UNIVERSITY OF CAPE COAST

FARMERS' PERCEPTION OF THE EFFECTIVENESS OF AGRICULTURAL EXTENSION SERVICES PROVIDED BY THE MINISTRY OF FOOD AND AGRICULTURE AND NGOs IN THE CENTRAL REGION OF GHANA

BY

COSMAS KWEKU ADJETEY MARSHALL

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ABSTRACT

Since independence in 1957, the government of Ghana has dominated and monopolised the supply of physical infrastructure, credit, research, extension and marketing systems for agriculture. However, escalating budget deficits is compelling the government to consider privatisation or private participation of agricultural extension services. However, with the growth in the participation of a third party such as Non-governmental organisations (NGOs) in the supply and financing of extension services in Ghana, there is therefore the need to conduct a study to determine if the involvement of NGOs has affected farmers' perception about the effectiveness of agricultural extension services in the Central Region.

A descriptive survey design was used for the study. Multistage cluster sampling was used to select three districts namely Cape Coast, Abura-Asebu-Kwamankese, and Twifo-Hemang Lower Denkyira. Stratified random sampling was then used to select 150 farmers based on operational area, type of service provider and sex.

The results showed that there were six NGOs engaged in agricultural extension activities in the study districts of the Central Region. However, through collaboration, the Ministry of Food and Agriculture (MoFA) extension staff provided services to NGO farmers. The most widely used form of interaction between MoFA and NGOs involved in agricultural activities was that of collaboration and this was rated as good.

it was found out that over 60% of the farmers interviewed were aware of the existence of most of the 19 basic agriculture technologies studied. Whilst very basic technologies, such as the use of improved varieties, timely weeding and inorganic fertilizers were perceived as good, those for line planting and agro-chemical storage were perceived as fair. All the technologies on livestock production were perceived as poor. Type of service provider (MoFA or NGO) did not significantly affect farmers' perception about extension effectiveness. The independent farmers demographic variables could only explain up to a maximum of 40% of observed variance for the dependent effectiveness variables.

Whilst education was the best predictor for the use of improved varieties and neem storage products, farm size was the best predictor variable for row planting, agro-pesticides, agro-chemical storage and improved maize crib storage. The best predictor variable for all the technologies studied on livestock production was total number (types) of livestock raised. Subsequently, the maximum unique significant contribution made by any best predictor variable was 33.1% for crops and 32.7% for livestock technologies. Sixty percent (61%) of the farmers' interviewed were willing to pay for extension advice. Of this, 54% were willing to pay up to 10% of the cost.

The recommendations of this study include;

- NGOs should employ their own permanent extension staff for the duration of their time-bound projects. The current practice of NGOs using MoFA extension staff without appropriate emoluments is a disincentive for enhanced performance.

- Government should begin to look into the issue of privatisation or private participation of extension services possibly through the contract extension system.

CANDIDATE'S DECLARATION

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Cosmas Kweku Adjetey Marshall............ Date 23-08-2005
(Candidate)

SUPERVISORS' DECLARATION

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Dr. J.A. Kwarteng........................ Date 25/08/05
(Principal Supervisor)

Dr. Moses Zinnah .... Date 23-08-2005
(Supervisor)

Dr. J.V. Mensah .... Date 23-08-2005
(Supervisor)

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DEDICATION

This thesis is dedicated to:

- My son, Joseph Marshall
- My daughters, Rose-Mary and Patience Marshall
- My wife, Seraphim Agbley
- My mother Malwine Abra Kudzete
- The memory of my late father, Mr. Lawrence Ogbeh who died in 1989.

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DEFINITION OF TERMS

Non-Governmental Organisations (NGOs). An Agricultural NGO is any organization, or establishment, which is not funded by the state but is involved in the provision of agricultural related services to any group of people solely on humanitarian or cooperative rather than for profit purposes.

Public Sector. The Ministry of Food and Agriculture (MoFA) that provides agricultural extension services represent the Public sector.

Extension Service. The operational definition of extension for this study is the exchange of agricultural information to enhance the productive capacity of farmers.

Interaction. This term refers to relationships that either encourage or discourage lines of communication between extension service providers.

Cooperation. The act of agricultural extension service providers working together for a shared purpose.

Consultation: Agricultural service providers meeting to exchange opinions, ideas and information about services they provide to farmers.

Confrontation. Act of public and NGO extension service providers working against one another.

Competition The struggle of one service provider to gain advantage over another service provider.

Delegation An extension service provider asking another service provider to discharge its legal functions.

Effectiveness. In this study, it refers to

- Awareness of an existing agricultural extension information or technology.
- Extent to which an agricultural extension information or technology is relevant to the farmer.
- Extent to which an agricultural extension information or technology provided is adequate to the farmer.
- Extent to which inputs are available to go with agricultural extension information or technology.
- Extent to which an agricultural extension information or technology has been adopted.
- Extent of output achieved for adopting agricultural extension information or technology.
- Extent of cost of inputs to go with agricultural extension information or technology.

ABBREVIATIONS

ADRA	Adventist Development and Relief Agency
AgSSIP	Agricultural Services Sub-Sector Investment Programme
BOPP	Benso Oil Palm Plantation
COCOBOD	Ghana Cocoa Board
CSIR	Council for Scientific and Industrial Research
CTA	Agency for Cultural and Technical Cooperation
CYMMIT	International Maize and Wheat Improvement Centre
FAO	Food and Agriculture Organization
GNAFF	Ghana Association of Farmers and Fishermen
GOPDC	Ghana Oil-Palm Development Corporation
GTZ	German Technical Cooperation
IFAD	International Fund for Agricultural Development
MoFA	Ministry of Food and Agriculture
NARP	National Agricultural Research Programme
NGO	Non-Governmental Organization
NRI	Natural Resources Institute
N.P.K.	Nitrogen, Phosphorus, Potassium Compound Fertilizer
ODI	Overseas Development Institute
SAA	Sasakawa Africa Association
SG 2000	Sasakawa-Global 2000
SSA	Soil Science Assiociation
TOPP	Twifo Oil Palm Plantation
UCC	University of Cape Coast

WVI World Vision International

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

After gaining independence, most developing nations including Ghana chose the statist models of development. Under these models, the public sector controlled all important aspects of the economy. In the agricultural sector for instance, the successive governments dominated and monopolised the supply of physical infrastructure, credit, research, extension, and marketing systems. They did this either directly or through specially established agricultural parastatals. As a result of this, many people think that extension and government are inseparable.

As noted by Rivera (1996), agriculture for most developing countries is and will remain in the foreseeable future, the main source of income for large numbers of people. It provides the basic food and subsistence needs for the majority of the population. Governments have played very important roles in the provision of agricultural extension services.

This is as a result of the importance of extension in agricultural development. Economic impact studies of agricultural extension have revealed very impressive effects in the areas of technology adoption, farm productivity and farm profits (Birkaeuser, Evenson and Feder 1991). Birkaeuser et al. (1991) further indicated that in 47 studies of extension impact on agriculture, 33 cases had a significant positive extension effects. The rates of returns to extension varied across countries and commodities.

Ranges were 13 to 500 percent in Brazil, 75 to 90 percent in Paraguay, 100 to 110 percent in the United States and 14 to 15 percent in two states over two time periods in India. Asia, Africa and Latin America showed returns of between 34 to 80 percent.

Unfortunately, escalating budget deficits in both developed and developing countries, coupled with the problems of poor implementation of publicly funded programmes, governments have or are redirecting attention towards how to make extension cost effective and responsive to specific farmer needs. In this direction, most governments are thus compelled to consider the privatisation or private participation of agricultural extension services (Rivera, 1996). However, the privatisation or private participation of traditionally publicly provided agricultural services raises several related questions.

According to Umali and Schwartz (1994), these questions include:

- Will the private sector delivery of fee for extension service lead to efficiency and equity?
- What are the social and income distributional implications of privatisation or private participation in terms of access to the service by small-scale farmers and the rural poor?
- What roles can non-profit and non-governmental organizations play in this scenario?
- Are there potential complementarities among public, private, non-profit and non-governmental sector activities?
- If complementarities exist, how can these linkages be enhanced?

Swanson and Sammy (2000) argue that financial, and manpower constraints would continue to limit the effective extension delivery process by the public sector. It was stressed that the public sector has been less effective in responding to the basic educational and technical needs of the small-scale farmers. This is often attributed to a lack of continuous flow of appropriate technology. The private sector is also selective in its clientele for extension services and also deals mostly with clients who can afford to pay for services. As a result of these shortcomings on the part of the public and private sectors, the participation of other third party institutions such as NGOs in the provision of agricultural extension services becomes crucial.

In the rural areas, especially those classified as complex, diverse and risk-prone, the majority of farmers cannot afford to buy extension advice. In such areas, government service systems are also very weak. Under such circumstances, NGOs may be the main providers of extension services. According to Amarnor and Farrington (1991), NGOs do not only provide extension services themselves but are also responsible for developing many of the methodologies for research and extension work which are subsequently adopted by the public sector. It is also argued that NGOs have a comparative advantage in working with small and marginalised farmers including women. It is, therefore, anticipated that the active participation of NGOs may ensure that more subsistence farmers who form the bulk of Ghana's agriculture production system can be reached. Despite these merits, NGOs lack the technical expertise to play an effective role in technology transfer (Swanson and Sammy, 2000).

The unresolved question is this: Would the hybridisation of the merits of the public and NGO sector extension delivery systems result in an enhanced effective agricultural extension system in Ghana? If yes, what linkages need to exist between the two sectors?

In Ghana, limited studies have been done to assess the agricultural extension activities of NGOs (Amanor and Farrington, 1991). However, there has not been a comparative study about the two sectors. Even though, literature abounds on some successes of NGO agricultural extension activities in other developing countries, there is often a caution on location specificity. Instances are the Aga Khan Rural Support Project (AKRSP) in Gujarat India, Se Servir de la Saison Seche en Savanne et en Sahel which promotes village level organizations, assists village groups to develop programmes, provides funding and technical assistance for projects (Amanor and Farrington 1991; Farrington, 1997 and Brache, 1999).

1.2 Justification of the Study

The agricultural extension system in Ghana is characterised by a variety of extension service providers. These extension service providers can be grouped into five categories as follows;

- Government institutions represented by Directorate of Agricultural Extension Services (DAES).
- Parastatals such as COCOBOD
- Private organizations such as Cotton companies, Pineapple exporters etc.

- NGOs such as SG 2000, Techno Serve, World Vision International, ADRA. etc.
- Cooperatives and Farmer associations such as Ghana National Association of Farmers and Fishermen (GNAFF).

It is worthy to note that each of these groups of agricultural service providers is beset with problems. Whereas the public sector represented by DAES has the mandate to provide extension services to all farmers in the country, evidence suggests that only 15 percent of farmers are currently using improved and appropriate technologies. Under Ghana's Vision 2020 programme, DAES's goal is to enable 50 percent of farmers use improved and appropriate technologies, (Albert, Braun, Donkoh Loos and Schill, 1999).

The private sector has also been well documented to be highly selective in its clientele for extension services. The private sector would supply a particular extension service only if reasonable returns can be made (Umali and Schwartz, 1994). This scenario implies that the small-scale subsistence farmer who forms the bulk of the farming population in Ghana falls outside the catch net of the private sector. As such, the participation of a third party service provider such as NGOs, especially where the service is free, is most welcome and a relief to the over stretched government resources.

As noted by Farrington (1997), donors have now begun to call for more NGO involvement in programmes that have traditionally been implemented by the public sector. This has been backed by an upsurge of donor interest in direct funding of South-based NGOs. It is, therefore, very important to determine how the recipients of extension services perceive the effectiveness of these services because this might have an influence on adoption of technologies and, consequently, on output levels.

Limited studies have been conducted in Ghana to assess farmers' perceived effectiveness of agricultural extension activities of the public sector and NGOs. Therefore, with the current influx and media prominence of NGO activities in the agricultural sector, it has become paramount to study and compare how farmers perceive the effectiveness of services received from these service providers. The end result of this study would be the basis for a more effective and efficient collaborative extension network in Ghana with associated improvement in agricultural output.

1.3 Statement of the Problem

As noted in the government of Ghana's Vision 2020, Ghana is to be transformed from the current low income rating to a prosperous middle income rating by the year 2020. MoFA's goal in this vision is to increase the agricultural sector annual growth rate from the current 2% to 3% during the 1990-1996 period to 6% by the year 2020. For these targets to be achieved, the Directorate of Agricultural Extension Services (DAES) is expected to increase the number of farmers using improved and appropriate technologies from the current 15% to 50% by the year 2020.

In Ghana, the last decade has seen an upsurge in private sector activity in extension service provision. Producer organizations, buyers, processing and export companies provide extension services to farmers for specific agricultural commodities e.g. cocoa, cotton, oil palm, pineapple and vegetables. The costs of such services are recovered through service charges deducted from payments to farmers at the time of sale. Asibey-Bonsu and Posamentier (2001) noted a growth in the involvement of NGOs in the supply and financing of extension services in Ghana. This increasing involvement of the private sector and NGOs in extension service delivery is expected to result in larger farmer coverage.

Swanson and Sammy (2000) therefore argue that, if NGOs work in collaboration with the public sector extension and with supportive government policies and resources, they could be more effective in helping resource poor farmers gain access to resources and technologies. Preliminary investigations revealed that NGOs did not have personnel trained in agriculture.

Therefore, some of the issues that this study seeks to address are:

- Will NGOs succeed where the public sector seemed to have failed?
- Are farmers receiving the type of extension services they require from both the public and NGO sectors?
- Are there any prospects of the subsistent farmer being able to pay for extension services under privitasation or private participation?
- How do farmers perceive the effectiveness of extension services they receive?

1.4: Hypotheses

The study seeks to determine if any relationship exits as stated below.

1. Ho: MoFA and NGO farmers do not differ significantly on their demographic characteristics.

   H_1: MoFA and NGO farmers do differ significantly on their demographic characteristics.

2. Ho: Type of service provider does not significantly affect farmers perceived level of effectiveness for extension services.

   H_1: Type of service provider does significantly affect farmers perceived level of effectiveness for extension service.

3. H_0: Sex does not significantly affect farmers perceived level of effectiveness for extension services.

   H_1 Sex does significantly affect farmers perceived level of effectiveness for extension services.

4. H_0: Residential status of farmers does not significantly affect their perceived level of effectiveness for extension services.

   H_1: Residential status of farmers does significantly affect their perceived level of effectiveness for extension services.

1.5 Research Questions

1. Which NGOs are providing agricultural extension services to farmers in Central Region of Ghana?
2. What are the human resource capabilities of MoFA at the district levels in the Central Region?
3. What are the demographic characteristics of farmers participating in the public sector and NGO extension programmes?
4. What types of interactions exist between the public sector and NGO extension service providers?

5. What are farmers' perceptions about the effectiveness of agricultural extension information or technology provided by MoFA and NGOs?

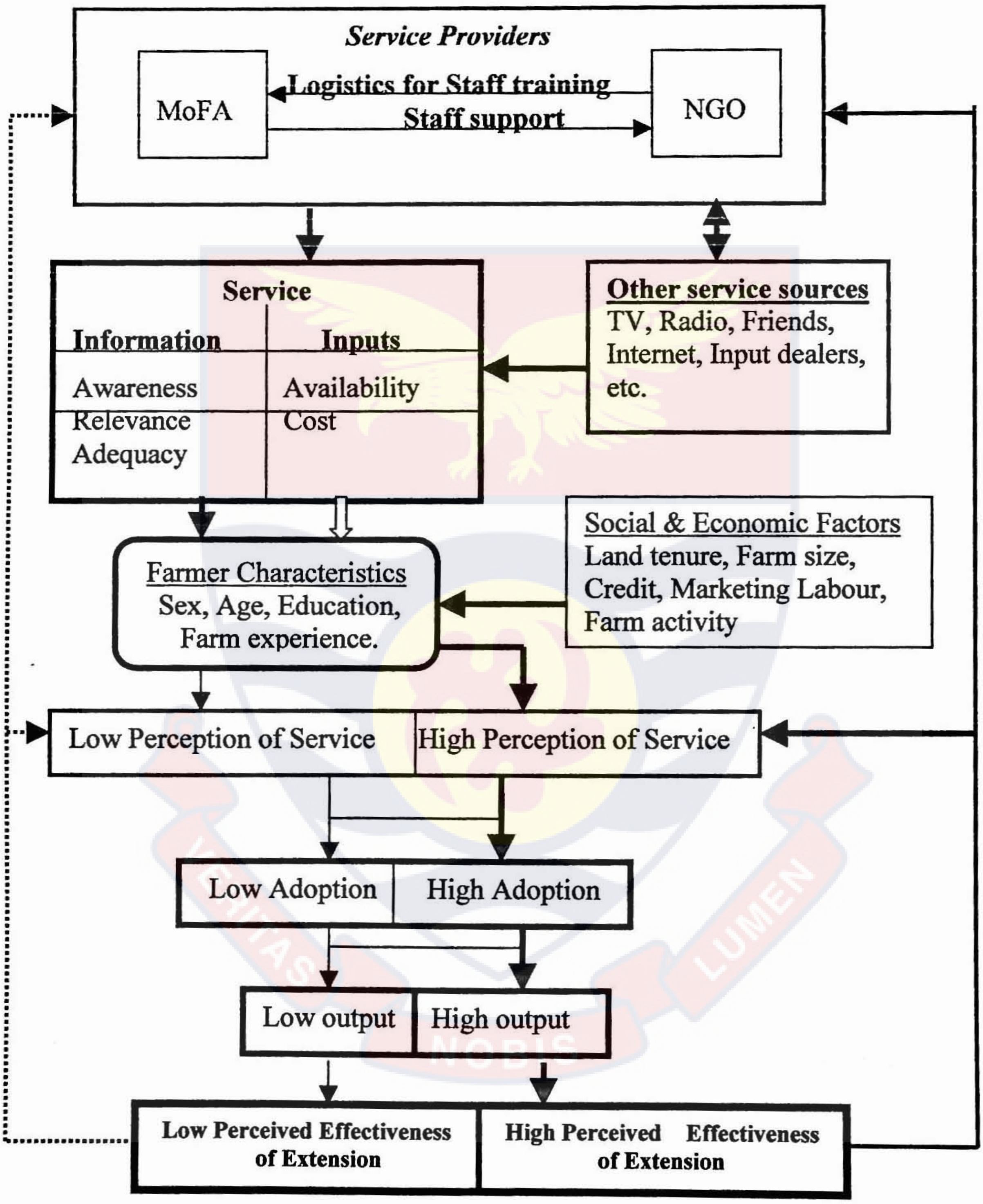
6. Would farmers be willing to pay for extension services under privatisation or private participation?

1.6: Conceptual Framework of Farmers' Perception of the Effectiveness of Agricultural Extension Services.

This section presents a conceptual framework (Fig. 1), which directed the study on farmers' perception of the effectiveness of agricultural extension services in the Central Region of Ghana as provided by MoFA and NGOs. The two key ingredients underlying the framework are perception and effectiveness. Basically, an extension service delivery system consists of a service provider creating the awareness of an improved technology or the client demanding an improved service.

The service may be in the form of information, inputs or both. Consequently, a client, who becomes aware of the technology, considers the relevance and adequacy of such information (Rogers, 1983); the availability (Adams, 1992) and cost of inputs (FAO, 1984) to the farming enterprise. In addition, any decision for adoption or non-adoption of a particular technology by a farmer is greatly influenced by social demographic characteristics such as age (CMMYT, 1993), education (Griliches, 1964; Chandri, 1968; Rogers, 1983) and farm size (Feder and Slade, 1985). These social demographic characteristics are the basis for impression or perception formation.

Fig. 1: Conceptual framework of farmers' perception of the effectiveness of agricultural extension services



....▶ Discontinuance ⟹ May or may not be part of package.

Source: Author's construct, 2002

They provide past experiences upon which impressions are made. An envisaged higher output level from a technology becomes the motivation for adoption.

Consequently, the actual net surplus (profitability) in the input-output domain eventually becomes the parameter for determining the effectiveness level of that particular agricultural extension technology which is based on perception because it is subjective.

As noted by Crooks and Stein (cited in Mensah, 2003), perception is subjective and it varies from one person to another. A high perceived effectiveness level for a particular technology would lead to a continuation in the adoption process and vice versa.

Wortman, Loftus and Marshall (1992) emphasised that learning and experience mould our expectations, which invariably shape our perceptions. They further stated that a perceptual set could also arise from what other people tell us. Chilonda and Van Huylenbrock (2001) observed that we code and decode messages and events using the code of past experiences locked up deep within us. Cultural psychologists have therefore argued that since people in various cultures have very different every day experiences, there should be differences in people's perception of some objects, events and, in this case, services (Zimbardo and Weber, 1997). Franzoi (1996) stated that the way we seek to know and understand other persons and events is termed social perception, which is the objective of this study. He further stated that impression formation is the process by which one integrates various sources of information about another, an event, a system or an object into an overall judgement. This process is viewed as a dynamic one with judgement being continually updated in response to new information. This forms the basis for feedback from perceived effectiveness to service provider and farmer in Fig 1.

With regard to effectiveness, Georgopoulous and Tannenbaum (1957) stated that an organizational effectiveness is the extent to which an establishment, given certain resources and means, fulfils its goals without incapacitating its means and resources and placing undue strain upon its members. FAO (1995) also noted that an effective extension is recognized as a pivot to achieving a sustained agricultural development for increased food production. On this basis, the effectiveness of agricultural extension as a functional concept would mean the ability of a service provider be it MoFA, an NGO or a private entity, as an establishment to meet the aspirations of farmers with resources available. The primary goal of extension is output maximisation.

The main assumption underlying the study framework is that;

The effectiveness of extension services provided is based mainly on the perception of the farmer in terms of the extent to which desired outcomes are obtained. For this study, it is higher output.

In any agricultural extension delivery system, the key players are the client (farmer) and the service provider. It is, however, acknowledged that farmers may have other sources of agricultural extension information such as TV, radio, farmer's friends and Internet (Rangaswamy, Rangaswamy, and Guruswami, 1972).

At the level of service providers, there is some level of interaction between MoFA, NGOs and others as depicted in Fig. 1. The interaction may be direct or indirect. Whereas some NGOs may offer training to MoFA staff, others provide logistics for the training. Most of the information provided by the mass media sources is contribution through collaboration with the public sector, universities and other research institutions. Most NGOs do not employ their own extension staff hence their reliance on MoFA extension staff.

As shown in Fig. 1, agricultural extension has two parts namely, information and input components. Until the introduction of training and visit extension concept into Ghana in 1992, both information and input components were delivered as one package. However, most NGOs still adopt this approach. Where inputs are not tied up with agricultural extension information, farmers could access these on the open market.

Based on the information-input component extension system, seven variables including level of adoption and level of output were used to determine the level of extension effectiveness. Several authors including Mosher (1966); Rogers (1983); and Ekong (1988) identified awareness, relevance and adoption in the technology adoption process. Fig.1 shows some farmer characteristics and socio-economic characteristics that enable farmers make informed decision for adoption or non-adoption of extension service. These farmer characteristics include sex (Olawoye, 1993); education (Chandri, 1968); age (Akinola, 1986). Some socio-economic characteristics are farm size (Arnon, 1981);output (Chandri, 1968); land tenure (Basu, 1969) and source of information (Williams and Williams, 1971).

The service, farmer characteristics and information, input, and socio-economic characteristics modules constitute what this study terms "service mix". The farmer characteristics and socio-economic characteristics modules enhance the critical analysis of the service module. As illustrated in Fig. 1, the farmer characteristics and socio-economic characteristics provide the experience pool from which perception is formed. The outcome from the service mix is based on perceptions developed over a time period and held by the farmer as elucidated by Wortman et al.., (1972); Franzio, (1995); Zimbardo and Weber, (1997); and Chilonda and Van Huylenbrock (2001). As soon as perception is formed about a service, a decision for adoption or non-adoption is made. A low perception of a service may result in no adoption, low level of adoption such as line planting for maize without the use of fertilizer or adopting full service package but on a small scale. A high perception of a service may result in full service package and large-scale adoption, full service package but small-scale adoption, part service package but large-scale adoption or any of the other combinations.

The effectiveness of agricultural extension service is closely linked to the adoption-output variables. As indicated in Fig 1, a low level adoption may result in a high or low output. Similarly, a high level of adoption may result in a low or high output. However, if output for any level of adoption were low without any justified cause, perceived level of extension effectiveness would also be low. There is the likelihood that the farmer may discontinue adopting that particular service after critical evaluation. This situation may also serve as a hindrance to the adoption of subsequent extension service.

Putting a level on the effectiveness of an extension technology is the final stage in the entire extension service delivery process. Within the context of this study, a high output would result in high perception effectiveness of extension and enhance the critical analysis of the service module. As illustrated in Fig. 1, the farmer characteristics and socio-economic characteristics provide the experience pool from which perception is formed. The outcome from the service mix is based on perceptions developed over a time period and held by the farmer as elucidated by Wortman et al.., (1972); Franzio, (1995); Zimbardo and Weber, (1997); and Chilonda and Van Huylenbrock (2001). As soon as perception is formed about a service, a decision for adoption or non-adoption is made. A low perception of a service may result in no adoption, low level of adoption such as line planting for maize without the use of fertilizer or adopting full service package but on a small scale. A high perception of a service may result in full service package and large-scale adoption, full service package but small-scale adoption, part service package but large-scale adoption or any of the other combinations.

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Putting a level on the effectiveness of an extension technology is the final stage in the entire extension service delivery process. Within the context of this study, a high output would result in high perception effectiveness of extension and vice versa. Favourably perceived extension effectiveness on the part of the farmer is required to keep the extension service delivery process functional. However, both client and service provider require this extension effectiveness feedback for further evaluation.

1.7 Objectives of the Study

The general objective of the study is to compare farmers' perceived effectiveness of extension services provided by the Public Sector and by the NGOs in the Central Region of Ghana.

The specific objectives were to:

1. Identify NGOs that are providing agricultural extension services to farmers in the Central Region of Ghana.
2. Determine the human resource capabilities of MoFA at the district level
3. Examine the demographic characteristics of farmers' participating in Public sector and NGO extension programmes.
4. Find out levels of interactions between the Public sector and NGOs in their service delivery.
5. Evaluate farmers perceived level of extension effectiveness on some basic crop production, crop storage and livestock producing agricultural extension information or technologies.
6. Determine the relationships between some farmer demographic characteristics and their perceived extension effectiveness on some basic agricultural technologies or information

7. Identify the best predictors of the variance in the dependent effectiveness variable with some independent farmer demographic variables
8. Examine the proportion and extent to which farmers would be willing to pay for extension services.

1.8 Limitations of the Study

The main limitation of the study was financial. This greatly influenced the number of districts, operational areas within the districts, communities and eventual number of farmers that were selected. Another limitation was the unwillingness of some farmers to participate in the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Historically, in most developing countries, the organization of agricultural extension programs has been the exclusive domain of the public sector. This phenomenon could be attributed to the statist model of development charted by these countries after gaining independence. Under the statist models of development, the public sector controlled all important aspects of the economy. In the agricultural sector, governments of developing nations dominated and monopolised the supply of infrastructure, research, credit, extension and marketing systems. However, according to Umali and Schwartz (1994), escalating budget deficits in developed and developing nations, coupled with the problem of poor governance of public programs, donor unwillingness to fund and subsidise large scale public sector recurrent expenditure, extension services suffered from under financing, staffing shortages and contracting.

In Ghana, for instance, apart from the public sector, the following have been identified as providers of extension services (Albert, et al., 1999):

- Private organizations e.g. Cotton companies, Pineapple exporters etc.
- NGO such as SG2000, Techno Serve, ADRA, World Vision; and
- Cooperatives and Farmer Associations e.g. Ghana National Association of Farmers and Fishermen (GNAFF), Citrus Growers Association, etc.

2.2. Basic Agricultural Extension Information or Technologies

The following are considered the most basic information or technologies required for any meaningful improvement in increasing agricultural production.

- Use of improved or modern varieties (MVs) and improved livestock breeds.
- Row planting.
- Plant stand and Germination test.
- Timely pest and disease control.
- Use of manures and fertilizers.
- Appropriate storage.
- Agro -forestry

2.2. 1 Use of Modern or Improved Varieties

Lipton and Longhurst (1989) noted that research confirms that MVs do tend to reach subsistence farmers, reduce risks, raise employment and restrain food prices. An outstanding example of how MVs transformed the land, its plants and its productivity was noted in Punjab. During the crop year of 1965-6, 1.55 million hectares were planted to wheat and 0.29million hectares to rice. Yields were 1.2 tonnes and 1.0 tonne per hectare respectively. Combined land cropped was 38 percent. In the crop year of 1980-81, farmers increased cropped area to 59 percent. MVs transformed yields to 2.73 tonnes (228%) and 2.74 tonnes (274%) per hectares for wheat and rice respectively. It was noted that MVs were usually good for small farmers as well as big ones in terms of levels of employment, returns to landowners, food availability to consumers and farm incomes.

According to Lipton and Longhurst (1989), the physical and chemical characteristics of MVs were selected to make more efficient and more stable use of sunlight, water and plant nutrients, even when farmers cannot afford to buy many inputs that normally go with their use. MVs in most environments outyield traditional varieties even at low levels of inputs and management. Many MVs owe their good average performance precisely to greater avoidance of risks, better capacity to cope with disease attack and moisture stress. However, the narrow range of genetic materials in some MVs increases the long run risk that some variety of insects or fungus will favour and destroy many of them. Soil mining due MVs may be due to high-output and low-input strategies.

Despite very strong arguments in favour of improved varieties, most of the qualities of MVs especially cereals (maize and rice), tuber (cassava) plantain-bananas and legumes (cowpea) have found little or no acceptability with most people especially the subsistence farmer and consumers. Some reasons cited for non-adoption are uncertainty. Lipton and Longhurst (1989) noted that although MVs reduce risks objectively, smaller farmers are likely to know less about them than more popular traditional varieties.

How improved varieties would perform if rain or pest attack were unfortunate is uncertain because smaller farmers enjoy less extension advice. Very substantial gains in profitability from MVs usually require higher input levels. In Ghana, MVs of maize that did not find favour with farmers include *Laposta*, Mexico, Composite-4 due to high chaff contents. Storage problems are also often cited for non-adoption. In most rural communities, people would only patronize the current MV of *Obatampa* and *Dorbidi* after the local varieties are completely sold out (personal observation). Similarly, low resistance of improved poultry breeds to Newcastle disease under village conditions makes them less likely to be adopted by subsistence farmers who cannot afford or do not have access to regular vaccination schedules.

2.2.2 Row Planting

Row or line planting is considered an agricultural technology because it is introduced with MVs. This low-cost input technology has been demonstrated to have very profound effects on crop production by ensuring that

- Plants get adequate space for growth.
- Optimum plant density is achieved thus avoiding low or excess plant densities normally associated with random planting.
- Weeds, disease control and harvesting operations are enhanced.

2.2.3 Plant Stand and Germination Test

This refers to the number of plants per stand. For cereals like maize, the recommendation is two plants per stand. However, observations have revealed that a high proportion of farmers have five to seven plants per stand. This practice results in stiff competition among plants resulting in some plant not producing cobs at all. The result is low yield per unit area. The issue of right plant stand may be associated with germination test. The inability of farmers to perform germination test coupled with some farmers using farmer grown seeds of traditional varieties results in having several seeds per stand to reduce the risk of some not germinating. This is complete waste of resources.

2.2.4 Timely Weed Control

The problem of weeds when considered on a worldwide scale is enormous. The sophisticated agricultural methods employed in much of the developed world tend to prevent our noticing the problem. However, the enormous annual bill for herbicides and considerable crop losses due to uncontrolled weeds will testify about the problems farmers have with weeds (Hill, 1977). In areas without access to herbicide technology as pertaining in Ghana, a very significant part of the physical process of cropping is still devoted to the relentless task of manual weed control.

Weeds cause losses and inconvenience to man and in many ways, but one to which attention is mostly directed is loss of crop yield. Losses of fruit crops due to weeds in Africa are given as 25%, pest and diseases combined 27.4% (Hill, 1977). Weeds may affect man's agricultural activities in many of the following ways.

- Weeds may be parasitic on crops;
- Weeds may be poisonous to livestock;
- Interference with the functioning of farm machinery or tools at harvest;
- Reduction in quality;
- Weeds may act as host for pest and diseases which affect crop plants;

As a result of the above that the timely weed control is considered very important in farming.

2.2.5 Plantain Paring

Plant parasitic nematodes such as *Pratylenchus goodeyi, Radopholous similes, Helicotylenchus multicinctus* and *Cosmopolites sordidus* (banana weevil) are obnoxious pest threatening banana and plantain cultivation (Prasad and Seshu-Reddy, 1994). Plant nematodes are root parasites, which cause lesions that are rapidly invaded by fungi and bacteria. Heavy nematode infestation leads to:

- A poorly developed root system.
- General weakening of the plant.
- Retarded growth of the plant.
- Production of small, poorly formed bunches.

The banana weevil is the main insect pest of plantain (CTA, 1987). The female weevil lays eggs in the upper part of the corm by burrowing tunnels, which in turn weakens it, and plants fall over or produce only small bunches, which are often deformed.

Paring in planting or banana production is a pest control measure aimed at eliminating nematodes and banana weevils. It basically involves using a sharp knife or cutlass to peel off all damaged part of the corm leaving only a white corm. When properly done, this process alone, without additional hot-water treatment ensures virtually nematode and weevil-free planting materials.

2.2.6 Inorganic Fertilizers and Organic Manures

Fertilizers and manures are used in agriculture to supplement the nutrients requirements for plants. The result is usually an increase in yield, which sometimes is spectacular. For efficient growth, the plant needs a range of essential elements in addition to the carbon, hydrogen and oxygen, which compose most of it. Food nutrients such as nitrogen, potassium and phosphorus are needed in large quantities. Others such as copper and molybdenum are required in smaller amounts termed traces or minor elements.

Manure is a term used to describe bulky organic materials, mainly plant residues and animal excreta. These are returned to the soil either directly or after some processing. The concentration of plant nutrients in manures is low; as such large quantities are needed to supply an appreciable part of the nutrient requirements of the plant. Manures have two functions. In a decomposed form as humus, manures persists in the soil and improves its physical properties. Primarily, manures supply a wide spectrum of plant nutrients derived from the residues of which they are composed. Manures most widely used are animal by-products such as farmyard manure.

Fertilizer is used to describe materials mainly inorganic and synthetic, which are rich in one or more of the essential plant nutrients. Most modern fertilizers are supplied in water-soluble forms to ensure rapid availability. They include a wide range of compounds in the form of nitrates, ammonium salts and urea, water-soluble phosphates and potassium salts such as potassium chloride.

The need for fertilizer and manures to support our current levels of cropping is evident on many soils if a small area is missed during application.

The use of Nitrogen-Phosphorous–Potassium (N.P.K) fertilizers have brought about very large increases in yield of crops. However, this could not have been achieved without the parallel improvement in weeds, diseases and pests control and the use of growth regulators and plant breeding.

Despite the various merits associated with fertilizer use, opponents of fertilizer usage describe fertilizers as "poison" affecting even the quality of food. In such cases, there has usually been gross abuse of fertilizers in terms of incorrect usage or excess. If fertilizers are properly used, the nutrients they contain become virtually indistinguishable within a few days of application from what was already in the soil (Ken, 1986).

2:2.7 Agro-forestry

Agro-forestry is a new term, but the practice of resource management, which includes trees and crops, is certainly not new to farmers in West Africa. Despite pressures by agricultural extension agents and foresters towards monoculture production, many subsistence farmers have persisted in agro-forestry practices, modifying them in relation to changing resources and demands.

According to Djarbeng and Ameyaw (2002), agro-forestry is a collective name for various land use systems and technologies in which woody perennials (trees, shrubs, palms, bamboo, etc) are deliberately combined on the same land management unit with herbaceous crops and or animals either in some form of spatial arrangement or temporal sequence. A good agro-forestry system should ensure increases in productivity, sustainability and adoption of practices. The trees and shrubs employed such as mangoes, cashew, and pawpaw, produce fruits.

In the Central Region, wood lots established with *Cassia siamea* have become the main source of charcoal production. In the Tolon-Kunbungu district, project farmers harvest poles to stake yams, rafters and timber for construction as well as sell to generate income. The adoption of agro-forestry has contributed to improvement of soil moisture, fertility, increased protection from erosion, loss of nutrients and the restoration of degraded soils. They indicated that crop yields have increased from a base-line figure of 400 kg per acre to 1,223 kg in 1999 with minimal application of chemical fertilizers at 50 kg per acre. Participatory discussion with farmers showed that cassia, teak, neem, Eucalyptus, *Leucaena leucocephela* and *Albizia lebbeck* are the most preferred species.

As noted by Ankrah (1996), firewood and charcoal are the most important domestic sources of heat energy in the savanna regions of Ghana. These account for more than 80% of the total fuel energy used in both the urban and rural areas in the savanna zones. Agro-processing activities such as fish smoking, *gari* roasting, bread baking, and *kenkey* making which are employment avenues are entirely dependent on firewood.

In the Northern savanna zone, ADRA clients grow a mixture of fruit trees and woody species on the same plot in alternating rows. Cereals and legumes are then cultivated between the wide rows of trees. ADRA in the Northern savanna zone is working with more than 3,000 farmers, made up of 174 communities in nine districts and 42% of these are females. Estimated acreage under wood lot production is 1,670 acres.

Chowdhry (2002) indicated that India has an area of over 300 million hectares of which 150 million is not used for agriculture. Twenty percent of this is either in the high Himalayas above the tree line or in arid deserts where plant life can hardly be sustained. Of the remaining 120 million hectares, about one-third is in reserved forests under the direct management of state forestry departments; the remaining two-thirds are under private ownership or are village and revenue lands. These lands, which are undergoing rapid degradation, are classified as waste lands although they are highly suitable for fuel and fodder trees. He argued that if such lands could be brought into productive potential through programmes of social and agro-forestry, the problem of energy and ecology as well as the issues of unemployment and income generation for the poor could be resolved.

King (1968) noted that the soil enriching impact of trees is one of the principal economic incentives to participation in *taungya* and *taungya*-type rotational systems within the forest. On economic cost and constraints militating against agro-forestry systems, Arnold (1983) noted the growing competition for land under pressures of expanding populations. Though trees constitute a productive element in so many traditional agricultural systems in the tropics and are essential for sustained production from the land, as land becomes scarcer, the overriding need to produce food and income in the short term naturally takes precedence over these longer-term values.

As such, any introduced agro-forestry system should have the potential to meet these immediate needs as well as the longer-term aimed at stability and sustained productivity.

Wiersum (1981) observed that as farm size decreases, due to fragmentation accompanying population growth, the proportion of land devoted to home gardens rises at the expense of staple food crops. However, when farm size falls below a certain point farmers increasingly forego the tree products in favour of staple food crop production.

2.2.8 Neem Strorage Products

Plant materials with insecticidal properties provide the small-scale farmers with a locally available biodegradable and inexpensive means of controlling storage pest, A plant such us Neem has been used for generations in Africa, Asia and the Americas. However, according to NRI (1999), survey conducted in Ghana revealed that many farmers are unaware of the use of insecticidal plants. The farmers also do nothing to protect their grains during storage largely because they find conventional synthetic insecticides too expensive and difficult to obtain.

In the northern part of Ghana, it was found that Azadirachta *indica* (Neem) used for its insecticidal properties is more often recognized for its medicinal properties. Azadiractin together with other constituents of neem seeds such as salanin,nimbin, nimbidin and maliantriol is used as a broad-spectrum botanical insecticide which can control about 300 insect species.

2.2.9. Wet-sack Cassava Storage

Though cassava is a well-adapted crop for small-scale agriculture in developing countries, rapid post-harvest deterioration of the fresh roots is a disadvantage that farmers take into consideration. Storage techniques such as packing in moist media (sawdust, jute sacks), freezing, waxing and canning are considered either technically or economically unsuitable for most marketing needs.

Traditional approaches to preventing rapid post-harvest deterioration include;

- Leaving the roots in the soil past the period of optimal root development until they can be immediately consumed processed or marketed.
- Storage in pits
- Moist soil reburials

Cassava roots stored at high relative humidity around 80-90% show a typical wound healing response with periderm formation (FAO,1995). Because cassava harvesting can be staggered, rapid post-harvest deterioration does not severely influence on-farm or village consumption. However, as noted by FAO (1995), unless motivated by economic considerations consumers in urban centres will not generally purchase old cassava roots due to poor eating and processing qualities.

According to Booth (1976), the rapid development of primary or physiological deterioration in cassava has been strongly associated with mechanical damage, which occurs during harvesting and harvesting operations. Frequently the tips are broken off as the roots are pulled from the ground and severance from the plant necessarily creates further wounds. Secondly, further abrasion results from transport from the field to the markets.

2.2.10 Preventive Health in Livestock

This study focuses much attention on preventive health issues on poultry. The domestic chicken is one of the commonly raised animals by subsistence farmers. Preventive health issues will emphasise on Newcastle disease. Current large-scale commercial livestock production is masked by the availability and use of veterinary drugs. In every aspect, livestock production has developed in favour of fighting pathogens. Soil Science Association (2002) noted that for livestock to be socially, biologically and economically sustainable, there is the need to shift from pathogen-targeted as in fire fighting towards proactive health-targeted policies and practices.

As noted by Singh (1981), Newcastle disease (*Ranikhef* Disease) is a widespread highly contagious viral infection of the respiratory and nervous systems of poultry. Mortality may be as high as 100% in young flock. It affects mostly chicken. The view of ACIAR has been that, little progress could be made with village chicken poultry until Newcastle disease was controlled.

As noted by Spradbrow (1999), in most developing countries, Newcastle is the most important infectious disease affecting village chickens. The virus causing Newcastle disease is classified within the genus Paramyxovirus. He further stated that most of cases of Newcastle disease seen in village chicken can be attributed to chicken that are shedding virus through nasal or mouth discharges by air or contaminated feed and litter. These could be birds that have recovered from clinical infection or vaccinated birds.

Seasonal outbreaks of Newcastle are usually attributed to the weather conditions prevalent at the time. However, Spradbrow pinioned that realistic explanations may be due to patterns of movement in chicken and changes in the volume of markets. In Uganda, outbreaks that occur in the dry season are not really because the virus survives better under these conditions. Careful examination revealed that, this is the time of low employment in the agricultural sector. Villagers use this spare time to visit kinfolks and usually carry chicken as gifts. Outbreaks in other countries might be related to marketing for festivals rather than to the season. Some instances are outbreaks in Ghana before Christmas and in Ethiopia before Easter.

Prevention is by vaccination. However, until very recently, there were no methods of controlling Newcastle disease in village chicken. The conventional Newcastle vaccines that were effective in commercial poultry found little use in village chicken. These village flocks were small, scattered, multi-aged and under minimal control. The vaccines were heat-labile, relatively expensive and produced in large-dose units suitable for large commercial flocks. Their application also required physical control over chickens. Fortunately, heat-stable vaccines have now been developed. Some of these can be administered on certain foodstuffs thus allowing easy vaccination of village flocks.

2.3. Agricultural Extension Effectiveness

According to F.A.O (1990), an effective extension system is recognised as a central mechanism to achieving a sustained agricultural development for increased food production. Against this background, effectiveness as a functional concept would mean the ability of MoFA as an organization to meet the goals or needs of clientele, utilising its resources efficiently in a constantly dynamic environment. An effective extension system would mean a continuous farmer participation in technology transfer programmes, decision-making process and their needs assessment and systematic evaluation of activities. It is envisaged that farmers would most willingly participate in extension activities when they expect to obtain usable technical advice.

2.3.1 Measurement of Effectiveness

Social organization and organizational effectiveness remains a complex and least explored issue. According to Georgopoulos and Tannenbaum (1957), organizational effectiveness implies the extent to which a social system given certain resources and means fulfils its objectives without incapacitating its means and resources and putting undue pressure upon its members.

In his univariate model of effectiveness measurement, Campbell (cited in Ntifo-Siaw, 1993), identified among other variables the following, which are relevant to agricultural extension.

- Productivity measured by actual output data
- Profit and rate of return
- Employee satisfaction
- Overall performance measured by employees

Boswell (1973) a critic of the univariate model asserted that a number of variables interplay to influence effectiveness.

In a multivariate model devised by Geogopoulous and Tannenbaum (1957), some variables were identified notably;

- Organizational productivity
- Organizational flexibility
- Absence of intra-organizational strain or tension and of conflict between organizational sub-groups.

These variables relate to movement of organizations towards its goals and the ability of the organization to survive in the face of external and internal variability and preservation of organizational means.

2.4 Public Sector Extension

The fundamental premise of Public sector extension according to ODI (1998) is that low-income farmers are unlikely to obtain technical information unless government provides it. This assertion is, however, now being challenged. In Ghana, the Public sector extension activities are implemented directly through the Directorate of Agricultural Extension Services (DAES) under the Ministry of Food and Agriculture. The DAES has representation in all the 110 district MoFA offices in Ghana. Asibey-Bonsu and Posamentier (2001) noted that agricultural extension in Ghana has undergone considerable changes since independence. They argued that, with changes in the political and economic situations especially the economic liberalisation with active private sector participation in service provision, decentralisation of governance and national focus on poverty reduction, there is the need for a rethinking of Ghana's agricultural development effort. In this direction, ODI (1998) noted that countries like Britain and France have made great strides towards complete privatisation of extension services. Chile and China have moved to new contractual extension arrangements.

The main characteristics of Public sector extension are as follows:

- Higher proportion of funding is by international agencies.
- Extension is linked to specific capital investment to ensure that farmers had sufficient access to inputs and technical information to make optimal use of extension e.g. irrigation infrastructure.

- Services are fragmented and lack coherent linkages with clients (farmers) and with information suppliers (research centres) (Umali and Schwartz, 1994).
- Extension staff especially the frontline staff are poorly trained, are responsible to more than one authority, have little contact with research services, biased towards working with wealthier than low- income farmers.
- Pre-programmed targets that the Department of Agriculture Extension has to meet each season like the number of demonstrations of a given type (Farrington, 1997)
- Overall allocation of resources is skewed in favour of well-endowed areas (Wellard, Farrington and Davies, 1990).
- Tendency to over- centralise the control of extension budget.

In addition to the above Farrington (1997) further noted that:

- Many of the technical recommendations from government organizations for dissemination are not relevant to small-scale farmers. Mechanisms for bottom-up feedback in existing technologies and for articulation of demand for new ones remain weak.
- Farmer training is more closely linked with government programmes and targets than with farmers' needs. Training is also often classroom based without the practical content necessary to engage farmers' interests.
- Reward system provides no incentive among either researchers or extensionists to respond to feedback.

- Government and donor programmes to create sustainable rural livelihoods aimed at generating early returns to investments tend to be dominated by time horizons e.g. National Agricultural Research Programmes (NARP) and Agricultural Services Sub-Sector Investment Programme (AgSSIP).

Recent trends in donor-sponsored extension programmes specify that extension should focus on information supply and feedback to the exclusion of such related activities as inputs provision. Farrington and Briggs (1990) have this to say "Such narrow specialisation (Information supply) runs farmers against constraints in other aspects of agriculture or in other sectors altogether as soon as a constraint i.e. agricultural technology has been removed".

2.5 Main Features of NGO Agricultural Activities

Many authors, including Korten (1987), have suggested that agricultural and rural development strategies would benefit from increased collaboration between the Public sector and NGOs. As noted by Bebbington and Riddell (1994), donors have begun to call for more NGO involvement in programmes that have traditionally been implemented through the Public sector. According to Farrington (1997), NGOs by definition are non-membership development-oriented organizations. They however, have very strong links with membership organizations e.g. farmer associations.

The strengths are that majority of NGOs are small and horizontally structured with short lines of communication and are therefore capable of responding flexibly and rapidly to client's needs and circumstances. This facilitates learning from farmers and innovativeness in modifying methodology suitable to farmers' circumstances and objectives (Farrington and Briggs 1990). NGOs are known to have work ethics conducive to generating sustainable processes and impacts. Their concern for the rural poor enables them to maintain a field presence in remote locations where it is difficult to keep government staff at post. This factor is an important potential to complement government services both spatially and in terms of technology type.

According to Farrington (1997), NGOs main concern has been to identify the needs of the rural poor in sustainable agricultural development. They have pioneered a wide range of participatory methods for diagnosis that have led to the development and introduction of systems approaches for testing new technology. Instances include soya production in Bangladesh (Buckland and Graham, 1990); sloping agricultural land technology in the Philippines (Watson and Laquihon, 1993). An important strength of NGOs is their work in group formation.

On the other hand, NGOs have weaknesses. One weak link in NGO activities is in the area of technical competence. However, working on a small scale in a few villages with people who have few options may not be questioned regarding their technical competence and their technical failures will attract little publicity beyond the village that suffers the consequences, (Korten, 1987). When NGOs position themselves to be system catalysts, their technical weaknesses become apparent.

According to Farrington, (1997) NGOs' small size means that their projects rarely address the structural factors that underlie rural poverty. Small size, independence and differences in philosophy militate against learning from each other's experiences and creating effective forums. Ayers (1992) noted that some fashionable locations have become so densely populated by a variety of NGOs that problems have arisen merely not only of competition for same clientele but some undermining the activities of others.

Some NGOs are more accountable to external agencies than to their clientele they claim to serve .The desire of donor pressure to achieve short-term impacts in some instances has led to promotion of inappropriate technologies such as the protected horticultural system in the Bolivian Andes (Khol, 1991). As suggested by Korten (1987), an NGO undertaking a third generation strategy must have the staying power to remain at the tasks for 10-20 years if necessary.

In situations where most NGOs place great emphasis on voluntarism, such as volunteer extension workers, such values are sometimes promoted at the expense of financially sustainable alternatives. This was evident in SIDA's farm level forestry project in North Vietnam.

2.5.1 Staying Power of NGOs

As a development strategy, relief and welfare activities of NGOs offer little more than temporary alleviation of the symptoms of underdevelopment. This according to Korten (1987) is a generation-1 NGO activity. Generation-2 activities stress on local self-reliance with the intent that benefits would be sustained beyond the period of NGO assistance. The generation-3 strategy has its focus on facilitating sustainable changes at regional or national basis. This would entail NGO involvement with a variety of public and private organizations that control resources and policies that impact on local development. Korten (1987) argued that a third generation NGO might only be able to influence but not control these other organizations.

Success would therefore depend on an NGO skillfully positioning its resources in relation to the target system as a particular agricultural production and marketing system, a small enterprise credit system etc. This requires high levels of both technical and strategic competence. And for NGOs, which have historically worked independently, there would be the need to develop skills in working collaboratively as members of larger coalition of both public and private organizations.

2.5.2 The Need for Collaboration

The potential for complementarities between NGOs and government is largely due to the ability of NGOs to operate in areas where the public sector is weakest. Participation is seen as a central feature of most NGO activities. As noted by Korten (1987), the most obvious incentive behind government collaboration in agricultural activities is financial. Resources at the disposal of government are insufficient to cover their whole mandated area. There is also donor pressure coupled with its recognition that it is more efficient to build on existing structures.

In some Latin America states, there is a high degree of staff fluidity between different types of institutions. Agriculturally trained professionals move with ease among public sector, private and voluntary organizations. In Gambia and Peru, the government involved NGOs in their national seed and seed potato programmes respectively. Where NGOs are leaders in a research field such as Catholic Relief Services (CRS) in sesame research in the Gambia it would be injudicious to ignore it.

NGOs' desire to collaborate with the public sector is perceived to be due to motivated individuals with extensive knowledge of the public sector and their recognition of the public sector's advantage in certain fields. There is also a strong desire for public recognition of their research activities and the wish to influence public sector methods and research agenda.

2.6. Extension Management Concepts

Extension management concepts provide the framework within which certain goals may be achieved. According to Albert et al. (1999), extension concepts adopted in Ghana include:

- Training and Visit (T&V);
- Nucleus farms (Out-grower scheme);
- Contract extension;
- Farmer field school;
- Community livestock worker;
- Vocational farmer training; and
- Participatory technology development and extension.

The document noted that MoFA, through DAES, currently has a strong focus on the Training and Visit concept. However, for the purpose of this work, literature review would be limited to Training & Visit, Nucleus Farms and Contract Extension concepts.

2.6.1 Training and Visit Extension Concept

The basic assumption was that there were sufficient technological packages for dissemination but farmers did not have adequate access to it. It was therefore thought that by strengthening extension services either through changes in methodology such as T&V system of extension in addition to the provision of office buildings, transport, training and operating funds, an effective channel for providing farmers with technology would be created.

The T&V concept was adopted in Ghana in 1992. The concept, as developed by Benor and Baxter (1984), has the following tenets:

- Intensive fortnightly training of Field level staff in specific agriculture practices combined with agents' visits to farmers' fields.
- A single organizational structure is involved. Field level staffs that are trained guided and supervised by Development Officers link farmers to extension.
- Subject matter specialists serve as direct link in organization and methodology between Field level staff, Research and Institutions.
- Field level staffs carry out extension education duties without any regulatory or input delivery responsibilities.
- Logistics and support services are provided under T&V.

However, evaluation study in Ghana (Ntifo-Siaw, 1993), of the system revealed the collapse of T&V after the World Bank, which provided the funds, withdrew its financial support. The conclusion was that, classical T&V is unsustainable through normal country budgetary funding.

A modified version of T&V utilised monthly training of front line staff instead of fortnightly. To also ensure linkages, a Research Extension Liaisons Committee was set up to strengthen research. This approach had Ghana divided into five zones with a coordinator in each. A researcher is based in the University or Research Unit within the zone. The University of Cape Coast (U.C.C.) coordinates zone four, which caters for Central and Western regions.

2.6.2 Contract Extension Concept

Contract extension concept involves the delegation of the responsibility to provide extension service by usually the public sector to a private extension entity. In all the contract cases reviewed, it was observed that the following conditions must prevail for this type of service to be applicable.

- There must be a specific agricultural need that the private sector is well disposed of delivery most effectively and efficiently.
- Recipients of service must have control over service provider.
- The public must have an agenda to eventually privatise extension service.

In contract extension, under most instances, a private enterprise or a publicly funded institution is employed to provide a specific service to a single producer, association or region for specified amount of funds. Contracts are always case specific, and carefully state what services and at what price they would be delivered. With this arrangement the client pays for only what information is needed to boost their agricultural enterprise.

In Finland, for example, the Rural Advisory Centres provide various development services such as appraisal of a business idea, entrepreneurial training, planning of operations and production aspects of business economy, taxation and marketing. A classic case of contract extension is one executed between the Faculty of Agriculture and Forestry of the University of Helsinki. When the Faculty wanted to test the concept of participatory extension for its Integrated Production (IP) programme, a cooperation contract had to be signed.

The programme was to develop a sustainable economically feasible IP system for cereal producing farms in Southern Finland. The contract required the University to provide advisory services, arrange seminars, training and to cover the expenses of soil analysis. The recipients (cereal growers) in turn agreed to follow IP-farming methods, maintained records of all farming activities, collected data as specified in the contract and allowed farm visits (Rajalahti and Pehu 2000).

2.6.3 Nucleus Farm Extension Concept

The Nucleus Farm or Out-grower Extension Concept involves a contractual relationship between farmers and a processing or export unit. This unit purchases produce from farmers cultivating their lands under terms arranged in advance through contracts. The most important merit in this arrangement is the supply of farm inputs such as improved planting material, fertilizer and agro-chemicals on credit. In most instances, nucleus estates serve as a ready market for out-growers produce. Classic examples in Ghana are Twifo Oil-Palm Plantation (TOPP), Benso Oil-Palm Plantation (BOPP), Ghana Oil Palm Development Corporation (GOPDC) and Adventist Development and Relief Agency.

As noted by Ntifo-Siaw (1999), the sustainability of this system depends on the integrity of recipients with regard to loan recovery and diversion or poaching of produce. He also asserted that extension providers should as a matter of concern to producers include the issue of marketing in their policy objectives and programmes.

2.7. Adoption

Adoption of an innovation or technology refers to the process by which a farmer who is exposed to the said technology considers and finally practises a particular innovation (Mosher, 1978). As pointed out by Ekong (1988), time is an important factor in diffusion and adoption. Williams and Williams (1971) also stressed that adoption of new ideas or practices by an individual or groups of people is not a snap decision taking but a mental process over a period of time. Studies in Western Nigeria by Alao (1979), for instance, indicated that it took four years for poultry farming to be widely accepted among farmers in that area.

Five steps that have been identified in an innovation or technology adoption process (Mosher, 1978, Williams et al. 1984, Rogers, 1983; Ekong 1988) are:

- Awareness or knowledge of the technology;
- Interest or relevance of technology;
- Evaluation of technology;
- Trial or implementation of technology; and
- Adoption of technology.

Adoption of new techniques is influenced by personal and socio-economic factors, characteristics of the innovation itself and psychological factors. One of the most prominent is Boserup's (1965) contention that increasing population density stimulates innovation in agricultural practices. She highlighted that population growth increases the frequency of land-use, which in turn encourages change in agricultural technology. Similarly, Smith, Barau, Goldman and Mareck (1993) demonstrated that market-driven intensification changes factors proportion and induces the adoption of land-saving input-using technologies.

According to Abolaji (1992), the rate of adoption of an innovation is related to:

- People's perception of its advantages relative to other innovations;
- The degree to which it is perceived to be compatible with the existing social systems;
- Its perceived communicability, The amount of positive contact the target system has with the innovation;
- The geographical accessibility of the innovation to the target system; and
- Its inverse relation to the degree of perceived complexity i.e. less complex innovation will have a higher rate of adoption than complex ones.

Abolaji (1992) continued that other factors influencing farmers' decision to adopt a new technology include:

- Farmers' social characteristics;
- An innovation's or technology's technical characteristics;
- Marketing opportunities; and

- Sources of information for that particular technology.

2.7.1 Influence of Farmer and Socio-Economic Characteristics on Adoption

This section reviews the influence of farmer characteristics and socio-economic characteristics on adoption of agricultural information or technology.

2.7.1.1 Sex

Over the years women have been considered as housewives fulfilling their reproductive functions in the society, resulting in discrimination and looking at women as being subordinate to men. The literature shows that men have more access and control over production resources (land, labour, capital), decision-making and extension services than women (Palmer 1985, Olawoye 1993). According to Nagy, Ohim , Sawadogo and Burkina-Faso (1990), female access to land is through males. They further state that women do not inherit land but obtain the right to use land through their husbands. Russo, Bremer-Fox, Poats & Graig (1989) reported that access to formal credit services is often an insurmountable barrier to women.

Moreover they stress that most lending activity is focused on large male-dominated firms not on micro-enterprises where most female farmers and entrepreneurs are found. Olawoye (1993) contended that rural men have traditionally been the recipients of most agricultural extension services. However, the agricultural information given to men does not trickle down to their wives as assumed (Spring, 1986).

2.7.1.2 Age

A farmer's age may influence adoption in one of several ways. Older farmers may have more experiences, resources or authority for trying a new technology while younger farmers are likely to adopt a new technology since they are more educated and more cosmopolite than the older generation (CIMMYT, 1993). According to Akinola (1986), age is inversely related to the probability of participating in the National Accelerated Food Production Project (NAFPP) scheme and the number of practices adopted by those who participated. Van den (1957) also reported that progressive farmers and young recipients of vocational training in agriculture were members of farmers' organizations and were modern in their mode of living. These findings confirm the fact that younger farmers are more likely to adopt improved agricultural technologies than older farmers.

2.7.1.3 Level of Education

According to Griliches (1964), schooling is an important source of gains in agricultural productivity. In the U.S., Chandri (1968) found that a statistically significant relation existed between schooling and farm output in traditional setting. Rogers (1983) pointed out that adoption of innovation could be regarded as a managerial concern that requires certain managerial skills, which are often gained through education. As farmers advance in their level of education the more they will tend to understand the importance, intricacies and need for adopting new improved farm practices (Ogunfiditimi, 1981).

Thus, whenever a technology requires little of technical knowledge it is those with education that are most likely to adopt.

2.7.1.4 Farm size

Arnon (1981) indicated that in most developing countries, land is excessively split up into very small producing units. In other areas land is concentrated in the hands of a few large landowners due to traditional inheritance. Farm size can have different effects on the rate of technology adoption depending on the characteristics of the technology and institutional setting.

Specifically, Feder and Slade (1985) stated that the relationship of farm size to adoption depends on such factors as fixed adoption costs, risk, preferences, human capital, credit constraints, labour requirements, and land tenure arrangements. Studies have also shown that inadequate farm size also impedes efficient utilisation or adoption of certain types of irrigation equipment such as pumps and tube wells (Gafsi and Roe, 1979).

2.7.1.5 Labour

Labour availability is another often mentioned variable, which affects farmers' decisions regarding adoption of new agricultural practices or inputs. Whilst some new technologies are labour saving others are labour intensive. The study of the adoption of dry-seeded rice (DSR) in the Philippines showed that the higher the labour index, the more likely farmers are to adopt DSR (Byerlee, and Hesse de Polanco, 1982).

2.7.1.6 Credit

Studies have found lack of credit to have significantly limited adoption of high yielding variety technology even though fixed pecuniary costs were not substantial. According to Rogers (1983), wealth and innovativeness appear to go hand in hand. The need for rural credit to small-scale farmers is supported by the FAO (1984) that credit, in the short run, enables the poor to weather shocks. Similarly, Perrin and Winklemann (1976) reported that in four out of six studies in different parts of the world on factors influencing the rate of adoption of new practices, the availability and the use of credit was significantly related to the adoption of high yielding varieties. They found that credit and practical adoption were associated and were not independent. Credit may be an important factor in determining adoption (CIMMYT, 1993)

In contrast; others have argued that lack of credit alone does not hinder adoption of innovation that is scale neutral. Accordingly, Schutjer and Van der Veen (1977) reported that the profitability of high yielding variety adoption would induce even small farmers to mobilize the relatively small cash requirement for necessary inputs. Credit may be an important factor in determining adoption and may be offered as a package that provides a set of inputs to farmers (CIMMYT, 1993). If a recommendation requires a significant cash investment for farmers, an efficient credit programme may facilitate its adoption.

2.7.2 An Innovation's Technical Characteristics and Adoption

Rogers (1983) lists five characteristics from the farmer's point of view, which affect their adoption as follows: relative advantage, compatibility, complexity, trialability and observability.

2.7.2.1 Relative Advantage

This is the degree to which an innovation is regarded as better than the idea or object it is intended to replace. The acceptance of an innovation is thus in relation to economic gains, social prestige factors, satisfaction and convenience associated with it. Farmers are astute economists and will not readily adopt technology, which appears to have some pecuniary risks. The more tangible the benefits of an innovation, the more farmers are willing to adopt it. For example, farmers may take a new variety of maize offering them higher yields more rapidly than one, which they perceive as low yielding.

2.7.2.2 Compatibility

It is the degree of consistency of the package with the farmer's value, management objectives, the level of technology and the stage of farm development (Adams, 1992). Farm size, availability of equipment and machinery are some facts that determine the compatibility of an innovation.

2.7.2.3 Complexity

This is the degree to which an innovation is understood and can be used by farmers (Rogers, 1983). According to Rogers, most members of a social system readily understand some innovations; others are more complicated and will be adopted more slowly. It therefore follows that the more complex an innovation is the more difficult it is for farmers to adopt (all other things being equal).

2.7.2.4 Trialability

A farmer will be more inclined to adopt an innovation which he has tried first on a small scale on his own farm and which proved to work better than an innovation he had to adopt immediately on a large scale which involves great risk.

2.7.2.5 Observability

It is the degree to which the results of an innovation are visible to farmers (Adams, 1992). Farmers are more inclined to adopt an innovation after seeing its results than when results are not easily seen.

According to the FAO (1984), the ultimate criterion for choosing an irrigation pumping system is to obtain the most "cost-effective" system. The parameters required to assess the true cost-effectiveness is not easy. Nevertheless, the following can be considered: reliability, availability of spare parts or maintenance skill, ease of use and cost.

2.7.3 Rate of Adoption

The relative speed with which members of a social system adopt an innovation is known as its rate of adoption. At first, only a few individual may adopt an innovation in time period such a year or a month; these individuals are known as the innovators. As more and more individuals adopt the innovation the rate of adoption begins to increase. The rate of adoption then levels as fewer individuals remain who have not adopted. Finally the rate of adoption begins to fall and the diffusion process approaches completion. Some innovations have a rapid rate of adoption, while others have a slower rate of adoption (Rogers, 1983).

2.7.4 Marketing

Many farm products sell in a barter system or as cash in local village markets. In these situations, price control of crop value is determined by local supply and demand. Marketing beyond the village immediately brings into play a variety of other factors. These are transportation, marketing organizations, and processing capacity. La Anyane (1988) observed that market women and other intermediaries provide internal marketing services. The marketing chain is short but marketing costs are high. The problem is not only one of eliminating the unnecessary services, but it relates also to the cost of required services. These costs are unduly high, because of poor roads, inadequate transport, and lack of credit and knowledge of supplies. Processing of crops can also be critical where bulk is a factor and transport vehicles are limited.

An inadequate marketing system can severely influence the small holders when their produce does not sell at a reasonable price. Farmers' inability to market their produce efficiently can severely hinder attempts to improve their income and livelihood. Small farmers may also find it hard to reach agricultural inputs at fair prices (Karunadasa, 1996).

Not only do markets influence the acceptability of a new crop variety, they may also influence farmers' interest in any technology that promises higher yields. If markets are inefficient, there may be little incentive to invest in improved technology. In addition, characteristics such as seasonal variation in market prices may influence the acceptability of technologies that change the timing of harvest (e.g. a technique that allows early planting).

2.7.5 Sources of Information

Various sources of information are used to disseminate agricultural techniques. In developing countries where resources are limited, the major sources of farm practice information remains undoubtedly the extension source. Williams, Fenley and Williams (1984) reported that the extension agent still plays an important role as source of information and hence exerts considerable influence on adoption of recommended agricultural practices.

Subsequently, contact with extension agents influences positively farmers' adoption behaviour of agricultural innovations. There is a high positive correlation between the use of personal information sources and adoption of recommended farm practice. Williams et al (1971), in their study of the relationship between rice farmers and extension agents in relation to adoption concluded that the closer a farmer associates with the extension agency and its personnel, the more likely it is that he can be influenced to adopt improved farm practices. It has been evidenced that farmers of different backgrounds appear to rely on different informational sources for particular types of innovations (Brown, 1981).

Many findings revealed that younger, better-educated farmers have more contact than other farmers with information sources and change agents (Nowak, 1987; Rogers 1983; Yapa and Mayfield 1978). While it is stated that the acceptance of information or idea by individuals depends on the credibility of the source, Akinbode (1969) pointed out that the extent to which farmers use information sources could also be influenced by their socio-economic status. On the other hand, personal sources such as friends, neighbours and relatives are the major sources of information accounting for 52 percent out of 12 selected sources of information in India (Rangaswamy , Ramasamy and Guruswami ,1972).

CHAPTER THREE

METHODOLOGY

3.1. Introduction

This chapter commences with a brief description of the study area, followed by a detailed account of the selected districts. Next is the study design, population and sample size. Also included are sampling procedure, instrumentation and variables. The chapter ends with data processing and analysis.

3.2. Study Area

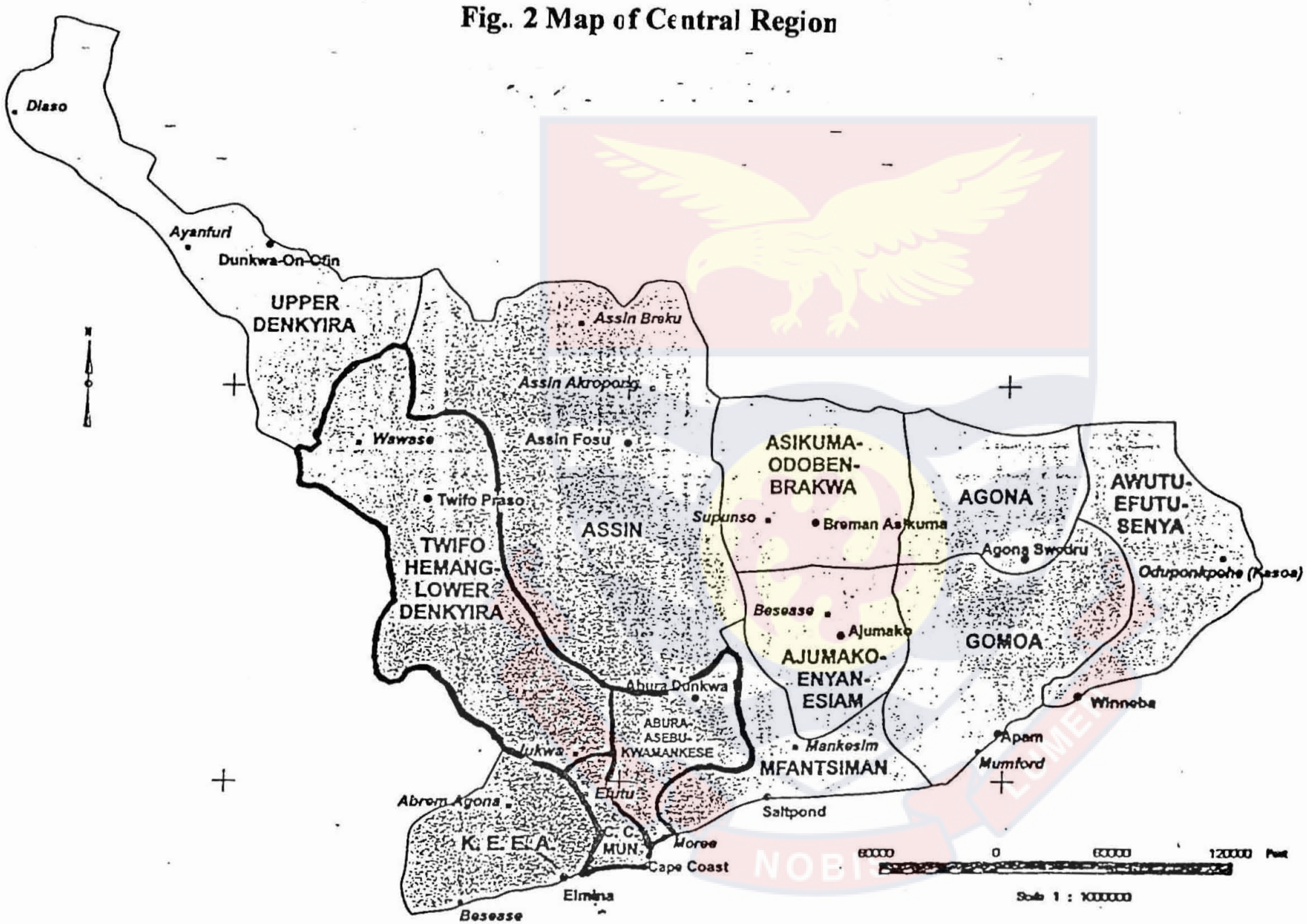
The study was conducted in the Central Region of Ghana. Central Region shares boundaries with Greater Accra and Eastern regions to the east, Ashanti region to the north, Western region the west and the Gulf of Guinea to the south. Cape Coast is the regional capital. There are 12 political districts, which also correspond to the agricultural districts. These districts are:

- Cape Coast
- Komenda-Edina-Eguafo-Abirem (KEEA)
- Mfantsiman
- Abura-Asebu-Kwamankese
- Ajumako-Enyan-Esiam
- Gomoa
- Awutu-Efutu-Senya
- Agona
- Asikuma- Odoben-Brakwa

- Assin
- Twifo Hemang-Lower Denkyira
- Upper Denkyira

The Central Region in 2000 had a population of 1,593,823, representing 8.4% of Ghana's total population. This figure was 39.5% over the 1984 population (Ghana Statistical Service, 2002). The Central Region has an adult urban population of 598,405 against a rural population of 995,418. Adult population was 807,241. The number of people involved in agriculture, animal husbandry, forestry and fishing is 395,770. The Central Region is quite low lying with vegetation type varying from coastal thicket along the coast through deciduous forest to semi-deciduous forest at the northern ends of Assin, Twifo Hemang-Lower Denkyira and Upper Denkyira districts.

Fig.. 2 Map of Central Region



Source: Ghana Statistical Service (2002) = Study Area

3.3 Profile of Study Districts

This section describes basically demographic features of the selected districts. Each district has a brief review on boundaries with neighbouring districts, topography, vegetation, human population and economic activities.

3.3.1 Cape Coast District.

Cape Coast District is the smallest district in the Central Region. The Cape Coast municipality doubles as the regional as well as the district capital. Cape Coast District shares boundaries with the Gulf of Guinea to the south, Abura-Asebu-Kwamankese district to the east and Twifo-Hemang-Lower Denkyira District to the north. The district covers a land area of 1178 square kilometres (sq km). The 2000 Human and Housing Census recorded a human population of 118,108. This constitutes 7.4% of the region's total population. The district is predominantly urban with rural fringes. Rural localities with their corresponding population include Nkanfoa (2,995), Ekon (3443), Efutu (2214) and Kakomdu (2,628). The rest of the rural fringes had population ranging from Amisano (848) to Akotokeyre (1,065). Out of the district's total population of 118, 108 and Cape Coast Township had 82,291.

3.3.2 Abura-Asebu-Kwamankese District

Abura-Asebu-Kwamankese District is centrally located within the Central Region. It is made up of three traditional areas namely, Abura, Asebu and Kwamankese. With a narrow lateral zone at Moree, it stretches inland along the Cape Coast-Assin Foso main road. Its northeastern most point is Abura Dunkwa, the district capital. The Cape Coast District bounds the district on the west, northwest by Twifo-Hemang- Lower Denkyira District, on the east by Mfantsiman District and on the north by Assin District.

It has a land area of 117sq km. Topography ranges from 50 metres to 150 metres above sea level. The district falls within the dry equatorial climatic zone with a monthly temperature of about 26°C. Rainfall is relatively low and occurs in two peaks. Mean annual rainfall is between 75 and 90 centimetres occurring from May to July. It is among the driest areas in the region. The vegetation along the coast is coastal shrub and grassland. This merges into a deciduous forest in Abura and Kwamankese traditional areas where rainfall is relatively moderate.

According to the 2000 Population and Housing Census, there were 90,093 people, which is 5.6% of the Central region's population. The major settlements with corresponding populations are Moree (17,761), Abura Dunkwa (8,577) and Amosima (3,255). The rest of the settlements have a population ranging from 978 to 1,862 each.

The population of Abura-Dunkwa the district capital has grown from 4,025 in 1970 through 5,267 in 1984 to 8,577 in 2000. There are about 57 primary schools, 32 junior secondary schools (JSS), and three senior secondary schools (SSS) in the district. The most important cash crop grown in the district is lime. Emil Ghana Ltd. is the sole factory, which processes the lime. Other cash crops are oil palm, oranges, coconut, tiger nuts and coffee. The main food staples in the district are maize, plantain, cocoyam and cassava. Fishing is done mostly at Moree, which is the most densely populated settlement in the district. There is a gari processing factory each at Old Ebu and Asomdwee, edible oil extraction factory at Kwadogya, local gin distillery at Pautubiw and soap making factory at Mpesedwadze.

3.3.3 Twifo- Hemang Lower Denkyira District

Twifo Hemang Lower Denkyira District has Twifo Praso as the district capital. It shares common boundaries with the Cape Coast and KEEA districts in the south, Abura-Asebu-Kwamankese district to the east stretching from the west to the northeastern part of Assin District and Upper Denkyira District in the north. The district is located within wet semi- equatorial climatic zone, which is mostly hot and humid throughout the year. Mean annual temperature ranges from 26°C to 28°C. Relative humidity ranges between 60% and 80% with a double maximal rainfall peaks between the months of May- June and September-October.

Mean rainfall is between 120cm and 200 cm. Vegetation type is moist semi deciduous forest. Where the forest has not been disturbed as in the Kakum forest Reserve, vegetation is very luxuriant. The Kakum Forest Reserve is an eco-tourism site noted for game and wildlife.

The 2000 Population and Housing Census put the districts population at 110,352 as against 95,998 (1984) and 53,066 (1970). Twifo-Hemang Lower Denkyira District is typically rural. Only two settlements Twifo Praso (9,011) and Twifo-Hemang (6,179) had a population of greater than 5000 the threshold for an urban category in Ghana. There are 129 primary schools, 63 JSS and two senior secondary schools in the district.

Agriculture is the main economic activity. Twifo Oil Palm Plantation (TOPP) operates an oil palm plantation and an oil mill at Twifo- Mampong. The main cash crops in the district are oil palm and cocoa. Cassava, plantain and cocoyam are the main food staples. Pottery, oil palm extraction, gin distillation and soap making are done on small-scale basis. The main road, Cape Coast through Twifo-Praso to Dunkwa–on-Offin, is aligned north to south with feeder roads criss-crossing it.

3.4 Profile of Study NGOs

This section gives a brief description of the NGOs studied with regard to their origin, social status, when they began agricultural activities in the Central Region and agricultural activities they are into.

3.4.1 World Vision International–Ghana (WVI-Ghana)

World Vision International is a Christian, relief and development agency, with a partnership working in more than 90 countries worldwide. World Vision International started work in Ghana in 1979 pursuing eight major programme areas namely:

- Food and Agriculture;
- Water and Sanitation;
- Health and Nutrition;
- Education (Formal and Informal);
- Gender and Development Activities;
- Micro-enterprise Development; and
- Christian Witness and Leadership Training;

Under the Food and Agriculture Programme, farmers, both men and women, in beneficiary communities benefit from revolving loan schemes and technical support from WVI agricultural extension officers. In 1986, WVI-Ghana shifted its development focus from the community to a cluster of communities in geographical area under the Area Development Programme (ADP). WVI- Ghana began its relief and development work in the Central Region in 1988. Currently, WVI-Ghana has three ADPs in Central Region at Assin, Twifo-Hemang Lower Denkyira and Mfantsiman districts.

3.4.2 Adventist Development and Relief Agency (ADRA)

Adventist Development and Relief Agency is a relief agency, which started work in Ghana in 1986. Its activities have, however, evolved from relief to long-term development projects. Since 1996, ADRA in collaboration with The University of Ghana is empowering over 1500 farmers to grow Late Valencia oranges that mature when the local variety is resting (Adventist News Network 2003). ADRA commenced its relief work in 1986 in the Central Region. Currently, ADRA is operating agro-forestry programmes with citrus, acacia, cashew and teak in the Cape Coast, K.E.E.A., Mfantsiman, Gomoa and Awutu-Efutu-Senya districts in the Central Region.

3.4.3 Sasakawa Africa Association- (SG2000)

The first SG2000 project began in Ghana in 1986. Since inception, SG2000 has worked in close collaboration with the Ministry of Food and Agriculture through the Department of Agriculture Extension Services. At the core of its project is technology demonstration of maize crop termed Production Test Plot (PTP). A PTP is grown by a participating farmer using a package of recommended production practices such as improved maize variety, row planting, two seedling per stand, timely weed control and fertilizer application. Similarly, the farmer is asked to cultivate a second plot using his or her conventional farming practices.

In the first year, 40 framers were involved. By 1989 there were 80,000 participating farmers. However, because the objective of demonstrating the improved technology appeared to have been achieved, the project then shifted emphasis to improving on-farm post-harvest technology and grain storage.

One of the most significant achievements of SG2000-Ghana is its assistance in developing and diffusion of Quality Protein Maize (QPM) called Obantapa, which is rapidly spreading, to other African countries. Currently, Conservation-Tillage or Zero-Tillage is being implemented by the Ghana project- SG2000 (SAA, 2003).

3.5 Study Design, Population and Sampling Procedure

Correlational descriptive survey design was used. The rationale for a survey design was to present an accurate description of the perceived effectiveness of extension services offered to farmers in their natural environment. The correlational aspect of the design enabled the researcher to determine any relationships that may exist between the dependent variable and independent variables of interest. It also enabled the researcher to perform regression analysis to determine the best predictor variable for the dependent variable.

Merits of a survey design include;

- The ability to collect wide scope of information from a large population;
- Data collection under real situation;

- It enhances the identification of more specific problems for research that goes beyond description;

Inherent demerits of the survey design include;

- Data collected may be more extensive than intensive;
- It is demanding of time and financial and human resources; and
- External validity could be affected due to sampling bias, non-cooperation, non-response and multiple visits (Oxford University Press, 1998).

Data collection was based on perceptions because there is a positive correlation between perceptual data and objective facts (Bennett, 1979). Campbell (cited in Ntifo-Siaw, 1993) indicated that perception scores could be used to compare performance in different organisations. A multi-stage cluster sampling procedure was used to select the districts. This method was meant to concentrate interviews within geographically, economically and socially linked districts. Secondly, it was also to help in reducing the cost of data collection and ensure the inclusion of a coastal, middle and forest zone districts in each cluster. This process enabled the coverage of the various crops cultivated by farmers in each geographical area in the region. Other probability sampling procedures would have resulted in the selection of disjointed or scattered districts, which would have defeated the objective of the above sampling criteria. After the clustering, three districts namely Komenda-Edina-Egufo-Abirem , Upper Denkyira and Awutu-Effutu-Senya which were in very close proximity to adjoining regions, were excluded. This was done to control for any spill over influence that agricultural extension activities in these regions might have on these districts. The clustering finally resulted in three clusters of districts namely;

- Gomoa, Agona and Asikuma-Odoben-Brakwa;
- Mfantsiman, Ajumako-Enyan-Esiam and Assin; and
- Cape Coast, Abura-Asebu-Kwamankese and Twifo-Hemang-Lower Denkyira (THLD).

The Cape Coast, Abura-Asebu-Kwamankese and THLD cluster of districts was then randomly chosen. The final sample for the study was a total of 150 farmers that is 50 farmers per district, three District Directors of MoFA and managers of three NGOs that were into food crop production in this cluster of districts. A two front approach was used to collect data. This procedure enabled data collection form both service providers and service recipients.

In each selected district, operational areas were stratified into presence and absence of an NGO. Because MoFA had far larger operational areas than NGOs, operational areas were selected in the ratio of 2:1 in favour of MoFA. In each selected operational area, two communities were randomly chosen. A list of farmers partaking in either MoFA or NGO programme within each selected community was drawn up with assistance from the respective AEA. These lists were then stratified based on sex into male and female. In each chosen community, four farmers, in most cases male (2) and female (2), were randomly selected for data collection. The number of farmers participating in either programme in a community ranged between seven (7) and 18.

3.6. Instrumentation

The survey was conducted using three sets of questionnaires.

Questionnaire for farmers (Appendix 1)

Questionnaire for District Directors of MoFA (Appendix 2)

Questionnaire for managers of NGOs (Appendix 3)

Questionnaire for farmers was designed and administered through interview schedule. Those for District Directors of MoFA and Managers of NGOs were self-administered. A three-part questionnaire was developed and data collected from respondents. The researcher determined face validity of the instruments. Colleagues, District Directors of MoFA and lecturers in the Department of Extension & Economics and Centre for Developmental Studies at the University of Cape Cost carried out content validity of the instruments.

Part I of each instrument dealt with demographic characteristics. Both closed and open-ended questions were asked. Demographic data collected on MoFA provided the following basic information:

- Number of communities per district;
- Number of operational areas within each district;
- Numerical strength of DDOs and AEAs;
- Average number of communities per operational area; and
- NGOs involved in agricultural activities in districts.

Part II of the instruments collected data on farmers and service providers with regard to the following:

Farmers:

- Demographic characteristics of farmers.

- Farmers' perceptions about the effectiveness of extension information provided.
- Farmers' ability to pay for extension services under privatisation Service providers:
- Types and levels of interaction between and among service providers.

3.7 Pilot Study

The total questionnaire developed was pilot tested in the Assin District from the 14th to 19th July 2002. In all, 12 farmers, the District Director of MoFA and the Area Development Programme Manager of World Vision-International (NGO) were involved. Results from the pilot test indicated that the reliability coefficient for the items rated on a 4-point or 5-point Likert- type scale ranged from 0.74 to 0.95 with an exceptional case of –0.14 for curative health as indicated in Table 1.

Table 1: Reliability of Variables

Variables	No. of items	Reliability coefficient.
Improved varieties	6	0.85
Line/row planting	6	0.87
Plant stand	6	0.88
Timely weeding	6	0.90
Pesticide use	6	0.83
Organic matter	6	0.39
Inorganic fertiliser	6	0.83
Plantain paring	6	0.85
Germination test	6	0.89
Agro-forestry	6	0.92
Chemical storage	6	0.92
Improved maize crib	6	0.95
Wet-sawdust/sack (Cassava)	6	0.88
Improved breeds	6	0.87
Supplementary feed	6	0.74
Housing	6	0.85
Preventive health	6	0.86
Curative health	6	-0.14

Source: Survey Data 2002.

These values were considered quite satisfactory. Cronbach's Alpha Reliability test was used to determine the internal consistency of the instrument. Some few items found to be ambiguous were either removed or changed. Some items also overlooked were added before the final questionnaires were used for data collection.

3.8 Data Collection

Four district development officers (DDOs) assisted in data collection. These were Cape Coast (1), Abura-Asebu-Kwamankese (1), Twifo-Hemang Lower Denkyira (2). A day's training was provided at their various conference rooms. DDOs were used because of their qualification. The minimum qualification was diploma. Secondly, some items were considered sensitive to Agricultural Extension Agents (AEAs) whose participation would have introduced some element of bias. Data collection started on 1st October and ended on 30th November 2002.

3.9 Data Processing and Analysis

This process began on the field by going through completed forms submitted for omissions and errors. In some few instances, respondents were re-contacted. Data collected were processed through the following steps.

- Preparation of a code file meant to direct the transformation of variable categories into numbers for entry into a computer;
- Editing to ensure that information gathered was meaningful and ready to be transferred to the computer.
- Entering of data into a computer using a fixed -column format. This was meant to aid the next phase of the process-data cleaning
- Running eyes down the various columns did data cleaning for errors. The process also indicated shifted and filled columns that should be blank. There were also wild codes and consistency checks.
- Finally, frequency distribution was run to detect, correct missing and excess entries.

The data was analysed using Statistical Package for Social Sciences (SPSS. 10). SPSS frequencies were used to evaluate assumptions. The following variables were negatively skewed; improved varieties, line planting, plant stand, use of inorganic fertilizer, pesticide use and neem storage products. Reflect square root transformation was required to normalize the distribution mathematically. Positively skewed variables include wet-sack cassava storage, neem storage products, and improved breeds. Square root transformation would have restored theses variables to normality. Near normally distributed variables were timely weeding, plantain paring, germination test, agro-forestry, organic matter, improved maize crib, chemical storage, livestock supplementary feed, livestock housing, livestock preventive health and livestock curative health.

As noted by Tabachnick and Fidell (1996) although transformations of data are recommended as a remedy for outliers and for failures of normality, linearity and homoscedasticity, they are not universally recommended. They argued that an analysis is interpreted from the variables that are in it. Sometimes transformed variables are harder to interpret. Pallant (2001) also stated that some authors argue against transformation of variables to better meet the assumption of the various parametric techniques. Due to the perceived extension effectiveness interpretation scale used, transformation of skewed variables would have rendered interpretation difficult. As a result of the above considerations, parametric analyses were performed without transforming the data.

Descriptive statistics involving means, frequencies, percentages and standard deviations were computed to summarise the data. The t-test was employed to compare means. Pearson's correlation was computed to determine direction and strength of relationship among some variables. Stepwise regression procedure was then used to determine the predictive power of the independent variables on farmers' perceived effectiveness of extension services on some basic agricultural information or technologies.

3.10 Definition of Variables

The dependent variable for the study is the level of effectiveness of extension service provided.

Independent variables examined for the study are as follows

Farmers.

- Sex
- Age
- Level of education
- Staple food crops grown
- Cash crops grown
- Types of livestock raised
- Land tenure
- Farm size
- Farming experience
- Service provider
- Sources of agricultural information
- Ability to pay for extension service.

Variables that constitute effectiveness.

- Awareness of some basic crop and animal husbandry information

- Relevance of some basic crop and animal husbandry information
- Adequacy of some basic crop and animal husbandry information
- Availability of inputs to go with some basic crop and animal husbandry information
- Adoption of some basic crop and animal husbandry information.
- Output for using some basic crop and animal husbandry information
- Cost of inputs

Variables under Service provider (MoFA).

- Number of communities in districts
- Numbers of District Development officers.
- Area of specialisation of District development officers(DDOs)
- Number of AEAs (Agricultural Extension Agents)
- Operational areas
- NGOs (Agric) in district

Variables under Service provider (NGO).

- Origin
- Social status

Variables common to Service Providers (MoFA & NGOs).

- Level of collaboration,
- Level of consultation,
- Level of delegation,
- Level of confrontation,
- Level of competition.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter states and discusses the findings of the study. The results start with the descriptive statistics followed by t-Test as applicable, correlation and finally regression.

4.2. Agricultural NGOs in the Central Region of Ghana

Six NGOs were identified to be involved in agriculture in the study districts of the Central Region. Also included in Table 2 are the agricultural activities of the NGOs. It was found out that ADRA, WVI and SG2000 selected for the study were foreign NGOs. Whereas ADRA and WVI were religious, SG2000 was secular in nature.

World Vision International was operating in two (2) districts, ADRA in one (1) and SG 2000 also in two (2) districts. These findings go to support the notion that NGOs are restrictive in their service delivery. It should however be noted that with the ease of forming an NGO as stated by Dicklitch (1998), this list could easily be subject to change.

Table 2: NGOs Involved in Agriculture in the study Districts of the Central Region

District	NGO	Agricultural Activity
Cape Coast	ADRA	Agro-Forestry
	Techno serve	Palm oil processing
	WVI	Input supply
	Catholic Relief Services	Fish Processing
Abura-Asebu-Kwamankese	PLAN International	NA
	SG2000	Zero tillage
Twifo-Hemang, Lower Denkyira	SG2000	Zero tillage
	WVI	Beekeeping,Snail-farming, Grasscutter production, Oil palm production and Vegetable gardening

Source: Survey Data, 2002.

4.3 Demographics of MoFA District Directorates

In order to be able to assess the perception of farmers about the effectiveness of extension services offered by MoFA, it was imperative to determine the human resources at the disposal of the various districts. It is believed that the numerical strength, quality and area of specialization of MoFA staff may greatly affect the quality of extension delivery. NGOs did not have personnel who were trained in agriculture.

4.3.1. Number of Communities per District

As shown in Table 3, the number of communities per district was Cape Coast (71), Abura-Asebu-Kwamankese (167) and THLD (150).

Table3: Districts and Number of Communities

District	Number of communities
Cape Coast	71
Abura-Asebu-Kwamankese	167
T.H.L.D	150

Source: Survey Data, 2002

4.3.2 District Development Officers (DDOs)

These are the officers who offer training and supervise the extension activities of the frontline staff or agricultural extension agents (AEAs). At the time of data collection, the three districts covered had a total of 17 DDO with a mean of about six (6) DDOs per district. In Table 4 is indicated DDOs and their areas of specialization at the district level. Only agriculture extension had one DDO per district. Unfortunately, none of the three districts had DDOs for Horticulture and Natural Resource Management. The result is a clear case of human resource deficiency for agricultural development in thee Central Region. I n my opinion, each subject area should have a DDO in each district.

Table 4: Area of Specilization of DDOs.

Area of Specialisation	No. of Districts Represented
Veterinary	1 (Cape Coast)
Plant Protection Regulatory services	1 (Abura-Asebu-Kwamankese)
Policy Planning, Monitoring and Evaluation	2 (Cape Coast, A.A.K)
Extension	3 (Cape Coast, AAK, THLD)
General Agriculture	1 (AAK)
Management of Information Systems	1 (AKK)
Crops	2 (Cape Coast, THLD)
Home Economics	1 (Cape Coast)
Horticulture	0
Land Survey	1 (THLD)
Animals Husbandry	2 (Cape Coast, THLD)
Agriculture Economics	1 (THLD)
Natural Resource Management	0
Fisheries	1 (Cape Coast)

N=3

Source: Survey Data, 2002

4.3.3 Agricultural Extension Agents

There were a total of 65 AEAs with a mean value of 22 AEAs per district. The minimum was 17 AEAs in the Cape Coast District and a maximum of 25 AEAs in the Abura-Asebu-Kwamankese District. There were 74 operational areas with a mean of 25 operational areas per district. Each AEA was allotted one operational area with an average of six (6) communities.

4.4. Demographic Characteristics of Farmers

This section of the study gives a broad overview of the demographic characteristics of farmers. These are farmer type, sex, age, educational background, major staple crops cultivated, minor staple crops cultivated, cash crops cultivated and types of vegetable cultivated. The rest are types of livestock kept, residence status, land tenure, farming experience, farm size, other sources of agricultural information and sources of farm finance.

4.4.1 Type of Farmer

One hundred and fifty farmers were interviewed. A ratio of 2:1 resulted in 102 farmers for MoFA and 48 farmers for the three NGOs. These numbers represent 68% for MoFA and 32% for NGOs. The NGOs were ADRA, WVI, and SG2000. As indicated in Table 5, the ratio of 2:1 was used in response to the number of communities each service provider had to cover. Whereas MoFA was mandated to cover all communities in the region, NGOs selected only a few communities.

Table 5: Type of Farmer.

Type of farmer	Frequency	Percent
MoFA	102	68
NGOs	48	32
Total	150	100

Source: Survey Data, 2002

4.4.2 Sex

The number of males who participated in the study was 87 representing 58 %. Females were 63 representing 42% as shown in Table 6. Even though the study aimed at equal representation, this objective was not achieved. This could be due to fewer numbers of women who were involved in the programmes. Palmer (1985) and Olawoye (1993) showed that men have more access and control over production resources, decision-making and extension services than women.

Table6. Sex Distribution of Farmers.

Sex	Frequency	Percent
Male	87	58.0
Female	63	42.0
Total	150	100.0

Source: Survey Data, 2002

Olawoye (1993) and Spring (1986) contended that rural men have traditionally been the recipients of most agricultural extension services, which does not trickle down to their wives.

4.4.3 Age

The age of participating farmers ranged from 29 to 69 years. The mean age was 51 years. This confirms La-Anyane's (1988) report that the average age of farmers in Ghana is between 50 to 60 years. The largest age group was 40-49 years, representing 36% as illustrated in Table 7.

Table 7. Age Distribution of Farmers

Age Group	Frequency	Percent
<39	16	10.7
40-49	54	36.0
50-59	50	33.3
60-70	30	20.0
Total	150	100

Source: Survey Data, 2002

Farmers over the age of 50 years represented 53.3%. Considering the physical nature of farming in Ghana, by the age of 50 most farmers would have lost vitality. Meaningful work output could not be realized from this age group. Unfortunately 20% of the farmers were above 60 years, a compulsory retiring age in the public service. As such, this age statistics does not augur well for the agricultural sector in the Central Region. A farmer's age may influence adoption of agricultural technology in several ways. Older farmers, it is said, have more experiences, resources or authority for trying new technology.

CIMMYT (1993) indicated that younger farmers are likely to adopt a new technology since they are more educated and more cosmopolite than the older generation.

4.4.4 Educational Background

The majority of the farmers had education only up to the middle school or junior secondary school (JSS) level. These represented 44.7% of respondents. Farmers with no formal education were 31.3%. Farmers with or above secondary school level of education constituted only 12.6% (Table 8). The results indicated that an overwhelming majority of farmers in the Central Region had lower than secondary school level of education. This situation might explain the low levels of farm output per unit area. The results also give credence to the observation that well educated people in Ghana do not embark on farming as a profitable venture. As noted by Griliches (1964), schooling is an important source of gains in agricultural productivity. Chandri (1968) in the United States found that a statistically significant relation existed between schooling and farm output in traditional setting.

Against this background, Ogunfiditimi (1981) stated that as farmers advance in age and in their level of education more they will tend to understand the importance, intricacies and need for adopting new improved farm practices. Hence, whenever a technology requires little of technical knowledge, it is those with education that are most likely to adopt.

Table 8: Educational Level of Farmers.

Educational level	Frequency	Percent
No formal education	47	31.3
Primary education	17	11.3
Middle school/JSS	67	44.7
Secondary/SSS/Technical	14	9.3
Diploma	3	2.0
Degree	2	1.3
Total	150	100

Source: Survey Data, 2002

4.4.5 Major Staple Crops Cultivated by Farmers in the Central Region

The results revealed that over 96.7% of farmers in the Central Region grow maize and cassava, 49.3% plantain, 18.0 % sweet potato and 15.3 % cocoyam as major staples. Less than 8.0% of farmers grew yams, rice and cowpea as major staples foods (Table 9). All farmers who grew rice were identified to have come from Twifo-Hemang Lower Denkyira District.

Table 9: Major Staple Crops Cultivated by Farmers in the Central Region

Crop type	Yes		No		Total	
	Freq	Percent	Freq.	Percent	Freq.	Percent
Cassava	148	98.7	1	1.3	150	100
Maize	145	96.7	5	3.3	150	100
Plantain	74	49.3	76	50.7	150	100
Sweet potato	27	18.0	123	82.0	150	100
Cocoyam	23	15.3	127	84.7	150	100
Yam	12	8.0	138	92.0	150	100
Rice	8	5.3	142	94.7	150	100
Cowpea	7	4.7	143	95.3	150	100

There were multiple responses

Source: Survey Data, 2002.

4.4.6 Minor Staple Crops Cultivated by Farmers in the Central Region

The results showed that less than 28.7 % of farmers in the Central Region cultivated cassava, maize, plantain, sweet potato cocoyam, rice and cowpea as minor staple crops (Table 10)

Table 10: Minor Staple Crops Cultivated by Farmers in the Central Region.

Crop type	Yes		No		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Cassava	2	1.3	148	98.7	150	100
Maize	5	3.3	145	96.7	150	100
Plantain	2.6	17.3	124	82.7	150	100
Sweet potato	34	22.7	116	77.3	150	100
Cocoyam	43	28.7	117	78.0	150	100
Yam	3	2.0	107	71.3	150	100
Rice	31	20.7	147	98.0	150	100
Cowpea	33	22.0	119	79.3	150	100

There were multiple responses

Source: Survey Data, 2002.

4.4.7 Cash Crop Cultivated by Farmers in the Central Region

The main cash crops grown in the Central Region are oil palm, cocoa, citrus and lime. Sixty-six percent of the farmers cultivated oil palm, 51% cultivated cocoa and 49% cultivated citrus (Table11). It should however be noted that the distribution of these crops vary across the districts depending on vegetation type.

Table11: Cash Crops Cultivated by Farmers in the Central Region.

Crop	Yes		No		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Cocoa	51	34.0	99	66	150	100
Oil palm	99	66.0	51	34.0	150	100
Citrus	49	32.7	101	67.3	150	100
Lime	11	7.3	139	92.7	150	100
Coconut	10	6.7	140	93.3	150	100
Cashew	7	4.3	143	95.3	150	100

There were multiple responses

Source: Survey Data, 2002.

4.4.8 Vegetables Cultivated by Farmers in the Central Region.

The most widely grown vegetables for subsistence purposes were pepper, tomatoes, garden eggs and okro. The proportions of farmers who grew these vegetables were pepper 85.5%, tomatoes 81.3%, garden eggs 52.7% and okro 44.7%. Correspondingly, the proportion of farmers who produced these vegetables on commercial basis were as follows; pepper, 16.0%, tomatoes, 22.7% garden eggs, 14.0 %; and okro, 20.0% as shown in Table 12.

Table 12: Vegetables Cultivated in the Central Region.

Vegetable	Subsistence		Commercial	
	Yes	Percent	Yes	Percent
Pepper	128	85.5	24	16
Tomatoes	122	81.3	34	22.7
Garden eggs	79	52.7	21	14
Okro	67	44.7	30	20

There were multiple responses **N = 150**

Source: Survey Data 2002

4.4.9 Livestock Production by Farmers in the Central Region

The results showed that the most widely raised animals by farmers in the Central Region were chicken 66.0%, goats 34.7%, and sheep 25.3%. With regard to other animals like pigs, guinea fowls, cattle and snails, none had more than 9.5 % of farmers raising them as indicated in Table 13. No farmer interviewed kept bees, rabbits and fish.

Table13. Livestock Production in the Central Region.

Livestock	Yes		No		Total	
	Freq	Percent	Freq.	Percent	Freq.	Percent
Chicken	99	66	51	34	150	100
Goats	52	34.7	98	65.3	150	100
Sheep	38	25.3	112	74.7	150	100
Ducks	14	9.3	136	90.7	150	100
Pigs	7	4.3	143	95.3	150	100
Snails	5	3.3	145	96.7	150	100
Guinea fowls	3	2.0	147	98	150	100
Cattle	2	1.3	148	98.7	150	100

There were multiple responses

Source: Survey Data, 2002

4.4.10 Residence Status of Farmers in the Central Region

Out of 150 farmers interviewed, 68.0% were natives of the communities they lived in and 32% were migrant or settler farmers (Table 14). This 32 % of migrant farmers in the Central Region is an indication that the region has a substantial population of farmers being migrant farmers.

Table 14. Residence Status of Farmers in the Central Region

Residence status	Frequency	Percent
Native	102	68
Migrant	48	32
Total	150	100

Source: Survey Data, 2002

4.4.11 Land Tenure

The most popular forms of land tenure systems under which farmers are operating in the Central Region are inheritance 62.0% and *Abusa* plus fees 20.7%. The less popular ones are Freehold 9.3%, Hiring 8.0%, *Abonu* 6.7% and *Abusa* 4.7% (Table15). The 62% of farmers practicing land tenure by inheritance could be attributed to the higher proportion of natives who by birth have right to land in the community. Migrant farmers could only ascribe to the other forms of land tenure systems.

Table 15. Land Tenure.

Land tenure system	Yes		No	
	Frequency	Percent	Frequency	Percent
By Inheritance	93	62	57	38
Abusa + fees	31	20.7	119	79.3
Freehold	14	9.3	136	90.7
Hiring	12	8.0	138	92.0
Abonu	10	6.7	140	93.3
Abusa	7	4.7	143	95.3
Abonu + fees	0	0	150	100

There were multiple responses **N = 150**

Source: Survey Data, 2002

4.4.12 Farm Size

With regard to current farm size, 38.0% of the farmers possessed between three (3) to five (5) acres and 35.3.0% of farmers have cultivated more than 5 acres (Table16). Farm size can have different effects on the rate of technology adoption depending on the characteristics of the technology and institutional setting. Specifically, Feder and Slade (1985) stated that the relationship of farm size to adoption depends on such factors as fixed adoption costs, risk, preferences, human capital, credit constraints, labour requirements, and land tenure arrangements. Gafsi and Roe (1979) indicated that inadequate farm size also impedes efficient utilization or adoption of certain types of irrigation equipment such as pumps and tube wells.

Table 16. Farm Size

Farm size in acres	Frequency	Percent
<1	1	0.7
1- 2	39	26.0
3-5	57	38.0
>5	53	35.3
Total	150	100

Source: Survey Data, 2002

4.4.13 Farming Experience

The results as shown in Table 17 indicate that 49.3% of farmers have 11-20 years of farming experience, 26.0% between 21-30 years of farming experience. Whereas 15.3% of farmers have been farming for the past 31 to 40 years, only 8.7% of the farmers had less than 10 years farming experience. The mean was 21 years.

Table 17: Farming Experience

Years in farming	Frequency	Percent
10	13	8.7
11-20	74	49.3
21-30	39	26.0
31-40	21	15.3
>40	1	0.7
Total	150	100

Source: Survey Data, 2002

4.4.14 Agricultural Extension Service Providers to Farmers in the Central Region

Of the 150 farmers interviewed, 91% indicated that their former service provider was MoFA, and 6.7% of farmers did not receive any extension service. Only 1% of farmers depended on NGOs as shown in Table18. This group of farmers could be the younger age group. This observation may be due to the fact that NGO agricultural extension activities in the Central Region did not start until 1986. This also goes to support the assertion that the Public sector was the sole provider of agricultural extension services.

On current service provider, 89% of the respondents indicated that MoFA still provided their services. Eleven percent of farmers are currently receiving services from both NGOs and MoFA. An overwhelming proportion of farmers still depend on MoFA despite some farmers having been identified as NGO farmers. This may be due to the fact that NGOs do not normally employ their own extension staff. NGOs by their collaborating links tend to depend on MoFA extension staff for their service delivery. The 11% of respondents who indicated that they were receiving services from both service providers could be those on specific NGO programmes, such as agro-forestry (ADRA), snail farming (WVI) and improved maize trials (SG2000). Despite these specific programmes, it is still MoFA extension staffs that are used.

Table18. Former and Current Agricultural Extension Service Providers

Service provider	Former service provider		Current service provider	
	Frequency	Percent	Frequency	Percent
MoFA	137	91.3	133	88.7
NGO	2	1.3	1	0.7
Both	1	0.7	16	10.7
None	10	6.7	0.00	0.00
Total	150	100	150	100

N = 150

Source: Survey Data, 2002

4.4.15. Other Sources of Agricultural Information

The request for participating farmers to indicate their other sources of agricultural information showed that a very large proportion (88.7%) mentioned farmer friends, followed by FM-Radio (80%) and television (26.7%) as indicated in Table 19 and captured in Fig.1 under the conceptual frame work of the study. Though television is known to make a better impact as a means of communication, the relatively lower proportion of farmers who listed television as additional source of information could be due to the inability of farmers to buy television sets or the very irregular supply of electricity to the rural communities where most of the farmers reside. With regard to textbooks, the poor educational background of farmers could be the reason. With over 86% of the farmers having no or just up to middle school / JSS education (Table 8), it would have been unlikely to have a good proportion of farmers listing textbook as an additional source of information.

Table: 19 Other Sources of Agricultural Information.

Source	Yes		No		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
Farmer friends	133	88.7	17	11.3	150	100
Radio-FM	120	80.0	30	20.0	150	100
TV	40	26.7	110	73.3	150	100
Textbook	24	16.0	126	84.0	150	100
Newspapers	11	7.3	139	92.7	150	100
Agric.sc. Teacher	6	4.0	144	96.0	150	100

There were multiple responses

Source: Survey Data, 2002

As noted by Dolliso and Martin (2001), apart from extension still attracting a significant number of farmers to its services, magazines and neighbours were leading sources of agricultural information for farmers. In their study involving members of Iowa Young Farmers Educational Association (a highly educated group) the declining ranked order of most preferred information sources were magazine, neighbour, extension, radio, relatives and television.

4.4.16 Sources of Farm Financing

The results on farm activity financing showed that 99% of farmers financed their farm operations with own labour, 75% relied on family labour, 91% used own funds, 12% remittances from children and only 9% received credit form the banks as indicated in Table 20.

Table.20 Sources of Farm Financing.

Source	Yes		No		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Own labour	148	98.7	2	1.3	150	100
Family Labour	113	75.3	37	24.7	150	100
Own funds	137	91.3	13	8.7	150	100
Money lenders	2	1.3	148	98.0	150	100
Susu savings	5	3.3	145	93.7	150	100
Remittances	18	12	132	88.0	150	100
Banks	14	9.3	136	90.7	150	100

There were multiple responses
Source: Survey Data, 2002

The majority of farmers indicating their reliance on own labour for farming operation go to support an earlier claim that farming activities in Ghana are largely manual and labour intensive. Also, the lower proportion of farmers in the Central Region receiving extension services from either MoFA or an NGO with credit from banks is an indication that formal credit from banks is mostly out of reach of rural farmers.

According to Owusu-Acheampong (1986), most farm operations are traditionally carried out using simple farm tools, traditional varieties of crops without the application of improved inputs and credit. He continued that the percentage of families, which borrow, is small. Conclusions were that little investment capital results in little marketable surplus, which in turn results in little income. ODI (1998) concluded that the very poor might never have adequate debt-bearing capacity to take on loan and it would be dangerous to insist that they should do so.

4.5 Interactions Between Service Providers

Interactions identified between MoFA and NGOs were those of collaboration, consultation and delegation. Confrontation and competition were not reported.

4.5.1 Level of Collaboration Between Service Providers

Of the three MoFA district directorates, only one indicated NGO collaboration at the national level. Only one of the participating NGOs indicated collaboration with MoFA at the national level (Table21). The higher collaboration at the district level may indicate that the NGOs view MoFA as important development partners.

Table21: Level of Collaboration Between Service Providers

Organisation	Collaboration at National level			Collaboration at Regional level			Collaboration at District level		
	Yes	No	NR	Yes	No	NR	Yes	No	NR
MoFA	1	1	1	1	1	1	2	0	1
NGOs	1	2	0	0	3	0	3	0	0

N (MOFA)=10 N (NGOs)=3 NR = No response

Source: Survey Data 2002

4.5.2 Forms of Collaboration.

All three participating NGOs and the three (3) MoFA directorates said collaboration was formal and documented.

4.5.3 Extent of Collaboration.

The extent of collaboration was measured on a 5-point Likert scale with 1 (poor) through to 5 (excellent). As shown in Table 22, two of the three MoFA district directorates indicated very good level of collaboration with NGOs. Two out of three NGOs also indicated very good collaboration with MoFA at the district level. The least level of collaboration indicated for both service providers was good. This outcome is encouraging.

This good level of collaboration may be due to the ability of NGOs to operate in areas where the public sector is weakest. As noted by Korten (1987), the most obvious incentive behind government collaboration in agricultural activities is financial. For NGOs, the desire to collaborate with the public sector is perceived to be due to motivated individuals with extensive knowledge of the public sector, their recognition of the public sector's advantage in certain fields. There is also a strong desire for public recognition of their research activities and the wish to influence the public methods and research agenda.

Table 22: Extent of Collaboration Between MoFA and NGOs

Organisation	Level of collaboration				Total
	Good	Very good	Excellent	No response	
MoFA	1	1	0	1	3
NGO	1	2	1	0	3

Source: Survey Data, 2002

4.5.4 Impact of Collaboration

When service providers were asked whether collaboration enhanced their service delivery, all the three responding MoFA directorates and all the three participating NGO managers said yes and would recommend future collaborating ventures. This goes to support the argument of Swanson and Sammy (2000) that, if NGOs work in collaboration with the public sector extension and with supportive government policies and resources, they could be more effective in helping resource poor farmers gain access to resources and technologies.

4.5.5 Collaboration with Other Agencies

All the three participating NGOs indicated collaborating with other agencies aside MoFA (Table 23) as envisaged in the conceptual framework of farmers' perception of the effectiveness of agricultural extension services (Fig.1). These organizations were other NGOs, Forestry Department, Department of Cooperatives, Rural Banks and Artisans (Black smiths). Two out of the three MoFA district directorates indicated collaborating with other agencies such as Forestry Department, Peace Corps volunteers, Universities, CSIR, and some agricultural export companies.

Table 23: Collaboration with other agencies.

Organisation	Collaboration			
	Yes	No	No response	Total
MoFA	2	1	0	3
NGO	3	0	0	3

Source: Survey Data, 2002

4.5.6 Consultation and Delegation

Only one out of the three MoFA district directorates indicated that they had ever consulted an NGO in the execution of their extension work in the Central Region. Two of the three participating NGOs indicated ever-consulting MoFA in their extension work in the Central Region.

On delegation, only one of the three districts of MoFA directorates affirmed that NGOs have ever delegated their extension services to MoFA. O n the contrary, none of the three participating NGOs indicated to have ever had MoFA delegating some extension service provision to it (Table 24).

Table: 24 Consultation and Delegation Between MoFA and NGOs.

Organisation	Consultation			Delegation		
	Yes	No	Total	Yes	No	Total
MoFA	1	2	3	1	2	3
NGO	2	1	3	0	3	3

Source: Survey Data, 2002

This observation is contrary to that noted by Sotomayor (1991). He stated that governments in Chile, Mozambique and Uganda contracted NGOs to cater for the extension needs of small-scale farmers. Farrington (1997) indicated that similar attempts in India failed. Amanor and Farrington (1991) argue that, because of NGOs independence from governments, any attempts to fit them into government agenda as an adjunct to existing extension service is likely to be resisted as a threat to NGO independence.

4.5.7 Confrontation and Competition

These types of interactions were not encountered between the two service providers. However, among NGOs, even though not officially stated they were informally mentioned. This goes to support the claim by Ayers (1992) that some locations have become so densely populated by diversity of NGOs that problems have arisen not of merely of competition for same clientele but some undermining the activities of others.

4.6 Awareness of Information on Some Basic Agricultural Extension Technologies.

With regard to the awareness of information on some existing technologies in question, well over 60% of farmers interviewed responded yes to 16 out of the 19 technologies listed. These 16 technologies could be considered as old technologies. With technologies such as the use of improved varieties, row planting, use of pesticides, fertilizer application and chemical storage, well over 80 % of the respondents were aware of their existence (Table 25).

Less than 50% of farmers indicated awareness of the existence of recent technologies such as plantain paring, grain storage with neem products and wet sack for cassava preservation. The following proportion of farmers indicated awareness of technologies; chemical storage 89%, improved maize crib 73%), wet sack for cassava storage 15% and neem storage products 14%. The relatively small proportion of farmers who were aware of wet sack for cassava storage and use of neem products may be due to the fact that they are fairly recent technologies as compared to chemical storage and improved maize crib technologies introduced by SG 2000. It could therefore be said that greater awareness had been created for old technologies.

Table 25: Farmers' Awareness of Some Basic Agricultural Extension Information or Technologies.

Technology	Frequency /Percentage			
	Awareness	%	Non-awareness	%
Use of improved varieties	150	100	0	0
Row planting	144	96	6	4
Plant stand	124	82.7	26	17.3
Pesticide use	135	90	15	10
Timely weeding	150	100	0	0
Organic manure use	120	80	30	20
Inorganic fertilizer use	149	99.3	1	.7
Plantain paring	72	48	78	52
Germination testing	79	52.7	71	47.3
Agro-forestry	90	60	60	40
Chemical storage	134	89.3	16	10.7
Improved maize crib	110	73.3	40	26.7
Wet sack cassava storage	23	13.7	127	84.7
Neem storage products	20	13.3	130	86.7
Improved livestock breeds	101	67.3	49	32.7
Supplementary livestock feeding	95	63.3	55	36.7
Livestock housing	93	62	57	38
Livestock preventive health	92	61.3	58	38.7
Livestock curative health	101	67.3	49	32.7

There were multiple responses. N =150

Source: Survey Data, 2002

4.7 Mean Perception on Effectiveness Variables of Some Basic Agricultural Extension Information Technologies

In this section, farmers' perceived effectiveness of 19 agricultural technologies are presented and discussed under the following headings.

- Crop production
- Crop storage
- Animal production

These variables; awareness, relevance and adequacy of information, availability of inputs, adoption, cost of inputs and output for adopting a particular technology, constituted the effectiveness variable conceptualized in Fig.1.

4.7.1 Farmers Mean Perception on Composite Effectiveness Variables Crop Production Technologies

The farmers perceived the information provided on timely weeding to be 4.08 (very relevant). That for use of improved varieties was 3.73, row planting 3.70 and use of inorganic fertilizer as 3.75. These mean values could be interpreted as slightly above relevant. Information on agro-pesticide use 3.33 and plant stand 3.21 was perceived as relevant (Table 26). Perception on relevance of extension advice on plantain paring 1.82, germination test 2.01, and agro-forestry 2.07 could be termed as fairly relevant.

On adequacy of information provided by service providers, timely weeding received the highest mean value of 3.79 meaning very adequate. Inorganic fertilizer use registered 3.35; row planting 3.47 and use of improved varieties 3.35 were perceived as slightly above adequate. Plantain paring 1.64, germination test 1.75 and agro-forestry 1.65 were perceived as below fairly adequate. With regard to availability of inputs to adopt information provided, farmers' perception for improved varieties as 2.81, row planting 3.03, timely weeding 3.30, and inorganic fertilizer 2.77 were considered as available (Table 26).

Table 26: Farmers Mean Perception on Composite Effectiveness Variables for Crop Production Technologies

Variable	Relevance	Adequacy	Adoption	Availability of inputs	Cost of inputs	Output
Improved varieties	3.73	3.35	3.21	2.81	3.36	3.40
Row planting	3.70	3.47	3.07	3.03	1.85	3.12
Plant stand	3.21	2.95	2.75	-	-	2.97
Timely weeding	4.08	3.79	3.99	3.30	3.89	4.01
Pesticide use	3.33	2.87	2.42	2.42	3.55	2.80
Organic manure	2.83	2.55	1.63	2.55	1.29	1.78
Inorganic fertilizer	3.75	3.35	2.55	2.77	3.96	3.01
Plantain paring	1.82	1.64	1.47	1.48	1.05	1.55
Germination test	2.01	1.75	1.35	1.51	0.91	1.53
Agro-Forestry	2.07	1.65	1.27	1.40	0.80	1.03

N = 150

Scales for effectiveness variables.
Relevance: 1=not relevant 2=fairly relevant 3=relevant 4=very relevant 5=excellent
Adequacy: 1=not adequate 2=fairly adequate 3=adequate 4=very adequate 5=excellent
Adoption: 1=never adopted 2=seldomly adopted 3=sometimes adopted 4=often adopted 5=always adopted.
Availability of inputs: 1=not available 2=barely available 3=available 4=readily available
Cost of inputs: 1=very cheap 2=cheap 3=moderate 4=expensive 5=very expensive
Out-put: 1=bad 2=fair 3=good 4=very good 5=excellent
Source: Survey Data, 2002

Pesticides use 2.42 and organic manure use 2.55 were perceived to be barely available. Inputs for agro-forestry 1.40, germination test 1.51 and plantain paring 1.48 could also be seen as barely available. These low perceived mean values could be attributed to the low frequency of awareness of information on these technologies (Table 25).

On adoption of information or technology, perceived mean values for the use of improved varieties, row planting and plant stand could be interpreted as sometimes adopted. Timely weeding was perceived as often adopted. Information on pesticide and organic manure use was perceived as seldomly adopted. Mean values for plantain paring, germination test and agro-forestry indicated that information on these technologies was either never or seldomly adopted (Table 26).

The low adoption value for agro-forestry may be due to economic cost as explained by Arnold (1983). He stated that the greatest constraint militating against agro-forestry systems is competition from land under pressures of expanding populations. He further elucidated that though trees constitute a productive element in farming traditional agricultural systems in the tropics and are essential for sustained production from land, as these lands become scarcer, the overriding need to produce food and income in the short term naturally takes precedence over these longer-term values.

Wiersum (1981) also observed that, as overall farm size decreases due to fragmentation accompanying population growth, when farm sizes fall below a certain point, farmers increasingly forego the tree products in favour of staple food production.

Perceived mean values of output for adopting technologies or information were timely weeding 4.01 use of improved varieties, 3.40, row planting 3.12 and inorganic fertilizer use could all be interpreted as good. The low values of below 1.55 considered as bad output for plantain paring, germination test and agro-forestry may be attributed to the low proportion of farmers that were aware of the technologies but means were computed based on all the 150 participating farmers.

With regard to cost of inputs to adopt technology, perceived mean values were timely-weeding 3.89, considered as expensive, improved varieties 3.36 (moderate) and inorganic fertilizer 3.96 (very expensive) and pesticides 3.55 could be rated between moderate to expensive. Inputs for planting in lines were perceived as 1.85 (cheap).

4.7.2 Farmers Mean Perception on Composite Effectiveness Variables for Crop Storage Technologies

Farmers' mean perceived relevance on chemical storage information of 3.29 indicated that information provided was relevant. That on improved maize crib (2.61) could be rated as fairly relevant to relevant. The mean values of 0.54 for wet sack cassava storage and 0.44 for neem products were noted as not relevant (Table 27). Information provided farmers on chemical storage 2.89 and improved maize crib 2.51 were perceived as adequate. On availability of inputs to adopt information, farmers' perceived mean values were chemical storage 2.49, improved maize crib 2.20, which could be interpreted as barely available.

Table 27: Farmers Mean Perception on Composite Effectiveness Variables for Crop Storage Technologies

Variable	Relevance	Adequacy	Adoption	Availability of inputs	Cost of inputs	Output
Agro-chemicals	3.29	2.89	2.40	2.49	3.09	2.52
Improved maize crib	2.61	2.51	1.67	2.20	1.40	1.73
Wet sack for cassava	0.54	0.47	0.25	0.43	0.13	0.23
Neem products	0.44	0.41	0.26	0.31	0.15	0.19

N = 150

Scales for effectiveness variables

Relevance: 1=not relevant 2=fairly relevant 3=relevant 4=very relevant 5=excellent

Adequacy: 1=not adequate 2=fairly adequate 3=adequate 4=very adequate 5=excellent

Adoption: 1=never adopted 2=seldomly adopted 3=sometimes adopted 4=often adopted 5=always adopted.

Availability of inputs: 1=not available 2=barely available 3=available 4=readily available

Cost of inputs: 1=very cheap 2=cheap 3=moderate 4=expensive 5=very expensive

Out-put: 1=bad 2=fair 3=good 4=very good 5=excellent

Source: Survey Data, 2002

With chemicals for storage, they are more readily available in the urban centres where agro-chemical shops are mostly located than in rural communities where majority of farmers stay. The barely available materials for improved maize crib construction could be for standard material recommended by SG2000. The current ban on chain saw activities in Ghana has made timber products scarce in the rural areas.

With regard to adoption of storage information or technology, perceived mean values were, chemical storage 2.40 and improved maize crib 1.67 which could be interpreted as seldomly adopted. This observation may be attributed to the issue of availability of inputs or the fairly relevance of information provided by service providers.

Farmers perceived the cost of storage chemicals as moderate with mean value of 3.09 and that for improved maize crib 1.40 as very cheap. Output for adopting information or technology was perceived as fair for chemical storage 2.52 and improved maize crib 1.73. Perceived mean values for relevance, adequacy, adoption availability, cost of inputs and output for adopting information or technology on wet sack for cassava storage and use of neem products were the least in all instances as indicated in Table 27.

The very low perceived mean value for relevance and adoption values for wet- sack cassava storage may be attributed to observation by Booth (1976). He indicated that the main traditional approach to preventing rapid post-harvest deterioration of cassava involves leaving the roots in the soil past the period of optimal root development until they can be immediately consumed, processed or marketed. According to FAO (1995), consumers in the urban centres where the demand for fresh cassava root is greatest, unless motivated by economic considerations, will not purchase old cassava roots due to poor eating and processing qualities.

Though neem has been used as a storage product in Africa, Asia and Americas for centuries, a survey by NRI (1999) revealed that many farmers are unaware of the use of insecticidal plants. The studies further revealed that majority of the farmers do nothing to protect their grain during storage.

4.7.3 Farmers Mean Perception on Composite Effectiveness Variables for Livestock Production Technologies.

Technologies considered under livestock production were; improved livestock breeds with emphasis on domestic chicken, livestock supplementary feeding, livestock housing, livestock preventive health and livestock curative health. Over 60% of farmers interviewed were aware of the existence of these technologies (Table 25) despite the presence of only one veterinary DDO and two animal husbandry DDOs in the study districts within the Central Region.

The calculated means of perceived relevance of extension information provided on livestock production were all less than 2.50, which could be interpreted as fairly relevant. The means on adequacy of information provided on the improved livestock breeds 1.99, livestock housing 2.11, livestock supplementary feed 1.93, livestock preventive health 1.89 and livestock curative health 1.98 were all perceived as fairly adequate.

Table 28: Farmers Mean Perception on Composite Effectiveness Variables for Livestock Production Technologies.

Variable	Relevance	Adequacy	Adoption	Availability of inputs	Cost of inputs	Output
Livestock improved breeds	2.35	1.99	1.35	1.49	1.53	1.47
Livestock housing	2.33	2.11	1.53	1.64	1.26	1.62
Livestock supplementary feed	2.35	1.93	1.27	1.56	1.32	1.41
Livestock preventive health	2.33	1.89	1.36	1.59	1.34	1.31
Livestock curative health	2.47	1.98	1.45	1.71	1.45	1.46

N = 150
Scales for effectiveness variables
Relevance: 1=not relevant 2=fairly relevant 3=relevant 4=very relevant 5=excellent
Adequacy: 1=not adequate 2=fairly adequate 3=adequate 4=very adequate 5=excellent
Adoption: 1=never adopted 2=seldomly adopted 3=sometimes adopted 4=often adopted5=always adopted.
Availability of inputs: 1=not available 2=barely available 3=available 4=readily available
Cost of inputs: 1=very cheap 2=cheap 3=moderate 4=expensive 5=very expensive
Out-put: 1=bad 2=fair 3=good 4=very good 5=excellent
Source: Survey Data, 2002

Regarding the availability of inputs to use information provided on livestock, the mean for use of livestock improved breed 1.49 indicated barely available. This situation could be attributed to the observation that it is only occasionally that peddlers in two to four weeks old poultry birds visit accessible communities.

The means for availability of livestock housing materials (1.64), livestock supplementary feed (1.56), livestock preventive health (1.59) and livestock curative health materials (1.71) for livestock were perceived as barely available with regard to local substitutes. In reality, availability of veterinary products for livestock health related products is very precarious. This unfortunate situation may help explain the perceived outcome on output.

Results on perceived mean adoption of information on livestock production revealed that, apart from livestock housing (1.53) interpreted as seldomly adopted, livestock improved breeds, (1.35) livestock supplementary feed (1.27), livestock preventive health (1.36) and livestock curative health (1.45) could be considered as very seldomly adopted if not never adopted (Table28). The non-adoption of livestock preventive health information may explain the very high proportion of local chicken and improved chicken raised under local conditions that die from Newcastle disease yearly in some communities in the Central Region (personal observation). As noted by Spradbrow (1999), Newcastle is the most important infectious disease affecting village chicken in developing countries. He also stressed that such seasonal outbreaks in Uganda occur in the dry season, in Ethiopia before Easter and in Ghana before Christmas.

In situations where extension advice on livestock production was adopted, output was perceived as bad as depicted in Table 28. This could be attributed to the fact that, until very recently, there were, for instance, no methods for controlling Newcastle disease in the village chicken. The conventional Newcastle vaccines that were effective in commercial poultry found little use in village chicken (Spradbrow, 1999). With regard to cost of inputs on livestock production, perceived means were all less than 2, which could be described as cheap (Table 28).

4.8 Extents and Proportion of Farmers Adopting Some 19 Basic Agricultural Extension Technologies in the Central Region

The following section presents results of the extent to which the respondents adopted the various extension information or technologies studied. The results are presented and discussed under the following headings:

- Crop production information
- Crop storage information
- Livestock production

4.8.1 Extent and Proportion of Farmers Adopting Agricultural Extension Technologies on Crop Production in the Central Region

The following section presents results of the extent to which the respondents adopted crop production extension technologies.

4.8.1.1 Improved Varieties

As shown in Table 29a, 8% of the respondents indicated that they never adopted improved varieties. Whereas 33% of the respondents sometimes adopted improved varieties, 35% often adopted. As such 92% of the respondents indicated adopting improved varieties, which ranged from seldom adoption to often adoption. This finally translated into a mean perceived adoption value of 3.21 indicating seldom adoption (Table 26). The seldom extent of adoption may be due to the assertion by Lipton and Longhurst (1984) that although improved varieties reduce risks, smaller farmers are likely to know less about them than more popular traditional varieties.

Table 29a: Extent and Proportion of Farmers Adopting Agricultural Extension Technologies on Crop Production in the Central Region

Technology	Extent and proportion of adoption						
	NA	Never	Seldom	Sometime	Often	Always	Total
Improved varieties	-	8.0	15.3	32.7	35.3	8.7	100
Row planting	4.0	16.0	10.7	25.3	26.0	18.0	100
Plant stand	18.0	10.0	8.7	16.7	35.3	11.3	100
Timely weeding	-	-	5.3	10.7	63.3	20.7	100
Agro-pesticides	11.3	18.7	23.3	20.0	16.7	10.0	100
Organic manure	20.7	32.0	23.3	16.0	3.3	4.7	100
Inorganic fertilizer	0.7	25.3	28.7	22.0	10.0	13.3	100
Plantain paring	52.7	9.3	8.0	8.7	10.7	10.7	100
Germination test	49.3	7.3	20.0	11.3	4.7	7.3	100
Agro-forestry	39.3	32.7	5.3	10.	10.0	2.7	100

NA = Not applicable

Source: Survey Data, 2002

4.8.1.2 Row planting

In Table 29a, it is revealed that 16% of the respondents never adopted line or row planting as against 18% of respondents who always adopted row planting. The observation resulted in a mean adoption level of 3.07 interpreted as sometimes adoption for row planting. The 80% of respondents adopting row planting to some extent may be attributed to the fact that 66% of the respondents (Table 26) perceived extension effectiveness to be within the good range.

4.8.1.3 Plant Stand

Results indicated that 11% of the respondents always adopted the recommended extension advice on plant stand as against 10% of the respondents who never adopted. (Table29a). The results also revealed that 35% of the respondents often adopted extension advice on plant stand and the mean of 2.75 interpreted as that of seldom adoption (Table 26).

4.8.1.4 Timely Weeding

Sixty-three percent of the respondents indicated that they often adopted extension recommendation on timely weeding as against 21% who always adopted (Table 29a). Consequently the 84% of respondents who indicated that they either often or always adopted extension advice on timely weeding resulted in a high adoption mean value of 4.0 (Table 26). This could also have been due to the losses and inconveniences caused by weeds to man's farming activities as noted by Hill (1977).

4.8.1.5 Agro-Pesticides

As indicated in Table 29a 19% of the respondents never adopted agro-pesticides as against 10% who always adopted extension recommendation on agro-pesticides. The mean adoption value observed for agro-pesticides was 2.4 interpreted as seldom adoption. This low adoption mean value for agro-pesticides may be attributed to the cost of agro-pesticides, which respondents perceived as expensive. Another contributing factor could be the barely available agro-pesticides as noted by the respondents (Table 26).

4.8.1.6 Organic Manure

Results indicated in Table 29a show that the item on adoption of organic manure was not applicable to 21% of the respondents because they were not aware of extension advice on organic manures (Table 25). Out of the about 80% of the respondents who were aware of extension advice on organic manures, 32% indicated they never adopted the technology. Similar, 23% of the respondents noted that they seldom adopted organic manures. Only 5% of respondents often adopted organic manures .The mean adoption value for organic manures was 1.6 interpreted as below seldom adoption (Table26). The low mean adoption value for organic manures cannot be attributed to non-availability or cost or organic manure materials but probably to the often bulky nature of organic materials and less drastic immediate results compared to inorganic fertilizers.

4.8.1.7 Inorganic Fertilizers

As noted in Table 29a, only 25%% of the respondents never adopted extension advice on inorganic fertilizers. However, for the respondents who adopted inorganic fertilizers to some extent, these ranged from 28.7% for seldom adoption to 13% who always adopted. The overall effectiveness rating for extension information on inorganic fertilizer is good. The expensive nature of inorganic fertilizers as perceived by the respondents (Table 26) may have contributed to the barely 51% of the respondents who either seldomly or sometimes adopted the technology.

4.8.1.8 Plantain Paring

The results as stated in Table 29a revealed that only 38% of the respondents adopted plantain paring technology to various extents. This may be attributed to about 42% of the respondents who were not aware of plantain paring technology (Table 25). Secondly, only 67% of the respondents cultivated plantain. Another contributing factor may be that plantain paring is a recent technology introduced in Ghana in 1994 under the West African Plantain Project (personal communication).

4.8.1.9 Germination Test

In Table 29a is illustrated the outcome of the proportion and extent to which the respondents adopted germination test information. Only 7.3% of the respondents who were aware of extension advice on germination test never adopted the technology. A similar percentage of respondents always adopted germination testing technology. The mean perceived adoption value for germination test was as low as 1.5 indicating seldom extent of adoption (Table 26).

4.8.1.10 Agro-Forestry

Results in Table 29a present the proportion and extent to which the respondents adopted extension practices on agro-forestry. Only 28% of the respondents adopted agro-forestry practices to some extent. This observation may be attributed to the excessive land fragmentation in the region. As noted by Wiersum (1981), as overall farm size falls below a certain critical point, farmers increasingly forego the tree products in favour of staple food crop production. Also, farmers in forest areas do not see agro-forestry as one of the means of livelihood.

4.8.2 Extent and Proportion of Farmers Adopting Agricultural Extension Technologies on Crop Storage in the Central Region

The following section presents results of the extent to which the respondents adopted crop storage extension technologies.

4.8.2.1 Agro-Chemical Storage

In Table 29.b is indicated the results of the extent to which the respondents adopted agricultural extension information on agro-chemical storage. Only 5% of the respondents always adopted agro-chemical storage practices. Respondents who never adopted agro-chemical storage practices constituted 25%. Though the respondents rated the cost of agro-pesticides as being moderate to very expensive, they indicated that output for storing with agro-chemicals ranged from good to excellent (Table 27).

Table 29b Extent and Proportion of Farmers Adopting Agricultural Extension Technologies on Crop Storage in the Central Region

Technology	Extent and proportion adopting						
	NA	Never	Seldom	Sometime	Often	Always	Total
Agro-chemicals	11.3	24.7	12.0	22.0	24.7	5.3	100
Improved maize crib	26.7	30.7	12.7	15.3	8.7	6.0	100
Wet sack (cassava)	84.7	10.0	2.7	1.3	1.3	-	100
Neem products	86.7	6.7	3.3	2.0	-	1.3	100

NA = Not applicable

Source: Survey Data, 2002

4.8.2.2 Improved Maize Crib

The results on the extent to which the respondents adopted improved maize crib technology are presented in Table 29b. Respondents who never adopted improved maize crib technology were 31%. Consequently, only 43% of the respondents adopted it to some extent. This observation may be attributed to barely available inputs and the fair output level for adopting the technology (Table 27)

4.8.2.3 Wet-Sack Cassava Storage

As illustrated in Table 29b, only 5.3% of the respondents adopted the wet-sack cassava storage technology. This may be attributed to the overwhelming 85% of the respondents who were not even aware of the technology (Table 25). Also, as noted by FAO (1995), at the farm level, cassava roots are not harvested until they can be immediately consumed processed or marketed. The perceived mean relevance level of wet-sack cassava storage technology was that of no-relevance to the respondents (Table 27).

4.8.2.4 Neem Storage Products

The proportion and extent to which the respondents adopted neem storage products are presented in Table 29b. Seven percent (7%) of respondents never adopted. This observation goes to confirm the assertion by NRI (1999) that in Ghana, many farmers are unaware of the use of insecticidal plants. In Northern Ghana, for instance, neem is more often recognized for its medicinal properties than its insecticidal properties.

4.8.3 Extent and Proportion of Farmers Adopting Agricultural Extension Technologies on Livestock Production in the Central Region

The following section presents results of the extent to which the respondents adopted livestock production extension technologies.

4.8.3.1 Livestock Improved Breed

In Table 29c are stated the results of the proportion and extent to which the respondents adopted extension information on improved livestock breeds. Whereas 23% of the respondents never adopted livestock improved breeds, 19% seldom adopted. About 59% of the respondents were either not aware or never adopted livestock improved breeds. This may be due to the limited number of veterinary and animal husbandry DDOs in the various districts in the Central Region. This observation may also have resulted in the fairly relevant and fairly adequate levels of information on improved varieties. Similarly, perceived mean output for adopting improved varieties revealed bad output (Table 28).

4.8.3.2 Livestock Supplementary Feed

As illustrated in Table 29c, 22% of the respondents never adopted extension advice on livestock supplementary feed for livestock, 5% adopted often and only 1% of the respondents adopted always.

4.8.3.3 Livestock Housing

In Table 29c is illustrated the proportion and extent to which the respondents adopted extension information on livestock housing. Only 8% of respondents always provided livestock housing for their livestock. Nineteen percent of the respondent never adopted livestock housing. These observations may be responsible for the frustrations veterinary workers face when they embark on vaccination programmes.

4.8.3.4 Livestock Preventive Health

Results in Table 29c show the proportion and the extent to which the respondents adopted extension advice on livestock preventive health. With regard to extension advice on livestock preventive health for livestock, 24.7% never adopted the information. Only 3% of the respondents always adopted extension advice on livestock preventive health. This may be responsible for the high numbers of village chicken lost during Christmas due to Newcastle disease as noted by Spradbrow (1999).

4.8.3.5 Livestock Curative Health

The proportion and extent to which the respondents adopted agricultural extension information on livestock curative health is contained in Table 29c. Sixty-seven percent of the respondents indicated awareness of extension advice on livestock curative health (Table 25). As with the other livestock production information, 27% of the respondents never adopted information on livestock curative health. Similarly, only 3% of the respondents adopted extension information on livestock curative health always. These very low proportions of respondents who always adopted livestock preventive and curative advice from extension may help explain the high mortality rate observed in livestock kept under subsistence level in the Central Region.

Table 29c: Extent and Proportion of Farmers Adopting Agricultural Extension Technologies on Livestock Production in the Central Region

Technology	Extent and proportion of adoption						
	NA	Never	Seldom	Sometime	Often	Always	Total
Livestock improved breeds	36.7	22.7	19.3	12.7	7.3	1.3	100
Livestock supplementary feed	36.0	22.0	22.7	10.7	5.3	1.3	100
Livestock housing	40.7	19.3	12.7	9.3	10.0	8.0	100
Livestock preventive health	40.0	24.7	12.0	9.3	10.7	3.3	100
Livestock curative health	34.0	26.7	14.0	16.7	3.3	5.3	100

NA = Not applicable

Source: Survey Data, 2002

4.9. Farmers' Perception of Extension Effectiveness on Some Basic Agricultural Extension Technologies.

The effectiveness rating is based on composite scores from seven independent variables listed below

- Awareness of information or technology
- Relevance of information or technology
- Adequacy of information provided
- Availability of inputs to adopt information or technology
- Adoption of information or technology
- Cost of inputs to adopt information or technology
- Output for adopting information or technology

The scale scores ranged from 7 (1 x 7) to 31 (5x5+ 2+4) and were classified into five categories. Scores ranging from 7–10 were regarded as very poor effectiveness, 11-15 as poor effectiveness, 16-20 as fair effectiveness, 21-26 as good effectiveness and 27-31 as very good effectiveness.

For the purpose of perceived effectiveness determination, the scale for Awareness (1 = yes, 2 = No) was recoded to become (1 = No 2 = Yes). The Cost of inputs (1 = very cheap, 2 = cheap, 3= moderate, 4 = Expensive and 5 = very expensive) became 1 = very expensive, 2 = expensive, 3 = moderate, 4 = cheap and 5 = very cheap. The recoding was meant to correspond with a planned interpretation that the higher the scores, the higher the perceived effectiveness.

A t-Test performed to compare the mean scores of perceived effectiveness for MoFA and NGO farmers revealed that the differences in mean scores for all the 19 agricultural extension information or technologies investigated were not statistically significant. Hence MoFA and NGO farmers were treated as a homogenous sample and the interpretation of the result done as such. . This implies that both service providers were reaching a similar socio-demographic type of clientele.

4.9.1 Farmers' Perception of Extension Effectiveness on Crop Production Technologies.

This section presents the results of farmers' perception of extension effectiveness on crop production technologies.

4.9.1.1. Farmers' Perception of Extension Effectiveness on Improved Varieties

As shown in Table 30, majority of the respondents 74% perceived extension's effectiveness on improved varieties to be within the good range.

Whilst 18% indicated a fair level of effectiveness, 8% perceived extension's effectiveness to be in the poor range.

Table 30: Farmers' Perception of Extension Effectiveness on Improved Varieties

Scores	Rating	Frequency	Percent
7 – 10	Very poor	4	2.7
11 – 15	Poor	8	5.3
16 – 20	Fair	27	18.0
21 – 26	Good	104	69.3
27-31	Very good	7	4.7
TOTAL		150	100

Source: Survey Data, 2002

Similarly, mean scores indicated that respondents sometimes adopted improved varieties (Table 29a). Respondents mean perception level of output from adopting improved varieties was good (Table 26).

4. 9.1.2 Farmers' Perception of Extension Effectiveness on Row planting

As shown in Table 31, 60% of the respondents perceived extension effectiveness on row planting as good and 9.3% as very poor. It could therefore be said that enough information has been provided to farmers with regard to the merits of row planting.

Table 31: Farmers' Perception of Extension Effectiveness on Row planting

Scores	Rating	Frequency	Percent
7 – 10	Very poor	14	9.3
11 – 15	Poor	21	14.0
16 – 20	Fair	16	10.7
21 – 26	Good	90	60.0
27-31	Very good	9	6
TOTAL		150	100

Source: Survey Data, 2002

4.9.1.3 Farmers' Perception of Extension Effectiveness on Plant Stand

The result shows that only 3% of the respondents indicated that extension effectiveness on plant stand was good. Whilst 58% of the respondents perceived extension's effectiveness as fair, 39% rated it as poor (Table32.).

Table: 32 Farmers' Perception of Extension Effectiveness on Plant Stand

Scores	Rating	Frequency	Percent
7 – 10	Very poor	42	28.0
11 – 15	Poor	17	11.3
16 – 20	Fair	87	58.0
21 – 26	Good	4	2.7
TOTAL		150	100

Source: Survey Data, 2002

This might go to support the observation that most farmers do not adhere to recommendation of two or three seeds per stand for grains such as maize, cowpea, okro etc. This assertion is supported by result on germination test, where only 20.7% of the respondents rated perceived extension effectiveness as good and 59.4% of them rating it as within the poor range (Table 38).

4.9.1.4 Farmers' Perception of Extension Effectiveness on Timely Weeding.

An overwhelming 74% of the farmers interviewed perceived extension effectiveness on timely weeding as good. Only 5% of the farmers rated it as fair. The good perceived effectiveness rating for timely weeding could be due to the relevance level of timely weed control to crop production. Consequently, the mean perceived rating for adoption of timely weeding information was often adopted (Table 26).

Table 33: Farmers' Perception of Extension Effectiveness on Timely Weeding

Score	Rating	Frequency	Percent
16 – 20	Fair	7	4.70
21 – 26	Good	111	74.0
27-31	Very good	32	21.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.1.5 Farmers' Perception of Extension Effectiveness on Agro-Pesticide Use.

As indicated in Table 33, 49% of the farmers interviewed rated perceived extension effectiveness on agro- pesticide use as fair, 20% as poor and 25% as very poor. However, the mean perceived rating of adoption was seldomly adopted. This could be attributed to the observed mean perceived rating for cost of agro-pesticides as being expensive (Table 26). As such, majority of the farmers may not have adopted the use of agro-pesticides hence the poor perceived effectiveness rating for the use of agro- pesticides.

Table 34: Farmers Perception of Extension Effectiveness on Agro-Pesticides

Scores	Rating	Frequency	Percent
7-10	Very poor	36	25.3
11-15	Poor	30	20.0
16 – 20	Fair	74	49.3
21 – 26	Good	8	5.3
TOTAL		150	100

Source: Survey Data, 2002

4.9 .1.6 Farmers' Perception of Extension Effectiveness on Organic Manure.

Results in Table 35, show that 34% of farmers rated their perceived extension effectiveness on organic matter as very poor, 18.7% as poor, 18% as fair and 25.3% as good. Only 4% of respondents indicated it was very good.

The poor perceived extension effectiveness may be attributed to the very small proportion (8%) of respondents who regularly adopted the use of organic manure (Table 29a).

Table 35: Farmers' Perception of Extension Effectiveness on Organic manure

Score	Rating	Frequency	Percent
7-10	Very poor	51	34.0
11-15	Poor	28	18.7
16 – 20	Fair	27	18.0
21 – 26	Good	38	25.3
27-31	Very good	6	4.0
TOTAL		150	100

Source: Survey Data, 2002

4.9.1.7 Farmers' Perception of Extension Effectiveness on Inorganic Fertilizers.

As illustrated in Table 36, 46.7% of respondents perceived extension's effectiveness on inorganic fertilizer as good and 14.7% as very good. Also, 26.7% rated perceived extension's effectiveness as fair. The overall effectiveness rating for inorganic fertilizer is 21.43 (good).

Table 36: Farmers' Perception of Extension Effectiveness on Inorganic Fertilizer

Score	Rating	Frequency	Percent
7-10	Very poor	3	2.0
11-15	Poor	15	10.0
16 – 20	Fair	40	26.7
21 – 26	Good	70	46.7
27-31	Very good	22	14.7
TOTAL		150	100

Source: Survey Data, 2002

4.9.1.8 Farmers' Perception of Extension Effectiveness on Plantain Paring.

Farmers interviewed who perceived extension effectiveness on plantain paring as very poor were 54.7% as against 28% who indicated good (Table 37). A considerable proportion of farmers (66%) therefore perceived extension's effectiveness on plantain paring as fairly poor. This could be attributed to the low level of awareness indicated for the technology, because 52% of respondents said they were not aware of the technology (Table 25). Secondly, only a small proportion of respondents often or always adopted the technology as indicated in Table 29a.

Table 37: Farmers' Perception of Extension Effectiveness on Plantain Paring

Score	Rating	Frequency	Percent
7-10	Very poor	82	54.7
11-15	Poor	12	8.0
16 – 20	Fair	6	4.0
21 – 26	Good	42	28.0
27-31	Very good	8	5.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.1.9 Farmers' Perception of Extension Effectiveness on Germination Test.

As illustrated in Table 38, 59.4% of the farmers perceived extension's effectiveness on germination test as within the poor category and 16.7% rated it as fair. When respondents in the good category are combined 24% perceived extension effectiveness on germination test as good. As noted in Table 29a, germination testing as a technology is hardly adopted by the subsistence farmer. This could be the reason for the five (5) to seven (7) seeds per stand often planted by farmers. The observation is that most subsistence farmers also hardly use certified seeds.

Table 38: Farmers' Perception of Extension Effectiveness on Germination Test

Score	Rating	Frequency	Percent
7-10	Very poor	76	50.7
11-15	Poor	13	8.7
16 – 20	Fair	25	16.7
21 – 26	Good	31	20.7
27-31	Very good	5	3.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.1.10 Farmers' Perception of Extension Effectiveness on Agro-Forestry.

Results on farmers' perceived extension's effectiveness on agro-forestry show that 58% of the respondents' perceived effectiveness of extension advice as very poor and 15.3% as poor. This implies that over 73.3% respondents see extension advice on agro-forestry as poor and only 20% as good (Table 39). This observation may be attributed to the results in Table 25 where 40% of the respondents indicated that, they were unaware of the existence of agro-forestry technology. Subsequently, 32.7% never adopted (Table 29a). Also, the fragmented nature of land normally owned by farmers could be a disincentive to agro-forestry practices.

Table 39: Farmers' Perception of Extension Effectiveness on Agro-Forestry

Score	Rating	Frequency	Percent
7-10	Very poor	87	58.0
11-15	Poor	23	15.3
16-20	Fair	10	6.7
21-26	Good	30	20.0
TOTAL		150	100

Source: Survey Data, 2002

4.9.2 Farmers' Perception of Extension Effectiveness on Crop Storage Technologies.

This section presents the results of farmers' perception of extension effectiveness on crop storage technologies.

4.9.2.1 Farmers' Perception of Extension Effectiveness on Agro-Chemical Storage.

In Table 40 are shown the results of how farmers perceived extension effectiveness on agro-chemical storage of farm products. Of the 150 farmer respondents, 48% perceived extension effectiveness on agro-chemical storage as within the good category and 23.3% perceived it as fair. The favourable perception about extension effectiveness on chemical storage may be linked to the fact that 89.3% of the respondents were aware of the use of agro-chemical for storage proposes (Table 25). Also 64% respondents adopted agro-chemicals for storage (Table 29b). They also indicated that output for storing with agro-chemicals ranged from good to excellent (Table 27). They however, rated the cost of agro-chemicals as being moderate to very expensive (Table 27).

Table 40: Farmers' Perception of Extension Effectiveness on Agro-Chemical Storage

Score	Rating	Frequency	Percent
7-10	Very poor	19	12.7
11-15	Poor	24	16.0
16-20	Fair	35	23.3
21-26	Good	61	40.7
27-31	Very good	11	7.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.2.2 Farmers' Perception of Extension Effectiveness on Improved Maize Crib

In Table 41 is the outcome of how farmers perceived extension's effectiveness on the improved maize crib technology. In all, 33.3% of the farmers interviewed perceived extension's effectiveness on improved maize crib as either good or very good. Whilst 11.3% respondents rated the technology as fair, 55.3% perceived it as either poor or very poor.

Even though, 73.3% of the farmers were aware of improved maize crib technology, (Table 25) and equally rated information received from it as being relevant and adequate, the mean perceived extent of adoption rating was sometimes adopted (Table27). The non-adoption might be responsible for the poor rating perceived of extension's effectiveness on improved maize crib technology.

Table 41: Farmers' Perception of Extension Effectiveness on Improved Maize Crib

Score	Rating	Frequency	Percent
7-10	Very poor	48	32.0
11-15	Poor	35	23.3
16-20	Fair	17	11.3
21-26	Good	41	27.3
27-31	Very good	9	6.0
TOTAL		150	100

Source: Survey Data, 2002

4.9.2.3 Farmers' Perception of Extension Effectiveness on Wet-sack Cassava Storage

Most of the respondents 86% perceived extension's effectiveness on wet sack cassava storage technology as very poor (Table 42). This could be accounted for by about the same number of respondents 84.7% in Table 25 who indicated that they were not aware of the technology. It should also be noted that, because cassava is harvested on demand in the rural communities, this technology might not be relevant to the farmers.

Table 42: Farmers' Perception of Extension Effectiveness on Wet-sack Cassava Storage

Score	Rating	Frequency	Percent
7-10	Very poor	129	86.0
11-15	Poor	13	8.7
16-20	Fair	3	2.0
21-26	Good	5	3.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.2.4 Farmers' Perception of Extension Effectiveness on Neem Storage Products

As indicated in Table 43, a very high proportion of the respondents perceived extension's effectiveness on neem as a storage product as very poor. Only 2.7% of the respondents perceived extension's effectiveness on neem storage products as good. As high as 87% of the respondents, were unaware of neem as a storage product. 6.7% never adopted, 3.3% seldomly adopted, 2% sometimes adopted with only 1.3% always adopting neem as a storage product (Table 29b).

The high number of respondents (86.7%) who were not aware of the technology (Table 25) could have been responsible for the very poor perceived extension effectiveness on neem.

Table 43: Farmers' Perception of Extension Effectiveness on Neem Storage Products

Scores	Rating	Frequency	Percent
7-10	Very poor	134	89.3
11-15	Poor	6	4.0
16-20	Fair	6	4.0
21-26	Good	4	2.7
TOTAL		150	100

Source: Survey Data, 2002

4.9.3. Farmers' Perception of Extension Effectiveness on Livestock Production Technologies.

This section presents the results of farmers' perception of extension effectiveness on livestock production technologies.

4.9.2.3.1. Farmers' Perception of Extension Effectiveness on Livestock improved breeds.

Farmers perceived extension's effectiveness on livestock improved breeds are as follows; 47.3% as very poor, 13.3% as poor, 11.3% as fair and 29% as either good or very good (Table 44). Though 67.3% of respondents were aware of the existence of livestock improved breeds, only 21.3% reported ever-adopting information of livestock improved breeds (Table 29c).

Table 44: Farmers' Perception of Extension Effectiveness on Livestock Improved Breeds

Score	Rating	Frequency	Percent
7-10	Very poor	71	47.3
11-15	Poor	20	13.3
16-20	Fair	17	11.3
21-26	Good	38	26.3
27-31	Very good	4	2.7
TOTAL		150	100

Source: Survey Data, 2002

4.9.3.2 Farmers' Perception of Extension Effectiveness on Livestock Supplementary Feed

As illustrated in Table 45, 64.7% of the respondents perceived extension's effectiveness on livestock supplementary feed to be within the poor range. Whereas 8% felt effectiveness on livestock supplementary feed was fair, 27.3% rated it as falling within the good range.

Generally, farmers kept livestock on subsistence basis on free range. This assertion is supported by results on adoption of information on livestock supplementary feed (Table 29c) where only 10.7% of the respondents sometimes adopted and only 1.3% always provided livestock supplementary feed for their livestock.

Table 45: Farmers' Perception of Extension Effectiveness on Supplementary Livestock Feed

Score	Rating	Frequency	Percent
7-10	Very poor	64	42.7
11-15	Poor	33	22.0
16-20	Fair	12	8.0
21-26	Good	38	25.3
27-31	Very good	3	2.0
TOTAL		150	100

Source: Survey Data, 2002

4.9.3.3. Farmers' Perception of Extension Effectiveness on Livestock Housing

Regarding farmers' perceived extension effectiveness on livestock housing, 60.7% of respondents' ratings were within the poor category and 35.3% as good (Table 46). Apart from 38% of the respondents (Table 25) who indicated that they were unaware of extension advice on livestock housing for livestock, another 19.3% of the respondents never provided livestock housing for their livestock. Only 12.7% seldomly provided livestock housing for their livestock. This might be responsible for the over 60% of respondents rating perceived extension's effectiveness as poor.

Table 46: Farmers' Perception of Extension Effectiveness on Livestock Housing

Score	Rating	Frequency	Percent
7-10	Very poor	66	44.0
11-15	Poor	25	16.7
16-20	Fair	6	4.0
21-26	Good	45	30.0
27-31	Very good	8	5.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.3.4. Farmers' Perception of Extension Effectiveness on Livestock Preventive Health

In Table 47 is the result of farmers' perceived extension effectiveness on livestock preventive health on livestock. As with other extension advice on livestock, 64% of respondents noted extension effectiveness on livestock preventive health was within the poor range. A total of 29.3% also indicated that it was either good or very good. Hence, the overall rating is perceived to be poor. This could be attributed to the fact that only 10.7% often adopted livestock preventive health advice in addition to 3.3% that always adopted livestock preventive health practices for their livestock (Table 29c).

Table 47: Farmers' Perception of Extension Effectiveness on Livestock Preventive Health

Score	Rating	Frequency	Percent
7-10	Very poor	72	48.0
11-15	Poor	24	16.0
16-20	Fair	10	6.7
21-67	Good	39	26.0
27-31	Very good	5	3.3
TOTAL		150	100

Source: Survey Data, 2002

4.9.3.5. Farmers' Perception of Extension Effectiveness on Livestock Curative Health

Table 48 illustrates that the majority of respondents (60%) perceived extension's effectiveness on livestock curative health on livestock as within the poor category. Respondents who perceived extension effectiveness on livestock curative health to be within the good category were 28.6%. As a result, the overall perceived effectiveness could be said to be poor since only 8.6% of respondents either often or always adopted extension advice on livestock curative health for their livestock (Table 29c).

Table 48: Farmers' Perception of Extension Effectiveness on Livestock Curative Health

Score	Rating	Frequency	Percent
7-10	Very poor	66	44.0
11-15	Poor	24	16.0
16-20	Fair	14	9.3
21-27	Good	38	25.3
27-31	Very good	8	3.3
TOTAL		150	100

Source: Survey Data, 2002

4.10. Mean Score Comparison on some Demographic Characteristics and Hypothesis Testing Between MoFA and NGO Farmers

An independent–samples t–Test was conducted to compare mean scores for farmers participating in MoFA supported or NGO supported agricultural extension programmes on the following demographic characteristics. This test was designed to determine whether the two service providers were reaching the same social clientele or not.

- Age of farmer
- Total number of staple crops grown
- Total number of cash crops grown
- Farm size
- Farming experience
- Types of livestock raised

In all instances, there were no significant differences in mean scores between MoFA and NGO farmers for all farmer demographic variables as shown in Table 49. All values were above the required alpha of 0.05. As such, the null hypothesis that stated that MoFA and NGO farmers do not differ significantly on their demographic characteristics studied was accepted in favour of the alternate hypothesis. The results indicated that both service providers were reaching similar demographic type of clientele.

Table 49: Independent–Samples t–Test on Farmer Demographic Characteristics.

Farmer characteristics	Mean		SD	t	P=0.05
Age (years)	MoFA	50.94	9.17	0.65	0.45
	NGO	50.23	8.81		
Total no. of staple crops	MoFA	4.17	1.38	0.21	0.93
	NGO	4.15	1.44		
Total no. of cash crops	MoFA	1.55	0.94	0.93	-1.27
	NGO	1.77	1.12		
Fame size (acres)	MoFA	3.01	0.78	0.12	-1.58
	NGO	3.23	0.83		
Farming experience (years)	MoFA	21.93	9.79	0.20	1.28
	NGO	20.04	7.70		
Total (types of) livestock	MoFA	1.54	1.19	0.60	0.52
	NGO	1.44	0.94		

N (MoFA) = 108; (NGO) = 42

Source: Survey Data, 2002

4.11. Mean Score Comparison and Hypothesis Testing of Farmers' (MoFA & NGOs) Perception of Extension's Effectiveness on Some Agricultural Extension Technologies

An Independent–samples t–Test was performed to compare mean scores on effectiveness for some basic agricultural extension or technologies. With regard to all the 19 agricultural extension information or technology listed, there were no significant differences on perceived effectiveness mean scores between MoFA farmers and NGO farmers as illustrated in Table 50 (a,b,c). The p-values obtained were all greater than the specified alpha level of 0.05. As such, the null hypothesis, which stated that type of service provider has no significant effect on farmers, perceived effectiveness on extension advice is accepted. This may be due to the observation that NGOs do not employ their own extension staff. NGOs provide extension services to their farmers via selected MoFA extension staff who have received training and other support financed by the NGO for a particular programme.

Table 50a: Independent-Samples t-Test Comparison of Service Provider on Farmers' Perception of Extension Effectiveness on Crop Production Technologies

Variable	Mean		SD	T	P=0.05
Use of improved varieties	MoFA	21.52	4.03	-.1.72	.088
	NGO	22.67	3.28		
Row planting	MoFA	20.25	6.71	0.05	.960
	NGO	20.18	6.05		
Plant stand	MoFA	13.17	7.16	-1.46	.112
	NGO	14.88	5.51		
Pesticide use	MoFA	24.57	2.87	-.002	.998
	NGO	25.27	2.27		
Timely weeding	MoFA	13.87	6.07	-1.49	.139
	NGO	13.88	6.49		
Organic manure use	MoFA	13.67	8.19	-.21	.831
	NGO	13.98	8.66		
Inorganic fertilizer use	MoFA	21.09	21.09	-1.23	.220
	NGO	22.14	22.15		
Plantain paring	MoFA	11.35	11.35	1.41	.161
	NGO	8.75	8.75		
Germination test	MoFA	11.39	10.03	1.45	.151
	NGO	9.02	9.03		
Agro- forestry	MoFA	9.53	8.85	-0.587	.558
	NGO	10.42	8.12		

Effectiveness scale: < 7 very very poor 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good N= (MoFA 102; NGO 48)

Source: Survey Data, 2002

Table 50b: Independent-samples t-Test Comparison of Service Provider on Farmers' Perception of Extension Effectiveness on Crop Storage Technologies.

Variable	Mean		SD	T	P=0.05
Agro-chemical storage	MoFA	18.16	7.83	-.95	.345
	NGO	19.44	7.45		
Improved maize crib	MoFA	13.99	9.39	.28	.783
	NGO	13.54	9.06		
Wet- sack (Cassava)	MoFA	3.46	5.99	.813	.417
	NGO	2.67	4.57		
Neem products	MoFA	3.24	5.51	1.34	.182
	NGO	2.15	4.23		

Effectiveness scale: < 7 very very poor 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 27-31 very good N= (MoFA 102; NGO 48)

Source: Survey Data, 2002

Table 50c: Independent-samples t-Test comparison of Service Provider on Farmers' Perception of Extension Effectiveness on Livestock Technologies

Variable	Mean		SD	t	P=0.05
Improved livestock breeds	MoFA	11.15	9.50	-1.34	.182
	NGO	13.33	8.90		
Use of livestock supplementary feed	MoFA	11.35	9.73	-.273	.785
	NGO	11.77	8.23		
Livestock housing	MoFA	12.27	10.66	.32	.750
	NGO	11.73	9.31		
Livestock preventive health	MoFA	11.78	11.78	.68	.499
	NGO	10.67	10.71		
Livestock curative health	MoFA	12.95	12.95	1.36	.171
	NGO	10.06	10.67		

Effectiveness scale: < 7 very very poor 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good N= (MoFA 102; NGO 48

Source: Survey Data, 2002

4.12 Mean Score Comparison and Hypothesis Testing of Sex on Farmers' Perception of Extension Effectiveness on some Basic Extension Information

An independent–samples t–Test was conducted to compare the perceived extension effectiveness on some basic extension information between female and male farmers. Results as indicated in Table 51a show that there was significant difference between males and females on perceived extension effectiveness on improved varieties. The p– value of 0.008 obtained is less than the specified alpha level 0.05.Therefore, the null hypothesis H_O that stated that sex has no significant effect on perceived extension effectiveness on improved varieties is rejected in favour of the alternate hypothesis.

Whilst men perceived extension effectiveness on improved varieties to be good, women perception was fair. The result might suggest that men are more likely to follow extension advice on improved varieties than women.

With respect to row planting, p–value of 0.006 obtained is lower than the specified alpha level of 0.05. This implies that there was significant difference in mean scores between men (mean = 21.51:SD = 5.63) and women (mean = 18.46:SD = 7.20) as shown in Table 50a. On this basis the null hypothesis (Ho) is rejected in favour of the alternate, which states "sex has a significant effect on farmers' perceived extension effectiveness on row planting".

Table 51a: Independent–samples t–Test Comparison of Sex on Farmers' Perception of Extension Effectiveness on Crop Production Information

Crop production	Mean		SD	t	P=0.05
Use of improved varieties	Male	22.59	4.11	2.68	.008**
	Female	20.92	3.21		
Row planting	Male	21.50	5.63	2.80	.006**
	Female	18.40	7.20		
Plant stand	Male	14.97	6.01	2.66	.009**
	Female	11.98	7.27		
Pesticide use	Male	24.67	2.71	-.67	.503
	Female	24.97	2.72		
Timely weeding	Male	14.99	5.37	2.54	.012**
	Female	12.33	6.92		
Organic manure use	Male	14.69	7.08	1.53	.129
	Female	12.49	9.67		
Inorganic fertilizer use	Male	22.27	4.16	2.21	.029*
	Female	20.35	5.66		
Plantain paring	Male	11.40	10.16	1.20	.232
	Female	9.30	11.14		
Germination test	Male	11.66	9.61	1.51	.134
	Female	9.22	9.85		
Agro- forestry	Male	11.23	9.59	2.41	.017**
	Female	7.86	8.31		

** Significant at 0.01 alpha level, * Significant at alpha level 0.05 N= (Males, 87; Females, 63) Effectiveness scale: 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good

Source: Survey Data, 2002

Men therefore perceived extension effectiveness on row planting as good and that for women as fair. Men are therefore more likely to adopt extension advice on row planting than women.

Table 51b: Independent–samples t–Test Comparison of Sex on Farmers' Perception of Extension Effectiveness on Crop Storage Information

Variable	Mean		SD	t	P=0.05
Agro-chemical storage	Male	20.11	6.43	2.53	.006**
	Female	16.43	8.78		
Improved maize crib	Male	15.69	8.48	2.92	.004**
	Female	11.32	9.74		
Wet- sack (Cassava)	Male	3.20	5.69	-.03	.977
	Female	3.22	5.44		
Neem storage products	Male	2.74	4.88	-.44	.661
	Female	3.11	5.52		

** Significant at 0.01 alpha level, * Significant at alpha level 0.05 N= (Males, 87; Females, 48) Effectiveness scale: 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 -good 26-31 very good

Source: Survey Data, 2002

On the variable of plant stand (Table 50a), results indicated that there was significant difference between males (mean = 14.97: SD = 6.01) and females (mean = 11.98; SD = 7.27) on perceived extension effectiveness on plant stand. The p – value of 0.009 obtained is lower than the 0.05 alpha level specified. On this basis, the alternate hypothesis (H_1), which stipulated that sex has a significant effect on perceived extension effectiveness on plant stand is accepted and the null hypothesis rejected. The mean values of 14.97 for men and 11.98 for women are interpreted as a poor level of perceived effectiveness. Women are therefore more likely not to adhere to extension recommendations on plant stand than men.

Table 51c: Independent–samples t–Test Comparison of Sex on Farmers' Perception of Extension Effectiveness on Livestock Production Information

Variable	Mean		SD	t	P=0.05
Improved livestock breeds	Male	11.61	8.90	-.36	.721
	Female	12.17	9.98		
Use of livestock supplementary feed	Male	11.56	8.70	.17	.908
	Female	11.38	10.04		
Livestock housing	Male	12.33	9.87	.33	.744
	Female	11.78	10.79		
Livestock preventive health	Male	11.95	9.26	.77	.443
	Female	10.73	10.08		
Livestock curative health	Male	13.23	9.00	1.53	.127
	Female	10.83	10.11		

Effectiveness scale: 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good. N= (Males, 87; Females, 48)

Source: Survey Data, 2002

With regard to farmers' perceived extension effectiveness on pesticide use, results in Table 51a indicated a no statistically significant difference between the mean scores for males (24.67: SD = 2.71 and females (24.97: SD = 2.72).

The p – value indicated 0.503, is greater than the specified alpha level 0.05. On this basis, the null hypothesis which states that "there is no significant difference between males, and females on the perceived extension effectiveness on pesticide use is accepted. Both sexes have similar perceived extension effectiveness on pesticide use as good. This suggests that men and women are more likely to implement extension advice on pesticides.

Pertaining to farmers' perceived extension effectiveness on inorganic fertilizer, t-Test results (Table 51a) showed a statistically significant difference in mean scores for men and women. An alpha level of 0.05 specified is greater that p – value of 0.029 obtained. Consequently, the null hypothesis (Ho) must be rejected in favour of the alternate hypothesis (H_1). Thus, "there is a significant difference between males and females on their perceived level of extension effectiveness on inorganic fertilizers. Whilst men perceived extension effectiveness to be good (22.21: SD = 4.216), women perception is fair (20.35: SD = 5.66).

The results also show that there was a statistically significant difference between the mean scores for males and females on their perceived level of extension effectiveness on agro-forestry. The result indicated a p–value of 0.017, which is less than the specified alpha of 0.05 .On this basis, the null hypothesis (Ho) is rejected in favour of the alternate hypothesis (H_1), which states that "sex has a significant effect on perceived extension effectiveness on agro-forestry". Women perceived extension effectiveness on agro–forestry to be very poor (7.86: SD = 8.31) and that of men as fair (11.23: SD = 8.59) as shown in Table 51b. With this interpretation, it may be said that men are more likely to implement extension advice on agro–chemical storage than women. When the scores of men and women were subjected to a t–Test analysis, results indicated a significant difference in their mean scores.

The variable under investigation was farmers perceived extension effectiveness on storage with agro–chemicals. The p – value of 0.006 obtained was less than the specified alpha level of 0.05. As a result of this, the null hypothesis is rejected in favour of the alternate hypothesis (H_1) stated as "there is a significant difference between men and women on perceived extension effectiveness on agro–forestry. Both men and women farmers perceived extension effectiveness on chemical storage with mean values of (20.11: SD 6.43) and (16.43: SD 8.78) as fair (Table 51b.

However, because of the significant difference indicated, it could be said that men were more likely to implement extension advice on agro–chemical for storage than women. There was also a significant difference in mean scores for males (15.69; SD = 8.48) and females (11.32: SD = 9.74) on perceived extension effectiveness on improved maize crib storage (Table 51b).

The P – value of 0.004 obtained is less that the specified alpha level 0.05. On this basis, the null hypothesis (H_o) that stated, that sex has no significant effect on perceived extension effectiveness on improved maize crib storage is rejected in favour of the alternate hypothesis (H_1). Despite the significant differences in their mean scores, both men and women perceived extension effectiveness on improved maize crib storage as poor.

However. it could be said that, under similar conditions, men who cultivated maize are more likely to implement extension advice on improved maize crib storage especially due to the constructional work involved.

Apart from the eight variables, which did indicate significant differences in the mean scores between men and women farmers, the remaining 11 variables did not. All p – values obtained were all greater than the specified alpha level of 0.05 (Table 51 b & c). Based on this, the null hypothesis (H_o), which stated that sex did not significantly influence farmers, perceived extension effectiveness on these technologies was accepted.

4.13. Mean Score Comparison and Hypothesis Testing of Residential Status on Farmers' Perception of Extension Effectiveness on Some Basic Extension Information

Tables 52 a,b,c show the results of independent–samples t–Tests conducted to compare the perceived effectiveness on some basic extension information between native and settler farmers. There was a significant difference in mean scores for natives (21.41, SD 4.31) and settler farmers (22.90, SD 2.29) on perceived extension effectiveness for improved varieties. The p – value of 0.007 obtained is less than the specified alpha level 0.05. Therefore, the null hypothesis (Ho) that stated that residential status has no significant effect on perceived extension effectiveness on improved varieties is rejected in favour of the alternate hypothesis (H1). However, settler farmers with mean value of (22.90, SD = 2.29) and native farmers with mean value of (21.41, SD = 4.31) both perceived extension effectiveness on improved varieties to be in the same range of 21-26, interpreted as good. This result might mean that settler farmers are more likely to follow extension advice on the use of improved varieties than natives.

Table 52a: Independent–samples t–Test Comparison of Residential Status on Farmers' Perception of Extension Effectiveness on Crop Production Information

Variable	Mean		SD	T	P=0.05
Use of improved varieties	Native	21.41	4.31	-2.75	.007**
	Settler	22.90	2.29		
Row planting	Native	19.70	6.08	-1.47	.145
	Settler	21.35	7.22		
Plant stand	Native	13.44	6.46	-.72	.471
	Settler	14.29	7.25		
Pesticide use	Native	24.64	2.83	-1.03	.305
	Settler	25.13	2.41		
Timely weeding	Native	13.79	5.81	-.23	.820
	Settler	14.04	6.98		
Organic manure use	Native	13.47	8.12	-.64	.527
	Settler	14.40	8.76		
Inorganic fertilizer use	Native	20.90	5.38	-2.22	.028*
	Settler	22.54	3.54		
Plantain paring	Native	9.42	10.39	-.1.87	.064
	Settler	12.85	10.76		
Germination test	Native	9.91	9.30	-.1.32	.188
	Settler	12.17	10.60		
Agro- forestry	Native	9.47	8.45	-.71	.479
	Settler	10.54	9.00		

** Significant at 0.01 alpha level, * Significant at alpha level 0.05
Effectiveness scale: 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good N= (Natives 102; Settlers 48)
Source: Survey Data, 2002

Similarly, with perceived extension effectiveness on inorganic fertilizer, the p – value of 0.028 obtained is less than the specified alpha level of 0.05. As such, the null hypothesis (Ho) is rejected in favour of the alternate hypothesis

(H1) stated as "there is a statistically significant difference between natives and settler farmers on their perceived extension effectiveness on inorganic fertilizer. Native farmers perceived extension effectiveness on Inorganic fertilizers with mean (20.90: SD 5.38) to be fair whilst settler farmers with mean value of (22.54: SD = 3.54) to be good. This might imply that settlers tend to adopt advice on inorganic fertilizers and as such have better yields culminating in a better-perceived effectiveness of extension.

Table 52b: Independent–samples t–Test Comparison of Residential Status on Farmers' Perception of Extension Effectiveness on Crop Storage Information

Information on crop storage	Mean		SD	T	P=0.05
Chemical storage	Native	17.93	7.61	-1.48	.142
	Settler	19.97	7.83		
Improved maize crib	Native	13.12	9.59	-1.41	.160
	Settler	15.40	8.38		
Wet- sack (Cassava)	Native	2.95	5.19	-.82	.414
	Settler	3.75	6.33		
Neem products	Native	2.46	4.62	-1.37	.176
	Settler	3.81	6.07		

Effectiveness scale: 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good N= (Natives 102) (Settlers 48)

Source: Survey Data, 2002

Apart from these two variables, there were no statistically significant differences in the mean scores of native and settler farmers on perceived extension effectiveness on the various extension technologies, as shown in

Tables52 (a,b,c) . All p-values obtained were greater than the specified alpha level of 0.05. As such, the null hypothesis (Ho) which states that" residential status of farmers does not significantly effect their perceived extension effectiveness on these technologies", is accepted.

Table 52c: Independent–samples t–Test Comparison of Residential Status on Farmers' Perception of Extension Effectiveness on Livestock Production Information

Variable	Mean		SD	t	P=0.05
Improved livestock breeds	Native	11.74	9.20	-.21	.832
	Settler	12.08	9.72		
Use of livestock supplementary feed	Native	11.06	8.95	-.83	.411
	Settler	12.40	9.91		
Livestock housing	Native	11.41	9.82	-1.20	.231
	Settler	13.56	11.03		
Livestock preventive health	Native	10.77	9.26	-1.24	.217
	Settler	12.85	10.24		
Livestock curative health	Native	11.76	9.37	-.85	.395
	Settler	13.19	9.86		

Effectiveness scale: 7-10 very poor, 11-15 poor, 16-20 fair, 21-26 good 26-31 very good N= Natives 102; Settlers 48

Source: Survey Data, 2002

4.14 Relationship between Variables of Perceived Effectiveness on some 19 Basic Agricultural Technologies

The variables for determining how farmers perceived the effectiveness of agricultural extension information or technologies provided by the public sector and NGOs for this study were:

- Awareness of information or technology
- Relevance of information or technology to the farmer
- Adequacy of information about the technology
- Availability of inputs to adopt information or technology
- Cost of inputs to adopt information or technology
- Adoption of information or technology
- Output for adopting information or technology

The relationships between the effectiveness variables were calculated using Pearson product-moment correlation and significant levels declared at alpha 0.05. . Interpretations on the strength of any relationship or association are based on a format suggested by Pallant (2001). However, data on awareness of information variable were not included because they were measured on a nominal scale.

SPSS frequencies were used to evaluate assumptions. The following variables were negatively skewed; improved varieties, row planting, plant stand, use of inorganic fertilizer, pesticide use and neem storage products. Reflect square root transformation was required to normalize the distribution mathematically. Positively skewed variables included wet-sack cassava storage, neem storage products, and livestock improved breeds. Square root transformation would have restored theses variables to normality. Near normally distributed variables were timely weeding, plantain paring, germination test, agro-forestry, organic matter, improved maize crib, chemical storage, livestock supplementary feed, livestock housing, livestock preventive health and livestock curative health.

As noted by Tabachnick and Fidell (1996) although transformations of data are recommended as a remedy for outliers and for failures of normality, linearity and homoscedasticity, they are not universally recommended. They argued that an analysis is interpreted from the variables that are in it. Sometimes transformed variables are harder to interpret. Pallant (2001) also stated that some authors argue against transformation of variables to better meet the assumption of the various parametric techniques. Due to the perceived extension effectiveness interpretation scale used, transformation of skewed variables would have rendered interpretation difficult. As a result of the above consideration, parametric analyses were performed without transforming the data.

On collinearity, Gupta (2000) indicated that a bivariate correlation coefficient > 0.8 between two variables indicate the presence of significant collinearity. Composite effectiveness variables on technologies such as improved varieties; timely weeding and inorganic fertilizers had their bivariate correlation coefficients < 0.8. These technologies had farmers indicating "no awareness" less than 17%. However, the remaining technologies had farmers indicating "no awareness" greater than 17%. With these technologies, some composite effectiveness variables had their bivariate correlation coefficients greater than 0.8. Hence, collinearity indicated might not be due to a linear relation between the composite variables but with the larger number of farmers who were not aware of the existence of such technologies. Once a farmer indicated "no awareness" to a technology, data was not taken on the remaining six composite variables but treated as "not applicable". However, analysis took cognizance of such farmers in the total number of respondents. Gupta (2000) also noted that collinearity is indicated if the R-square is greater than 0.75. Fortunately, the largest R- square value after stepwise regression was 0.41 (farm size). Implication of collinearity is that it causes a problem in the interpretation of the regressions results. With a close linear relationship, the estimated regression coefficients and T-statistics may not be able to properly isolate the unique effect of each variable and the confidence with which we can presume these effects to be true.

4.14.1. Improved Varieties

There were significantly strong or large and positive associations between relevance of information on improved varieties and output for adopting improved varieties (r = 0.522), adequacy of information on improved varieties & output for adopting improved varieties (r = 0.507) and adoption of improved varieties & output for adoption improved varieties (r = 0.699), as indicated in Table53. Therefore, with a coefficient of determination value ($R = r^2$) of 0.489 implies that adopting improved varieties helps explain 48.9% of variance observed in farmers' perceived scores on output for adopting improved varieties.

Table 53: Correlation Matrix for Variables of Perceived Effectiveness on Improved Varieties

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.178*					
X3	0.466**	0.487**				
X4	0.499**	0.345**	0.414**			
X5	0.522**	0.410**	0.507**	0.699**		
X6	0.100	0.077	0.227**	0.153	0.274**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on improved varieties

X2= Availability of inputs to adopt improved varieties

X3=Adequacy of information on improved varieties

X4=Adoption of improved varieties

X5= Output for adopting improved varieties

X6= Cost of input to adopt improved varieties

Source: Survey Data, 2002

The implications of these results may be that the higher the level of relevance of a technology or information is to a farmer coupled with a higher adequate level of information provided, there is a greater likelihood that the technology would be adopted with a consequent higher level of output.

Medium level associations were also detected for the following variables; relevance of information on improved varieties & adequacy of information provided on improved varieties (r = 0.466), relevance of information of information on improved varieties and adoption of improved varieties (r = 0.499), availability of inputs to adopt improved varieties &

adequacy of information provided on improved varieties (r = 0.487), availability of inputs to adopt improved varieties and adoption of improved varieties (r = 0.345), availability of inputs to adopt information & output for adopting improved varieties (r = 0.410), adequacy of information provided on improved varieties & adoption of improved varieties (r = 0.414) as depicted in Table 53. However, no significant associations were detected among the following variables; cost of inputs to adopt information & relevance of information provided on improved varieties (r = 0.100), cost of inputs to adopt improved varieties & availability of inputs to adopt improved varieties (r = 0.077), and cost of inputs for adopting improved varieties & adoption of improved varieties (r = 0.153).

The no significant association detected among cost of inputs to adopt improved varieties and the availability of inputs to adopt improved varieties may be due to the fact that farmers who indicated no awareness of information on improved varieties and no adoption of information on improved varieties were asked not to respond to items on cost of inputs to adopt improved varieties and output for adopting information on improved varieties. It is however expected that a higher level of relevance of information to a greater number of farmers would lead to a greater desire to adopt information. Consequently, the demand for inputs and possible effect on availability of these inputs may lead to higher prices that might have to the paid for them.

4.14.2 Row planting

The results of the correlation between effectiveness variables on row planting are indicated in Table 54.

Table 54: Correlation Matrix for Perceived Effectiveness on Row planting

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	.553**					
X3	0.700**	0.659**				
X4	0.660**	0.445**	0.739**			
X5	0.668**	0.430**	0.685**	0.823**		
X6	0.459**	0.111	0.466**	0.572**	0.550**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on row planting

X2= Availability of inputs to adopt row planting

X3=Adequacy of information on row planting

X4=Adoption of row planting

X5= Output for adopting row planting

X6= Cost of input to adopt row planting

Source: Survey Data 2002

There were significantly very strong, positive associations between the following variables; relevance of information on row planting & adequacy of information on row planting (r = 0.700), adequacy of information on row planting & adoption of row planting (r = 0.739).

Similarly, significantly strong, positive associations were observed between the following variables under row planting technology; relevance of information on row planting & output for adopting row planting (r = 0.688), adequacy of information on row planting & output for adopting row planting (r = 0.685), relevance of information on row planting & availability of inputs to adopt row planting (r = 0.553), relevance of information on row planting & adoption of row planting (r = 0.660), availability of inputs to adopt row planting & adequacy of information on row planting (r = 0.659).The only effectiveness variables that did not show any significant correlation were availability of inputs to adopt row planting & cost of inputs to adopt row planting.

The overall correlation results on row planting could be interpreted as follows; where a technology is very relevant to a farmer, with adequate information provided, and availability of inputs at an affordable cost, the said technology has a greater chance to be adopted with an expected greater output.

4.14.3. Plant Stand

As shown in Table 55, there were very strong or large positive correlations between the effectiveness variables on plant stand. The least value of r = 0.776 was between output for adopting correct plant stand & relevance of information on plant stand

Table 55: Correlation Matrix for Variables of Perceived Effectiveness on Plant Stand

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	-					
X3	0.900**	-				
X4	0.801**	-	0.863**			
X5	0.776**	-	0.828**	0.875**		
X6	-	-	-	-	-	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on plant stand

X2= Availability of inputs to adopt plant stand

X3=Adequacy of information on plant stand

X4=Adoption of row planting plant stand

X5= Output for adopting plant stand

X6= Cost of input to adopt plant stand

Source: Survey Data, 2002

A maximum value of r = 0.900 was recorded between relevance of information on plant stand & adequacy of information on plant stand. There was no output value between availability of inputs on plant stand and the other effectiveness variables because no physical inputs are required.

4.14.4 Timely Weeding

As indicated in Table 56 the correlation between effectiveness variables on timely weeding only indicated small to medium correlation coefficients, which were positive and significant at alpha 0.01.

Table 56: Correlation Matrix for Variables of Perceived Effectiveness on Timely Weeding

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.104					
X3	0.375**	0.465**				
X4	0.403**	0.219**	0.389**			
X5	0.402**	0.330**	0.402**	0.402**		
X6	0.388**	0.084	0.245**	0.473**	0.399**	

N =150 *P=0.05 **P=0.01

X1=Relevance of information on timely weeding

X2= Availability of inputs to adopt timely weeding

X3=Adequacy of information on timely weeding

X4=Adoption of row planting timely weeding

X5= Output for adopting timely weeding

X6= Cost of input to adopt timely weeding

Source: Survey Data, 2002

The only variables that did not show significance were between relevance of information on timely weeding & availability of inputs to adopt timely weeding and availability of inputs to adopt timely weeding & cost of inputs to adopt timely weeding.

The small to medium associations observed for effectiveness variables under timely weeding may be due to the fact that both educated and uneducated as well as the endowed and less endowed farmers all acknowledge the importance of timely weeding in farming.

4.14.5 Agro-Pesticide

Positive and significant correlation coefficients were observed between all the six (6) effectiveness variables analysed at an alpha level of 0.01 as shown in Table 57 (0.737). Very large associations were observed between the following effectiveness variables; relevance of information on agro-pesticide use & adequacy of information provided on agro-pesticides (r = 0.781), relevance of information on agro-pesticide use & adoption of agro-pesticides (r = 0.700); relevance of information on agro-pesticides & output for adopting agro-pesticides (r = 0.737). Similar results were obtained for adequacy of information on pesticides & adoption of agro-pesticides (r = 0.725), adequacy of information on agro-pesticides & output for adopting agro-pesticides and between adoption of agro-pesticides & output for adopting agro-pesticides (r = 0.788).

Table 57: Correlation Matrix for Variables of Perceived Effectiveness on Agro-Pesticides

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.589**					
X3	0.781**	0.670**				
X4	0.700**	0.529**	0.725**			
X5	0.737**	0.496**	0.731**	0.788**		
X6	0.540**	0.451**	0.568**	0.535**	0.603**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on agro-pesticides

X2= Availability of inputs to adopt agro-pesticides

3=Adequacy of information on agro-pesticides

X4=Adoption of agro-pesticides

X5= Output for adopting agro-pesticides

X6= Cost of input to adopt agro-pesticides

Source: Survey Data, 2002

The only medium associations observed were between availability of inputs to adopt agro-pesticides & output for adopting agro-pesticides (r = 0.496) and availability of inputs to adopt agro-pesticides & cost of inputs for agro-pesticides (r = 0.451). As such, results could be interpreted to mean that a higher perceived value on one variable is associated with a corresponding higher perceived value for the other variable.

4.14.6 Organic Manures

As presented in Table 58, very large, positive correlation coefficients were detected between the following effectiveness variables under organic manure use; relevance of information on organic manure use & adequacy of information provided on organic manure (r = 0.815), relevance of information on organic manure & availability of inputs to adopt organic manure (r = 0.813.) and between adoption of organic manure & output from adopting organic manure (r = 0.803).

Table 58: Correlation Matrix for Variables of Perceived Effectiveness on Organic Manures

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.813**					
X3	0.815**	0.766**				
X4	0.706**	0.716**	0.745**			
X5	0.619**	0.546**	0.631**	0.803**		
X6	0.504**	0.442**	0.560**	0.792**	0.760**	

N = 150 *P=0.05 **P=0.01
X1=Relevance of information on organic manure
X2= Availability of inputs to adopt organic manure
3=Adequacy of information on organic manure
X4=Adoption of organic manure
X5= Output for adopting organic manure
X6= Cost of inputs to adopt organic manure
Source: Survey Data 2002

Very high correlation coefficient values above (r > 0.700) were observed for these effectiveness variables under agricultural extension information on organic manure; relevance of information on organic manure & adoption of organic manure(r =0.706), availability of inputs on organic manure & adequacy of information on organic manure (r = 0.766), availability of inputs on organic manure and adoption (r = 0.716), adoption of organic manure and adequacy of Information on organic manure (r = 0.745), cost of inputs on organic manure & adoption (r = 0.792) and cost of inputs on organic manure & output for adopting organic manure (r = 0.760). Significant levels were detected at alpha = 0.01.

4.14.7 Inorganic Fertilizers

The relationships between perceived effectiveness variables of some agricultural extension technologies were investigated using Pearson product - moment correlation. As presented in Table 59, there were strong, positive correlation between relevance of information on inorganic fertilizers & adequacy of information provided on inorganic fertilizer (r = 0.577), relevance of information on inorganic fertilizer & adoption of inorganic fertilizers (r = 0.526), relevance of information on inorganic fertilizer & output for adopting inorganic fertilizers (r = 0.554), adequacy of information on inorganic fertilizers & adoption of inorganic fertilizers (r = 0.597) and a seemingly strong association between adoption of inorganic fertilizer & output for adopting inorganic fertilizers (r = 0.757).

The remaining correlation coefficients between the variable ranged from r = 0.274 to r = 0.377. These associations are considered as small to medium and significant associations were all detected at alpha level of 0.01.

Table 59: Correlation Matrix for Variables of Perceived Effectiveness on Inorganic Fertilizers

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.323**					
X3	0.577**	0.377				
X4	0.526**	0.343**	0.597**			
X5	0.554**	0.309**	0.483**	0.757**		
X6	0.373**	0.274**	0.277**	0.295**	0.285**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on inorganic fertilizer

X2= Availability of inputs to adopt inorganic fertilizer

3=Adequacy of information on inorganic fertilizer

X4=Adoption of inorganic fertilizer

X5= Output for adopting inorganic fertilizer

X6= Cost of inputs to adopt inorganic fertilizer

Source: Survey Data, 2002

4.14.8 Plantain Paring

Pearson product-moment correlation of six (6) effectiveness variables on plantain paring technology as indicated in Table 60, revealed very strong associations. The least value of r = 0.688 was detected between relevance of information & cost of inputs to adopt plantain paring.

Table 60: Correlation Matrix for Variables of Perceived Effectiveness on Plantain Paring

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.815**					
X3	0.858**	0.897**				
X4	0.765**	0.820**	0.875**			
X5	0.758**	0.791**	0.870**	0.929**		
X6	0.688**	0.706**	0.734**	0.700**	0.750**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on plantain-paring

X2= Availability of inputs to adopt plantain-paring

3=Adequacy of information on plantain-paring

X4=Adoption of plantain-paring

X5= Output for adopting plantain-paring

X6= Cost of inputs to adopt plantain-paring

Source: Survey Data, 2002

An exceedingly large value of r = 0.929 was between adoption of plantain paring & output for adopting plantain paring. In the Ivory Coast, crop loss in plantain due to nematodes may reach 30%-35% under optimal growing conditions in the fertile soils and more than 75% where soils are poor or eroded. Yield loss is attributed mainly to the decrease of both bunch weights and toppling of plants. Similarly, damage caused by the banana weevil *Cosmopolite sordidus* to the rhizome is far more important than the damage caused by nematodes (Sarah, 1989). As such, the removal of these pests in plantain planting material by paring would give the new plant roots a good start before any re-infestation. Hence, the large value of r = 0.929 between adoption of plantain paring & output for adopting plantain paring is an indication that farmers who pared plantain-planting materials had higher yields.

All correlation coefficient values were significant at alpha 0.01 level. Therefore, with a coefficient of determination value of $R^2 = 0.835$ implies that the adoption of plantain paring explain 83.5% of variance in respondents' scores on output for adopting plantain-paring technology.

4.14.9 Germination Test

As shown in Table 61, very large positive and significant correlation coefficients were detected between the effectiveness variables of relevance of information on germination test, adequacy of information on germination test, availability of inputs on germination test, adoption cost of inputs on germination test and output for adopting germination test technology at alpha level of 0.01. Correlation coefficients ranged from r = 0.535 (adequacy of information on germination test & cost of inputs to adopt germination test) to r = 0.892

(adoption of germination test & output for adopting germination test). This implies that the least coefficient of determination between any two variables was 0.473, and maximum value being 0.863. As such, the least shared variance between any two variables was 47.3%.

Table 61: Correlation Matrix for Variables of Perceived Effectiveness on Germination Test

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	.0815**					
X3	0.858**	0.897**				
X4	0.765**	0.820**	0.875**			
X5	0.758**	0.791**	0.870**	0.929**		
X6	0.688**	0.706**	0.734**	0.700**	0.750**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on germination test

X2= Availability of inputs to adopt germination test

3=Adequacy of information on germination test

X4=Adoption of germination test

X5= Output for adopting germination test

X6= Cost of inputs to adopt germination test

Source: Survey Data, 2002

4.14.10 Agro-Forestry

The result of Pearson product-moment correlation between effectiveness variable on agro-forestry are presented in Table 62. There were very strong, positive and significant associations between the variables.

Table 62: Correlation Matrix for Variables of Perceived Effectiveness on Agro-Forestry

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.835**					
X3	0.781**	0.891**				
X4	0.801**	0.797**	0.748**			
X5	0.649**	0.626**	0.571**	0.892**		
X6	0.623**	0.594**	0.535**	0.829**	0.891**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on agro-forestry

X2= Availability of inputs to adopt agro-forestry

3=Adequacy of information on agro-forestry

X4=Adoption of agro-forestry

X5= Output for adopting agro-forestry

X6= Cost of inputs to adopt agro-forestry

Source: Survey Data, 2002

Whereas the least r = 0.535 was detected between adequacy of information on agro-forestry and cost of inputs to adopt agro-forestry, the largest r = 0.892 was between perceived adoption of agro-forestry and perceived output for adopting agro-forestry.

A correlation coefficient of r = 0.535 implies a coefficient of determination of 0.247. This is an indication that the least shared variance between any two-effectiveness variables under agro-forestry technology was 24.7%.

4.14.11 Agro-Chemical Storage

The relationships between effectiveness variables on chemical storage of agricultural form produce analysed using person product-moment correlation are presented on Table 63.

Under chemical storage the least correlation value of r = 0.496 considered as medium was noted between availability of inputs to adopt storage agro-chemicals & output for adopting storage agro-chemicals. The largest correlation value of r = 0.904 was detected between adoption of storage agro-chemicals & output for adopting storage agro-chemicals. All correlation coefficients were positive and significant at an alpha level of 0.01. Therefore, an increased perceived effectiveness level of one variable results in an increased perceived effectiveness level in the other variable. With a correlation value of r = 904 between adoption of storage agro-chemicals & output for adoption of storage agro-chemical translates into a coefficient of determination value of 0.817.This implies that perceived adoption of storage agro-chemicals helps to explain 81.7% of the variance in farmers' scores on the perceived output for adoption scale.

Table 63: Correlation Matrix for Variables of Perceived Effectiveness on Agro-Chemical Storage

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.775**					
X3	0.785**	0.745**				
X4	0.704**	0.629**	0.737**			
X5	0.642**	0.496**	0.641**	0.904**		
X6	0.648**	0.626**	0.659**	0.554**	0.517**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on agro-chemical storage

X2= Availability of inputs to adopt agro-chemical storage

3=Adequacy of information on agro-chemical storage

X4=Adoption of agro-chemical storage

X5 Output for adopting agro-chemical storage

X6= Cost of inputs to adopt agro-chemical storage

Source: Survey Data, 2002

4.14.12 Improved Maize Crib Storage

As illustrated in Table 64, large to very large positive and significant correlation coefficients were observed between all the six (6) effectiveness variables analysed. Between perceived adoption of improved maize crib storage & output for adopting improved maize crib technology, r = 0.902 is the maximum correlation value for improved maize crib storage. The least correlation value of r = 0.548 was recorded between availability of inputs to adopt improved maize crib storage technology & cost of inputs to adopt improved maize crib storage technology. Correlation coefficients between the other variables therefore ranged from r = 0.548 to r = 0.902.

Table 64: Correlation Matrix for Variables of Perceived Effectiveness on Improved Maize Crib Storage

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.871**					
X3	0.886**	0.887**				
X4	0.769**	0.734**	0.767**			
X5	0.651**	0.607**	0.634**	0.902**		
X6	0.580**	0.548**	0.565**	0.741**	0.743**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on improved maize crib storage

X2= Availability of inputs to adopt improved maize crib storage

3=Adequacy of information on improved maize crib storage

X4=Adoption of improved maize crib storage

X5 Output for adopting improved maize crib storage

X6= Cost of inputs to adopt improved maize crib storage

Source: Survey Data, 2002

storage & output for adopting improved maize crib technology, r = 0.902 is the maximum correlation value for improved maize crib storage. The least correlation value of r = 0.548 was recorded between availability of inputs to adopt improved maize crib storage technology & cost of inputs to adopt improved maize crib storage technology. Correlation coefficients between the other variables therefore ranged from r = 0.548 to r = 0.902.

Table 64: Correlation Matrix for Variables of Perceived Effectiveness on Improved Maize Crib Storage

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.871**					
X3	0.886**	0.887**				
X4	0.769**	0.734**	0.767**			
X5	0.651**	0.607**	0.634**	0.902**		
X6	0.580**	0.548**	0.565**	0.741**	0.743**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on improved maize crib storage

X2= Availability of inputs to adopt improved maize crib storage

3=Adequacy of information on improved maize crib storage

X4=Adoption of improved maize crib storage

X5 Output for adopting improved maize crib storage

X6= Cost of inputs to adopt improved maize crib storage

Source: Survey Data, 2002

This correlation coefficient range translated into a coefficient of determination range of 0.300 and 0.814 respectively. These values imply that variables concerned could explain within the range of 30% and 81.4% of variance between them.

4.14.13 Wet-Sack Cassava Storage

As shown in Table 65, very large positive and significant correlation coefficients were detected between the effectiveness variables studied.

Table 65: Correlation Matrix for Variables of Perceived Effectiveness on Wet-Sack Cassava Storage

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.920**					
X3	0.927**	0.983**				
X4	0.899**	0.831	0.829**			
X5	0.714**	0.553	0.574**	0.839**		
X6	0.670**	0.511**	0.566**	0.790**	0.952**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on wet-sack cassava storage

X2= Availability of inputs to adopt wet-sack cassava storage

X3=Adequacy of information on wet-sack cassava storage

X4=Adoption of wet-sack cassava storage

X5 Output for adopting wet-sack cassava storage

X6= Cost of inputs to adopt wet-sack cassava storage

Source: Survey Data, 2002

These ranged from cost of inputs to adopting wet-sack cassava storage & availability of inputs to adopting wet-sack cassava storage (r = 0.511) through output for adopting on wet-sack cassava storage & output for adopting wet-sack cassava storage (r = 0.714) to adequacy of information on wet-sack cassava storage & availability of inputs to adopt wet-sack cassava storage (r = 0.983). All significant levels were detected at alpha 0.01. A positive correlation implies that an increased in level of perception on one variable, results in an increased level of perception on the other variable.

4.14.14 Neem Storage Products

Positive and significant correlation coefficients were observed between all the six (6) effectiveness variables studied at an alpha level of 0.01 as indicated in Table 66. Only the availability of inputs to adopt neem storage products & cost of inputs to adopt neem storage products recorded a medium strength correlation coefficient of r = 0.472. The correlation coefficients between the other effectiveness variables for the study are all considered as large. These ranged from r = 0.539 for adequacy of information on neem storage products & cost of inputs to adopt neem storage products to as high as r = 0.938 for perceived adequacy of information on neem storage products & perceived relevance of information on neem storage products. Hence, with a determination coefficient of R (r^2) = 0.880, perceived effectiveness information on neem storage products explains as much as 88% of the observed variance with perceived effectiveness of adequacy of information on neem storage products.

Table 66: Correlation Matrix for Variables of Perceived Effectiveness on Neem Storage Products

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.832**					
X3	0.938**	0.895**				
X4	0.848**	0.740**	0.810**			
X5	0.752**	0.568**	0.615**	0.879**		
X6	0.664**	0.472**	0.539**	0.786**	0.884**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on neem storage products

X2= Availability of inputs to adopt neem storage products

3=Adequacy of information on neem storage products

X4=Adoption of neem storage products

X5 Output for adopting neem storage products

X6= Cost of inputs to adopt neem storage products.

Source: Survey Data, 2002

4.14.15 Livestock Improved Breeds

The results of Pearson product-moment correlation between effectiveness variables on livestock improved breeds are shown in Table 67. There were very strong, positive and significant associations between the various variables. For instance, relevance of information on livestock improved breeds & cost of inputs to adopt livestock improved breeds recorded an r = 0.623, being the least value observed.

Table 67: Correlation Matrix for Variables of Perceived Effectiveness on Livestock Improved Breed

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.754**					
X3	0.730**	0.892**				
X4	0.720**	0.808**	0.824**			
X5	0.625**	0.672**	0.694**	0.873**		
X6	0.623**	0.677**	0.687**	0.839**	0.920**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on improved livestock breed

X2= Availability of inputs to adopt improved livestock breed

X3=Adequacy of information on improved livestock breed

X4=Adoption of improved livestock breed

X5 Output for adopting improved livestock breed

X6= Cost of inputs to adopt improved livestock breed

Source: Survey Data, 2002

The largest correlation coefficient of r = 0.920 was detected between cost of inputs to adopt livestock improved breeds & output for adopting livestock improved breed. As such, majority of variables had correlation coefficient values ranging from r = 0.623 through r = 0.730 to r = 0.892. Significant values were detected at alpha 0.01.

4.14.16 Livestock Supplementary Feed

As presented in Table 68, large to very large positive and significant correlation coefficients were noted between the various effectiveness variables studied at 0.01 alpha level. The largest correlation coefficient value of r = 0.939 was observed for availability of inputs on livestock supplementary feed & adequacy of information for adopting livestock supplementary feed. The least but large value of r = 0.599 was between relevance of information of livestock supplementary feed & cost of inputs to adopt livestock supplementary feed.

Table 68: Correlation Matrix for Variables of Perceived Effectiveness on Livestock Supplementary Feed

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.840**					
X3	0.826**	0.939**				
X4	0.770**	0.810**	0.804**			
X5	0.651**	0.696**	0.663**	0.862**		
X6	0.599**	0.638**	0.634**	0.811**	0.873**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on livestock supplementary feed

X2= Availability of inputs to adopt livestock supplementary feed

X3=Adequacy of information on livestock supplementary feed

X4=Adoption of livestock supplementary feed

X5 Output for adopting livestock supplementary feed

X6= Cost of inputs to adopt livestock supplementary feed

Source: Survey Data 2002

4.14.17 Livestock Housing

The results of Pearson product-moment correlation between effectiveness variables on agro-forestry are shown in Table 69.Correlation coefficient values observed could be described as very large. The least value detected was r = 0.692. This was between adequacy of information of livestock housing & cost of inputs to adopt livestock housing. For instance, correlation coefficient noted between adequacy of information on livestock housing & availability of inputs to adopt livestock housing and being the greatest was r = 0.953.

Table 69: Correlation Matrix for Variables of Perceived Effectiveness on Livestock Housing

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0..895**					
X3	0.905**	0.953**				
X4	0.776**	0.833**	0.816**			
X5	0.732**	0.777**	0.753**	0.898**		
X6	0.708**	0.693**	0.692**	0.778**	0.896**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on livestock housing

X2= Availability of inputs to adopt livestock housing

X3=Adequacy of information on livestock housing

X4=Adoption of livestock housing

X5 Output for adopting livestock housing

X6= Cost of inputs to adopt livestock housing

Source: Survey Data, 2002

This translates into a determination coefficient of 0.906. Consequently adequacy of information on livestock housing helps explain 90.6% of the variance on farmers' scores on the perceived availability of inputs to adopt livestock housing. Significant levels were all at alpha 0.01.

4.14.18 Livestock Preventive Health

The relationships between farmers' effectiveness variables on livestock preventive health calculated using Pearson product-moment correlation are illustrated in Table 70.

Table 70: Correlation Matrix for Variables of Perceived Effectiveness on Livestock Preventive Health

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.843**					
X3	0.792**	0.899**				
X4	0.739**	0.783**	0.812**			
X5	0.617**	0.666**	0.648**	0.814**		
X6	0.683**	0.724**	0.641**	0.770**	0.893**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on livestock preventive health

X2= Availability of inputs to adopt livestock preventive health

X3=Adequacy of information on livestock preventive health

X4=Adoption of livestock preventive health

X5 Output for adopting livestock preventive health

X6= Cost of inputs to adopt livestock preventive health

Source: Survey Data, 2002

The least correlation coefficient value of r = 0.617 considered large was noted between relevance of information on livestock preventive health & output for adopting livestock preventive health. Adequacy of information on livestock preventive health & adoption of livestock preventive health had r = 0.812. The largest correlation coefficient value of r = 0.899 was between adequacy of information on livestock preventive health & availability of inputs to adoptive-stock livestock preventive health technologies.

4.14.19 Livestock Curative Health.

As shown in Table 71, from large to very large positive and significant correlation coefficients were detected between the effectiveness variables investigated. These ranged from adequacy of information on livestock curative health & cost of inputs to adopt livestock curative health (r = 0.590) through effectiveness variables such as relevance of information on livestock curative health & adoption of livestock curative health (r = 0.757) to cost of inputs to adopt livestock curative health & output for adopting livestock curative health (r = 0.881). All significant levels were detected alpha 0.01. As the results indicated, a positive correlation implies that an increase level of perceived effectiveness on one variable is accompanied by an increase level of perceived effectiveness on the other variable.

Table 71: Correlation Matrix for Variables of Perceived Effectiveness on Livestock Curative Health

Variable	X1	X2	X3	X4	X5	X6
X1						
X2	0.822**					
X3	0.810**	0.877**				
X4	0.757**	0.801**	0.813**			
X5	0.658**	0.736**	0.631**	0.850**		
X6	0.672**	0.720**	0.590**	0.772**	0.881**	

N = 150 *P=0.05 **P=0.01

X1=Relevance of information on livestock curative health

X2= Availability of inputs to adopt livestock curative health

X3=Adequacy of information on livestock curative health

X4=Adoption of livestock curative health

X5 Output for adopting livestock curative health

X6= Cost of inputs to adopt livestock curative health.

Source: Survey Data, 2002

4.15 Relationship Between Some Independent Farmer Demographic Variables and Perceived Effectiveness of Agricultural Extension Information

The relationships or associations were investigated using Pearson product–moment correlation coefficient. Interpretation on the strength of any relationship or association is based on that suggested by Pallant 2001 as follows:

r (-/+) = 0 .10 to 0.20 small

r (-/+) = 0.30 to 0.49 medium

r (-/+) = 0.50 to 1.00 large

As conceptualised in Fig. 1, farm size, level of education, farm activity, and farming experience showed various levels of associations with farmers' perceived effectiveness of the basic agricultural extension technologies studied.

4.15.1 Type of Farmer

There was a weak correlation between type of farmer (MoFA or NGO) and perceived effectiveness on all the 19 basic agricultural extension information or technologies listed as shown in Table 72.

4.15.2 Sex of Farmer

There was weak but significant correlation between sex of farmer and perceived effectiveness on the following; use of improved varieties (r = -.22), row planting (r = -0.23), plant stand (r = -0.23), pesticide use (r = 0.21), chemical storage (r = 0.24) and improved maize crib (r = 0.23). The strength of relationship between sex and perceived effectiveness on the remaining technologies was less than r = 0.13 (Table 72).

4.15.3 Age of Farmer

There was small but not significant relationship between age of farmer and perceived effectives on all the 19 basic technologies covered. The highest value was on improved varieties (r = 0.143). The Work by Ahmad, Ali and Davidson (2000) however, found a medium relationship between age and perceived effectiveness of extension advice by the Department of Agriculture in the Punjab district in Pakistan. The results of this study could be interpreted to mean that perceived effectiveness of agricultural extension is not strongly linked to the age of a farmer.

Table 72: Correlation Matrix for Farmer Demographic (Independent) Variables and Perceived Extension Effectiveness (Dependent) Variable on some Agricultural Technologies

Variable	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X8	X_9
Y_1	.14	-.22**	.14	.33**	.35**	.37**	.27**	.35**	-.04
Y_2	-.00	-.23**	.07	.29**	.38**	.37**	.36**	.39**	-.12
Y_3	.12	-23**	.05	.37**	.46**	.42**	.41**	.40**	-.09
Y_4	.12	.055	.05	.22**	.39**	.30**	.31**	.21**	.04
Y_5	.00	-21**	.01	.21**	.30**	.39**	.24**	.45**	-.05
Y_6	.02	-.13	.03	-.01	.35**	.27**	.42**	.32**	-.17*
Y_7	.10	-.19*	-.03	.30**	.30**	.40**	.27**	.39**	-.17*
Y_8	-.12	-.10	-.06	.14	.58**	.42**	.50**	.41**	-.13
Y_9	-.11	-.12	.01	.03	.18*	.15	.33**	.26**	-.12
Y_{10}	.05	-.19*	.07	.04	.24**	.20**	.34**	.26**	-.10
Y_{11}	.08	-24**	.02	.18*	.40**	.35**	.34**	.45**	-.10
Y_{12}	-.02	.23**	-.03	.03	.26**	.21**	.27**	.37**	-.12
Y_{13}	-.07	.00	-.04	.02	.11	-.01	-.22**	.01	-.05
Y_{14}	-.10	.04	.05	.30**	.17*	.04	.09	.06	.06
Y_{15}	.11	.03	-.06	.26**	.49**	.27**	.48**	.34**	-.16
Y_{16}	.02	-.01	-.09	.20*	.52**	.28**	.57**	.33**	-.13
Y_{17}	-.03	-.03	-.04	.19*	.48**	.23**	.53**	.26**	-.10
Y_{18}	-.05	-.06	.01	.18*	.47**	.24**	.53*	.26**	-.07
Y_{19}	-.11	-.13	-.01	.24**	.40**	.27**	.51**	.27**	-.05

N = 150 * p= 0.05 ** p = 0.01

Y=Perceived extension effectiveness on:

Y_1= Improved varieties Y_2= Row planting
Y_3= Plant stand
Y_4= Timely weeding Y_5= Pesticide use
Y_6 = Organic manure Y_7= Inorganic fertilizer
Y_8= Plantain paring Y_9=Germination test
Y_{10}= Agro-forestry Y_{11}= Chemical storage
Y_{12}= Improved maize crib storage Y_{13}= Wet-sack cassava storage
Y_{14}= Neem storage products Y_{15}= Livestock livestock improved breeds
Y_{16}= Livestock supplementary feed Y_{17}= Livestock housing
Y_{18}= Livestock preventive health Y_{19}= Livestock curative health

X= Demographic characteristics of farmers

X_1 Type of Farmer (MoFA /NGO) X_2= Sex of farmer
X_3=Age of farmer X_4=Highest education X_5=Total no. of staple crops

X_6=Total no. of cash crops X_7=Total (types) of livestock X_8=Farm size
X_9= Farming Experience

Source: Survey Data, 2002

4.15.4 Educational Level of Farmer

The level of farmer education had a medium, positive and significant relationship with perceived effectiveness of extension advice provided on the following; improved varieties (r = 0.33), plant stand (r = 0.37), inorganic fertilizer (r = 0.30), and neem products for storage (r = 0.30).

The interpretation may be that, well-educated farmers would tend to appreciate the use of improved varieties, use recommended plants per stand, use inorganic fertilizers and adopt neem products for storage. Since the adoption of recommended practices associated with this extension advice would lead to higher outputs, it is expected that such farmers would have higher perceived effectiveness levels for such technologies.

Though the strength of the relationship would be considered as small for the following extension advice, the relationships were positive and significant. Row planting (r = 0.29), timely weeding (r = 0.22), use of pesticides (r = 0.21), chemical storage (r = 0.18), livestock improved breeds (r = 0.26, livestock supplementary feed (r = 0.20), livestock housing (r = 0.19), livestock preventive health (r = 0.18) and livestock curative health (r = 0.24), as shown in Table 72.

4.15.5 Total Number of Staple Crops Grown

The number of staple crops grown by a farmer had a significantly positive relationship with all the 19 technologies listed except use of wet-sack technology for cassava storage (Table 72). The strength of the relationships was small for use of agro-pesticides (r = 0.30), germination test (r = 0.18), agro-forestry (r = 0.24, improved maize crib storage (r = 0.26); neem products for storage (r = 0.17).

Those that had medium strength of relationship were; improved varieties (r = 0.35), row planting (r = 0.38), plant stand (r = 0.46), timely weeding (r = 0.39), organic manure (r = 0.35), inorganic fertilizer (r = 0.30), chemical storage (r = 0.40), livestock improved breeds (r = 0.49), livestock housing (r = 0.48) and livestock preventive health (r = 0.47). Extension advice with very large strength of relationship with total number of staple crops cultivated was; plantain paring (r = 0.58) and livestock supplementary feed for livestock (r = 0.52).

The interpretation for these observed positive relationships with the various extension advice and number of staple crops a farmer cultivated is that, farmers who grow more staple crops and have their extension aspiration met would have a higher perceived effectiveness for extension advice than farmers who cultivate a few staple crops. Hardly would a subsistent farmer go into mono cropping. As noted in the mean number of staple crops grown by farmers, Ahmad, Ali and Davidson (2000) also noted that extension agencies deal with a heterogeneous farming community.

4.15.6 Number of Cash Crops

The total number of cash crops grown by a farmer had a medium positive relationship with the effectiveness of the following extension technologies; use of improved varieties (r = 0.37), row planting (r = 0.37), plant stand (r = 0.42), timely weeding (r = 0.30) pesticide use (r = 0.39); inorganic fertilizer (r = 0.40), plantain paring (r = .42) and chemical storage (r 0.35)

Extension technologies that had small but positive and significant perceived effectiveness with number of cash crops grown by farmers were organic manure use (r = 0.27), agro–forestry (r = 0.20) and all the extension technologies on livestock production as depicted in Table 72.

Cash crops are mostly grown for commercial purposes and therefore serve as a more reliable source of income. Since cash crops such as oil palm, cocoa and citrus do not come into season simultaneously, a farmer with more cash crops would have income spread over a longer timeframe. This type of income would enable such farmers' access inputs to adopt extension advice culminating in improved outcomes and consequently a much better perceived effectiveness of extension advice.

The lack of any significant relationship observed between number of cash crops grown and perceived effectiveness on germination test (r = 0.15) may be due to the fact that most of the cash crops are passed through the nursery and not planted at stake. Similarly, there were no significant relationships between the number of cash crops grown and perceived effectiveness for Wet-sack cassava storage (r = -0.01) and neem storage products (r = 0.04). These are technologies, which have no bearing to Cash crop production.

4.16.7 Farm Size

Farm size was significantly and positively associated virtually with all the 19 extension technologies investigated except wet sack cassava storage (r = 0.08). As the results indicated, an over whelming majority of farmers were either not aware of the technology or information provided on wet sack cassava storage was not relevant to them.

Farm size had medium, significant and positive association with perceived effectiveness of improved varieties (r = 0.35), row planting (r = 0.39), plant stand (r = 0.40) pesticide use (r = 0.45), organic manure use (r = 0.32), inorganic fertilizer use (r = 0.39), plantain paring (r = 0.41), chemical storage (r = 0.45) and improved maize crib storage (r = 0.37) as illustrated in Table 72.

Where extension advice is adhered to, a larger land area under cultivation would result in higher output with accompanying higher income. Farmers who have large farm size and have followed extension advice would have a much greater perceived effectiveness value for extension advice. Work by Ahmad, Ali and Davidson (2000) also indicated a positive and large association between farm size and perceived effectiveness for extension advice.

There were small, but significantly positive associations between farm size and perceived effectiveness of extension advice on technologies such as timely weeding (r = 0.21), germination test (r = 0.26), agro–forestry, livestock housing for livestock (r = 0.26), livestock preventive health (r - = 0.26) and livestock curative health (r = 0.27). A farmer with a larger farm size would very much try to avoid the consequences at planting grains with poor viability by conducting germination-test as against a farmer with smaller land size under cultivation. Similarly, a farmer with larger farm size might control weeds on time in order to have a better yield.

With regard to the medium and significant association between farm size and perceived effectiveness on improved livestock breeds (r = 0.34), livestock supplementary feed (r = 0.33) level of association could mean that a farmer who has a larger farm size and intends to keep livestock would use improved seeds, provide livestock supplementary feed to his livestock, implement extension advice on livestock housing, livestock preventive health and livestock curative health than a farmer with smaller farm size.

4.15.8 Farming Experience

There were no significant associations between farming experience of a farmer and the perceived effectiveness of 17 out of the 19 extension technologies investigated as depicted in Table 72. Only extension advice on organic manure (r = 0.17) and inorganic fertilizer (r = 0.17) indicted a small but significant negative association with farming experience. The other technologies with r < -0.17 values, did not indicate any significant associations with farming experience This observation could mean that as farmers gained more farming experience, they would perceive extension advice on manures and fertilizers to be less effective. This may be due to the less drastic effects of manures and fertilizers on crop yields as observed during the early stages of their adoption.

4.15.9 Total Number (Types) of Livestock Raised

Variables of interest were effectiveness of extension information on organic manure, livestock improved breeds, livestock supplementary feed, livestock housing, livestock preventive health and livestock curative health.

There were positive medium or moderate associations between total number (types) of livestock raised and effectiveness rating for organic manure (r = 0.42) and livestock improved breeds (r = 0.46). The strong positive association between total number (types) of livestock and perceived extension's effectiveness on livestock supplementary feed r = 0.57, livestock housing (r = 0.53), livestock preventive health (r = 0.53), livestock curative health (r = 0.51) and plantain paring (r = 0.50) could be treated as large or strong. The result implies that total number (types) of livestock appears to be the explanatory factor for perceived extension effectiveness on livestock improved breeds, livestock housing, livestock supplementary feed, livestock preventive health, livestock curative health and plantain paring. Consequently, as a farmer increases the types of livestock kept, the greater the likelihood that such a farmer would utilize extension advice on these variables.

4.16 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness

Stepwise regression analysis was employed at this stage to determine how well the set of independent variables used is able to predict the outcome of each of the 19 basic agricultural extension variables studied. Secondly, the regression outcome was capable of identifying which variable in the set is the best to predict the outcome.

Multiple regression makes a number of assumption about the data. One of such assumption of great concern is multicollinearity (collinearity). Multicollinearity exists when the independent variables are highly correlated.

According to Tabachnick and Fidell (1996) care should be taking before including two variables with a bivariate correlation of > 0.7. The statistical problems created by multicollinearity occur at much higher correlations (r >.9). Multicollinearity renders unstable, matrix inversion, which is the logical equivalent of division. Though with multicollinearity, the determinant is not exactly zero, division with a near zero determinant produces very large and unstable numbers in the inverted matrix. In regression, for instance, error terms get so large that none of the coefficients is significant.

Pearson product-moment correlation was performed to test for multicollinearity between independent variables used in regression analysis. The largest bivariate correlation r = 0.55 was between total number of staple crops cultivated (X5) and total number (types) of livestock raised (X7) which was less than r = 0.7 the maximum value recommended by Tabachnick and Fidell (1996). The least bivariate correlation r = -0.02 was between age (X3) and total number of staple crops cultivated (X5). Since the data do not appear to have violated the multicollinearitry assumption, all independent variables were retained.

The independent variables for stepwise regression analysis are as follows.

- Age of farmer (X_3)
- Highest educational level of farmer (X_4)
- Total number of staple crops cultivated (X_5)
- Total number of cash crop cultivated (X_6)
- Total number (types) of livestock raised. (X_7)
- Farm size (Land size under cultivation) (X_8)
- Farming experience (X_9)

Apart from educational level of farmer that was measured on an ordinal scale, the remaining independent variables were all measured on a ratio scale. The dependent variable was farmers' perceived effectiveness of agricultural extension information as provided by the public sector and NGOs on some 19 basic agricultural technologies. This perceived effectiveness variable is a composite score of the following seven (7) variables

- Awareness of information or technology
- Relevance of information or technology
- Adequacy of information provided
- Availability of inputs to adopt information or technology
- Adoption of information or technology
- Cost of inputs to adopt information or technology
- Output for adopting information or technology

Apart from awareness of information or technology variable, which was measured on a nominal scale, the remaining variables were measured on a Likert-type, 4-point or 5-point scale.

4.16.1. Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Improved Varieties (Y_1)

In Table 73 is shown the results of step-wise regression of seven independent farmers' demographic variables with their perceived effectiveness level of extension information on improved varieties. The criteria for entering or dropping a variable were ₣ 0.050 and F ≥ 0.150 respectively. Only four independent variables satisfied this criteria leaving out farm size and farming experience.

An adjusted R^2 value of 0.130 implies that 13.0% of variance in the perceived effectiveness of extension information on the use of improved varieties could be attributed to total number of cash crops cultivated (X_6) by a farmer. Highest educational level of farmer (X_4) also made a significant contribution of 7.2% to observed variance. As a team the four independent variables could only explain 26% of observed variance (Table 72).

As individual independent variables, highest educational level of farmer (X_4) made the most significant contribution of 0.293 followed by total number of cash crops (X_6) cultivated with 0.245 then total number (types) of livestock raised (X_7) contributing 0.217 with 0.147 attributable to age of farmer (X_3). On this basis, educational level of farmer (X_4) becomes the best predictor variable for farmers' perceived extension effectiveness on use of improved varieties. As noted by Griliches (1964), schooling is an important source of gains in agricultural productivity.

In the U. S. A. Chandri (1968) found that a statistically significant relation existed between schooling and farm output in the traditional setting. Rogers (1983) also pointed out that adoption of innovation could be regarded as a managerial concern that requires certain managerial skills, which are often gained through education. Ogunfiditimi (1981) concludes that, as farmers advance in their level of education, the more they will tend to understand the importance, intricacies and need for adopting improved farm practices. Whenever a technology requires little of technical knowledge, it is those with education that are most likely to adopt.

The regression equation for farmers' perceived effectiveness of extension information on improved varieties could be stated as:

$$Y_1 = 13.750 + 0.942X_6 + 0.947X_4 + 0.746X_7 + 0.062X_3$$

Where 13.750 is a constant and represents the regression estimate when

$$X_3 = X_4 = X_6 = X_7 = 0$$

It could therefore be said that four factors, educational level of farmers, total number of cash crops cultivated total number (types) of livestock raised and age of farmer had contributed significantly to enhancing farmers' perceived effectiveness of extension information on improved varieties.

Table: 73 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Improved Varieties.

Variable	Step of entry	Un std B	Beta Std.	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		13.750							
Total no. of cash crops (X_6)	1	0.942	0.245	0.136	0.130	0.136	3.5778	23.201	0.000
Highest educational level (X_4)	2	0.947	0.298	0.208	0.197	0.072	3.437	13.276	0.000
Livestock (types) raised (X_7)	3	0.746	0.217	0.249	0.233	0.040	3.3603	7.792	0.000
Age of farmer (X_3)	4	0.062	0.147	0.270	0.250	0.021	3.323	4.191	0.000

Source: Survey Data, 2002

4.16.2 Best Predictors of the Dependent Variable: Farmers' Perception of Extension Effectiveness on Row planting (Y_2)

The outcome of stepwise regression of seven independent farmers demographic characteristics with their perceived effectiveness of agricultural extension information on row planting is illustrated in Table 74.

The criteria for entering or dropping a variable were $F \leq 0.050$ and $F \geq 0.150$ respectively. Three independent variables namely, age of farmer (X_3) total number of staple crops grown (X_5) and farming experience (X_9) failed to satisfy the criteria. The remaining four independent variables as a unit had an adjusted R^2 value of 0.270. This implies that they could only explain 27% of significant observed variance. Of this value, land size cultivated (X_8) with an R-change value of 0.150 made a significant contribution of 15.0% to observed variance.

Of the total observed variance (27%) attributable to the four independent variables, Livestock (types) raised (X_7) made a unique significant contribution of 0.264 This was followed by highest educational level of farmer (X_4) 0.225, total farm size (X_8) and total number of cash crops cultivated (X_6) made unique significant contributions of 0.169 and 0.173 respectively. With an R^2 value of 0.169, total farm size (X_8) and livestock (types) raised (X_7) made a combined contribution of 6.1% to observed variance of 27.0%.

On the basis of individual unique significant contributions made to the total observed variance, total livestock (types) raised emerged as the best predictor variable, with highest educational level as second best under farmers' perceived extension effectiveness on row planting technology. The outcome may be due to the observation that livestock production requires more attention and time than crop production. There is also the notion that farmers who fail to adopt row planting cite time consuming as a factor. Therefore, a farmer who is able to take good care of more than one type of livestock might not perceive row planting as time consuming. This, coupled with a higher level of education, may easily lead to the adoption of extension advice on row planting and its attendant improved yields. Such a farmer might, therefore, be expected to have a higher level of perceived effectiveness for extension advice on row planting.

The regression equation for farmers' perceived extension effectiveness on row planting is: $Y_2 = 8.896 + 1.372(X_8) + 1.533(X_7) + 1.208(X_4) + 1.128(X_6)$

Where 8.896 is a constant and represents the regression estimate when $X_4 = X_6 = X_7 = X_8 = 0$.

The above equation shows that farm size (X_8), total number (types) of livestock raised (X_7), educational level of farmer (X_4) and total number of cash crops grown (X_6) had significant positive contribution to farmers' perceived extension effectiveness on row planting.

Table 74. Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Line planting.

Variable	Step of entry	Un std Beta	Beta Stand.	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		8.896							
Farm size (X8)	1	1.372	0.169	0.150	0.145	0.150	6.000	26.002	0.000
Livestock (types) raised (X7)	2	1.533	0.264	0.211	0.201	0.061	5.800	11.302	0.000
Highest educational level(X4)	3	1.208	0.225	0.268	0.253	0.056	5.608	11.150	0.000
Total number of cash crops (X6)	4	1.128	0.173	0.289	0.270	0.022	5.544	4.423	0.000

Source: Survey Data, 2002

4.16.3 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Plant Stand (Y_3)

The result of stepwise regression of seven independent farmer demographic variables against farmers perceived extension effectiveness on plant stand is illustrated in Table 75. The criteria for entering or dropping a variable were $F \leq 0.050$ and $F \geq 0.150$ respectively.

Whilst three variables namely, total number of cash crops cultivated (X_6), Livestock (types) raised (X_7) and highest educational level of farmer (X_4) satisfied the criteria, total number of staple crops (X_5), age of farmer (X_3) and farming experience (X_9) did not. With an R^2 adjusted value of 0.379, the three independent variables could help explain 37.9% of observed variance .Of this observed variance, total number of cash crops cultivated (X6) contributed 20.3%

Livestock (types) raised registered a unique significant contribution of 0.329 as against 0.315 for highest education level variable and 0.310 for total number of cash crops cultivated, Livestock (types) raised thus becomes the best predictor independent variable under farmers perceived extension effectiveness information on correct plant stand. SG 2000 improved maize technology package recommends two seeds per stand at 90cm by 45cm. With all other factors being equal, this recommendation would give an optimum yield per acre.

As revealed by the stepwise regression analysis a farmer's willingness to adopt the recommendation would be greatly influenced by his or her educational background (Ogunfiditimi, 1981).

The regression equation for farmers' perceived extension effectiveness on plant stand could be stated as: $Y_3 = 3.044 + 2.087(X_4) + 1.977(X_7) + 1.752(X_3)$

Where 3.044 is a constant and represents regression estimate when $X_3=X_4=X_7=0$

The above model implies that educational level of farmer, total number of (types) of livestock raised and age of farmer influenced positively, significant effects on farmers' perceived extension effectiveness on plant stand information.

Table 75. Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Plant Stand.

Variable	Step of entry	Un Std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		3.044							
Total number of cash crops (X_6)	1	2.087	0.310	0.208	0.203	0.208	5.990	36.637	0.000
Livestock (types) raised (X_7)	2	1.977	0.329	0.296	0.286	0.088	5.667	18.198	0.000
Highest educational level(X_4)	3	1.752	0.315	0.391	0.379	0.095	5.288	22.682	0.000

Source: Survey Data, 2002

4.16.4 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Timely Weeding (Y_4)

Stepwise regression procedure was adopted to determine the best predictor variables of farmers' perceived extension effectiveness on timely weeding. In all seven independent farmers demographic variables were used. The criteria for entering or dropping a variable were $F \leq 0.050$ and $F \geq 0.150$ respectively.

The criteria were satisfied by total number of staple crops grown (X_5) and highest educational level of farmer (X_4). Whilst total number of staple crops grown (X_5) explains 15.1% of observed variance, the inclusion of the second variable namely highest educational level of farmer (X_4), only added 2.4% to total observed variance of 16.4% (Table76). The result is an indication that, 83.6% of variation not explained may be due to variables not investigated in this study.

As unique independent variables, total number of staple crops grown made a significant contribution of 0.363. Under such a circumstance it becomes the best predictor variable. It is common knowledge that majority of farmers in Ghana do not practice mono cropping. Mixed cropping is viewed as a mens of risk aversion. As such, non-timely weeding on a mixed farm could lead to a greater loss to several crops. It may, therefore, be said that a farmer practising mixed cropping would make conscious efforts to follow extension advice on timely weeding.

The stepwise regression model for farmers' perceived extension effectiveness on timely weeding is as follows:

$$Y_4 = 20.974 + 0.710(X_5) + 0.355(X_4)$$

Where 20.974 is a constant and represents regression estimate when $X_4=X_5=0$. The model reveals that total number of staple crops grown and educational level of farmer made significantly positive effects on farmers perceived extension effectiveness on timely weeding information.

Table 76. Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Timely Weeding

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		20.974							
Total number of staple crops grown (X_5)	1	0.710	0.363	0.151	0.145	0.151	2.502	26.110	0.000
Highest educational level (X_4)	2	0.355	0.158	0.175	0.164	0.024	2.474	4.321	0.000

Source: Survey Data, 2002

4.16.5 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Agro- Pesticide (Y_5).

Seven independent farmer demographic variables were regressed step-wise against their perception of extension information effectiveness on agro-pesticides. Probability of F – to enter was$\leq$ 0.05 and F – to remove was$\geq$ 0.100. The results as indicated in Table 77 indicate that only two variables satisfied the criteria and could only explain 23.1% of observed variance. Farm size (X_8) could explain 20.6% of total observed variance. This implies that total number of cash crops cultivated (X_6) accounted for 3.4% of observed variance.

As individual independent variables, farm size (X_8) a made a unique significant contribution of 0.347 to observed variance while that for total cash crops grown (X_6) was 0.215. The significant contributions made by total farm size to perceived extension effectiveness on agro-pesticide use may be attributed to the follow: Larger amounts of resources are required for cultivating and maintaining a larger farm unit.

Under very favourable conditions a disease or pest outbreak on a larger farm unit without intervention from agro-pesticides could be disastrous. The ability of agro- pesticides to save such a situation may result in higher level of perception of the effectiveness of agro-pesticides.

Cash crops are also able to provide seasonal but substantial incomes to farmers and such farmers may be in a better position to afford agro-pesticides. Resources from cash crops could also be employed to cultivate and maintain large farm units.

The regression model could be stated as follows:

$Y_5 = 3.423 + 2.678(X_8) + 1.333(X_6)$; where 3.423 is a constant and represents regression estimate when $X_6 = X_8 = 0$.

Table 77: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Agro-Pesticides.

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		3.423							
Farm size (X_8)	1	2.687	0.347	0.206	0.201	0.206	5.530	38.249	0.000
Total number of cash crops grown (X_6)	2	1.333	0.215	0.241	0.231	0.034	5.427	6.634	0.000

Source: Survey Data, 2002

4.16.6 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Organic Manure (Y_6).

Using stepwise regression analysis, the results of seven independent farmer demographic variables regressed against their perceived extension effectiveness on the use of organic manure is presented in Table 78. Probability of F – to enter was ≤ 0.05 and F – to remove was ≥ 0.100.

Four independent variables satisfied the criteria set. Total number (types) livestock raised (X_7), farm size (X_8), farming experience (X9) and age (X_3) could explain 24.3% of observed variance. Farming experience contributed only 2.6 % to observed variance of 24.3%. Total number (types) livestock kept (X_7) made a unique significant contribution of 0.335 to observed variance. Similarly, farm size (X_8) and age of farmer (X_3) made unique, significant contributions of 0.228 and 0.187 respectively. Total number (types) livestock raised therefore emerges as the best predictor variables for farmers' perceived extension effectiveness information on organic manure use.

This observation may be due to availability of organic manure from several sources e.g. hencoop and goat pen. The most often adopted practice is to dispose of rubbish from these sources at a refuse dump where plantains are planted. Plantains on such soils produce heavier bunch, healthier suckers and remain productive over an extended period of time. This outcome may have a greater positive effect on the perception level of such a farmer. Age and farming experience are known to be positively correlated. Older farmers' may have more experience and resources. As such, an older farmer who has been harvesting heavy bunches of plantain from a refuse dump would continue to use organic manure in order to get better yield.

The regression model could therefore be stated as:

$Y_6 = -0.913 + 2.493(X_7) + 2.373(X_8) + -0.240(X_9) + 0.172(X_3)$; where –0.913 is a constant and represents the regression estimate when $X_3 = X_7 = X_8 = X_9 = 0$

Table 78: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Organic Manure

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-.913							
Livestock (types) raised (X_7)	1	2.493	0.335	0.176	0.170	0.176	7.571	31.398	0.000
Farm size (X_8)	2	2.373	0.228	0.212	0.201	0.036	7.428	6.703	0.000
Farming experience (X_9)	3	-0.240	-0.265	0.239	0.223	0.026	7.328	5.027	0.000
Age of farmer (X_3)	4	0.172	0.187	0.263	0.243	0.025	7.233	4.825	0.000

Source: Survey Data, 2002

4.16.7 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Inorganic Fertilizers (Y_7)

The outcome of stepwise regression of seven independent farmers' demographic variables with their perceived effectiveness of agricultural extension information on inorganic fertilizer is indicated in Table 79. Probability of F – to enter was ≤ 0.05 and F – to remove was ≥ 0.100.

Three independent variables, total number of staple crops cultivated (X_5) and age of farmer (X_3) failed to satisfy probability levels set. An adjusted R^2 value of 0.265 indicates that, only 26.5% of observed variance is attributable to total number of cash crops cultivated (X_6), highest educational level of farmer (X_4), farm size (X_8) and farming experience (X_9). Of the 26.5% observed variance, total number of cash crops cultivated (X_6) made the most contribution 16.2%, which translates into 0.276 of unique positive significant contribution to observed variance.

This observation may mean that farmers with several cash crops have more income to access inorganic fertilizer inputs with associated improved yields. Unique significant contributions to observed variance by the other predictor variables are farm size 0.229, highest educational level of farmers 0.170 and farming experience -0.186. The negative significant contribution made by farm experience may be interpreted as, the greater a farmer's farming experience, the less level of perceived extension effectiveness on the use of inorganic manure. Like organic manure, an older farmer with more farming experience may not see the effect of inorganic fertilizer on crop yield to be very impressive as before. This could be attributed to the fact that something observed over a longer period of time ceases to make any drastic impact as against the first time it was noticed.

The regression model could thus be illustrated as:

$Y_7 = 15.281 + 1.364(X_6) + 0.693(X_3) + 1.411(X_8) + -0.094(X_9)$, where 15.281 is a constant and represents the regression estimate $X_3 = X_6 = X_8 = X_9 = 0$.

Table 79: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Inorganic Fertilizer

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		15.281							
Total no. of cash crops grown (X_6)	1	1.364	0.276	0.162	0.156	0.162	4.517	28.400	0.000
Highest educational level (X_4)	2	0.693	0.170	0.215	0.204	0.053	4.386	9.886	0.000
Farm size (X_8)	3	1.411	0.229	0.252	0.237	0.037	4.296	7.178	0.000
Farming experience (X_9)	4	-0.094	-0.186	0.285	0265	0.032	4.217	6.540	0.000

Source: Survey Data, 2002

4.16.8 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness Plantain Paring (Y_8)

A stepwise regression analysis was performed to examine the best predictor of farmers' perceived extension effectiveness on plantain paring. Explanatory variables used in the stepwise regression analysis were farmers' demographic attributes (age, education, farm size, and number of staple crops and cash crops grown, farming experience and total livestock (types) raised. The criteria for entering or dropping a variable were $F \leq 0.050$ and $F \geq 0.150$ respectively.

Only three explanatory variables namely total number of staple crops grown (X_5), farm size (X_8) and total livestock (types) raised (X_7) satisfied the criteria as shown on Table 80.

An adjusted R^2 value of 0.395 implies that the three predictor variables could only account for 39.5% of observed variance on farmers perceived extension effectiveness on plantain paring. Total number of staple crops grown (X_5) made a significant contribution of 33.1% out of 39.5%. This value translates into 0.370 of significant unique contribution to observed variance. Livestock (types) raised (X_7) also made a unique contribution of 0.241 and farm size, 0.180. Total number of staple crops thus emerges as the best predictor variables for perceived extension effectiveness on plantain paring. This may suggest that farmers growing several staple crops may utilize extension advice on plantain paring in order to reduce nematode and banana weevil population in plantain planting materials.

The regression model could be represented as:

Y_8 = -12.038 + 2.830(X_5) + 2.285(X_7) + 2.384(X_8) where –12.038 is a constant and represents regression estimate when $X_5 = X_7 = X_8 = 0$.

Table 80: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Plantain Paring

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-12.038							
Total no. of staple crops grown (X_6)	1	2.830	0.370	0.331	0.327	0.331	8.698	72.789	0.000
Total livestock (type) raised (X_7)	2	2.285	0.241	0.381	0.373	0.050	8.394	11.817	0.000
Farm size (X_8)	3	2.384	0.180	0.408/	0.395	0.026	8.242	6.436	0.000

Source: Survey Data, 2002

4.16.9 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Germination Test (Y_9)

Stepwise regression analysis was performed to determine the best predictor variable of farmers perceived extension effectiveness on germination test (Table 81). The criteria were probability of F- to enter $\leq .05$ and F - to remove ≥ 0.100.

An adjusted R^2 value of 0.125 recorded. This adjusted R^2 value of 0.125, which translates into 12.5% of observed variance, was contributed by only two variables.

Of the 12.5% observed variance, 11.2% is attributed to total number (types) livestock raised (X_7) with only 2.5% being contribution from farm size (X_8). These values translate into 0.278 and 0.168 unique significant contributions to observed variance by total number (types) livestock (X_7) and farm size (X_8) respectively. The low observed variance might be an indication that the variables employed in the study may not be the most suitable for predicting perceived effectiveness on germination test. Another probable reason may be due to the generally low mean perception values on composite effectiveness variables (Table 26) under germination test information.

The regression model thus becomes: $Y_7 = 0.630 + 2.434(X_7) + 2.057(X_8)$, where 0.630 is a constant and represents regression estimate when $X_7 = X_8 = 0$.

Table 81: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Germination Test

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		0.630							
Total livestock (type) raised (X_7)	1	2.434	0.278	0.112	0.106	0.112	9.228	18.464	0.000
Farm size (X_8)	2	2.057	0.168	0.137	0.125	0.025	9.127	4.270	0.000

Source: Survey Data, 2002

4.16.10 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Agro–Forestry (Y_{10})

In Table 82 is shown the results of stepwise regression analysis of the best predictor variables out of seven regressed with farmers' perceived effectiveness of extension advice on agro–forestry. The probabilities of F- to enter ≤0.05 and F-to remove ≥0.100 criteria were set.

Only two variables namely, total number (types) livestock raised (X_7 and farm size (X_8) satisfied the criteria and therefore contributed significantly to farmers' perceived extension effectiveness on agro-forestry.

An adjusted R^2 value of 0.130 implies that these two variables could only be responsible for explaining 13.0% of observed variance. This low value may be due to the very low mean perceived adoption score on agro- forestry (Table26). The significant unique contribution of 0.169 from farm size (X_8) may be due to the observation that as farmland becomes scarcer, the overriding need to produce food and income in the short term naturally takes precedence over long term soil improvement values. Weirsum (1981) noted that as overall farm size decreases below a certain point, farmers forego the tree product in favour of staple food crop production. On this basis, a farmer with a larger land size may be able to afford agro-forestry practices.

The regression model is as follows: $Y_{10} = 0.872 + 2.199\ (X_7) + 1.827\ (X_8)$. Where 0.872 is a constant and represents the regression estimate when $X_7 = X_8 = 0$

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Table 82: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Agro-Forestry

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		0.872							
Total livestock (type) raised (X_7)	1	2.199	0.285	0.116	0.110	0.116	8.121	19.351	0.000
Farm size (X_8)	2	1.827	0.169	0.142	0.130	0.026	8.030	4.353	0.000

Source: Survey Data, 2002

4.16.11 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Agro-Chemical Storage (Y_{11})

A stepwise regression analysis was computed to find the best predictor of farmers' perceived extension effectives on chemical storage. Seven independent variables were entered for analysis. The probabilities of F- to enter ≤ 0.05 and F-to remove ≥ 0.100 criteria were set

Only farm size and total number of staple crops satisfied the criteria (Table 83). An adjusted R^2 value of 0.246 indicated that 24.6% of observed variance could be ascribed to these two variables. Of the 24.6% of observed variance, farm size (X_8) made a unique significant contribution on 0.347. Total number of staples crops grown (X_5) also made a unique significant contribution of 0.253 to observed variance. Implications of these observations may be that a farmer with a larger farm size of a staple like maize is more likely to apply extension advice on storage agro-chemicals. This may predispose such a farmer to a better perceived effectiveness on storage agro-chemicals.

The regression model is: $Y_{11} = 2.375 + 3.352(X_8) + 1.410\ (X_5)$, where 2.375 is a constant and represents the regression estimate when $X_5 = X_8 = 0$.

Table 83: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Agro-Chemical Storage

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		2.375							
Farm size (X_8)	1	3.352	0.347	0.203	0.197	0.203	6.912	37.350	0.000
Total no. of staple crops grown (X_5)	2	1.410	0.253	0.256	0.246	0.054	6.699	10.512	0.000

Source: Survey Data, 2002

4.16.12 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Improved Maize Crib Storage (Y_{12})

Stepwise regression analysis procedure was employed to determine the best predictor variable for farmers' perceived effectiveness of extension advice on improved maize storage technology. The probabilities of F- to enter$\leq$0.05 and F-to remove $\geq$0.100 criteria were set.

Out of seven independent farmer demographic variables entered, only farm size (X_8) and total number (types) livestock raised (X_7) satisfied the probability levels set. An adjusted R^2 value of 0.150 indicated an observed variance of 15.0%. These two variables therefore made unique significant contributions of 0.312 and 0.170 to observed variance respectively (Table 84). Hence, farm size becomes the best predictor independent variable for farmers' perceived effectiveness of extension advice on improved maize storage technology.

The results may support the idea that farmers cultivating larger land areas with maize may utilize improved maize crib technology for temporary storage. The results on regression analysis also reinforce that of correlation where farm size had medium association with effectiveness of improved varieties (Table 73).

The low observed variance could also be attributed to very low mean perception scores especially on adoption with composite effectiveness variables on crop storage information (Table 27).

The regression model can thus be stated as: $Y_{12} = 0.577 + 3.618 (X_8) + 1.411 (X_7)$, where 0.577 is a constant and represents the regression estimate when $X_7 = X_8 = 0$.

Table 84: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Improved Maize Crib Storage.

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		0.577							
Farm size (X_8)	1	3.618	0.312	0.136	0.130	0.136	8.633	23.100	0.000
Total livestock (types) raised (X_7)	2	1.411	0.170	0.162	0.150	0.026	8.531	4.488	0.000

Source: Survey Data, 2002

4.16.13 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Wet-Sack Cassava Storage (Y_{13})

Stepwise regression analysis was used to determine the best predictor variable of farmers' perceived effectiveness of extension advice on wet-sack cassava storage technology.

An F-change value of 0.479 was not significant. Hence, none of the independent variables entered satisfied the probabilities of F- to enter$\leq$ 0.05 and F-to remove$\geq$ 0.100 criteria set. Subsequently the model did not fit the data and the independent variables have not assisted in predicting the dependent variable.

The result may be due to the fact that an overwhelming majority of farmers indicated non-awareness (Table 25) and very low mean perception scores on the other composite effectiveness variables (Table 27). Secondly, to prevent rapid post-harvest deterioration, cassava harvesting is delayed until it can be immediately consumed, processed or marketed as is required (FAO, 1995).

4.16.14 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Neem Storage Products (Y_{14})

Stepwise regression analysis was performed to determine the best predictor variable for farmers perceived extension effectiveness on neem storage products. The probability criteria set were F- to enter≤0.05 and F -to remove ≥0.100.

An extremely low adjusted R^2 value of 0.086 equivalent to 8.6% observed variance attributable to educational level of farmer (X_4) (Table 85) was recorded. Only educational level of farmer (X_4), made a unique significant 0.304 contribution to observed variance. The low predictive power of explanatory variables may be due to non-awareness of the technology as indicated by the majority of farmers (Tables 25). This is also confirmed by a survey conducted by NRI (1999), which revealed that many farmers are unaware of the use of insecticidal plants. However, it could be said that a well-educated farmer would be more likely to adopt extension advice on the use of neem products to preserve agricultural products.

The regression can thus be stated as: $Y_{14} = 0.276 + 1.296 (X_4)$, where 0.276 is a constant and represents the regression estimate when $X_4 = 0$.

Table 85: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Neem Storage Products

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-0.276							
Highest educational level of farmer (X_4)	1	1.296	0.304	0.092	0.086	0.092	4.920	14.94	0.000

Source: Survey Data, 2002

4.16.15 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Improved Livestock Breeds (Y_{15})

The outcome of stepwise regression of seven independent farmers demographic characteristics with their perceived effectiveness of agricultural extension information on livestock improved breeds is illustrated in Table 86.The probabilities of F- to enter ≤0.05 and F-to remove≥0.100 criteria were set.

Three independent variables namely total number of staple crops grown (X_5), total number (types) livestock raised (X_7) and highest educational level of farmer (X4) indicated an adjusted R^2 value of 0.333. This value translates into 33.3% explanation of the observed variance. Total number (types) livestock (X_7) raised made a unique significant contribution of 0.326 as against 0.277 for total number of staple crops grown (X_5) and 0.218 attributable to highest educational level of farmer (X_4). The regression results are also confirmed by Pearson correlation coefficients between these three variables and information on improved livestock breeds classified as of medium strength (Table 67)

The relatively low observed variance (34.7%) could be attributed to the similarly low mean perception scores on composite effectiveness variables for livestock improved breeds (Table 28). Farmers perceived extension information on livestock improved breeds to be fairly relevant (2.35), fairly adequate (1.99) very seldom adopted (1.35) and availability of livestock improved breeds as very barely available (1.49). The mean perceived score for output was perceived as poor (1.47).

Despite these observations, total number (types) livestock raised emerged as the best predictor variable on improved livestock breeds. As such, a farmer raising more than one type of improved livestock for instance, poultry and goats with good returns would have a higher perception level of extension advice on livestock improved breeds.

The regression model can be stated as: $Y_{15} = -4.158 + 1.869(X_5) + 2.726(X_7) + 1.686(X_4)$ where – 4.158 is a constant and represents the regression estimate when $X_4 = X_5 = X_7 = 0$.

Table 86: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Improved Livestock Breeds.

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-4.158							
Total no. of staple crops grown (X_5)	1	1.869	0.277	0.241	0.236	0.241	8.162	46.693	0.000
Livestock (types) raised (X_7)	2	2.726	0.326	0.301	0.292	0.060	-7.859	12.585	0.000
Highest educational level of farmer (X_4)	3	1.686	0.218	0.347	0.333	0.046	7.624	10.123	0.000

Source: Survey Data, 2002

4.16.16 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Supplementary Livestock Feed (Y_{16})

Stepwise regression analysis was perfumed to determine the best predictor variable of farmer perceived extension effectiveness on livestock supplementary feed (Table 87). The probabilities of F- to enter≤0.05 and F -to remove ≥0.100 criteria were set.

The results revealed an R^2 adjusted value of 0.401. This R^2 value translates into an observed variance of 40.1% attributable to only three independent farmer demographic variables. Out of seven independent variables entered, only total number (types) of livestock raised (X_7), total number of staple crops grown (X_5) and highest educational level of farmer (X_4) satisfied the criteria established.

Of the 40.1% observed variance explained by the three variables, total number (types) of livestock raised (X_7) made a unique significant contribution of 0.433, followed by total number of staple crops grown (X_5) 0.257 and highest educational level of farmer (X_4) 0.163. A farmer with several types of livestock may have income from different sources and possibly at different times. Coupled with different types of staple crops offering variety of livestock supplementary feed sources then with good education, such a farmer is most likely to adopt extension advice on livestock supplementary feed. Consequently, with good output, such a farmer may have better-perceived extension effectiveness on livestock supplementary feed.

The regression model is stated as: $Y_{16} = 4.110 + 3.591 (X_5) + 1.715 (X_7) + 1.247 (X_4)$, where 4.110 is a constant and represents the regression estimate when $X_4 = X_5 = X_7 = 0$

Table 87: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Supplementary Feed.

Variable	Step of entry	Un std Beta	Std Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-4.110							
Total no. of staple crops grown(X_5)	1	3.591	0.433	0.327	0.323	0.327	7.615	71.508	0.000
Livestock (types) raised (X_7)	2	1.715	0.257	0.388	0.380	0.061	7.287	14.527	0.000
Highest educational level of farmer (X_4)	3	1.247	0.163	0.414	0.401	0.025	7.159	6.278	0.000

Source: Survey Data, 2002

4.16.17 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Housing (Y_{17})

In Table 88 is indicated the results of stepwise regression analysis of the best predictor variable out of seven regressed with farmers perceived effectiveness of extension information provided by MoFA and NGOs on livestock housing for livestock. The probabilities of F- to enter ≤ 0.05 and F-to remove ≥ 0.100 criteria were set.

Consequently, only total number (types) of livestock raised (X_7), total number of staple crops grown (X_5) and highest educational level of farmer (X_4) satisfied the criteria. An adjusted R^2 value of 0.339 implies that the three variables were responsible for explaining 33.9% of observed variance. A significant unique contribution of 0.398 from the total number (types) of livestock raised (X_7) to observed variance may imply that, a farmer keeping several types of livestock is more likely to provide livestock housing for such animals. This is collaborated by Pearson correlation results where there was a large, positive and significant relationship (r = 0.525) between total number (types) of livestock raised and livestock housing (Table72).

The unique significant contribution of 0.163 by highest educational level of farmer to observed variance implies that an educated livestock farmer is very likely to provide livestock housing for livestock.

Regression model can thus be stated as:

Y_{17} = -3.217 +3.543 (X_7) + 1.552(X_5) +1.170 (X_4), where –3.982 is a constant and represents the regression estimate when $X_4 = X_5 = X_7 = 0$

Table 88: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Housing.

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-3.982							
Livestock (types) raised (X_7)	1	3.649	0.398	0.275	0.270	0.275	8.741	55.820	0.000
Total n of staple crops grown (X_5)	2	1.731	0.235	0.327	0.318	0.052	8.450	11.295	0.000
Highest educational level of farmer (X_4)	3	1.382	0.163	0.353	0.339	0.026	8.316	5.720	0.000

Source: Survey Data, 2002

4.16.18 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Prevention Health (Y_{18})

Stepwise regression analysis was computed to determine the best predictor variables of farmers perceived extension effectiveness on livestock preventive health practices out of seven independent farmer demographic variables. The criteria set were probabilities of F- to enter≤0.05 and F - to remove ≥0.100.

Three variables, total number (types) of livestock raised (X_7), total number of staple crops grown (X_5) and highest educational level of farmer (X_4) satisfied the criteria set with an adjusted R^2 value of 0.338. This value explains 33.8% of observed variance attributable to the three variables. Total number (types) of livestock raised (X_7) as the best predictor variable made a unique significant contribution of 0.412 to observed variance. This was followed by total number of staple crops grown (X_5) 0.224 and highest educational level of farmer (X_4) 0.147 (Table 89). As such, a farmer keeping several types of livestock is more likely to provide livestock preventive health medication to livestock.

This observation collaborated correlation results where livestock preventive health had a positive, large and significant association with total number (types) of livestock raised (Table 72). The relatively low observed variance could be attributed to the low mean perception scores on composite effectiveness variables for livestock preventive health (Table 28).

The regression equation for the model is stated as:

$Y_{18} = -3.217 + 3.543\ (X_7) + 1.552\ (X_5) + 1.170\ (X_4)$, where –3.217 is a constant and represents the regression estimate when $X_4 = X_5 = X_7 = 0$

Table 89: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Preventive Health.

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		-3.217							
Livestock (types) raised (X_7)	1	3.543	0.412	0.284	0.279	0.284	8.148	58.355	0.000
Total no. of staple crops grown(X_5)	2	1.552	0.224	0.331	0.322	0.047	7.904	10.208	0.000
Highest educational level of farmer (X_4)	3	1.170	0.147	0.352	0.338	0.021	7.807	4.652	0.000

Source: Survey Data, 2002

4.16.19 Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Curative Health (Y_{19})

A stepwise regression analysis was performed to determine the best predictor of farmers' perceived effectiveness of extension advice on livestock curative health for livestock. Seven farmer demographic variables were used. The criteria set were probabilities of F- to enter $\leq$ 0.05 and F - to remove $\geq$ 0.100.

As indicated in Table 90, only two variables, namely total number (types) of livestock raised (X_7) and highest educational level of farmer (X_4) satisfied the criteria. The observed variance attributable to the two variables was 31.8%. Of the observed variance of 31.8%, total number (types) of livestock raised (X_7) made a unique significant contribution of 0.518 and 0.250 by highest educational level of farmer (X_4). On this basis, it could be said that a farmer keeping several types of livestock with good education has a higher probability of providing livestock curative health for his/her stock. This may have accounted for the low observed variance on livestock curative health considering the low educational level of majority farmers studied (Table 8).

The regression model can be stated as:

$Y_{19} = 0.743 + 4.42\ (X_7) + 1.968\ (X_4)$, where 0.743 is a constant and represents the regression estimate when $X_4 = X_7 = 0$

Table 90: Best Predictors of the Dependent Variable: Farmers' Perceived Extension Effectiveness on Livestock Curative Health.

Variable	Step of entry	Un std. Beta	Std. Beta	R^2	R^2 Adjusted	R^2 Change	SE	F-Change	Sig.
Constant		0.743							
Livestock (types) raised (X_7)	1	4.421	0.518	0.265	0.260	0.265	8.192	52.91	0.000
Highest educational level of farmer (X_4)	2	1.968	0.250	0.327	0.318	0.062	7.864	13.51	0.000

Source: Survey Data, 2002

4.17.1 Farmers Willingness to Pay for Extension

Financing an efficient extension system has now become a serious problem to most governments. Therefore the desire of farmers to pay for part of the cost could be relief to governments. Results from the study as shown on the Table 91 revealed that 60.7% farmers participating in either MoFA or NGO extension activities are willing to pay for extension advice they receive. Farmers not willing to pay for extension advice were 39.3%.

It should however, be noted that the result was only for farmers who were participating in either MoFA or NGO programmes. As noted by ODI (2002), the public sector alone cannot finance, let alone deliver, extension services to meet all requirements.

Table 91: Farmers Willingness to Pay For Extension Advice

Willingness to Pay	Frequency	Percent
Yes	91	60.7
No	59	39.3
Total	150	100.0

Source: Survey Data, 2002

4.17.2 Proportion of Total Extension Cost Farmers are Willing to Pay

The result of the proportion of total extension cost that respondent farmers were willing to pay is summarised in Table 92. Of the 60.7% farmers that were willing to pay for extension service, 53.85% were willing to pay less than 10%, 26.37% were prepared to pay between10% to 19% of extension cost and 14.29% could afford to pay 20 to 29% of extension cost. Only 7.70% were willing pay above 30% of total extension costs they received.

With this outcome, should the Ghana Government decide to privatise extension services, she should consider an initial amount of not more than 10% for farmers who would be willing to pay for the services.

Table 92: Proportion of Extension Cost Farmers are willing to Pay.

Proportion of Total Cost	Frequency	Percent
<10%	47	53.85
10-19%	24	26.37
20-29%	13	14.29
30-39%	2	2.20
40-49%	4	4.40
>50%	1	1.09
Total	91	100.0

Source: Survey Data, 2002

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter is a summary of the major findings of the study. The conclusions drawn and the recommendations to improve the effectiveness of agricultural extension service provision in the Central Region are also stated. The chapter concludes with possible areas for future research.

5.2 Summary of Findings

Objectives 1 sought to identify NGOs that were engaged in agricultural extension activities in the study districts of the Central Region. Six NGOs were identified.

Objective 2 was to determine the human resource at the disposal of MOFA at the district level. Only the Cape Coast District had less than 100 communities. There were 20 DDOs under 14 areas of specialization. Apart from the area of extension, which had a DDO in each of the three districts, the other areas of specialization were not represented in some districts. There was an average of 7 AEAs per district, one operational area per AEA, with an average of six communities.

Objective 3 sought to examine the demographic characteristics of farmers. The results indicated that 58% of the respondents were males. The average age was 51 years. The age group of 40 to 49 years constituted 36% of the respondents. Whilst 31% of the respondents had no formal education, 45%

only had up to middle school or JSS level of education. The main staple food crops cultivated by the respondents were cassava (99.7%), maize (97%) and plantain (49%). Similarly, the most widely grown cash crops were oil palm (66%), cocoa (34%) and citrus (33%). Over 80% of the respondents cultivated pepper and tomatoes at subsistence level.

Regarding livestock production, 66% of the respondents raised chicken, 35% goats and 25.3% sheep. Only 3% of respondents were engaged in snail farming. On residential status of respondents, 68% were natives or indigenes whilst 32% were migrant or settler farmers. The most widely practiced land tenure systems were inheritance (62%) and *Abusa* + fees (21%). The average land size cultivated was 3 acres. The average farming experience was 21 years with 49% of respondents having been farming for the past 11- 20 years in the Central Region.

Whilst 91% of the respondents received extension advice from MoFA, only 7% had no service provider formerly. Currently, an overwhelming majority (99.4%) of the respondents still depended on MoFA for extension advice. Apart from extension staff, over 80.0% of the respondents indicated farmer friends and FM-radio as their additional sources of extension advice. On sources of farm financing, over 90% of the farmer respondents in the Central Region depended on own labour and funds. Whilst 75% of the respondents depended on family labour, only 9% received assistance from the banking sector.

Objective 4 which sought to find out interaction between MoFA and NGOs, revealed only collaboration, consultation and delegation. The most widely used interaction was collaboration with the least perceived extent rating expressed as good.

Objective 5 was to evaluate farmers perceived effectiveness of extension on some basic agricultural information provided by MoFA and NGOs. Additionally the objective was intended to find out if significant differences existed in the level of perceived effectiveness between the two categories of farmers on 19 extension technologies. Age and type of farmer or service provider did not have any significant association with farmers' perception on extension effectiveness. As a result, the overall perceived extension effectiveness means on investigated technologies were: improved varieties 22 (good), line planting 20 (fair), plant stand 14 (poor), timely weeding 25 (good), agro-pesticides 14 (poor), organic manure 14 (poor), inorganic fertilizer 21 (good), germination test 11 (very poor), agro-chemical storage 19 (fair), improved maize crib 14 (poor). Neem storage products and wet sack cassava storage had a mean of 3 (very, very poor). Farmers perceived extension effectiveness on all livestock technologies fell within the mean range of 11 to 15 interpreted as poor.

There were significant differences in the level of farmers perceived extension effectiveness between male and female farmers on the following crop production technologies; improved varieties, line planting, timely weeding, inorganic fertilizer and agro–forestry

There were significant differences in the level of farmers perceived extension effectiveness between male and female farmers on the following crop storage technologies; agro-chemical storage and improved maize crib

Similarly, there were no significant differences between males and females on the level of perceived extension effectiveness on all the technologies associated with livestock production studied (improved breed, supplementary feed, housing, preventive health and curative health).

Apart from improved varieties and inorganic fertilizers, residential status of farmer did not significantly affect the level of perceived extension effectiveness on all the 19 technologies studied.

The first null hypothesis "MoFA and NGO farmers do not differ significantly on their demographic characteristics" was accepted in favour of the alternate hypothesis. Similarly, the second null hypothesis "Type of service provider has no significant effect on farmers' perceived level on extension advice was also accepted for all the 19 extension technologies investigated.

However, the third null hypothesis "Sex does not significantly affect farmers perceived level of extension effectiveness" was rejected for the following technologies; use of improved varieties, row planting; plant stand, timely weeding, agro-forestry; agro-chemical storage, and improved maize crib storage.

Finally, the fourth null hypothesis "Residential status of farmer does not significantly affect their perceived level of extension effectiveness" was accepted for 17 of the technologies studied except for the use of improved varieties and inorganic fertilizers.

Objective 6 was meant to determine the relationships between composite effectiveness variables; independent farmers demographic variables and dependent composite effectiveness variables of some 19 extension technologies.

Pearson product-moment correlation was used to determine the relationships between the following composite effectiveness variables of some 19 basic agricultural extension information or technologies.

- Relevance of information or technology
- Adequacy of information
- Availability of input to adopt information
- Cost of inputs to adopt information
- Adoption of information
- Output for adopting information.

It was only the use of improved varieties that correlation coefficients ranged from as low as r = 0.100 (no significance) through r = 0.345 to r = 0.699. The effectiveness variables on all the other basic agricultural extension technologies registered correlation coefficients within the medium (r > 0.400) to very large (r > 0.700) categories. All significant values were positive and declared at alpha of 0.01. The positive correlation implies that an increased level of perception on one variable would lead to an accompanied increased level of perception on the other variable.

The relationships between independent farmers' demographic variables and dependent composite effectiveness variables of some 19 basic extension technologies were determined using Pearson-product moment correlation.

There was weak but no significant correlation between type of farmer (MoFA or NGO), age of farmer and perceived extension effectiveness on all the 19 basic agricultural extension technologies studied. Sex of farmer had small but significant correlation with improved varieties (r = 0.26), line planting (r =0.

23), plant stand (r = 0 .22), agro-pesticides (r = 0.19), agro-chemical storage (r = 0 .24) and improved maize crib (r = 0 .23).

Educational level of farmer had medium, positive and significant association with perceived extension effectiveness on improved varieties (r = 0.33), plant stand (r= 0.37), inorganic fertilizer (r = 0.30) and neem storage products (r =0 .30). Associations with farmer demographic variables though small (r <0 .30) were significant.

Total number of staple crops cultivated by a farmer had significant correlation values ranging from small (r = 0 .18) to large (r = 0.52) with the agriculture extension technologies studied. Only wet-sack cassava storage did not show any significant association. Similar results were indicated by the total number of cash crops a farmer had. Farm-size had positively and significant association with virtually all the 19 basic agricultural extension technologies investigated except wet-sack cassava storage. Farming experience did not show any significant association with farmers' perceived extension effectiveness on virtually all the 19 technologies studies except organic manure and inorganic fertilizer with (r = < 0.2).

On livestock production, variables of interest were farmers' perceived extension effectiveness on organic manure (r = 0.42), improved breeds (r = 0 .48), supplementary feed (r = 0 .57), housing (r =0 .53) preventive health (r = .53) and curative health (r = 0 .57). All had positive, significant medium to large correlation values with total (types) number of livestock a farmer raised.

Objective 7 sought to determine the best predictors of observed variance in farmers perceived extension effectiveness on 19 agricultural extension technologies and seven farmer demographic variables (age, education, farm size, farming experience, number (types) of staple crops cultivated, number (types) of cash crops cultivated and total types of livestock raised.

The results of step-wise regression analyses showed that the composite effectiveness variable used (awareness of information, relevance of information, adequacy of information, availability of inputs to use information, adoption of information, cost of inputs to use information and out-put for using information) could not predict above 40% of observed variances for the technologies.

On crop production technologies, apart from germination test and agro-forestry, which registered 13%, predicted observed variances ranged from 16% to 39%. With crop storage technologies, observed variances were as low as 4 % for wet-sack cassava storage to 25% for agro-chemical storage. With regard to livestock production technologies, effectiveness variables were able to predict observed variances in the range of 32% to 40 %.

Objective 8 was designed to determine the willingness and proportion of costs which farmers involved with MoFA and NGOs agricultural extension services were willing to pay for services they received. Results revealed that 61% of the respondents were willing to pay for extension advice. Subsequently, 54% of this group was prepared to pay 10% of extension cost. About 24% of the group was willing to pay up to 19% of extension cost.

5.3 Conclusions

Based on the results, the following conclusions are made:

1. All the three NGOs namely SG2000, ADRA and WVI, studied depended mostly on MoFA extension staff for the execution of their extension programmes.
2. The human resource of MoFA to effectively deliver extension services in the districts is inadequate.
3. The average age of the farmers interviewed was 50 years and 53% of them were in the age group of 50 to 70 years.
4. The educational level of farmers is quite low with 45% of the respondents being graduates from middle school or J.S.S.
5. The most widely held land tenure system is inheritance by 62% of the respondents followed *Abusa* plus fees (21%).
6. The average farm size of the farmers was 3 acres.
7. Apart from extension, over 80% of the farmers depended on farmer friends and FM-radio for additional extension advice.
8. The most widely utilized type of interaction between MoFA and NGO service providers was collaboration. The extent of collaboration was perceived as good.
9. Type of farmers or service provider, and age did not significantly affect farmers perceived extension effectiveness on the agricultural technologies investigated but sex did on about 50% of the technologies.

10. Farmers in the Central Region had good perceptions of the effectiveness of extension services provided them by MoFA and NGOs of only improved varieties, timely weeding and inorganic fertilizers technologies investigated.

11. As envisaged in the conceptual framework of the study, significant though, small to medium relationships existed between the following farmer demographic variables; sex, education, total number of staple, total number of cash crops grown, farm size, total number (types) of livestock raised and farmer perceived extension effectiveness of most agricultural technologies studied.

12. The best predictors of farmers perceived extension effectiveness of the extension technologies studied were as follows:

    - Education for neem storage products.
    - Farm size for line planting, agro-pesticides, and agro-chemical storage and improved maize crib.
    - Total number (types) of livestock raised for improved breeds, supplementary livestock feed, timely weeding and plantain paring. The rest are organic manure, germination-test, wet-sack cassava storage, livestock housing, livestock preventive and livestock curative health.
    - Total number of cash crops grown for plant stand, improved varieties, and inorganic fertilizer.

13. Sixty percent of the farmers who were willing to pay for extension services could readily afford about 10% of extension cost.

14. The intervention by NGOs did not significantly affect farmers' perception about the effectiveness of agricultural extension services in the Central Region of Ghana.

5.4 Recommendations

Based on the findings and conclusions drawn from this study, for farmers in the Central Region to have a better level of perception about the effectiveness of agricultural extension services provided them either by the MoFA or NGOs, the following actions are recommended:

1. Instead of NGOs relying exclusively on MoFA extension staff for service delivery, they should employ their own extension staff for the duration of their projects if the desired effects are to be realised.
2. The human resource capabilities of the District Development Officers of MoFA would have to be strengthened for:

- Plant protection & regulatory services
- Crop husbandry
- Animal husbandry & veterinary services
- Policy planning, monitoring & evaluation
- Agricultural economics
- Management of information systems
- Fisheries.
- Home Economics
- Horticulture

MoFA, linking up with the universities and sponsoring students to major in these areas, can help in minimizing the problem.

3. With the general perception of agricultural extension activities in the Central Region regarded as poor for most of the basic technologies investigated, it would be prudent to have an evaluation of the current extension delivery system for the necessary lapses to be amended.

4. There is the urgent need for MoFA and NGOs involved in agricultural extension activities in the Central Region to begin to focus attention on technologies associated with livestock production, especially for poultry and small ruminants, if the minimum protein requirement needs of the subsistence farmers are to be met. There should also be very extensive educational campaigns during periods identified as very suitable for Newcastle vaccination, especially for the village chicken on district basis.

5. MoFA and NGOs should initiate plans to have FM-radio stations give more airtime to agricultural extension service outreach programmes in order to reach a wider coverage. This can be done by lobbying these FM- stations to see this service as part of their corporate social responsibility to the communities in which they operate.

6. With about 60% of the farmers willing to pay about 10% of extension cost, the government, through MoFA should initiate moves to have private sector participation of agricultural extension piloted for crops like citrus, oil palm, maize and rice via contract extension system and piloted in selected districts in Ghana.

7. MoFA and NGOs should take advantage of the good collaboration between the two service providers to initiate serious discussions on contract extension.

5.5 Areas for Further Research

Areas for which further research is suggested are:

1. A similar study should be conducted in the other districts in the Central Region so that a more accurate situation about the state of agricultural extension in the Region can be assessed.

2. A study into the factors that militate against the adoption of extension advice on livestock technologies, such as of improved breeds, housing, preventive and curative health practices.

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APPENDIX 1

QUESTIONNAIRE FOR DISTRICT DIRECTORS OF MoFA

Kindly read through the following statements and provide answers which best describes the situation to your organization. All information provided is treated as confidential

1. Demographic data

1.1 Name of District...

1.2 How many communities are under your District?.........

1.3 How many Development Officers are in your department?

1.4 How many Agric. Extension Agents (AEAs) are currently under your directorate?

1.5 Do you have any NGOs undertaken any agricultural activities in your District currently? 1) Yes [ ] 2) No [ ]

1.6 If no, skip to **Collaboration** Q.1

1. 7 If yes, kindly provide the following information.

Name of NGO	Agricultural activity	NO. of communities

2. Collaboration

2.1 Has MoFA ever collaborated with any NGO in executing any Agricultural project in your District? 1) Yes [ ] 2)No [ ]

2.2 If no, skip to Q 2.5

3.3 If yes, kindly provide the following information.

Use the following grading scale. You can select more than one option where appropriate.

Level of collaboration…1) National 2) Regional 3) District

Type of collaboration…. 1) Official 2) Un Official

Extent of collaboration… 1) Poor 2) Fair 3) Good 4) Very good 5) Excellent

Agricultural Project	Level of collaboration	Type of collaboration	Extent of collaboration
	1 2 3	1 2	1 2 3 4 5
	1 2 3	1 2	1 2 3 4 5
	1 2 3	1 2	1 2 3 4 5

2.4. Are you collaborating on any currently ON-GOING agricultural projects with any NGO in your District? 1) Yes [ ] 2) No [ ]

2.5 If yes, provide the following information on projects involved.

Use the following grading scale. You can select more than one option where appropriate.

Level of collaboration…1) National 2) Regional 3) District

Type of collaboration…1) Official 2) Un official

Extent of collaboration… 1) Poor 2) Fair 3) Good 4) Very good 5) Excellent

Agricultural Project	Level of collaboration	Type of collaboration	Extent of collaboration
	1 2 3	1 2	1 2 3 4 5
	1 2 3	1 2	1 2 3 4 5

2.6 On those projects you collaborated with NGOs, in your opinion did you find collaboration to have enhanced the effectiveness of your services?

1) Yes [ ] 2) No [ ]

2.7 Where your collaboration with NGOs was formal, did you have any written document as to what was expected of each partner? 1) Yes [ ] 2) No[ ]

2.8 In your overall assessment, would you want your Organisation to collaborate with NGOs on future projects? 1) Yes [ ] 2) No[ ]

2.9 Apart from NGOs, has your organisation collaborated with ANY OTHER development organization in agriculture? 1) Yes [ ] 2) No[ ]

2.10 If no, skip to **Consultation** Q.1

2.11 If yes, kindly provide the following information on agricultural projects involved.

Use the following grading scale. You can select more than one option where appropriate.

Level of collaboration…1) National 2) Regional 3) District

Type of collaboration….1) Official 2) Un official

Extent of collaboration… 1) Poor 2) Fair 3) Good 4) Very good 5) Excellent

Name of Organisation	Level of collaboration			Type of collaboration		Extent of collaboration				
	1	2	3	1	2	1	2	3	4	5
	1	2	3	1	2	1	2	3	4	5

3. Consultation

3.1 Have you ever consulted any NGO on any agricultural project you carried out in the district? 1) Yes [ ] 2) NO [ ]

3.2 Have you ever consulted ANY OTHER organisation on any agricultural project you carried out in your district? 1) Yes [ ] 2)NO [ ]

4. Delegation

4.1 Has an NGO ever delegated a project or part of it to MoFA for execution in your district? 1) Yes [ ] 2)No [ ]

4.2 If no, has your organization ever requested for a project or part of it to delegated to it by an NGO? 1) Yes [ ] 2) No [ ]

4.3 Has MoFA in your district ever delegated a project or part of it to ANY OTHER organization for execution? 1) Yes [ ] 2)No [ ]

5. Competition

5.1 Has MoFA ever competed with an NGO in the execution of any of your projects in the district? 1) Yes [ ] 2) No [ ]

5.2 Has MoFA ever competed with ANY OTHER organisation in the execution of any of your projects in the district? 1) Yes [ ] 2)No [ ]

6. Confrontation

6.1 Has your organization ever had any confrontation with any NGO in the execution of any of your projects in the district? 1) Yes [ ] 2) No [ ]

6.2 Has your organization ever had any confrontation with ANY OTHER organisation in the execution of any of your projects in the district? 1) Yes [ ] 2)No [ ]

Thanks for your precious time.

APPENDIX 2

QUESTIONNAIRE FOR PROJECT MANAGERS OF NGOs

Kindly read through the following statements and provide answers which best describes the situation to your organization. All information provided is treated as confidential

1.Demographic Data

Please, tick where appropriate.

1.1 Name of Organisation……………………………………………………

1.2 District …………………………………………….

1.3 Origin of NGO 1) Local [ ] 2) Foreign [ ]

1.4. How would you descibe your NGO? 1) Secular [ ] 2) Religious [

1.5. If religious, specify……………………….

1.6. In which year did your Organisation start agricultural operations in Ghana?

1.7 In which year did your Organisation start agricultural operations in Central region?

2. Collaboration

2.1 For projects that have ALREADY been executed, did your organization ever collaborate with MoFA? Yes [ ] No [ ]

2.2 If no, skip to Q.5

2.3. If yes, kindly provide the following information using the following grading scale.

You can select more than one option where appropriate.

Level of collaboration……1) National 2) Regional 3) District

Type of collaboration…….1)Official 2) Un-official

Extent of collaboration…1)Poor 2)Fair 3)Good 4) Very good 5) Excellent

Agric. Project	Year	Areas of collaboration	Level of collaboration	Type of collaboration	Extent of collaboration
			1 2 3	1 2	1 2 3 4 5
			1 2 3	1 2	1 2 3 4 5

2.4. Are you collaborating on currently ON-GOING agricultural projects?

1) Yes [ ] 2)No [ ]

2.5. If yes, kindly provide the following information on projects involved.

Use the following grading scale. You can select more than one option where appropriate.

Level of collaboration……1) National 2) Regional 3) District

Type of collaboration…….1)Official 2)Un official

Extent of collaboration 1)Poor 2)Fair 3)Good 4)Very good 5) Excellent

Agric. Project	Year	Areas of collaboration	Level of collaboration	Type of collaboration	Extent of collaboration
			1 2 3	1 2	1 2 3 4 5
			1 2 3	1 2	1 2 3 4 5

2.6. On those projects you collaborated with MoFA, in your opinion did you find collaboration to have enhanced the effectiveness of your services? 1)Yes [ ] 2) No [ ]

2.7 Where your collaboration with MoFA was official, did you have any written document as to what was expected of each partner? 1)Yes [ ] 2) No[ ]

2.8. In your overall assessment, would you want your Organisation to collaborate with MoFA on future projects?1) Yes [ ] 2) No[ ]

2.9. Apart from MoFA, has your organisation collaborated with ANY OTHER development organization in agricultural development? 1) Yes [ ] 2) No[

2.10. if no, give your reasons and skip to **Consultation** Q. 1

2.11. If yes, kindly provide the following information on agricultural projects involved.

Use the following grading scale.

You can select more than one option where appropriate.

Level of collaboration……1) National 2) Regional 3) District

Type of collaboration…….1)Official 2)Un official

Extent of collaboration… 1)Poor 2)Fair 3)Good 4) Very good 5) Excellent

Name of Organisation	Year	Level of collaboration			Type of collaboration		Extent of collaboration				
		1	2	3	1	2	1	2	3	4	5
		1	2	3	1	2	1	2	3	4	5

3. Consultation

3.1. Have you ever consulted MoFA on any agricultural project you carried out?

1) Yes [ ] 2) NO [ ]

3.2. Have you ever consulted ANY **OTHER** organisation on any agricultural project you carried out…1) Yes [ ] 2) NO [ ]

4. Delegation

4.1. Has your organization ever had a project or part of it delegated to you by MoFA for execution? 1)Yes [ ] 2) No [ ]

4.2 If no, has your organization ever requested for a project or part of it tobe delegated to it by MoFA?…… 1) Yes [ ] 2)No [ ]

4.3.Has your organization ever had to delegate a project or part of it to ANY OTHER organization for execution? 1) Yes [ ] 2)No [ ]

5. Competition

5.1. Has your organization ever competed with MoFA in the execution of any projects? 1)Yes [ ] 2) No [ ]

5.2. Has your organization ever competed with **ANY OTHER** organisation in the execution of any of your projects?1) Yes [ ] 2) No [ ]

6. Confrontation

6.1. Has your organization ever had any confrontation with MoFA in the execution of any of your projects?1) Yes [ ] 2)No [ ]

6.2. Has your organization ever had any confrontation with ANY OTHER organisation in the execution of any of your projects? 1)Yes [ ] 2) No[ ]

Thanks for giving out your precious time.

APPENDIX 3

QUESTIONNAIRE FOR FARMERS

Kindly read through the following items and provide answers which best describes your situation. All information provided is treated as confidential. Thanks for your precious time

1. Demographic Characteristics of farmer

1.1 Name of interviewee...

1.3 District...

1.4 Name of village..

1.5 Name of farmer..

1.6 Sex 1) Male [ ] 2) Female[ ]

1.7 Age as at last birthday...........years

1.8 Highest educational level attained

1) No formal education [ ] 2) Primary education [ ]

3) Middle/JSS education [ ] 4) Secondary/SSS/Technical [5) Diploma [ ] 6) Degree[ ] 7) Others (specify) [ ]

1.9 Name four (4) main staple food crops (e.g. Cassava, maize, plantain, sweet potato, cowpea etc.) that you grow?

....

1.10 Name four minor staple food crops (e.g. Cassava, maize, plantain, sweet potato, cowpea etc.) you grow?

....

1.11 Name cash crops (e.g. Cocoa, oil palm, citrus etc) that you cultivate?

1.12 Please, list all vegetables (e.g. pepper, okra, garden-eggs, tomato alefu etc.) that you grow for home consumption only.

....

1.13 Please, list all vegetables (e.g. pepper, okra, garden-eggs, tomato, alefu etc.) that you grow for commercial purpose only.

....

1.14 Please TICK as many of these animals that you keep.

1) Cattle [ ] 2) Sheep [ ] 3) Goats [ ]

4) Pigs [ ] 5) Guinea pigs [ ] 6) Rabbits [ ]

7) Fowls [ ] 8)Guinea fowls [ ] 9) Ducks [ ]

10) Snails [ ] 11) Bees [ ] 12)Fish [ ]

13) Others (specify).......................................

1.15 What is your resident status? 1) Native [ ] 2) Migrant [ ]

1.16 How did you acquire your farmland?

1) By inheritance [ ] 2)Purchased [ ] 3) Hired [ ]

4)Abunu [ ] 5) Abusa [ ] 6) Abusa + Fees [ ] 7) Abunu + Fees [ ] 8) Others specify.......................................

1.17 How many acres of farmland are you cultivating now?

1) Less than 1 poles [ ] 2)1 - 2 poles [ ] 3) 3-5poles [

4) More than 5 poles [ ]

1.18 How many poles of farmland are not under cultivation?

1) Less than 1 pole [ ] 2) 1 - 2 poles [ ] 3) 3-5poles [

4) More than 5 poles [ ]

1.19 How many years have you been farming?.........................

1.20 Who was your first your agricultural extension service provider?

1) MoFA [ ] 2) NGO [ ] 3) Both [ ] 4) Other specify........

1.21 Who has been your main agricultural extension service provider for the past five years? 1) MoFA [ ] 2) NGO[ ] 3) None [ ] 4) Other s (specify)........

1.22 From which of these additional sources do you also receive agricultural information? 1) Radio (FM) [ ] 2)Farmer friends [ ] 3)TV [ ] 4) News papers [ ] 5) Agric Sc. Teacher in the community [ ] 6) Textbooks [ ]

1.23 How do you finance your farm operations? Choose as many sources that are available to you. 1) Own labour [ ]2) Family labour [ ] 3) Own funds [ ] 4) Money lenders [ ] 5) Susu [ ] 6) Credit from Bank [ ] 6) Financial support from children [ ]

2. Effectiveness of agricultural extension information:

For each extension service indicated, kindly choose by circling/ticking an option that best applies to you.

Please use these scales and do not leave any blank spaces.

Awareness of information: 1) Yes 2) No

Relevance of information to your work: 1) Not relevant 2) Fairly relevant 3) Relevant 4) Very relevant 5) Excellent

Availability of inputs to go with information: 1) Not available 2) Barely available 3) Available 4) Readily available

Cost of inputs to use information: 1) Very cheap 2) Cheap 3) Moderate 4) Expensive 5) Very expensive

Adequacy of information provided: 1) Not adequate 2) Fairly adequate 3) Adequate 4) Very Adequate 5) Excellent.

Adoption of information: 1) Never applied 2) Seldomely applied 3) Sometimes applied 4) Often applied 5) Always applied

Output for using information: 1=Bad 2=Fair 3=Good 4= Very good 5= Excellent

Crop production	Awareness	Relevance	Availability	Adequacy	Adoption	Output	Inputs Cost
1. Improved varieties	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Line/Row planting	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Correct plant per stand	Yes No	1 2 3 4 5	**Ignore**	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	**Ignore**
4. Timely weeding	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Pesticide use	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Organic manure use	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Inorganic Fertilizer use	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. Paring for Plantain	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. Germination testing	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10. Agro-forestry	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Crop production (Storage)	Awareness	Relevance	Availability	Adequacy	Application	Output	Inputs Cost
Chemicals	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Improved maize crib	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Wet-sack for cassava	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Neem products	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Livestock information	**Awareness**	**Relevance**	**Availability**	**Adequacy**	**Application**	**Output**	**Inputs Cost**
1.Use of improved breeds	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2.Feed supplement	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3.Housing	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4.Health (prevention)	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5.Health (curative)	Yes No	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

3. Paying for Extension information

3.1 If from today, you are asked to start paying for agricultural extension information, will you be willing to pay? Yes [ ] No [ ]

3.2 If yes, what proportion of the cost are willing to pay?

1) Less than 10%[ ] 2) 10-19% [ ] 3) 20-29% [ ] 4)30-39% [ ]

5) 40-49% [ ] 6)>50%

THANK YOU VERY MUCH FOR YOUR TIME