM foods have also been observed (Amofah, 2009). In Ghana, Civil Society Group, Food Sovereignty Ghana (FSG) has championed the opposition to GM food introduction into the country. It has organised series of demonstrations in Accra and other parts of the country to demand that government halts plans to introduce GM foods into Ghana. The group has also sued government at the Human Rights Court, asking the court to ban GM food production in the country (www.foodsoverigntyghana.org, 2015).

1.2 Open Forum on Agricultural Biotechnology (OFAB)

The Open Forum for Agricultural Biotechnology (OFAB) is a platform of various agricultural stakeholders for networking and sharing of knowledge and experiences on GM foods and other biotechnologies (www.ofabafrika.org). It provides avenues for the exploration of the benefits of agricultural biotechnology to farmers in Africa. The platform enables interactions between scientists, journalists, civil society and policy makers to discuss and shape the way forward for agricultural biotechnology on the continent. The first chapter of OFAB was launched in Kenya in September 2006 by charity organisation, African Agricultural Technology Foundation and the International Service for the Acquisition of Agri-biotech Applications. OFAB now has chapters in eight African countries - Kenya, Uganda, Nigeria, Tanzania, Burkina Faso, Zimbabwe, Ethiopia and Ghana. In Ghana, the OFAB Chapter is hosted by the Council for Scientific and Industrial Research (CSIR). Since 2013, OFAB has been holding educational sessions across the country for farmers and agricultural industry stakeholders to educate them on GM foods. OFAB's campaign seeks to assure farmers that GM foods are safe and more beneficial. It uses interpersonal means of communication to reach farmers with their messages, supported with the occasional use of mass media platforms like Radio XYZ, TV3, Peace FM, Daily Graphic among others.

OFAB's team of scientists works with farmer groups including the Ghana National Association of Farmers and Fishermen. They travel to rural communities and hold meetings with them to educate them on the health, socio economic and environmental benefits of growing GM seeds, and to encourage them to accept the technology. OFAB's messages to farmers focus on three main areas:

- 1) Genetically modified crops are same as traditionally produced ones, except for the foreign gene that has been introduced into them. They are thus as safe as traditionally produced food for human consumption.
- 2) GM crops help increase productivity and yield on the farm, thereby increasing farmers' income.
- 3) GM crops help create a safer environment because they reduce the use of chemicals for the prevention of pest and disease attacks on farms.

One of the areas OFAB has taken its educational campaign to as part of efforts to spread the GM seeds technology in Ghana, is the Ga South Municipality in the Greater Accra region. The study will be conducted in this municipality. The Ga South Municipality was carved out of the Ga West District in November 2007 with Weija as the Municipal capital. It lies at the South Western part of the region, occupying a total land area of about 341 square kilometers with a population of 210,727 (Population and Housing Census, 26th September, 2010). In this municipality, 12.3% of households are engaged in agriculture. More than three-quarters (76.5%) of the agricultural households in the municipality are involved in crop farming. These crop farmers are the targets of OFAB's educational campaign in the area.

Crop farmers in Ga South mainly grow cassava, pepper, okro, maize, rice, pineapples, and cowpea (www.gasouth.ghanadistricts.gov.gh, 2015). The Municipality lies in the catchment area of the defunct President's Special Initiative for cassava introduced in the early 2000s, and still produces a lot of cassava for supply to residents in the region and beyond. Livestock rearing is the second main agricultural activity undertaken by agricultural households

in the municipality, followed by fish farming (Population and Housing Census, 26th September, 2010).

The social system in the Ga South Municipality is similar to most communities in the Greater Accra Region of Ghana. The farming communities in the municipality are mainly habited by indigenes. These communities have local chiefs who residents look up to for directions in all spheres of their lives including their economic well being. Agricultural extension officers operating in these communities rely mainly on the endorsement of these local chiefs to propagate their messages and when it comes to introducing new technology into the communities. Ga South Municipality is also located just on the outskirts of the Accra Metropolis. This allows the transmission of all the radio and television stations operating in Accra to reach the municipality, thereby exposing residents highly to the mass media.

1.3 Problem statement

Educational campaigns are usually conducted to introduce new ideas to a group, sometimes with the intention to persuade. It's usually undertaken within a given time period, and applies organised communication activities involving mass media and inter personal activities (Rice and Atkin, 2009). The work being done by the Open Forum on Agricultural Biotechnology (OFAB) is one such educational campaign which has the objective of introducing GM food technology to farmers. But in order for the campaign to be successful, the message being communicated must reach the farmers, and they must respond favourably to it. A major problem with educational campaigns is reaching the audience, getting their attention to the message and retaining it (Hornik, 2002). According to (Gyau *et. al.*, 2009), plant genetic modification (GM food

technology) has received more intense discussion than almost every other topic in agriculture. This means that most likely, farmers have received different messages on GM foods from several other sources than OFAB. Farmers in the Ga South Municipality have relied mainly agric extension officers from the municipal office of the Ministry of Food and Agriculture and leaders of farmers' cooperative society for agric information. This study will thus investigate what farmers know about GM foods, their views on the socio economic implications of GM foods, and how they get information on the technology.

1.4 Objective of Study

The objective of the study is to investigate the dissemination of information on genetically modified foods to farmers in the Ga South Municipality, using the Open Forum on Agricultural Biotechnology's educational campaign as a case study.

1.5 Specific Objectives

- 1) To assess crop farmers' in Ga South Municipality's knowledge of GM foods
- 2) To explore crop farmers in Ga South Municipality's opinion on the health, economic and environmental outcomes of GM foods
- 3) To examine crop farmers in Ga South Municipality's sources of information on GM foods

1.6 Research Questions

- 1) What is the knowledge level of crop farmers in the Ga South Municipality on GM foods?

- 2) What perceptions do crop farmers in Ga South Municipality hold about GM foods' health, economic and environmental costs?
- 3) What are the sources from which crop farmers in Ga South Municipality obtain information on GM foods?

1.7 Significance of Study

The study will provide empirical data on what farmers in Ga South Municipality know about GM foods and their views on the technology, which can help agric industry stakeholders make informed policies. The study will also provide specific information on the most effective channels in communicating GM food information to farmers. It will also provide good feedback for organisations engaged in the dissemination of information on GM foods to farmers, particularly, the Open Forum on Agricultural Biotechnology.

1.8 Scope of Research

The study is a quantitative one, with farmers in the Ga South Municipality of the Greater Accra Region as respondents. It will be conducted in five communities in the district. These are; Tuba, Obom, Joma, Hobor, and Aplaku. It seeks to ascertain farmers' level of knowledge on GM foods, their perception of the technology and their sources of information on GM foods. The study surveys 120 farmers. All crop farmers were targeted in the study although current trials on GM crops for introduction into Ghana's food chain focus on cotton, rice and cowpea (www.ofabafrika.org, 2014). Most farmers in the five surveyed communities grow both rice and cowpea, but not cotton. The decision to target all crop farmers in the study was also influenced

by the knowledge that OFAB is not selective in the kinds of farmers targeted in their educational campaign.

1.9 Operational Definitions

a) Knowledge of GM foods: This refers to what farmers know about the effect that growing GM foods will have on productivity compared to growing traditional seeds, what they know about how growing GM foods will affect the environment and how consuming GM foods will affect one's health compared to traditional seeds. Knowledge on GM foods also includes farmers' awareness on whether GM foods are being grown in the country.

b) Perception of GM foods: This refers to whether farmers are convinced GM foods will make their farms more productive, whether they are convinced consuming GM foods will not cause them any diseases and whether GM foods will damage the environment. It also refers to whether farmers trust in the regulatory system government has established to manage the production of GM foods.

c) Sources of information on GM foods: This refers to channels through which information on GM foods reaches farmers.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews related research which are relevant to this study. The chapter is divided into two parts. In the first part, the theoretical frameworks that guide the study are discussed. They are; the Diffusion of Innovation Theory and Two Step Flow Theory. Then in the second part of the chapter, related studies are reviewed.

2.1 Diffusion of Innovation Theory and its relevance to this study

Diffusion of Innovations is a communications theory that offers explanation on the processes, the reason and the rate at which fresh ideas and technology spread through a society (Dearing, 2009). The Diffusion of Innovation Theory developed by Everett Rogers in 1962 is relevant to this study because the research is mainly aimed at understanding how information on GM food as a new idea, is spread among farmers in the Ga South Municipality. There are many theories that deal with the generation of innovations, and their diffusion and adoption or non-adoption by a populace. Such theories include the actor network theory, knowledge systems and network theory, and diffusion of innovations theory (Rogers, 2003). Among the theories, Rogers (2003) argues the diffusion of innovation theory is the theory that has dominated the understanding and practice of agricultural extension all over the world for more than half a century.

Dearing (2009) also noted few social science theories have had a history of abstract and experimental study for as long as the diffusion of innovations theory. The theory has been used widely to study the spread of a variety of new ideas, practices, programs, and technologies across

several disciplines. It offers insight into strategies for agro based information sharing and rural community capacity building (Dearing and Meyer, 2006). From the above, the researcher can conclude that the Diffusion of Innovation Theory is the best fit theory for investigating the introduction and spread of information on new agricultural technologies among groups like farmers. Hence, this study will apply the theory in analysing the dissemination of information on GM foods among farmers in the Ga South Municipality.

2.2 Elements of Diffusion of Innovation Theory

Diffusion of innovations among people is deemed important in the life of society because it is relatively hard to invent the kinds of useful knowledge necessary for the advancement of societies (Rogers, 1995). Inventing new ideas usually take more time and require more resources than transferring an already established idea from one environment to another. Rogers (1995) listed four basic ingredients of Diffusion of Innovation Theory. They are:

2.2.1 Innovation

An innovation is an idea, practice, or project that is perceived as new by an individual or society (Rice and Atkins, 2009). Rogers (1995) identifies the following as characteristics that encourage the adoption of innovation:

- a) **Relative advantage:** This is a comparism of the expected benefits and the costs of adopting an innovation. The factors that constitute relative advantage include: economic profitability, low initial cost, social prestige, and immediate reward.
- b) **Compatibility:** The extent to which an innovation is consistent with past experiences and needs of individuals.

c) Complexity: It is the degree to which an innovation is difficult to understand and utilize.

d) Trialability: The extent to which an innovation can be experimented with on limited basis.

e) Observability: It is the degree to which the results of an innovation adopted by an individual are visible to others. According to Rogers (1962), the higher the observability and communicability of results, the higher would be the rate of adoption.

Once the innovation is disseminated to individuals in a society, a decision is taken on whether to adopt or reject it. An individual's decision to adopt an innovation is not taken instantaneously, but the process consists of series of actions and choices by the individual over time (Rogers, 1983). The innovation decision process is the process through which an individual or other decision making unit passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject an innovation. Rogers (2003) explained the innovation decision process consists of five stages:

(i) Knowledge stage: This is when the individual becomes aware of the existence of an innovation through various communication channels, and gives it some attention.

(ii) Persuasion stage: At this stage, an individual forms a favourable or unfavourable attitude towards the innovation. Here, the individual actively seeks information about the innovation.

(iii) Decision stage: This is when a decision is taken whether to adopt or reject the innovation. Adoption means the individual has decided to make full use of the innovation while rejection means a decision has been taken not to adopt the innovation.

(iv) Implementation stage: Here, the individual applies the innovation, leading to behavioural change. But at this stage, the individual still harbours some amount of uncertainty about the expected consequences of the innovation.

(v) Confirmation stage: At this stage, the individual will seek to strengthen the decision to adopt or reject the innovation, avoiding all forms of dissonance.

2.2.2 Communication Channels

A communication channel is the means by which message about an innovation or technology is shared among two or more individuals. According to Rogers, the two important types of communication channels that would help the communicator in diffusion of innovations are interpersonal and mass media channels.

(i) Interpersonal channels involve face-to-face communication between two or more individuals. These channels are the means for persuading individuals to accept a new idea. These channels include opinion leaders, experts on the issue, friends, among others.

(ii) Radio, television and newspaper constitute mass media channels which enable messages to reach a larger, diverse audience simultaneously within a shorter duration. They are used mainly for awareness creation.

Rogers' (2003) noted media alone are limited in their effectiveness towards individual or social change. Rather the media's role in spreading new information works perfectly if they complement other means of communication, particularly interpersonal. Mass media channels are necessary to disseminate messages of awareness of new possibilities and practices, but, when it is time to decide whether to adopt or not, personal communication is far more influential (Servaes 2002).

2.2.3 Time

An innovation diffuses within a social system through its adoption by the members of the society. It takes time for an innovation to diffuse throughout the social system (Richerson 2011).

When an agricultural innovation is introduced into a society, not all farmers within a community adopt it immediately. Some will adopt it immediately, others will adopt it later. Those who adopt the innovation early influence other members of the social system to adopt the innovation, and they in turn influence others and it goes on.

i) Innovators: According to Rogers (2003), innovators or pioneers are the first to adopt an innovation. They usually are the youngest among the population, possessing the highest social class, are fairly well resourced financially, are very social, have close contact to scientific sources and those introducing the innovation.

ii) Early adopters: Beyond the innovators, this group is the second fastest to adopt the innovation. Among this population, you will find the largest number of opinion leaders compared with the other four categories.

iii) Early majority: They only adopt the innovation after consulting those who have adopted it earlier. They have above average social status, they are rarely opinion leaders, and tend to spend a lot more time considering when to adopt than innovators and early adopters.

iv) Late majority: Those in this category will adopt the innovation, only after average society members have adopted it.

v) Laggards are the final category of people to adopt an innovation. These persons are characteristically always against change in the society, and usually the elderly in society. They are very traditional in their approach to things, most likely of the lowest social status, and are the least worthy persons.

2.2.4 Social System

The fourth element of diffusion Rogers describes is the social system. A social system is a set of individuals, informal groups or organizations that are engaged in solving a common problem or in accomplishing a common goal. Diffusion happens within a social system, hence the spread of an innovation would obviously be affected by the social system.

Two key factors affect the diffusion of innovation within a social system, according to Rogers (1995). First is the complexity of the technology, and secondly the nature of the social system. Diffusion of agricultural innovations at the village level depends upon the structural characteristics of the village or social system, which may be homogenous or heterogeneous. The homogenous village may have population similar in social characteristics like social grouping, religion, culture, etc, whereas a heterogeneous village may have population varied in the characteristics.

2.3 Limitations of the Diffusion of Innovation Theory

The diffusion of innovation theory has provided a broad understanding on how new ideas spread in a society in varied fields of study. But just like any other theory of study, it has its negatives. Some scholars have criticized the Diffusion of Innovation Theory for placing too much focus on innovators to the detriment of the four other late innovation adopters, thereby skewing the orientation of the theory. Selwyn (2003) also notes the theory paints a picture that all innovations are accepted in the long run one way or the other, which may not be accurate. So, it categorises populations that are targeted by new ideas into innovators, early adopters, early majority, late majority, and laggards. There is little room for non-adopters. According to Selwyn (2003), one of

the least understood areas of innovation diffusion is the non-adoption of new technology. The theory is also usually criticized for being overly focused on the broadening of information reach, while focusing less on feedback from targeted individuals (Stephenson, 2003).

MacVaugh and Schiavone (2010) observes that familiar theories from which the diffusion of innovation theory emanated like the marketing theory is dominated by the assumption that users adopt new technology to maximise their utility. But sociology literature argues that consumers may adopt a new technology, for instance, by following a temporary fashion where the user is not maximising their utility, but rather maximising their social orientation. The Diffusion of Innovation theory does not integrate the overlapping effects of the different contexts and domains in which almost all new technology operates. The theory is also said to focus less on ongoing processes, but more on using historic incidents to explain dissemination of information in contrast to the norm. The diffusion of innovation theory has tended to focus on descriptive history, while neglecting causal processes (Richerson, 2011).

2.4 Two step flow theory

Paul Lazarsfeld and Elihu Katz in 1955 developed the two-step flow mass communication theory. The Two step flow theory was proposed out of the Hypodermic needle / Magic Bullet theory which says audiences respond to media messages without putting up any challenge. It says media audiences are passive and are easily manipulated by media messages. It was born out of a 1944 study of the decision-making process of electorates during the presidential election campaign. The study by Paul Lazarsfeld and Elihu Katz found that informal, personal contacts were mentioned far more frequently than radio and newspaper as a source of influence on voting

behaviors (Bennett and Manheim 2006). According to the theory, there are two stages that information from the media passes through. It is first received by opinion leaders (influential people in society) who pay close attention to mass media messages and delivers it. They then add their own interpretation to the original message and pass on to the audience. This two-step flow theory is based on the assumption that opinion leaders are more often the only persons with direct access to information from the mass media.

The theory of the two-step flow of communication reversed the dominant paradigm in mass communication at the time (Klapper, 1960). Before Lazarsfeld's study, the popular assumption was that mass media have a direct influence on a mass audience who consume media messages. Media were thought to significantly influence people's decisions and behaviours. But Lazarsfeld's study showed that only about 5 percent of people changed their voting preference as a result of media consumption and that interpersonal discussions of political issues were more prevalent than consumption of political news within one typical day (Klapper, 1960). A number of other factors including interpersonal communication with family members, friends, and members of one's social and professional circles turned out to be better predictors of a person's voting behaviour than that person's media exposure (Klapper, 1960). Bennett and Manheim (2006) pointed to the evolution of media formats, individual media use habits, and social distribution of media as evidence of a changing media landscape. According to the theory, the technological and media changes are what have made it possible for organisations to target their messages to increasingly more specific publics.

According to the analysis by Bennett and Manheim (2006), public communication has transformed from a two-step flow of messages passing from mass media through a social mediation process, to a one-step flow involving the refined targeting of messages directly to individuals. This one-step flow reflects both a transformation in communication technologies and fundamental changes in the relations between individuals and society. They say opinion leaders who played a pivotal role in the two step paradigm are increasingly less likely to do that anymore. The mass media in the one-step flow theory are increasingly fragmented and differentiated, and contribute to the individualizing process through shrinking audiences, demographically driven programming, and transmission (Bennett and Manheim, 2006). Despite the frequent mention of the One Step flow Theory in communication books, the Two Step Flow theory has been commended widely for throwing more light on how the mass media influences decision making and offers insight into how media campaigns fail to alter audience behaviour.

2.5 Relevance of Two Step Flow Theory to this study

Traditionally, farmers in the Ga South Municipality have relied on both interpersonal and mass communication channels for agric information. They have relied on agric extension officers from the Ministry of Food and Agriculture, local chiefs, leaders of farmers' cooperative society as well as educated and highly successful farmers for agric information. The campaign by OFAB encompasses both interpersonal means of communication where scientists travel to the community to interact with farmers, and the use of mass media platforms including Peace FM, Daily Graphic and Radio XYZ. This is an indication that messages sometimes reach opinion leaders in the community first before getting to farmers, indicative of the Two Step Flow process of information flow. There is also the direct flow of information to farmers through the mass

media. This study will seek to understand from farmers, how they get information on GM foods, exploring the specific channels through which the farmers get information. Hence, the application of the Two Step Flow theory is relevant.

2.6 Criticisms of the two step flow theory

According to Davis and Baron (1981), the two step flow theory was developed at a time when the media space was limited, and there were only radio sets and print media which were available to less people. Now, the trend has changed. There are television sets, there is the internet, among others. Davis and Baron (1981) also argue the two step flow theory was developed based on voting patterns in American presidential elections, without using other events to test the validity of the results. The emergence of the multiple step flow (Diffusion of Innovation) has further weakened the concept of diffusion of the Two Step Flow Theory.

2.7 Related studies

The aim of the study is to investigate the dissemination of information on GM food among crop farmers in the Ga South Municipality. It specifically examines their knowledge and perception on GM foods, and the channels through which the farmers receive information on GM food. The review of literature was done along those three themes:

2.7.1 Knowledge of farmers and public on GM foods

Almeida, Massarani and Moreira (2014) investigated the perception of small scale farmers in different regions of Brazil on GM foods. The objective of the study was to explore farmers' familiarity and practical experience with GM crops, as well as their understanding of the benefits

and consequences of growing GM crops. Survey method was used to collect data from the farmers. Although Brazil has adopted GM crops into the country's food chain, not all regions are growing them. In 15 such communities where GM foods are not grown, farmers in only one community responded that they have heard of GM food before. All farmers in the 14 other communities were unaware of what GM foods are, and even after it was explained to them in their local dialect, they insisted they were hearing about it for the first time. Small scale farmers in regions where GM crops were already being planted were more familiar with the subject. Even for farmers within specific GM crop growing regions who participated in the discussion, those who had adopted the cultivation of GM crops, or were members of social movements or cooperative societies had better knowledge about GM crops; including their advantages, disadvantages, impact on the environment, among others. So, farmers who grow GM seeds or live in communities where GM foods are grown showed a higher level of knowledge on GM crops than farmers in areas where GM seeds are not grown.

In a similar study in America, Hallman, Hebden, Aquino, Cuite and Lang (2003) sought to establish how well ordinary Americans know GM foods. Respondents had varied backgrounds including academia, food and agricultural companies, government, industry and consumer groups. There were 50 respondents in the survey. GM foods are common on supermarket shelves in America because that is where GM foods first originated from. But the study found that the issue of GM foods is not a topic that most Americans knew about. The respondents were first asked how much they had 'heard' or 'read' about GM foods. Only a little over a tenth of the respondents (12 percent) said they had heard or read 'a great deal' about GM crops, while 14 percent said they had heard or read "nothing at all" about GM foods. Close to a third of the

respondents (28 percent) said they had heard or read “nothing much” about GM foods, while 45 percent said they had ‘heard’ or ‘read’ just ‘something’ about GM foods. Beyond the self-rated knowledge, the survey assessed their actual knowledge on GM foods by asking the respondents to answer 11 true or false questions on the technology. More than half of the respondents (52 percent) did not pass the test. Only 4 percent of the sample answered all quiz questions correctly. This further confirms how little the respondents know GM foods. But the sample of only 50 respondents the researchers chose was too small. They could have doubled it or tripled the sample to make the results more representative of the entire American population.

When Chen and Li (2007) conducted surveys in five different countries including America on citizens’ level of knowledge and information on GM crops, the above figures were confirmed. In a random quantitative survey involving about 3000 respondents, residents in America, Norway, Spain and Japan were asked to assess themselves on how much information they have about GM foods. The Japanese came first, with 94 percent of respondents saying they were somewhat informed about GM crops. The figures were relatively lower in the other countries. That is; 53 percent for Norway, 39 for Spain, 59 for Taiwan and 45 percent for the U.S.

Lewis, Newell, Herron and Nawabu (2010) conducted a study on Tanzanian farmers' knowledge and attitudes to GM crops and the potential use of GM crops to provide improved levels of food security. It was a qualitative research which involved farmers as both producers and consumers to gauge their understanding of the technology, its acceptability, and identify issues of concern. The researchers conducted interviews with 19 individuals and undertook five mixed gender focus group discussions. The study found that understanding, awareness and knowledge of GM foods

and its potential risks and benefits was very poor in all regions. This is despite the fact that government had passed a legislation to allow for scientific trials of GM foods ahead of commercialisation. Only three respondents had heard the term "GM foods" before. All the respondents indicated they had no understanding of the technology. Agricultural extension officers interviewed also showed very poor understanding of what GM foods are. Some of them felt that they could accurately explain it, but when asked to do so, they did it incorrectly.

The studies reviewed above showed the researcher in several parts of the world including America, Europe and other parts of Africa, knowledge on GM foods is low. The reviewed studies also showed the researcher that the issue of low levels of knowledge on GM foods cuts across from farmers to ordinary members of the public. The low level of knowledge also cuts across countries where GM foods are being consumed, to where GM foods are not being consumed and where plans are underway to introduce GM foods like Tanzania. That category of countries where GM foods will soon be introduced is where Ghana falls. This study will thus assess the knowledge of crop farmers in the Ga South Municipality, in Ghana. It will be interesting to find out whether knowledge levels on GM foods will equally be low, or otherwise. This study will explore the knowledge of farmers in the Ga South Municipality on GM foods, and investigate what they know about the technology.

2.7.2 Perception of farmers and public on GM foods

Voss, Spiller and Ennenking (2009) studied the spread and acceptance of information on GM food among farmers, farm owners and farm managers in Germany. Note that, no GM foods have been approved for sale in Germany. Using the Technology Acceptance Model as theoretical

frame work, the researchers identified four main issues relating to GM crops that would influence farmers to accept GM foods. The factors were mainly economic. They are: the capacity to manage the GM seeds, cost effectiveness, acceptance by the general society, and preference of industries that procure the crops. The farmers said they will accept GM crops if there is evidence the crops will offer them all the above benefits. Most of them were however unsure if they had been convinced by promises of GM seed producing companies that these benefits will accrue to them if they planted GM crops. The study recommended that any educational campaign that seeks to educate farmers on the technology focuses on these economic factors in order to get their attention.

The findings agree with another study by Gyau *et. al.*, (2006) of 202 farm managers in North Western Germany. Farm managers interviewed in the study were those engaged in large scale commercial production and sale of various traditionally produced crops. The study wanted to find out from the farmers whether they will accept to grow GM seeds on their farms. They were also asked what factors would influence their decisions on whether or not to adopt GM seeds. More than two thirds of the respondents indicated they were ready to adopt GM crops, as long as the economic benefits will be greater than the traditionally produced ones.

A study by Adenle (2013) that surveyed government policy makers and scientists in Ghana and Nigeria showed they, just like the farmers in Germany surveyed by Gyau *et. al.*, (2006), were of the opinion it will be a good idea for their countries to adopt GM crops. The study used semi-structured interviews to sample 20 policymakers and 58 scientists at research institutes and universities. Most respondents in both countries were of the belief that GM food technology

has great potential to solve part of agricultural problems, including the biggest challenges like low productivity, drought, pests and diseases which affects the economic powers of farmers. Though they are not farmers who directly grow the crop, their opinions are important in shaping government policy on the adoption or otherwise of GM crops by farmers.

This outcome disagrees with a study by Dhan-Prakash *et. al.*, (2011) of government officials in Europe. The study revealed government officials in Europe were apprehensive about the introduction of GM foods into their countries because of health concerns associated with the technology. The study was to understand the precautions that guide policy makers in decisions on whether to accept GM crops into the food chain of various countries. The researchers found that governments particularly in the European Union based their decisions mainly on the health and environmental implications of adopting GM crops, not economic. Decision makers in government applied what is called the precautionary approach, which is premised on the concept of reducing and possibly eliminating risks to human health and the environment. This approach in decision making places the interest of the individuals who would be negatively affected by the introduction of a technology above the interest of those who would benefit from it. The researchers noted countries like Austria, UK, and Germany have used this principle in approaching the issue of GM foods.

In Kenya, Bett, Newton, Ayieko, and Amolo (2014) conducted a survey of students at the Kenyatta University on whether they will be ready to buy and consume genetically modified tomato if it was introduced onto the market. About two thirds of the respondents said “yes.” The respondents said they were convinced about promises of higher yield and improved nutritional

content, and were convinced the techniques in GM food production are not any more harmful than the techniques used in the traditional production of crops. The researchers found a direct correlation between awareness about GM crops and the high level acceptance of GM tomatoes by the students at the Kenyatta University. The study recommended that firms involved in the production and marketing of GM tomatoes employ the use of print and electronic media in raising awareness levels about GM tomatoes, highlighting these attributes.

This agrees with a study by Malyska and Twardowski (2014) in Poland which found that scientists (who obviously have direct access to scientific data) present mostly positive attitudes toward GM foods. This increases the notion that in depth knowledge of the technology increases the level of acceptance of products. The study involved 17 in-depth individual interviews with scientific experts. The researchers discovered that the absence of effective information flow from producers to potential users of new technologies increases the fear of innovation, which in turn inhibits further development and commercialisation of scientific discoveries.

The studies reviewed above show the researcher that farmers in other parts of the world are generally receptive to GM foods, as long as they are convinced adopting the technology will increase yield on the farm. From the studies above, other agric sector stakeholders including scientists are also generally receptive to GM foods as well. The study points to a correlation between higher knowledge about GM foods and acceptance. It is based on this that the researcher finds it necessary to survey farmers in the Ga South Municipality, to find out their opinions on the introduction of GM foods in to the country. The researcher will explore the linkage between farmers' knowledge and awareness of GM foods and acceptance of the technology.

2.7.3 Farmers' sources of general agric and GM food information

Zakaria, Adam, and Abujaja (2011) investigated farmers' knowledge and perception on GM foods. The study also sought to establish which channels are farmers' regular sources of agric information. The study surveyed 305 leaders of farmer based organisations in the Upper East, Upper West and Northern regions. More than half of the respondents (56.7 percent) indicated that their main sources of agricultural information are agricultural extension agents from the Ministry of Food and Agriculture. A little over one fifth of the population (23.6 percent) sourced their information on agriculture mainly from their fellow farmers and a little less than one fifth of them (19.7 percent) said they get agric information from extension agents working for Non-Governmental Organisations.

But contrary results were seen when they were asked about their main and regular sources of information on GM foods. The study found that most (61.7 percent) of them got their information about GM crop from the mass media, mainly radio and television. According to 3.6% of the respondents, they got their information from agricultural extension agents who work at the Ministry of Food and Agriculture, while the remaining 34.7% get their information on GM crops from their fellow farmers. This showed that when it comes to the channels of farmers' agricultural information generally, they mainly rely on extension officers. But specifically with GM crops, the farmers rely more on the mass media. Zakaria *et. al.*, (2014) recommended that any communication strategy designed to promote and educate farmers on GM crops should engage the mass media effectively.

This agrees with a study by Ndaghu *et. al.* (2013) that sought to assess the utilisation of mass communication tools in disseminating agricultural information among farmers in the Adamawa State in Nigeria. It identified radio, a mass communication tool as the most popular source of information among 82 respondents surveyed. Majority of the farmers indicated that their information needs were satisfied through the radio channels. This was attributed to various factors including the high level of literacy among the farmers, availability and accessibility of the radio channels and easy language comprehension. The study showed the use of radio in spreading agricultural information among farmers is increasing at a faster rate than personal contacts by extension workers.

An analysis of the Malawian government's agricultural policy launched in year 2000 revealed the policy made vast use of mass media particularly radio in communicating to farmers (Farm Radio International, 2010). Radio was one of the key components under the policy to provide relevant and appropriate information to farmers in Malawi through a number of channels. The study by Farm Radio International revealed new techniques such as phone-in programmes, live community forums, and radio diaries are making radio a more interactive medium which is providing farmers with a real voice and information.

But farmers' reliance on interpersonal media for agric information instead of mass media was evident in another study by Otu and Dauda (2011) in the Benue State in Nigeria which assessed farmers' use and preference of agricultural extension communication channels. Majority (66.77%) of the respondents indicated use of radio in obtaining agricultural information but only 10.44% of them indicated they regularly apply what they hear in their work, while 56.33%

indicated that they used it only some times. The study found that interpersonal communication channels of disseminating agricultural information were generally more available and accessible for use by farmers than the mass media. Specifically, the study found that relatives, friends and neighbours of farmers, as well as extension agents were the main sources of farmers' information, although a government run programme had been ongoing in the community to encourage the use of radio to educate farmers. These findings corroborated those of Tologbonse, Mesini and Tsado (2006) that television and extension publications like bulletins, newsletters, posters and hand bills were not considered as important sources of agricultural information among the farmers in Nigeria mainly because of the low level of literacy there.

Obidike (2011) observed a number of other factors that hindered the effectiveness of mass media in communicating agricultural extension information. These challenges include poor radio and television signals, none availability of electricity supply in most villages, vast poverty which made it impossible for farmers to purchase newsletters and leaflets containing agricultural information. Additionally, the study indicated illiteracy and inability of radio and television stations in Enugu State to broadcast agricultural information programmes in the native Nsukka dialect hindered the use of mass media as a communication tool in reaching farmers. This study will find out if these factors equally inhibit the dissemination of GM food information among farmers in the Ga South Municipality.

With the numerous challenges confronting modern mass media as tools for spreading agricultural information, Dauda (2009) suggested a return to traditional media. The study investigated the problems and prospects of traditional media (folk media) in agricultural extension service

delivery in the Benue State in Nigeria. A survey of 100 farmers showed folk songs were the most used traditional means of spreading agricultural information, followed by friends, community groups, and then folk theatre and drama. But the use of folk songs, theatre and drama were associated with a number of challenges including lack of trustworthiness in the message, and poor clarity in information delivery. The study recommended that in order to deal with the problem of lack of trustworthiness, farmers should be involved in the packaging of messages and respected members of the community selected as actors to deliver the messages. Obviously, the folk media remains a communication vehicle for promoting and improving dialogue which the common people or rural farmers employ to deliver their messages (Zwaal, 2000).

A study by Tadesse (2008) examined the participation of farmers themselves in the spread and utilisation of agric information in Ethiopia. The respondents were asked to explain their involvement in the dissemination of the agric information they had obtained to other farmers and neighbours. The result showed that, 87.5% of respondents participated in local information exchange during community meetings, social gathering time, religious sessions and when they met in places like markets. These results confirm that local information exchange network plays important role in the dissemination of simple and easily understandable agricultural information like the need to use government approved chemicals on one's farm.

The results of a study by Ndilowe (2013) that investigated how ideas of new agricultural practices are communicated to farmers under the Malawian Agriculture Development Program Support Project showed both personal and non-personal means of communication are necessary to properly impact farmers with agric information. The research established that farmers receive

messages through a variety of interpersonal communication means. These include communication through extension workers, using the lead farmer concept, communication through village meetings and communication through field days. Farmers also receive messages through electronic media (radio), although it has not been so much utilized under the project. Print communication through the use of leaflets is also common under the project. The study thus recommended that agric communication methods including print, electronic and interpersonal need to be taken into great consideration if interventions for developing agriculture are to be successful. It recommended that the Ministry of Agriculture streamlines the management of all stakeholders involved in the communication process on the project so as to achieve harmony and consistency in message development and dissemination.

The review of the above literatures informed the researcher about the several available channels of communicating agricultural information – both interpersonal and mass means. It also showed regular channels of agric information for farmers are usually influenced by a number of factors including literacy, availability of technological gadgets among others. This informed the researcher about what to look out for in this study in relation to how information on GM foods spreads. This study will find out if in Ga South, GM food information dissemination is mainly through mass media platforms or interpersonal means of communication.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

In this chapter, the researcher itemizes the methods used in carrying out the study. The chapter outlines the study design, instrument of data collection, sample size, sampling method, pre-testing procedures, data analysis, quality assurance and ethical considerations.

3.1 Study Design

The quantitative method, specifically survey was used in this study. Quantitative methods of research usually study behaviour under controlled conditions, by using the collected data to test a theory or hypothesis (Babie, 2008). Most of the literature that were reviewed used the survey method in the data gathering process, including the study by Zakaria, Adam, and Abujaja (2011) on farmers' knowledge and perception on GM foods which surveyed 305 leaders of farmer based organisations. According to Babie (2008), survey research is the best method available to the social researcher who is interested in collecting data for describing a population too large to observe directly. Careful probability sampling provides a group of respondents whose characteristics may be taken to reflect those of the larger population.

3.2 Sample Method and Sample Size

The Ga South Municipality has a population of 210,727 people, out of which an estimated 5,000 are crop farmers (Population and Housing Census, 26th September, 2010). A list of the 35 farming communities in the municipality was prepared in alphabetical order. The first was selected, and four others were picked at an interval of seven. The five communities which were

picked are: Tuba, Obom, Joma, Hobor, and Aplaku. The researcher was in each of the communities to attend meetings of the farmer associations there. The farmers were briefed on the data collection exercise. At the meeting, all farmers were asked to write down their names on pieces of paper which were mixed up and placed in a bowl. The first 24 names which were randomly picked in each of the communities were the subjects of the survey. In all, the study surveyed 120 farmers in five communities in the municipality. A basic principle of probability sampling is that a sample will be representative of the population from which it is selected. All members of the population must have an equal chance of being selected in the sampling (Babie, 2011). This is exactly what the researcher did to ensure the sampling was a random one.

3.3 Data Collection Instrument and Data Collection Method

The researcher designed a 24 item questionnaire for the data collection exercise. The questionnaire was a standard one that was used for all the farmers. All the questions were close ended. The questionnaire was designed in line with the objectives of the study. The questionnaire was in four parts; demographics, knowledge on GM foods, perception on GM foods and regular source of information on GM foods. Conscious efforts were made to ensure the questionnaire was almost perfect, with adequate spacing and carefully thought through questions. An improperly laid out questionnaire can lead respondents to miss questions and confuse themselves about the desired data (Babie, 2008). Fowler (2002) suggests questionnaires for surveys should be: self-explanatory, questions must be limited to closed-ended items, a limited number of question forms should be used, and amount of instructions plus introduction must be limited so as not to confuse the respondent. The researcher prepared the questionnaire in line with these recommendations. Those farmers who could read were handed the questionnaire to fill, and the

researcher and three assistants subsequently visited the ones who could not read and write to administer the questionnaires for them.

3.4 Pre-Testing method

Without a doubt, the best way to discover whether a research instrument is adequately designed is to pretest it (Wimmer and Domnick, 2011). Areas of misunderstanding or confusion can be easily corrected without wasting time or money on a large sample population (Wimmer and Domnick, 2011). Before the collection of data was started, the researcher did a pre-test of 15 questionnaires in the district capital, Weija. The researcher realized it was inappropriate that the possible answers to six of the questions on the questionnaire did not previously make room for other options (other). This was fixed after the pre-test. The previous questionnaire also had the possible answers lined up one after the other in single sentences. After the pretest, it was realized this makes it clumsy; hence the need to ensure every response is in a single sentence. This made the questionnaire bulky, but it made it clearer. The previous questionnaire also had OFAB represented in the abbreviated format, with the full meaning of it noted at the top of the questionnaire. But this was changed and OFAB was written in full in all the possible answers. These corrections were made to the questionnaire before the real data collection exercise was done.

3.5 Data Analysis

The collated data was input into the Statistical Package for Social Science (SPSS) computer software for analysis. The findings were then represented using frequency tables and graphs.

3.6 Quality assurance

Pretesting of the questionnaire, undertaking random sampling and gathering data from five different communities were all done to ensure the validity and reliability of the data that was gathered.

3.7 Ethical considerations

Consent was sought from all persons involved in the study before data was collected from them. The researcher also made them understand that the research is mainly for academic purpose, and nothing else. They were also assured their identities will be kept anonymous. No one was coerced or tricked into joining the survey, all in a move to ensure the sanctity of the work was protected.

CHAPTER FOUR

FINDINGS

4.0 Introduction

The study sought to investigate the dissemination of information on Genetically Modified Foods among crop farmers in the Ga South Municipality. Specifically, the study examined farmers' knowledge on GM Foods, their perception about GM foods and their sources of information on GM Foods. The researcher considered three main demographics in relation to farmers in the municipality. They are; sex, level of formal education and age. A survey was used in gathering the data, which was then analyzed using the Statistical Package for Social Science (SPSS).

4.1 Demographic characteristics of farmers

Table 1: Respondents' level of education

Level of Education	Frequency	Percentage
No education	39	32.5
Basic Education	43	35.8
Senior High School	34	28.3
Tertiary	4	3.3
Total	120	100.0

When it comes to the educational qualification of respondents, three out of every 10 farmers (32.5 percent) surveyed has no formal education. Most of the respondents had basic and senior high school education, but only three percent of respondents had tertiary education.

Table 2: Age of respondents

Age bracket	Frequency	Percentage
18-30 years	22	18.3
31-40 years	35	29.2
41-50 years	29	24.2
51 years and above	34	28.3
Total	120	100.0

A categorisation of the respondents by age showed they cut across the various age groups from 18 years to above 50 years. The youthful age group of 18 to 30 years recorded the lowest number of respondents with only 18.3 percent of them falling within this category. The proportion of farmers aged 51 years and above was 28.5 percent. The study did not really place any emphasis on gender and its role in the dissemination of information on GM Foods. But the data gathered showed the number of male respondents outnumbered females four times, with 80 percent of those surveyed being males while 20 percent were females.

4.2 Farmers' knowledge on GM Foods

OFAB's message to farmers in its educational campaign have emphasised that GM foods help increase yield, GM foods help improve upon human health by producing more nutritious food, and GM foods help improve upon the quality of the environment by reducing pesticide and insecticide use. Farmers' knowledge on these specific messages churned out by OFAB were tested in the study.

Table 3: Farmers' knowledge on effects of growing GM foods on yield

Effect	Frequency	Percentage
Yield will increase	70	59.8
Yield will remain same	20	17.1
Yield will reduce	27	23.1
Total	117	100.0

Majority of farmers (59.8 percent) are aware that GM foods increase yield. The remaining 40.2 percent of farmers do not have the knowledge that GM food increases yield.

Table 4: Farmers' knowledge on effects of GM foods on the environment

Effect	Frequency	Percentage
It will damage the environment	32	27.4
It will improve upon quality of environment	48	41.0
Nothing will change	37	31.6
Total	117	100.0

Two out of every five farmers (41 percent) are aware that growing GM foods will help improve upon the environment. The rest, that is 27.4 percent and 31.6 percent respectively, believe GM foods will either damage the environment or nothing will change.

Table 5: Farmers' knowledge on effects of GM foods on one's health

Effect	Frequency	Percentage
It causes diseases	56	47.1
It improves upon human health	29	24.4
Nothing changes	34	28.6
Total	119	100.0

The table above shows 24.4 percent of farmers know that GM foods will help improve upon human health. When you strike the average of farmers' knowledge on the specific messages OFAB churns out relating to the effect of GM foods on yield, human health and environment, 41.7 percent of farmers showed they have full knowledge on the issues. The remaining 58.3 percent are unaware. And the farmers admit that they have low levels of knowledge on GM foods. When they were asked to do self assessments on how well they know GM foods, 3.3 percent of farmers self rated their level of knowledge on GM foods as very good. One in every four farmers (25.0 percent) rated their level of knowledge as very poor, and 24.2 percent rated their knowledge as poor. It is clear from the above that generally, farmers in the Ga South Municipality have low knowledge on the issue of GM foods.

4.3 Farmers' Perception of GM foods

Table 6: What do farmers think about GM foods?

Response	Frequency	Percentage
Good	43	35.8
Bad	47	39.2
Undecided	30	25.0
Total	120	100.0

Opinion among respondents is almost split with 35.8 percent of them expressing the view GM foods are good. A slightly higher number (39.2 percent) said GM foods are bad.

Table 7: Do farmers believe GM foods will increase their income?

Response	Frequency	Percentage
Yes	61	51.3
No	27	22.7
Unsure	31	26.1
Total	119	100.0

More than half of the respondents, that is, 51.3 percent are convinced growing GM seeds will increase their income. Less than a quarter of the respondents, that is 22.7 percent are of the opinion GM seeds will not increase their income.

Table 8: Do farmers think consuming GM foods will damage their health?

Response	Frequency	Percentage
Yes	53	44.5
No	39	32.8
Unsure	27	22.7
Total	119	100.0

When the farmers were asked about whether they think GM foods will damage their health, 44.5 percent of them said yes, while 32.8 percent said no, and 22.7 percent were unsure.

Table 9: Will farmers be ready to grow GM seeds?

Response	Frequency	Percentage
Yes	47	39.5
No	45	37.8
Undecided	27	22.7
Total	119	100.0

Views on farmers' readiness to grow GM foods were also almost split, with 39.5 percent of respondents saying they are ready to grow them, while 37.8 percent said they are not. Almost a third of the farmers, that is 22.7 percent said they are undecided.

Table 10: Do farmers believe public will accept their produce if they grow GM foods?

Response	Frequency	Percentage
Yes	49	41.2
No	39	32.8
Undecided	31	26.1
Total	119	100.0

Results of the survey showed 41.2 percent of the respondents are convinced the public will accept their produce if they grow GM foods, while 32.8 percent felt people will reject them. A sizeable proportion of the farmers (26.1 percent) were undecided.

Table 11: Do farmers trust in government's ability to appropriately regulate GM food production in Ghana?

Response	Frequency	Percentage
Yes	28	23.7
Partially	25	21.2
No	41	34.7
Undecided	24	20.3
Total	118	100.0

When farmers were asked about whether they trust in government's ability to adequately regulate the production of GM foods and thus keep the public safe, 34.7 percent said no, and

21.2 percent said they only trusted in government’s ability partially. Meanwhile, 23.7 percent of respondents said they trust in government’s ability fully, while 20.3 percent were undecided.

In summary, 35.8 percent of farmers believe GM foods are good, 39.5 percent of farmers are ready to grown GM foods on their farms, 32.8 percent believe GM foods are healthy, only 41.2 percent of farmers are convinced the public will accept their produce if they grow GM foods, and 23.7 percent said they trust government fully to be able to adequately regulate the production of GM foods, so as to keep the public safe. This gives the indication that the opinion of farmers in the Ga South is heavily skewed against GM foods. A large portion of the respondents are not in support of growing GM foods.

4.4 Farmers’ sources of information on GM foods

Table 12: Farmers’ first source on information on GM foods

Source	Frequency	Percentage
OFAB	36	30.8
Radio	49	41.9
TV	2	1.7
Newspaper	3	2.6
Colleague farmers	16	13.7
Extension agents	4	3.4
Opinion leaders	7	6.0
Total	117	100.0

When farmers were asked about their first source of information on GM foods, 41.9 percent of them mentioned radio. Three in every ten farmers (30.8 percent) indicated OFAB was their first source of information, while 13.7 percent pointed to colleague farmers, 3.4 percent said extension officers and 6.0 percent said opinion leaders.

Table 13: Farmers regular source of information on GM foods

Source	Frequency	Percentage
OFAB	4	3.4
Radio	62	53.4
Colleague farmers	30	25.9
Extension agents	7	6.0
Opinion leaders	13	11.2
Total	116	100

The table above shows more than half of the respondents, 53.4 percent, identified radio as their regular source of information on GM foods. A quarter of them (25.9 percent) mentioned colleague farmers, while only six percent mentioned extension officers. But contrary results were seen when farmers were asked about their regular sources of information on agric generally.

Table 14: Farmers' sources of agricultural information generally

Source	Frequency	Percentage
Electronic media	24	20.5
Print Media	3	2.6
Colleague farmers	27	23.1
Extension agents	43	36.8
Opinion leaders	20	17.1
Total	117	100.0

More than a third of all the farmers surveyed, that is 36.8 percent, said they rely on extension agents as their main and regular source of general agricultural information, while 23.1 percent pointed to their colleague farmers, and 17.1 percent mentioned opinion leaders.

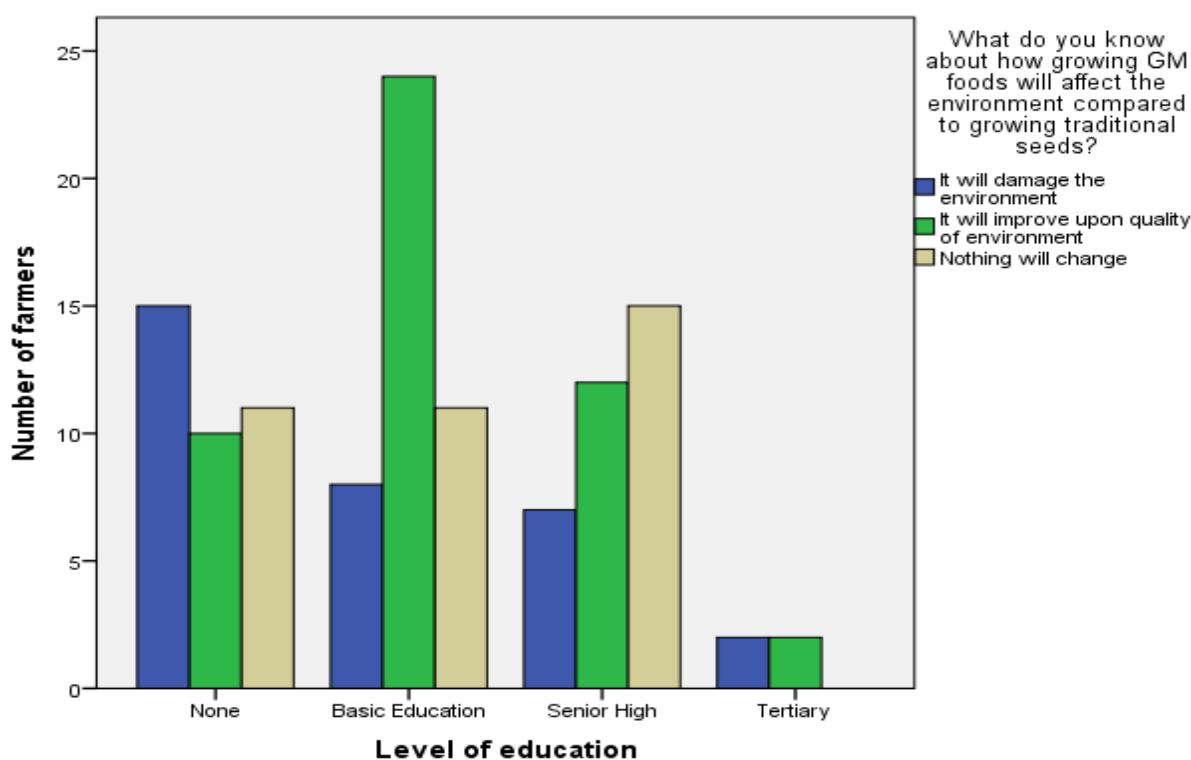
Table 15: Farmers preferred source of information on GM foods

Source	Frequency	Percentage
OFAB	22	19.0
Radio	33	28.4
TV	4	3.4
Newspaper	2	1.7
Colleague farmers	26	22.4
Extension agents	14	12.1
Opinion leaders	15	12.9
Total	116	100.0

When farmers were asked about which of the sources of information they preferred most, 28.4 percent said radio, 22.4 percent said colleague farmers, 19 percent said OFAB, 12.9 percent said opinion leaders and 12.1 percent said extension officers.

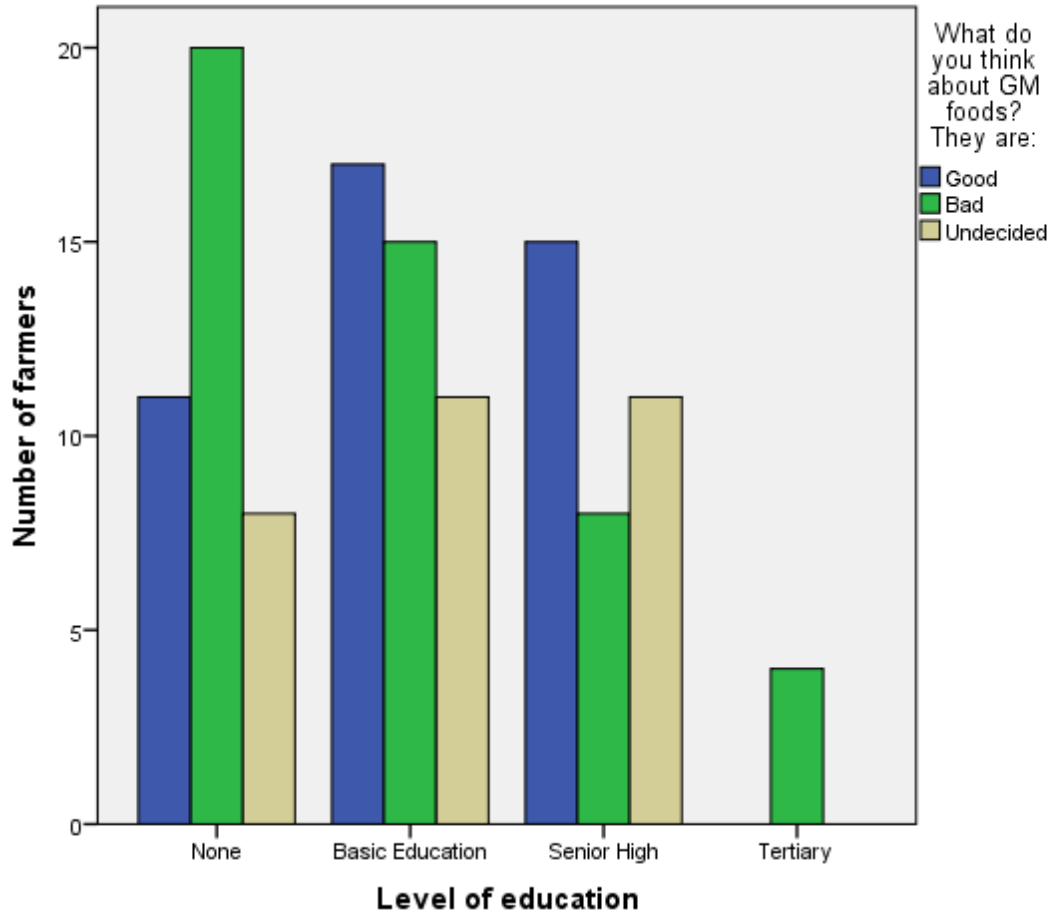
4.5 Cross tabulations

Graph 1: Farmers’ educational level and knowledge on GM foods



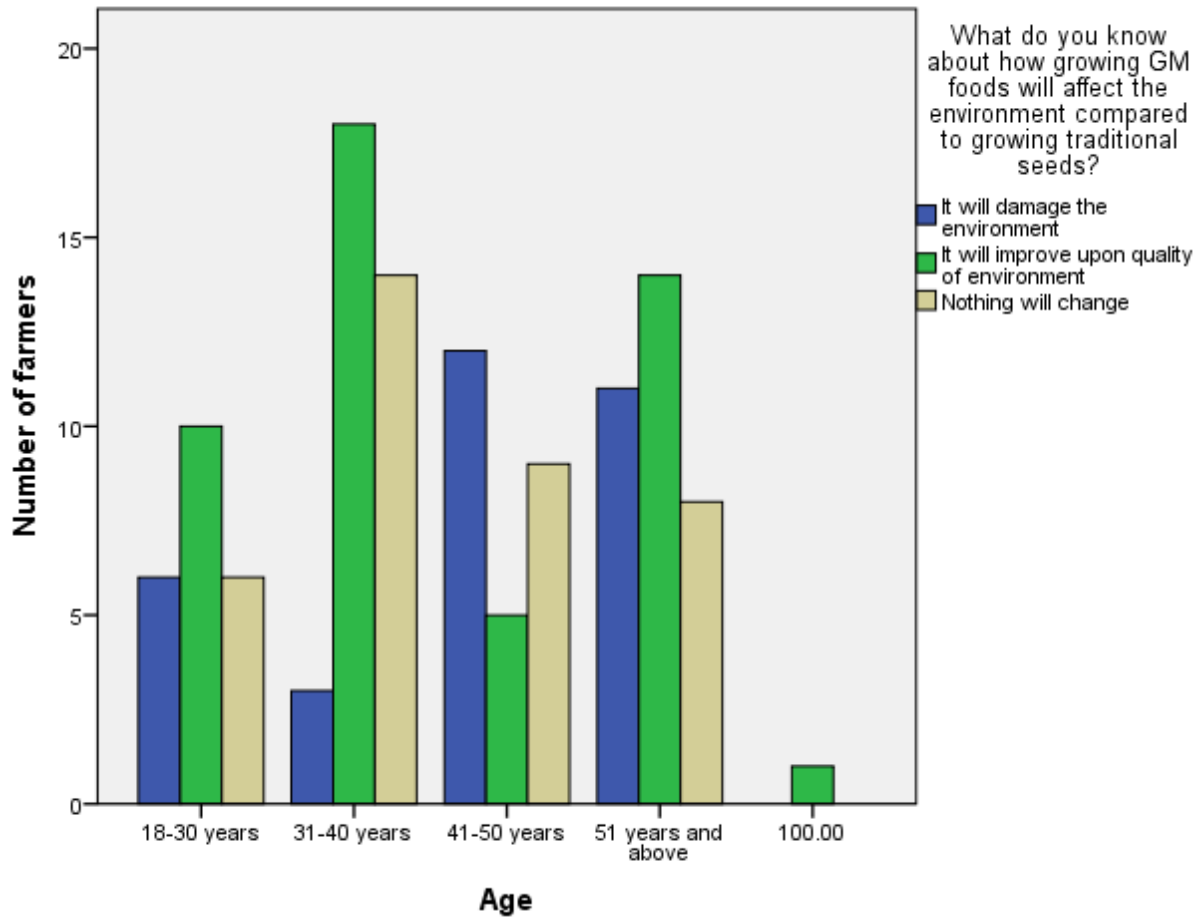
A cross tabulation of farmers’ level of education and their knowledge on GM foods showed those with basic education recorded the highest number of those with the right knowledge that GM foods will improve upon the quality of the environment. The category of farmers without any formal education recorded the highest number of those who wrongly claimed GM foods will damage the environment, while those with Senior High School education recorded the highest number of those who wrongly claimed nothing will change with regards to the environment.

Graph 2: Farmers’ educational background and what they think about GM foods



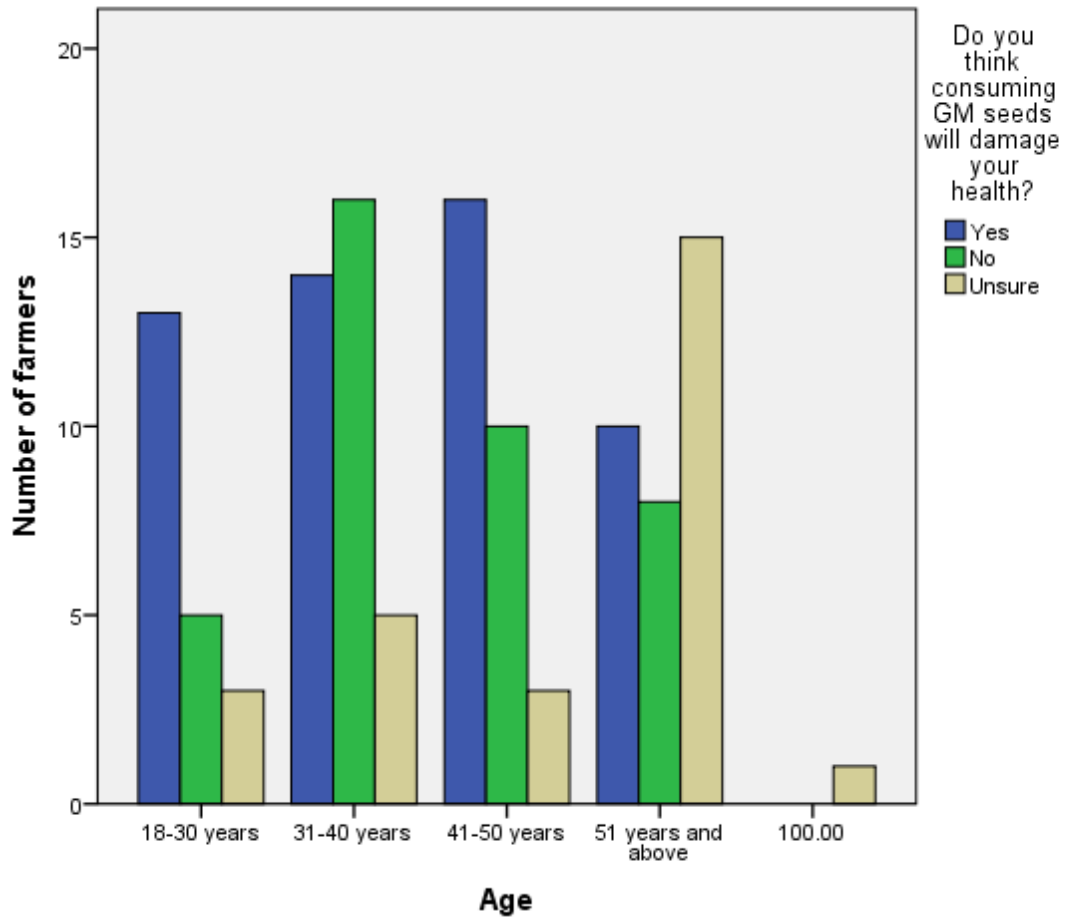
A cross tabulation of the level of education of farmers with their view on whether GM foods are good or bad shows majority of those who have no education at all believe GM foods are bad. All those with tertiary qualification are of the view GM foods are bad. Those with basic and senior high school qualifications had the highest number of undecided respondents when it comes to their view on whether GM foods are good or bad.

Graph 3: Farmers' age and knowledge on GM foods



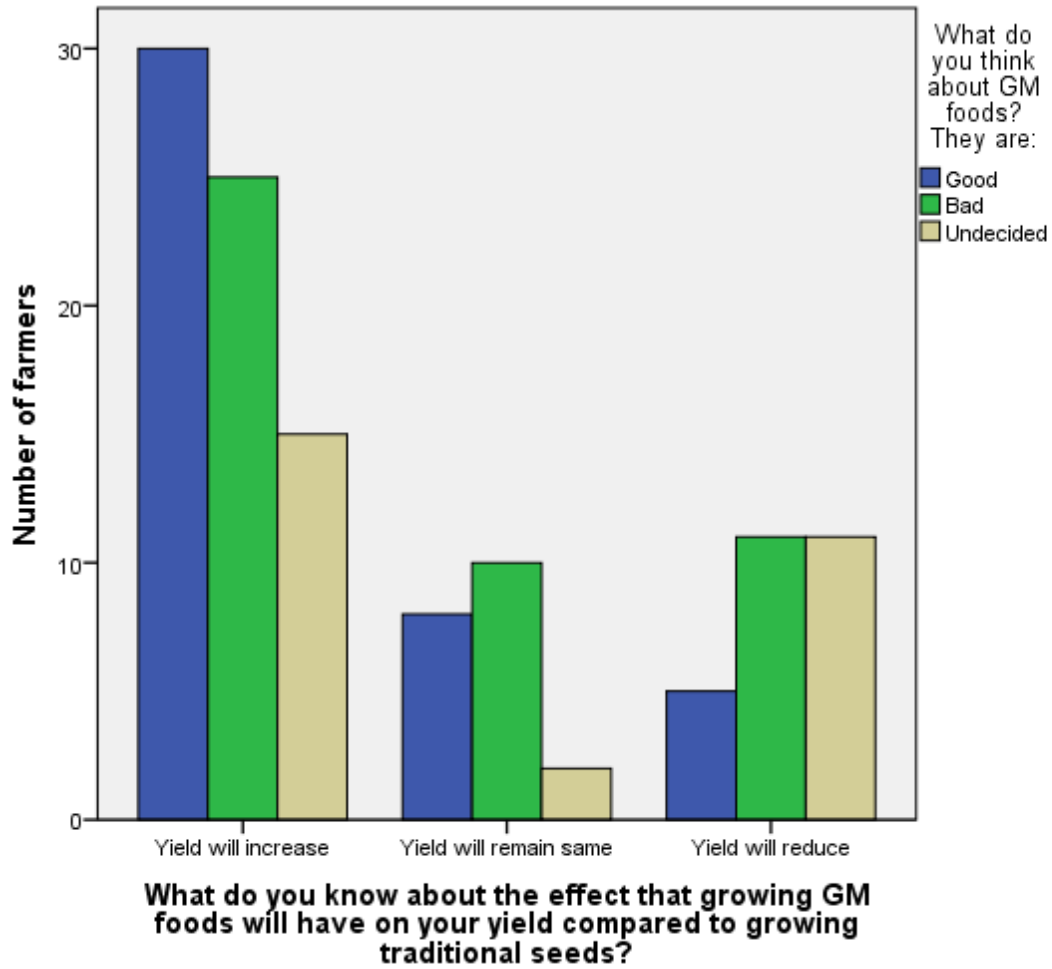
A cross tabulation of farmers' age and their knowledge on the environmental effects of GM foods showed farmers within the 31 to 40 years age bracket recorded the highest number of persons with the right knowledge that GM foods will improve upon the quality of the environment. That same age bracket again recorded the highest number of persons who wrongly said nothing will change.

Graph 4: Farmers' age and perception on GM foods



A cross tabulation of farmers' age and perception about GM foods showed those within the age bracket of 18 to 30 years recorded the lowest number of those with the view that GM foods are unhealthy. Those farmers in the bracket of 41 to 50 years recorded the highest number of those who expressed the opinion that GM foods are good.

Graph 5: Farmers knowledge on effects of GM foods on yield and their perception



A cross tabulation of what farmers think about GM foods and their knowledge showed those who say GM foods are good recorded the highest number of those who accurately said GM foods will increase yield. Those who said GM foods are good recorded the lowest representation among those who wrongly indicated GM foods will reduce yield.

Further cross tabulations of farmers' knowledge on the effects of GM foods and readiness to adopt showed those who had rejected the technology, were those with little knowledge about it.

An equal number of those who have embraced GM foods as having the potential to improve human health both said they will accept and reject GM foods. A cross tabulation of farmers' level of education and their regular source of information on GM foods showed radio is the most dominant source of information for persons across all the educational levels.

4.6 Summary of key findings

Forty-one percent of farmers are aware that growing GM foods will help improve upon the quality of the environment. Meanwhile, 24.4 percent of farmers know that GM foods will help improve upon human health. When they were asked to self-assess themselves on how well they know GM foods, 3.3 percent of farmers self-rated their level of knowledge on GM foods as very good. On farmers' perception about the technology, 35.8 percent of them are of the view that GM foods are good. Also, 32.8 percent of them are convinced GM foods are healthy and just 39.5 percent said they are ready to grow GM foods. When farmers were asked about their first source of information on GM foods, 41.9 percent of them mentioned radio. And radio was also identified again as their predominant source for regular information on GM foods. Farmers with basic education recorded the highest number of those with the accurate knowledge that GM foods will improve upon the quality of the environment. The category of farmers without any formal education recorded the highest number of those who wrongly claimed GM foods will damage the environment. A large number of those who said GM foods are unhealthy and bad, are without any form of education at all. Those who wrongly claimed GM foods will cause diseases recorded the highest number of those who said they will not be ready to grow GM foods.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

The study sought to examine the dissemination of information on Genetically Modified Foods among crop farmers in the Ga South Municipality. Their knowledge on GM crops, their views on it and the channels through which they get information on GM foods were all examined. Data was obtained from 120 farmers in the Ga South Municipality using the survey method.

5.2 Farmers' knowledge on GM foods

The study found that most farmers in the Ga South Municipality have very little knowledge about Genetically Modified Foods. All the farmers surveyed have heard about GM foods before. But when their knowledge was tested on specific issues relating to GM foods (environmental, health and economic effects), they were found to have very little knowledge. An average of 41.7 of the farmers showed they were aware of what GM foods are, with the rest showing little or no understanding. And the farmers admit they have low levels of knowledge on GM foods. When they were asked to do self-assessments on how well they know GM foods, more than 70 percent rated their level of knowledge as either very poor, poor or average.

Note that GM foods have not been approved for local production in Ghana. This is probably why most farmers in the Ga South Municipality have low levels of knowledge on GM foods because it's common for people not to have much information on materials they are not making use. A study by Almeida, Massarani and Moreira (2014) in different regions of Brazil to test their knowledge on GM foods showed similar results. The study found that farmers in 14 out of 15

communities surveyed where GM crops are not being grown have not even heard about GM foods before. Once the farmers are not growing GM foods, they will hardly seek information on it. They will not discuss the subject during their meetings and they will not bother to seek information on it from their partners like seed traders, extension agents, among others, hence the low level of knowledge. That is what may probably be happening with farmers in Ga South Municipality.

According to the diffusion of innovation theory, various factors including relative advantage, compatibility, complexity, triability and observeability influence the spread of innovations among a population (Rogers, 1995). So, it's an evidence based thing. Once members of the community observe that the innovation is beneficial to those who adopt it early, then it is very likely that more persons will be ready to seek information on the technology, more individuals would acquire additional knowledge on it, and once it is seen to be beneficial, more persons would accept the technology. But all the above stated characteristics of the innovation will not be seen once the innovation has not been introduced in the environment yet. That is what appears to be happening in this particular case with the GM Food technology.

5.2.1 Why did farmers fail the knowledge tests on OFAB's messages?

Out of the 120 farmers surveyed, 59.8 percent of respondents were aware of the OFAB message that GM foods will increase yield, 41 percent were aware GM foods will help improve the quality of the environment, and only 28.3 percent were aware GM foods will not affect one's health in any way. A number of factors could account for this. Communication campaigns can fail due to a number of reasons. It could be because the audience members find the message

contradictory to their habits, and are thus resistant to it. Or the wrong strategies were applied in the educational campaign when it comes to the choice of messages, targets and channels. A major problem also is reaching the audience and attaining attention to messages (Hornik, 2002). Effective communication is hampered when audience perceive messages as offensive, disturbing, boring, confusing, irritating, misleading, irrelevant, uninformative, useless, or not motivating (Rice and Atkin, 2009). That could be accounting for how come farmers are not getting the message of OFAB.

5.2.2 Comparism of knowledge levels on GM crops in different communities

The five different communities where the survey was conducted recorded varying levels of understanding of GM foods. When farmers were tested on the specific OFAB message about the environmental effect of GM foods, 53.2 percent of respondents in Tuba were aware GM foods will help improve environmental quality, while in Obom, it was 41.6 percent. In Joma, it was 45.8 percent. In Hobor, it was 37.5 percent and in Aplaku, it was 54.2. Clearly, the level of knowledge in Aplaku was well above those of the other areas. As the study in Brazil by Almeida, Massarani and Moreira (2014) had pointed out, farmers who are members of social movements or cooperative societies had better knowledge about GM crops; including their advantages, disadvantages, impact on the environment, among others. This probably explains why the level of knowledge on GM foods is highest in Aplaku because it is considered the community where the Ghana National Association of Farmers and Fishermen is most active in the municipality. Most of the leaders of the association in the municipality live there, and the ease in accessibility of the community makes it the preferred location for general meetings of farmers from across the municipality.

Level of knowledge could also be the result of literacy rates in the communities. A cross tabulation of farmers' level of education and the knowledge of farmers on the environmental effects of GM foods showed those with basic education recorded the highest number of those with the appropriate knowledge that GM foods will improve upon the quality of the environment. The category of farmers without any formal education recorded the highest number of those who wrongly claimed GM foods will damage the environment. Farmers in Aplaku recorded the highest number of educated persons among all the five communities.

It was also expected age will play a crucial role in how well farmers know GM foods. It would have been expected that younger people who are more exposed to new technology would have more knowledge, but the contrary was the case. A cross tabulation of farmers' age and their knowledge on the environmental effects of GM foods showed farmers within the 31 to 40 years age bracket recorded the highest number of persons with the right knowledge that GM foods will improve upon the quality of the environment. Less of those in the 18 to 30 years bracket had adequate knowledge on the technology.

5.3 Farmers' Perception of GM Foods

When farmers were asked whether GM foods are good or bad, 35.8 percent were of the opinion GM foods are good, with 39.2 percent saying they are bad. When farmers were asked about what they think the health effects of consuming GM foods will be, 24 percent said GM foods are healthy, with 47.1 percent saying they cause diseases. Onyango *et. al.*, (2004) observes that the discussion on plant genetic engineering has split the public into two. There are those who support the technology, emphasizing it improves food availability and reduces insecticide and labour cost

which provide economic benefits to the adopters. On the other side are the opponents who argue that plant genetic engineering is an interference of nature and may have unknown and disastrous consequences (Nelson, 2001). That near split is clearly observed in the Ga South Municipality, except that the population of those who think GM foods are bad and unhealthy, outnumber those who believe it is a good and healthy technology.

But as the Diffusion of Innovations Theory by Everett Rogers (2003) explains, when a technology is introduced into a new environment, various elements including the innovation itself, communication channels, time, and social system will cause it to spread over a period of time. A small population known as the innovators will be the first to accept, then a slightly higher early majority population accepts, then the late majority, and then the laggards who would be the last to accept. This could be explanation of why only a few have accepted the technology in Ga South so far. Those who believe GM foods are good may fall in the category of the innovators and early adopters. Subsequently, it is possible the innovation will spread to other members of the population too. Especially when a sizeable portion of the population, that is 25 percent noted they are undecided on whether GM foods are good or bad. So, only time will tell whether the rest will also soon accept the technology, or take the position of the current majority of farmers that it is bad.

5.3.1 Farmers' perception on GM foods and knowledge on GM foods

In this study, farmers were asked to state their positions despite the fact that they do not grow GM foods. Breustedt, Müller-Scheeßel, and Meyer-Schatz (2008) divided the analyses of biotechnology adoption in agriculture into *ex post* and *ex ante* studies. The *ex post* scenario refers

to the case where GM crops are already being grown in the area, which makes it possible for the researcher to conduct the analyses based on information collected on the actual behaviour of the farmers. The *ex ante* analyses have to do with analyses using expected behaviour although the technology has not been introduced yet. This study was an *ex ante* one which revealed there are more farmers who are against GM foods in the Ga South Municipality than are for. The result was expected looking at the fact that farmers have reported low levels of knowledge on GM foods, with an average of only 41.7 percent of them showing they have full knowledge about specific messages on the technology that OFAB had disseminated to them.

According to Hasseini and Rezael (2010), a fair knowledge of what exactly GM crops are, is important in encouraging the acceptance of GM crops, as a lack of understanding about the process and scientific concepts upon which it is based, are generally seen as the reason why this technology is rejected. A study by Malyska and Twardowski (2014) in Poland found that those who have direct access to scientific data present mostly positive attitudes toward GM foods. This increases the notion that in depth knowledge of the technology increases the level of acceptance of products. The researchers discovered that the absence of effective information flow from producers to potential users of new technologies increases the fear of innovation, which in turn inhibits further development and commercialisation of scientific discoveries. So, with the study showing farmers have low levels of knowledge on GM foods; it is not surprising that more of them are rejecting GM foods than accepting it.

5.3.2 Benefits of GM seeds and farmers' readiness to adopt

It is rather interesting that although majority of the respondents, that is, 51.3 percent were convinced that growing GM seeds will increase their income, only 39.5 percent of them were ready to grow GM foods on their farms. This contradicts a study by Gyau (2006) of farm managers in North Western Germany, which revealed majority of farmers will only be ready to adopt GM seeds if they are convinced it will increase their income. In most of the studies that were reviewed, it was clear that farmers would usually make economic benefits the most important factors in deciding whether to adopt a particular technology or not. Researchers would thus usually advise that campaigners for new technologies should focus on economic benefits of technology in order to successfully convince farmers to adopt. According to Diffusion of Innovation Theory by Rogers (2003), relative advantage, which is the comparison of the expected benefits and the costs of adopting an innovation including economic profitability, low initial cost, and immediate reward are crucial in farmers' decisions to accept technologies. But a different scenario is seen in the Ga South Municipality. This could probably be explained by the number of farmers who expressed the opinion that they are not convinced the public will accept their produce if they grow GM foods. Results of the survey showed 41.2 percent are convinced the public will accept their produce if they grow GM foods. The rest thought otherwise or were undecided. Hence, although they believe GM foods will give them higher yield, they were not ready to adopt because they were afraid the populace would not accept their produce.

5.3.3 Educational level of farmers and perceptions on GM foods

According to Rogers (2003) who developed the diffusion of innovations theory, "the individuals or other units in a system who most need the benefits of a new idea (the less educated, less

wealthy, and the like) are generally the last to adopt an innovation.” A cross tabulation of the results of what farmers think about GM foods with their level of education showed almost half (42.5) percent of respondents who felt GM foods are bad did not have any form of education at all. This could be due to a number of factors, including a lack of understanding about the technology which then makes it impossible for them to comprehend. This is further confirmed by the results in the cross tabulation of the results having to do with level of knowledge and acceptance or otherwise of GM foods. More than half of those who failed the knowledge test on specific environmental and health OFAB messages claimed GM foods are bad and unhealthy. This confirms the assumption that lower levels of education and knowledge makes it more likely the person would reject GM foods.

5.4 Farmers’ sources of information on GM foods

When farmers were asked about their first source of information on GM foods, 41.9 percent of them mentioned radio. Three in every ten farmers (30.8 percent) indicated OFAB was their first source of information, while 13.7 percent pointed to colleague farmers, 3.4 percent said extension officers and 6.0 percent said opinion leaders. Majority of the farmers (53 percent) identified colleague farmers, community leaders and extension agents as their main sources of information on GM foods, an indication the two step flow model of communication (where opinion leaders serve as intermediary between the message and the ordinary recipient) was active here. So, when it comes to farmers’ first source of information on GM foods, majority of the farmers relied on interpersonal means of communication. This agrees with a study by Tologbonseet. *al.*, (2006) in Nigeria which found that broadcast and print media were not

considered as important sources of agricultural information among the farmers in Nigeria mainly because of the low level of literacy there.

Beyond their first ever source of information, when farmers were asked about their regular source of information, 53.4 percent identified radio as their regular source of information on GM foods. A quarter of the respondents, 25.9 percent said they relied on their colleague farmers most of the times for their information on GM foods, while only six percent said they got information most of the times from agric extension officers. Eleven percent of farmers indicated they got their information on GM foods from opinion leaders. So most of the respondents rely on radio as their main source of information on GM foods. The Ga South Municipality is located just on the outskirts of the national capital Accra. This means residents here have access to all the more than 30 radio stations that broadcast in the English and local languages that operate from the capital. They are being bombarded continuously with media information on GM foods, and the messages from the mass media are being directly disseminated to the populace. This way of direct communication of information could be fraught with various challenges as Obidike (2011) observed including poor radio and television signals, and non availability of electricity supply in most villages. But clearly, farmers in the Ga South Municipality do not face these challenges. The problem with electricity is real, but most farmers rely on small radio sets that make use of batteries, hence even in communities without electricity, these farmers are able to get access to radio in order to get their information.

Farmers' reliance on radio more as their main source of information on agric subjects agrees with a study by Ndaghu *et. al.* (2013) that sought to assess the utilisation of mass communication

tools in disseminating agricultural information among farmers in the Adamawa State in Nigeria. Ndaghu *et. al.* (2013) attributed the situation in Adamawa state to high literacy rates there and high levels of income. The literacy rate in Ga South is not that high, but the several number of radio stations broadcasting in the local “Twi” and “Ga” languages mean farmers can still rely on radio for their information, despite the low literacy rates in the area.

The messages farmers in Ga South usually get from radio which is their main source of information on GM foods, may not exactly be aimed at educating them on the technology. This is because most of the radio stations in Accra do not have specific programmes that educate farmers on agricultural technology and for that matter GM food. Except that issues about GM foods feature regularly in news bulletins when there are demonstrations and court hearings over demands for a ban on them. So, most of the regular information about the technology farmers may be hearing on radio obviously would not give them in depth knowledge but just surface information. This to a certain extent confirms the low level of knowledge among most farmers in the area. When farmers were asked about which of the sources of information they preferred most, 28.4 percent said radio, 22.4 percent said colleague farmers, 19 percent said OFAB, 12.9 percent said opinion leaders and 12.1 percent said extension officers. Another indication the farmers appear excited themselves about information on GM foods reaching them directly from the mass media, instead of spreading through intermediaries.

5.4.1 Linkage between farmers' reliance on radio for information and majority rejection of GM foods

Although all the respondents to the survey have heard about GM foods, about 30 percent are convinced GM foods are good and health. When farmers were asked about their regular sources of information on the technology, majority of them (41.9 percent) mentioned radio. As the developer of the Diffusion of Innovation Theory Everett Rogers (2003) notes, the media alone are limited in their effectiveness towards individual or social change. Rather the media's role in spreading new information works perfectly if they complement other means of communication, particularly interpersonal. This is corroborated by the outcome of the study by Otu and Dauda (2011) which showed although majority (66.77%) of farmers in a Nigerian survey on their sources of agric information indicated they rely mainly on radio, 10.44% of them said they regularly apply what they hear in their work.

Mass media channels are necessary to disseminate messages of awareness of new possibilities and practices, but, when it is time to decide whether to adopt or not, personal communication is far more influential (Servaes 2002). It's interesting to note that despite OFAB's ongoing campaign which is an interpersonal one, 3.4 percent of farmers say they rely on OFAB as their regular source of information on GM foods. So, despite this district being an educational campaign zone for OFAB, most farmers are not really feeling their presence and are not exactly buying into their message. OFAB's campaign is hardly shaping their perceptions nor forming the major base of their knowledge as is evident in how most farmers got the quiz wrong when they were tested on the messages of OFAB.

5.4.2 Contradiction in farmers sources of GM Food information and general agric information

Interestingly, when farmers were asked about their major sources of information on agriculture generally, they pointed to the agric extension officers. The farming areas in the municipality have been divided into operational areas with each having an extension officer stationed there. The officers occasionally hold meetings with the farmers to educate them on new technology and good agricultural practices. About one third of all the farmers surveyed said they relied on the extension agents for their general agricultural information, that is, 36.8 percent, while 23.1 percent of farmers pointed to their colleague farmers, and 17.1 percent mentioned opinion leaders as their sources of agric information. But when it comes to the specific issue of GM foods, almost half of them (41.9 percent) rely mainly on radio. This agrees with a study by Zakaria (2014) which showed (76.7%) of leaders of farmers based organisations got their agricultural information from extension agents. But contrary results were seen when they were asked about their main sources of information on Genetically Modified crop technology. The study found that most (61.7%) of them get their information about GM crop mainly from the mass media, that is, radio and television. This is possibly because of the huge controversy the issue of GM foods has generated in the Ghanaian media, particularly radio.

The situation of farmers relying almost solely on mass media for their information is confirmed by the results of the survey question that sought to find out from farmers whether they share information on GM foods with their colleagues at all. About 12.7 percent of farmers indicated they often share information with colleagues on GM foods, with 27.1 percent saying they rarely share information on GM foods with farmers. This means interpersonal communication

regarding GM foods is hardly done by farmers, with most of them solely relying on mass media. This agrees with a claim by Rogers (1999) that mass media channels enable messages to reach a larger, diverse audience simultaneously within a shorter duration. This is useful mainly for awareness creation purposes. Demonstrations by Civil Society Groups opposed to GM foods, and court suits over its introduction have made the issue of GM foods topical discussions on mass media platforms, which the farmers appear to pay keen attention to. This may have fueled farmers' reliance on mass media for information on GM foods, compared to OFAB, their colleagues and extension officers.

What is clear from the above is that sometimes, the process of spreading innovations among farmers could be completely out of the control of extension agents who are primarily farmers' major sources of new technology. That may have been the case with the issue of GM foods in Ga South. Richerson (2011) observes one of the many limitations of the Diffusion of Innovation theory is that it does not integrate the overlapping effects of the different contexts and domains in which almost all new technology operates. The theory appears to abide by narrow, laid out historic principles without considering the fact that outside influences can interfere in the process.

5.5 Limitations of Study

The study focused on only five communities in one municipality. A multiplication of the study in other municipalities in different regions could have made it more representative of Ghana as a whole. The study collected data on gender and found out that 79 percent of respondents to the study were males, and 21 percent were females. But the issue of gender is not of interest to this

study, so no analysis was done on it. It is recommended that the issue of gender is explored in a further study to understand its dynamics in influencing the dissemination of information on GM foods.

5.6 Conclusion

The study investigated the dissemination of information on GM crops among farmers in the Ga South Municipality, using the Open Forum on Agricultural Biotechnology (OFAB's) educational campaign as the focus. The research revealed most farmers in the Ga South Municipality have low levels of knowledge on GM foods, although they know about it. The problem is that they lack in depth understanding of the technology. The study also revealed majority of farmers are convinced GM foods are unhealthy, would damage the environment and are bad. The study found that most farmers in the municipality rely on mass media mainly for information on GM foods. This is despite an ongoing campaign in the area by OFAB to educate them on GM foods and encourage them to accept the technology. But it's possible more farmers will accept the technology once Ghana officially starts producing GM foods in future. According to Rogers (1962), the higher the observability and communicability of results, the higher would be the rate of adoption. Once the benefits of GM foods become evident, that may inspire more farmers to accept it.

The study found that most farmers rely mainly on radio stations for their information on GM foods. Most farmers also have low levels of information on GM foods although all of them know about GM foods. Majority of the farmers are of the opinion that GM foods are not good and would not be ready to grow them on their farms. A number of reasons including literacy rates,

age, farmers' perception about public acceptability, among others could have accounted for this. Further studies on what residents in the Ga South Municipality know and think about GM foods could be conducted, so as to be able to properly align the views of farmers with that of their potential GM food customers.

5.7 Recommendation

It will be important for OFAB to take a second look at the nature of campaign it is running in the Ga South Municipality. It could look beyond the meetings it holds with farmers occasionally to discuss the benefits of the technology, and make more use of both community and commercial radio stations to educate farmers and the public. This is important because the evidence from this study shows the mass media, particularly radio is the dominant source of farmers' information on GM foods. But OFAB must also strengthen its inter personal communication activities with farmers, especially when it is clear that this is the better communication means to ensure acceptance. This is particularly important because the promises of higher income OFAB says GM foods will bring, can only manifest if farmers adopt the technology. Mefalopulos (2008) advises that sustainability in rural development interventions will depend heavily on the perception of the stakeholders towards the proposed change and their involvement in assessing and deciding about how the change can be accomplished. A proper shaping of perception of farmers will be necessary if the plan to introduce GM foods into the country would be a success.

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8) What do you know about how growing GM foods will affect the environment compared to growing traditional seeds?

- 1) It will damage the environment []
- 2) It will improve upon quality of environment []
- 3) Nothing will change []
- 4) Other (Please specify).....

9) What do you know about how consuming GM foods will affect one's health compared to growing traditional seeds?

- 1) It causes diseases []
- 2) It improves upon one's health []
- 3) Nothing changes []
- 4) Other (Please specify).....

Perception of farmers on GM foods

11) What do you think about GM foods? They are:

- 1) Good []
- 2) Bad []
- 3) Undecided []

12) Do you think growing GM seeds will increase your income?

- 1) Yes []
- 2) No []
- 3) Undecided []

13) Do you think consuming GM seeds will damage your health?

- 1) Yes []
- 2) No []
- 3) Undecided []

14) Do you think growing GM seeds will damage the environment?

- 1) Yes []
- 2) No []
- 3) Undecided []

15) Will you be ready to grow GM crops on your farm?

- 1) Yes []
- 2) No []
- 3) Undecided []

16) Do you think people will still buy your produce if you grow GM crops?

- 1) Yes []
- 2) No []
- 3) Unsure []

17) Do you trust in government's ability to appropriately regulate the production of GM crops in Ghana?

- 1) Yes []
- 2) Partially []
- 3) No []
- 4) Undecided []

Farmers' channels of information on GM Foods

18) Where do you generally get agric information from?

- 1) Radio and Television []

- 2) Print Media[]
- 3) Colleague farmers[]
- 4) Extension agents[]
- 5) Opinion Leaders []
- 6) Other.....

19) How did you first hear about GM foods? Through

- 1) Open Forum on Agricultural Biotechnology (OFAB) []
- 2) Radio[]
- 3) TV[]
- 4) Newspaper[]
- 5) Colleague farmers []
- 6)Extension agents[]
- 7)Opinion Leaders[]
- 8)Other.....

20) Apart from the above channels, which other channels do you regularly hear about GM Foods from? Through

- 1)OFAB[]
- 2)Radio[]
- 3)TV[]
- 4)Newspaper[]
- 5)Colleague farmers[]
- 6)Extension agents[]
- 7)Opinion Leaders []
- 8)Other (Please specify).....

21) Which of these platforms do you see as your most preferred source of information on GM Foods?

- 1)OFAB[]
- 2)Radio[]
- 3)TV[]
- 4)Newspaper[]
- 5)Colleague farmers[]
- 6)Extension agents[]
- 7)Opinion Leaders []