

**EXTENSION, CREDIT AND ADOPTION:
A CASE STUDY OF FARMER PRODUCTION PLOT FARMERS
IN THE CENTRAL REGION OF GHANA**



by

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ABSTRACT

This study sought to determine the relationship between extension access and/or access to credit and adoption of maize technology by small-scale maize farmers in the Central Region of Ghana. It is expected that the findings of this study will increase our understanding of the importance of extension and credit access in agricultural development.

The study was carried out in six districts of the Central Region of Ghana. These are Assin, Asikuma-Odoben-Brakwa, Agona, Awutu-Efutu-Senya, Gomoa and Komenda-Edina-Eguafo-Abrem districts. A survey questionnaire was used to collect data on personal socio-economic characteristics, extension access, access to credit and adoption of maize technology from a sample of 160 farmers. The sample, comprising 80 farmers who were members of the Farmer Production Plot (FPP) group and have access to Sasakawa Global 2000 (S.G. 2000) credit, and 80 farmers who were non-members of the FPP group (NFPP) were drawn using multi-stage sampling technique. Data collected was analysed using Statistical Package for Social Sciences (SPSS). Analysis yielded descriptive statistics of frequency counts, percentages, as well as cross-tabulations of variables that enabled the statistical testing of hypothesis using Chi-square.

The findings indicate significant differences were found between FPP and NFPP farmers in relation to extension access, credit source, and adoption of innovations. The FPP approach, which combines both extension education and credit delivery, leads to higher extension and credit access. Such access leads to fuller understanding of the package of maize innovations. Farmers who had access to extension but not

credit tended to partially adopt the maize innovations. This was attributed to lack of adequate funds, particularly to buy fertilizer. More significantly farmers who had a combination of access to extension and credit tended to adopt the innovations fully. Thus, a combination of extension access and credit greatly enhances adoption. The findings also indicate that apart from S.G. 2000 being the main source of credit for farmers, majority of them did not use other sources of credit in their maize farming activities. The FPP programme tended to favour large scale farmers and those who hire labour (implying wealthier ones) contrary to its documented target beneficiary who are the small-scale and poor farmers.

Considering the positive relationship between access to extension and access to credit and adoption of innovations, it is concluded that both extension and credit are necessary to enhance agricultural development among small-scale farmers. However, considering that extension agencies directly administering credit is inimical to their role of providing education to farmers, it is recommended that extension programmes should be complemented with appropriate means of financial service provision, implemented by other agencies. However, such rural finance programmes should be able to cater for the credit needs of small-scale farmers. For instance part of the District Assembly Common Fund for poverty alleviation can be channeled through rural banks, traders, credit unions, susu-collectors, rotating savings and credit associations (ROSCA) and non-governmental organisations (NGOs) to cater for the credit needs of farmers, whilst savings mobilisation is encouraged at the same time. However, this requires effective and efficient joint consultation and collaboration between extension agencies and financial service providers to ensure maximum benefits, outreach and repayment of such loans.

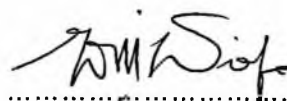
DEDICATION

This work is dedicated to my family – to my wife, Perdita, without whose faith and encouragement this work would never have been completed; to my children, Cecil and Agnes, both of whom arrived in this world during the period of study and partially missed me at home.



DECLARATION

I hereby declare that the work presented in this thesis was carried out by myself and has never in part or whole been presented to any other University for the award of a degree.



William Mintah Wiafe



Dr. Owuraku Sakyi-Dawson

(Supervisor)

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List of acronyms

FPP : Farmer Production Plot

NFPP : Non- Farmer Production Plot

MOA : Ministry of Agriculture

VORADEP: Volta Regional Agricultural Development Project

URADEP: Upper Regional Development Project

ASRP : Agricultural Services Rehabilitation Project

S. G. 2000 : Sasakawa Global 2000

G.G.D.P. : Ghana Grains Development Project

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CHAPTER 1

AGRICULTURAL CREDIT AND TECHNOLOGY ADOPTION IN GHANA

1.0. Introduction

Most small-scale farmers practise traditional agriculture characterised by slash and burn, use of low input technology which together affects overall yields. The little use of purchased inputs is the result of low access to funds, which affects farmers' ability to maximise the use of extension recommendations. A majority of Ghanaian farmers are in this category and account for over 80% of the total agricultural production in the country. This means that there is generally low productivity of the agricultural sector. Among the reasons given for this low productivity include weak extension system coupled with poor research linkage, inefficiencies in the market system including the availability of credit and unfavourable economic environment. To enhance the productive potentials of these farmers a policy environment must be provided. Some components of the policy environment are the provision of extension and credit to these farmers. The provision of extension recommendation implies the use of innovative inputs. This most farmers do not have the cash outlay to purchase. The provision of credit, it is contended, will help these farmers. The issue about the provision of credit to small-scale farmers, however, appears unsettled. Whereas some observers see credit as an important factor in enhancing the productive potential of farmers and hence adoption of innovations (Bhalla, 1976), others contend that credit does not lead to increased productivity of farmers as well as their incomes (Salami, 1988). And still, others contend that where profitable opportunities for investment in an innovation exist and where extension recommendation are available even

small farmers are likely to be induced to mobilise from whatever sources to which they have access, the relatively small cash requirements for the necessary inputs (Wague, 1988).

1.1. Role and Characteristics of the Small Scale farmer in Agricultural Production and Productivity

Ghana's agriculture is predominantly small holder, traditional and rainfed. Farming is done by numerous independent - holders with an average of 60% of the holdings being 1.2 hectares or less per farmer (MOA, 1991). The farmer's main system of farming is traditional using simple farm tools such as hoe and cutlass, and traditional crop varieties. Thus characteristically, the small farmer uses low- input technology, which often requires more or very little borrowed capital. Where there is the need for credit his main sources is the informal sector, examples of which are moneylenders, susu-collectors, traders, friends and relatives. The average amounts often borrowed are low. Their capital base is thus low (Owusu-Acheampong, 1986:90). This traditional system of farming has developed over time as adaptation to the six major agro-ecological zones in the country, namely, rainforest, deciduous, forest, transition, coastal savanna characterised by bimodal rainfall; sudan and guinea savanna by unimodal rainfall. These ecological zones allow for a large variety of food crops (cereals, roots and tubers, vegetables) and cash crops (cocoa, coffee, pineapples etc.) to be cultivated by farmers. In cultivating the land most of the small scale farmers employ slash and burn method of farming which invariably leads to loss of plant nutrients. The use of purchased inputs such as chemical fertilizer

to replace lost nutrients, however, is generally low among small scale farmers (Anaman, 1988). This is because many farmers do not have the funds to purchase inputs, particularly fertilizer. This lack of funds greatly affects farmers' ability to maximise the use of extension recommendations. In the circumstance, crop yields have remained low. For instance in Ghana, maize yields have remained at about 20% of national projected yield of 5 tons per hectare (MOA, 1990). Despite these low yields the contribution of these small-scale farmers, who use rudimentary technology, is enormous. They produce about 80% of the total agricultural production in the country (Dapaah, 1994). In spite of this production level, the level of adoption of agricultural technology by farmers in Ghana is low as attested to by the very low figures of crop yield. For instance maize yields range from 1 – 1.2 tons/ha as against national projected yield of 5 tons/ha (MOA, 1990). Some of the main reasons given for the poor level of adoption of innovations by farmers in Ghana have been outlined in the World Bank's Staff Appraisal Report on the National Agricultural Extension Project (1992).). These include:

- (i) weak extension system with poor training, leading to poor capacity to diagnose farmers needs,
- (ii) inadequate research-extension linkages, which have been responsible for the technologies already developed by the research system not being extended to the farmers, and not being refined to suit the different agro- ecological regions of Ghana and farmers access to other services,
- (iii) tendency of the extension system, even where it has been strengthened, to rely too much on the research system for its technological recommendations, and

- ignoring the indigenous technologies developed by farmers themselves, particularly in areas such as post-harvest, root and tubers, and intercropping,
- (iv) non-utilization of intermediate technology to increase labour efficiency;
 - (v) inefficiencies in the market system including the availability of credit and inputs and access to commodity markets with adequate incentives; and
 - (vi) the risks associated with adopting innovations, and the inability of the administration to provide the farmers with a risk-minimizing environment.

Thus a weak extension system coupled with poor research extension linkage, inefficiencies in the market system including the availability of credit and unfavourable economic environment constrained the adoption of improved technology.

In summary small-scale farmers practise traditional agriculture which involves slash and burn, use of low input technology which invariably affect their yields. The very little use of purchased inputs is the result of low access to funds from their own sources or credit. Majority of Ghanaian farmers are in this category and account for over 80% of the total agricultural production. In spite of the farmers' contribution, their level of adoption of agricultural technology is low as attested to by the very low crop yields, an indication of the low productivity of the agricultural sector. Reasons accounting for this among others include weak extension system coupled with poor research linkage, inefficiencies in the market system including the availability of credit and unfavourable economic environment. This suggests that the provision of these components will enhance farmers' productivity.

1.2. The role of agricultural extension programme in agricultural production

To enhance the food production potential of rural farmers, governments and non-governmental organizations (NGOs) have undertaken major initiative to help resource poor farmer households improve their living standards and production capacity. Some major initiative undertaken in meeting such needs include technology development by research institutions as well as the provision of agricultural service programmes like credit, extension and marketing to enhance the production and marketing activities of resource - poor farmers. The provision of extension services in Ghana, however, has been bedevilled with issues of lack of provision of educational experience for farmers, lack of inputs, lack of credit to purchase such inputs where they are available. The following is a brief on extension in Ghana drawn from a study on comparative assessment of alternative extension programmes implemented in Ghana and prepared for the government of Ghana / USAID by Geker, Fiadjoe, Sakyi-Dawson, Atengdem and Ocloo (1990) of the Department of Agriculture Extension, Faculty of Agriculture, University of Ghana, which informs this discussion.

1.2.1. Brief history of extension activities in Ghana

In Ghana, agricultural extension has been an essential component of agricultural development especially in the provision of innovative technologies to farmers since the early 1900s. During the colonial era, the major thought of extension was in enforcing regulations and providing some services to farmers. The main focus was on the export market. Cocoa was, thus supported very well by the British. The main emphasis then was

to ensure the production of good quality cocoa. Very little educational experiences were provided the farmers. Food crop production had only a small amount of attention. In effect focus was placed more on export crops at the expense of food production with very little education experience provided these farmers. This suggests that the provision of educational experience was necessary. Since independence the country has experimented with various approaches of agricultural extension under the co-operative movements, church related development schemes and several donor-assisted projects. The United Ghana Farmers Co-operative Council (UGFCC) started to provide extension services in the early 1960s to farmers who were organised into co-operatives. Late in the 1960s the “Focus and concentrate” pilot project was initiated to promote technology transfer in areas with high potential. Its impact was, however, limited. In both approaches, extension agents gave advice and supplied inputs, with input supply preoccupying the staff at the expense of delivering extension messages thus limiting coverage of their services. Later extension activities were centred more on input supply with very little attention paid to the educational aspects of agricultural extension. It could be concluded that whiles pre-independence extension was centred more on export crops with little educational experience provided farmers early independence extension activities focussed on input supply and extension advice, with input supply preoccupying the staff more at the expense of providing extension advice. This suggests that a balance must be established between input supply and provision of extension advice. The need to further help farmers, especially those with limited resources in their agricultural enterprise saw the establishment of various donor-sponsored projects. The more recent and prominent

experiences were the extension programmes initiated under the World Bank assisted Upper Regional Agricultural Development Project (URADEP) during 1976-84, Volta Regional Agricultural Development Project (VORADEP) during 1982-88. These were regional based programmes, which assisted farmers with relevant extension recommendations and inputs to enhance their productive potential. Farmers who had regular visits from the extension staff appreciated the extension provided under VORADEP and URADEP. Even though the project benefited some of the targeted farmers many more farmers could not adopt the extension recommendations because they did not have the funds to purchase the inputs particularly fertilizer, the key component of the technology although input selling points were in place. It could be concluded that these projects provided the necessary extension recommendations and logistic support to the target farmers but many more farmers could not adopt the recommendations because of lack of funds (World Bank,1992). This suggests that credit was a constraint to the adoption of the technologies. Whiles these projects were going on none of the other regions benefitted from such programmes particularly Central Region. They had to contend with limited extension provided by the then Crop Services, Animal Husbandry and Home Extension divisions since the focus was more on input supply. It was not until 1987 when a new Extension Service was established to provide unified extension service in the areas of crop, livestock, fishery and home economics. Even where extension recommendations and inputs were available most farmers did not have access to credit for buying them. This suggests that credit was still a constraint to the adoption of technology. This fact of credit constraint was affirmed by Sasakawa Global 2000 project

(Dowswell, 1989). They note that by 1986 virtually no small food producers received production credit for food crops. Thus difficulty of getting access to credit was a great handicap to small-scale farmers.

In summary while pre-independence extension saw emphasis placed on export crops to the neglect of providing educational experience for farmers, early independence extension and thereafter focused on input supply and extension advice with input supply preoccupying the staff more to the neglect of providing extension advice. Certain regional based projects URADEP and VORADEP were established to provide extension recommendations and input to target groups. However many more farmers were unable to use the extension recommendation particularly fertilizer due to lack of funds to purchase the items. Similarly a unified extension system was established in 1987 with the aim of providing extension recommendations, however, farmers were unable to use them due to lack of funds. Thus credit was a limiting factor to the adoption of the technologies. This suggests that the provision of credit will enhance farmers' productive potential.

1.3. Credit programmes and agricultural productivity

Lack of credit has received much attention as a major constraint limiting agricultural development especially among small-scale farmers in Ghana. This is explained by the fact that most small-scale farmers practise traditional agriculture with little use of innovative inputs and production technologies. The provision of innovative production technologies will greatly enhance the work of these farmers. This, however, requires the use of purchased- inputs which most farmers do not have the funds to buy. Thus lack of credit



has been blamed for delaying, if not preventing a timely adoption of new production technologies and the dissemination of the use of non-labour intensive inputs such as fertilizer, thereby slowing down the growth and development of the agriculture sector (Yaron, 1992). This suggests that credit is critical and that its provision is likely to enhance the productive potential of the small-scale farmer. To this end some credit schemes were instituted in the early 1970s for small-scale farmers with a view to enhancing their productive potential. For instance in Ghana the Agricultural Development Bank (ADB) has been providing credit to group of farmers under its commodity credit scheme. The institution of the scheme was to allow farmers who hitherto could not avail themselves of credit to make a maximum use of it to increase output. A problem, however, that arose with such groups was the poor loan repayment and the apparent failure of the bank to pursue loan defaulters as rigorously as needed to induce a serious interest in repayment. Godwin (1972) concludes that while ADBs credit programme was seen as an important factor in enhancing the productive potential of the farmers it was not necessarily the major problem facing the small farmer. The small farmer then in Ghana was faced with the problem of profitability of existing improved technology, inadequate delivery system and infrastructure such as transportation and marketing. Since the 1980s, however, the issue of credit lending in the agricultural sector to farmers has been critical. Agriculture's share of total credit to all sectors of the economy declined from 32.0% in 1983 to 19.0% in 1987 (MOA, 1990) and further declined to 10.8% in 1996 (ISSER, 1997:53). The Ministry of Agriculture (1990) further notes that commercial banks were reluctant to increase their level of direct financing of agriculture, largely on account of

administrative costs of lending to small, dispersed borrowers and lack of collateral. To avert this situation loans were rather given to groups of farmers under group credit schemes. Repayment performance, however, declined as the programme expanded because groups were hastily formed with little cohesiveness, and the banks again did not enforce loan collection. This resulted in a restricted flow of credit funds in the formal banking system to the small-scale farmer. It can be concluded that credit to farmers is important but the issue of non-repayment seems to restrict the flow of money and threaten the very farmers for whom such programmes are intended. The period also saw a steady decline in agricultural growth. Agriculture's growth rate declined from 9.7% in 1984 to as low as 4.0% in 1996 (ISSER, 1997:82). Predictably, the agricultural sector's contribution to the Gross Domestic Product (GDP) steadily declined from 42.6% in 1992 to 40.6% in 1996 compared to the service's sector contribution of 45.2% in 1992 to 48.4% in 1996 (ISSER, 1997:12): an indication that the service's sector remained the sector contributing largely to total GDP followed by agriculture. Thus, the agriculture sector has suffered in terms of a decline in credit lending, declining growth rate as well as a decrease in their contribution to total GDP. Despite these, the issue of credit remains important, especially where extension recommendations and input selling points were made available under the VORADEP project, and yet many farmers did not have the funds to purchase inputs particularly fertilizer which was a key component in the recommended technologies (World Bank, 1992). However in cases where farmers were given a package of technical assistance, input credit and markets for output, particularly under Sasakawa Global 2000 project, farmers were responsive. Yield levels of maize

recorded was 4,100kg/ha, a 150% increase over farmers' traditional practices and technologies in a major season (Martinez, Hong and Akposoe, 1989). Initially credit repayment was high. However as the number of beneficiaries of credit increased and storage and marketing of output became a problem, loan repayment slackened, and extension agents became saddled with the problem of loan recovery. A rapid expansion in an extension effort such as this often compromises the ability to target appropriate farmers (GGDP, 1991). It can be concluded that the provision of credit, notwithstanding the problem of non-repayment, is important and that its function is facilitated more in the presence of extension recommendation and available inputs. And that extension agents should not be saddled with the provision and recovery of credit from farmers.

1.4. Description of Central Region and its selection for the study

The Central Region covers an area of 9830 sq. km, with 1,145,000 inhabitants. A high percentage of the population (71.2%) is rural dwellers who obtain their livelihood from agriculture. The Central Region is bounded on the east and west respectively, by Greater Accra and Western Regions, to the north by Ashanti and Eastern Regions, South by a long stretch of coastline of about 160km. It lies between latitudes 5° 0' north and 6° 20' and longitudes 2° 15' west and 0° 25' east. Climatically, the region is characterised by relatively high temperatures and humidity. The average annual temperature ranges between 24° - 32° C while the relative humidity variation is 60% - 90%. The mean annual rainfall is between 800-1500mm. There is double maxima rainfall with peaks in May-June and September October. The vegetation of the region consist of the tropical

rainforest around Assin Fosu, moist and semi-deciduous forest, a coastal shrub and grassland, and a mangrove zone immediately along the coast as one moves eastwards. Over 80% of the region's area are suitable for farming and about 40% of the cultivable land are currently under cultivation. In the forest zone tree crops are significant with cocoa, oil palm, citrus, coffee being of particular importance. The food crops in this area are mainly inter-cropped mixtures of maize, plantain, cocoyam, cassava and vegetables. The coastal savanna zones are characterised by mixed or sole cropping of maize, legumes, coconut, pineapple, rice and vegetable. Among the food crops, maize is the predominant crop followed by cassava in terms of area of production hence its selection for the study.

The economy of the area rests largely on a small holder, more or less traditional agriculture and small-scale fishing. Farming is largely done by numerous independent small-holders with holdings averaging about one hectare per farmer. These crop fields tend to be scattered and it becomes difficult for the relatively few trained agricultural extension agents to reach individual farmers. The extension agent farmer ratio in the region is 1:2000 (World Bank, 1992). This is far beyond the number of farmers they can handle during their scheduled visits, hence the need to meet them through farmer-contact groups. This suggests that some farmers may not obtain extension advice. It is from such scattered farms that the bulk of the region's agricultural output is produced. Most of the farmers employ slash-and-burn method of farming. Production technology has until recently been entirely traditional using mainly hoes and cutlasses. The use, however, of purchased inputs, particularly, fertilizers is generally low. Most farmers do not have the

money to buy this basic input. The low use of purchased inputs greatly affects crop yields. For instance, maize, the most important staple in the Central Region has an achievable yield of 1.15 tons/ha (MOA, 1994) as against national projected yield of 5 tons/ha (MOA, 1990). This suggests low productivity of the agricultural sector and that the national potential yield could be obtained if farmers grew their crops under improved husbandry condition using improved seeds, correct plant population and planting date, moderate amounts of fertilizer, timely weed and pest control. These technologies for maize are available from the Department of Agricultural Extension Services but constrained by the fact that farmers lack the funds to buy some of the inputs. This is inspite of the fact that some banks are located in Cape Coast, Swedru, Dunkwa-On-Offin, with rural banks pervading every district in the region. Thus their low access to funds from their own sources or credit is likely to constrain their use of these technologies. Until 1987 when Sasakawa Global 2000 project was initiated, the Central Region had not had the benefits of such World Bank assisted projects like VORADEP, URADEP. The Sasakawa Global 2000 project was one such project that demonstrated the import of advancing input credit, technical assistance and provision of markets for enhancing the production potential of farmers. Under the Sasakawa Global 2000 project a simple informal input credit and supply system was put in place, adequate to meet the logistics requirement of a relatively small number of farmers. This system was called the Production Test Plot (PTP), the centre- piece of the 1986-1988 programme. Sakyi, Donkor, and Tetteh (1993) in a report on Farm Production Plot (FPP) groups, a pilot approach to agricultural production credit in Ghana undertaken by the Department of

Agricultural Extension Services (DAES), Agricultural Development Bank (ADB), and Sasakawa Global 2000 (S.G.2000), noted that the input credit granted was essential for the technology transfer; without it, the PTP programme would not have been successful. They further noted that it was essential for farmers to learn that technology is not free, and that they have to pay for the credit that goes with the technology. Subsequent experience of DAES/S.G. 2000 in 1989/90 with a large number of farmers, on the other hand, revealed that certain deficiencies existed precluding the implementation of a sustainable large-scale production effort. It became clear that the extension service cannot supply inputs, provide credit and recover loans at the same time. It was thus necessary to have closer working links with other institutions to assist the farmers in obtaining credit and inputs. The Farmer Production Plots (FPP) programme was thus conceived to link small-scale farmers directly to local credit institutions. The programme consisted of small groups of 5-20 members. The programme was a collaborative effort of DAES, S.G. 2000 and ADB. Farmers were highly responsive to the programme. This high response may suggest that apart from SG 2000 credit source, farmers' access to other sources of credit were rather low. And that without S.G. 2000 credit source, farmers' adoption of the recommended maize technologies is likely to be low.

The selection of the Central Region for this study was based on the fact that inspite of the existence of rural banks and some commercial banks in the districts farmers complained of access to credit as a constraint to adoption of technology (MOA, 1994). Again, until 1987 the Central Region had not had the benefits of such World Bank assisted projects like VORADEP and URADEP. The inception of Global 2000 project provided an

opportunity for maize farmers to make use of technical assistance and input credit to enhance their productive potential. Maize was chosen because it was the most important staple amongst the food crops followed by cassava in terms of area of production. The technology for its production is available but most farmers lack the funds to purchase some of the relevant inputs. It was thus necessary to look at farmers' use of credit, extension and their relationship to adoption of technology. Hence the choice of Central Region and maize for the study.

1.5. The nature of the problem

Even though credit appears to enhance the adoption of technology and hence productivity of farmers, some observers have a different view. They contend that credit does not lead to increased productivity of farmers as well as their income. For instance, Salami (1988) assessed whether credit extended to small farmers by formal agricultural institutions in the Ashanti region of Ghana improved farm efficiency and agricultural development. He noted that no significant difference was found in the average productivity of inputs such as land and labour in the sample of credit-and non-credit receiving farmers. Boakye (1979) even provides a mixed result. While affirming the importance of credit on agricultural production and adoption of technology among maize farmers in the Somanya district he noted that credit per se has no significant effect on the incomes the farmers received. Others even contend that where profitable opportunities for investment in a technology exist and where extension recommendations are available even small farmers are likely to be induced to mobilise from whatever sources to which they have access, the relatively small cash

requirements for the necessary inputs. The issue that arises then is, do farmers access to credit and/ or extension advice enhance the adoption of innovations. Whereas credit is seen as enhancing the adoption of technology by farmers, others think otherwise. The purpose of this study is to determine the relationship between access to extension messages and/or credit and adoption of maize technologies in the Central Region of Ghana. It is expected that the findings from the study will increase our understanding of the importance of agricultural extension and credit in agricultural development.

1.6. Research Question

The main question is, is access to credit an important factor for adoption of agricultural innovations in the Central Region of Ghana? The specific questions that arise are:

- (1) What is the extent of the farmers' access to extension in the study area?
- (2) What is the extent of the farmers' access to credit and from which sources?
- (3) What is the level of farmers' adoption of maize technologies in the study area?
- (4) What are the relationships between farmers' access to extension and/or credit and the adoption of maize technologies?
- (5) What are the policy and research implications of the relationships between farmers' access to extension and/or credit and the adoption of maize technologies?

1.7. Main Objective of the study:

To determine the relationships between farmers' access to extension and/or credit and the adoption of maize technologies in order to suggest ways in which small-scale farmers' adoption of innovations can be enhanced.

1.8. Specific Objectives:

1. To compare the personal socio-economic characteristics of small scale maize farmers in the study area and to determine which of them are likely to be important factors distinguishing one group of farmers from the other.
2. To determine the maize farmers' access to extension services.
3. To determine maize farmers access to credit.
4. To determine the relationship between maize farmers' access to extension and/or credit and adoption of maize technologies.
5. To deduce the policy and research implications of farmers' access to extension and/or credit on the adoption of maize technologies.

1.9. Hypotheses

The following hypotheses were developed to enable the achievement of the objectives.

- (i) Farmers' with high access to credit in addition to high access to extension are likely to adopt agricultural innovations than farmers with low access to credit and extension.
- (ii) The sources of credit used by farmers are likely to be related to the adoption of agricultural innovations.

1.10. Justification for the Study

The requirement of modern agriculture in Ghana today necessitates the use of borrowed funds, especially among low-income households. Credit has been one of the programmes

for removing constraints to agricultural and rural development. With credit, farmers can buy and use essential inputs such as fertilizers, improved seeds, insecticides, weedicides and pesticides. The crucial point is that with credit the farmer can increase his productivity which in turn would ensure greater farm output and increased income (Owusu-Acheampong, 1986). However, in granting credit hardly are the resource base, other sources of credit available to farmers and their contact with extension determined to ensure effective grant of credit for specific inputs. A critical look at farmers resource base, their sources of credit, exposure to extension will greatly facilitate farmers use of credit and hence adoption of extension recommendations.

1.11. Definition of Concepts

The three main concepts of the study are extension access, access to credit, and adoption.

Extension Access: This refers to a combination of contact and the number of years that an extension worker has been known, frequency of contact, and the time the extension worker spends with the farmer and the provision of specific messages to small scale maize farmers by the extension staff. Extension access was further conceptualised as high, low and no extension access. High extension access refers to farmers who had contact with extension for at least one year and had frequent visits (at least weekly or bi-weekly). Low extension access refers to farmers who had contact with extension for at least one year and had infrequent visits (occasional or monthly). No extension access refers to farmers who had no contact with extension agents.



Access to Credit: This refers to farmers' relative use of various sources of credit to buy farming inputs. Credit is money or assets acquired from a third party with the intention of paying back, usually with interest, in order to help finance a farm (Anaman, 1988).

Adoption: This refers to the use of innovative inputs or technology by a farmer. Different levels of adoption can be conceptualized. These are full adoption, partial adoption and non-adoption. Full adoption refers to a situation where a farmer uses improved maize seeds, practises planting in lines, applies fertilizer, and uses recommended storage insecticide. Partial adoption refers to a situation where a farmer uses improved maize seeds and any one of planting in lines, fertilizer application, and use of recommended storage insecticide. Non-adoption refers to farmers who did not use improved maize seeds, did not plant in lines, did not use fertilizer and recommended storage insecticide.

1.12 Outline Of Thesis

In chapter 2 a review of the literature is presented. This covers adoption of agricultural innovations; importance of agricultural credit, the argument about credit enhancing or not enhancing agricultural productivity, effects of farm sizes, labour availability on adoption of innovations; relationships between credit and extension on adoption of innovations. Chapter 3 describes the methodology of the study including conceptual framework, nature of information required and their sources, selection of the study area, population and sample size, design of data collection instrument, data collection, analysis and limitation

of the study.

Chapter 4 describes and analyses findings on personal socio-economic characteristics of the sampled farmers. This is to determine, if any differences exist between the two sampled groups, that is, Farmer Production Plot farmers (FPP farmers) and Non-Farmer Production Plot farmers (NFPP farmers). And if the most significant of these are likely to be associated with different behaviours, that is, access to extension, credit and adoption.

Chapter 5 describes and analyses farmers' access to extension, especially whether there are any differences between FPP and NFPP farmers. In addition the relationship between the selected socio-economic characteristics and access to extension is also examined.

Chapter 6 describes and analyses farmers' access to credit. This includes the sources of credit, the relationship between socio-economic characteristics and access to extension and access to credit.

Chapter 7 describes adoption of innovations by farmers and its determinants as indicated by the relationship between extension access, access to credit, extension access coupled with credit access on one hand and extent of adoption on the other. In addition the extent to which selected farmers socio-economic characteristics are important determinants of adoption of maize technologies is examined.

Chapter 8 discusses the findings, their meaning and implications with regards to extension access, credit delivery and adoption of technology. Conclusions, recommendations and implications for policy and research are indicated.

CHAPTER 2

LITERATURE REVIEW: EXTENSION AND CREDIT ACCESS AND ADOPTION OF TECHNOLOGIES

2.0. Introduction

This chapter reviews literature related to extension, credit and adoption of technology. Adoption of an innovation is a decision taken at the individual level, and it is subject to various factors. These include the characteristics of the innovation, farmers attitude to risks associated with various technologies, socio-economic characteristics such as age, education, farm size, labour availability, access to information and credit.

2.1. Characteristics of the innovation, socio-economic factors and adoption

It is observed that innovations themselves have certain characteristics, which either militates against their adoption. Identified are such characteristics as relative advantage, complexity, divisibility and communicability of the innovations (Grilliches, 1957). Apart from these characteristics personal socio-economic characteristics such as age, education, income, farm size, labour availability as well as risks associated with a technology also affect adoption. In a study of socio-economic factors influencing the adoption of farm innovations in maize and cassava production in Oyo State, Nigeria, Daramola (1989) found age, education, and income to significantly influence adoption. Kumar and Wasnik (1989) similarly found age, level of education and farm size to be significantly related to technology adoption in a progressive village whereas in the less progressive village, only age was found to be linked to adoption in Uttar Pradesh, India. Chandra and Singh (1992)

also found income from crops, age, farm size and attitudes of farmers towards the use of high-yielding-variety as important determinants of technology adoption. Shields, Rauniyar and Goode (1993); Chandra and Singh (1992); Kumar and Wasnik (1989) also found availability of capital, risks associated with the technology and farm size as affecting significantly the adoption process. Parthasarathy and Prasad (1978) also found a significant positive relationship between farm size and high yielding variety seed adoption in an Andhra-Pradesh village in 1971 to 1972 (about seven years after high yielding variety introduction). These indicate that age, education, income; risks associated with a technology as well as farm size are important factors affecting adoption of innovations. Farm size has been found to have different effects on the rate of adoption depending on the characteristics of the technology and institutional setting. The relationship of farm size to adoption depends on such factors as fixed adoption cost, human capital, credit constraints, and labour requirements, among others. The theoretical literature suggests that large fixed costs cause a reduced tendency to adopt and a slower rate of adoption on smaller farms. These conclusions are supported by Weil (1970) in Feder, Just and Zilberman (1982:25) who found in Central Gambia that adopters of ox cultivation cropped larger areas and operated significantly larger farms than those using hand cultivation are. The study by Weil (1970) in Feder et al. (1982:26) indicates that the negative relation between adoption of lumpy technology and farm size may be caused by credit constraints. He suggests that capital may be more available for large farms so that even though all farms may wish to adopt (and may increase short-run profit by adopting), larger farms are more likely to do so. However Feder et al. (1982) note that

credit constraints may or may not be binding in some areas and in some size classes; but, again noted that, when credit is binding, use may be positively related to size. This indicates that farm size as related to adoption of technology is influenced by the characteristics of the technology and institutional setting and access to credit.

Labour availability also affects farmers' decisions regarding adoption of new agricultural practices or inputs. Feder et al. (1982) note that some new technologies are relatively labour-saving and others are labour using. For example, ox cultivation technology is labour saving, and its adoption might be encouraged by labour shortage. On the other hand, high yielding variety (HYV) technology generally requires more labour inputs so labour shortages may prevent adoption. Moreover, new technologies may increase the seasonal demand of labour so that adoption is less attractive for those with limited family labour or those operating in areas with less access to labour markets. A study by Harris (1972) in Feder et al. (1982:33) found that shortages of family labour explain non-adoption of HYV in India. Most of the studies seem to agree that the operative constraint in African farming systems is the peak-season labour scarcity (Helleiner, 1975 in Feder et al. 1982:33). Norman (1969) in Feder et al. (1982:33) provides specific evidence to that effect for the North Central Region of Nigeria. However, he suggests that the seasonal peak labour shortage may be overcome if neighbouring regions peak at different times thus allowing temporary labour migration. In conclusion labour usage as related to adoption of technologies is influenced by its availability at specific periods of the farming season. Where such scarcity exists access to credit at the appropriate time is

likely to enhance its use and therefore adoption of innovations requiring additional or higher labour inputs especially at peak seasons.



2.2. Extension access

Education plays a strong role in determining rates of adoption of new technology in developing agriculture. Evenson (1974) in Feder et al. (1982:32) affirms this. Some indirect support for this assertion can be inferred from other studies by Lockheed, Jamison, and Lau (1980) in Feder et al. (1982:32). These studies find a significant relationship between education indicators and farm productivity. Since the adoption of innovations generally increases productivity, the importance of education (and extension) in affecting adoption behaviour seems to be implied. Thus, education enhances efficient utilisation of the limited resources available to the farmers. This extension effect notes Hiebert (1974) in Feder et al. (1982:9) increases the probability of adoption as the stock of information pertaining to modern production increases. He notes that if different producers have different abilities to decipher and analyze information, the likelihood of adoption is positively related to producer skills. However, a study by Yaron, Dinar and Voet (1992) noted that innovativeness was affected by extension but not necessary by education. The implication was that farmers with elementary school education are capable of adopting complex technologies if proper extension services are provided. Ghana Grains Development Project (1991) also found knowledge gained by farmers' as related more to extension contact and to minor degree to schooling. Similarly, Hussain, Byerlee and Heisey (1994), in a study of the impacts of the training and visit (T&V) extension

system on farmers' knowledge and adoption of technology in Pakistan, noted that extension contact (the quality of contact and not the quantity) increased farmers' knowledge, and by implication adoption of technology. Invariably where extension personnel coverage of these farmers is low, information dissemination regarding extension recommendations would be affected. This indicates that extension effort, especially where extension personnel coverage is inadequate, is likely to affect the knowledge and skill base of these farmers. In conclusion, although age, income, level of education of farmers and extension contact tend to influence adoption, more of extension contact and less of education appears to enhance the knowledge base of these farmers and hence adoption.

2.3. Agricultural Credit and Adoption

The provision of extension is not enough as some of the technologies provided require relevant inputs that need to be purchased. The use of credit to purchase these inputs coupled with proper education is known to speed up agricultural development and adoption of innovations. Anaman (1988) notes that credit is particularly needed in the period when income is lacking, especially between growing and harvesting times. Wiggins (1992) similarly notes that credit is usually needed and valued in agriculture because it has the potential to help to smoothen out seasonal swings of household cash flows between incurring cost of production (including consumption or living expenditure) and output and income from the economic activities. It is also seen as a way of providing funds for investment in new technology and enterprise and thus removing one of the

critical blocks to innovation and entrepreneurship (Patrick, 1966; World Bank, 1974 in Sakyi-Dawson, 1996:21,22). Moreover, Feder et al. (1982) note that the need to undertake fixed investments may prevent small farmers from adopting new innovations quickly. That access to capital in the form of either accumulated savings or capital markets is necessary in financing the adoption of many new agricultural technologies. Thus, differential access to capital is often cited as a factor affecting differential rates of adoption. This is, in particular, the case with indivisible technology, such as tractors, or other machinery that requires a large initial investment that cannot be divided into smaller payments. The usefulness of credit and implications has been confirmed by descriptive and empirical work (Lipton, 1976; Bhalla, 1976; in Feder et al., 1982:34).

On the other hand, others have argued that lack of credit is not a crucial factor inhibiting adoption of innovations, which are scale neutral. Yaron (1992) notes that the general validity of the premise that credit shortages inhibit adoption of new technology is questionable because many inputs and technologies are divisible and can be adopted in a gradual manner, so little capital is needed initially. He cites poor marketing networks, input supplies and distorted product prices as more crucial constraints on technology adoption than lack of credit. He notes further that unless the new technology requires substantial up-front outlays, with returns spread over time, it is not obvious that the credit is the best mechanism to encourage adoption of new technologies. Studies indicate that even small farmers have a significant savings potential, and are capable of mobilising resources when profitable opportunities for investment exist (Wague, 1988 ; Cuevas, 1988

in Yaron, 1992: 6). Schutjer and Van der Veen (1977) in Feder et al. (1982:34) cite a number of scholars who point out that the profitability of high yielding variety (HYV) adoption will induce even small farmers to mobilize (from whatever sources to which they have access) the relatively small cash requirements for necessary inputs. Von Pischke (1978) in Feder et al. (1982:34) similarly questions the assertions presenting credit availability as a precondition for adoption.

In contrast, a number of studies have found that lack of credit is an important factor limiting adoption of high yielding variety technology where fixed pecuniary costs are not large. Daramola (1989) in a study of socio-economic factors influencing fertilizer adoption decisions in Nigeria found credit to significantly influence adoption of the technology. Similarly in a study of Indian agriculture, Bhalla (1979) in Feder et al. (1982:34) reported that small and large farms differed in the reasons offered for not using fertilizer in 1970-71. Lack of credit was a major constraint for 48 per cent of small farms and for only 6 per cent of large farms. Bhalla (1979) concludes that access to credit may be responsible for the gain in income made by the larger farmers. Similarly, many other studies have found that a majority of small farms reported shortage of funds as a major constraint on adoption of divisible technology such as fertilizer use (Wills, 1972; Frankel, 1971; Khan, 1975 in Feder et al., 1982:35). However, even more confounding is the findings of Salami (1988) on the impact of formal agricultural credit on small farm development in the Ashanti region of Ghana. He found no significant differences in the samples of credit- and non-credit receiving farmers in relation to the

average productivity of inputs such as land and labour.

External off-farm income sources are of relevance as well since they enable the farmer to undertake agricultural practices, which may otherwise jeopardize his subsistence income. Also, off-farm income can help to overcome a working capital constraint or may even finance the purchase of a fixed-investment type of innovation. These effects have been verified empirically by Gehart (1975); Perrin (1976); Demir (1976); Rochin and Witt (1975) in Feder et al. (1982:35) among others, through the introduction of a measure of such income.

A study by Scobie and Franklin (1977) in Feder et al. (1982:35) also concludes that access to credit may not encourage adoption if it entails restrictions on input use (e.g. lower limit on fertilizer and pesticide applications). In fact, evidence suggests that rational farmers will evade the restrictions. In areas where adoption of divisible innovations (such as HYV) is dependent on (or greatly enhanced by) complementary indivisible investment (such as tubewells), lack of credit can impede the uptake of the divisible innovation by smaller farms (Clay, 1975 in Feder et al. 1982: 35). These results are fully consistent with the theoretical explanation advanced by Feder (1982) in Feder et al. (1982: 35) on the role of credit and risk in explaining adoption of interrelated agricultural innovations. One policy advanced for minimizing the adoption-discouraging effects of credit scarcity is a subsidization of credit (Braverman and Guasch, 1989). But Lipton (1978) in Feder et al. (1982:35) argues that subsidization of credit does not

necessarily circumvent the problem for smaller farms since, in many cases, the larger and more influential farms manage to get the bulk of such credit. Huppi and Feder (1989) also noted that the provision of subsidized credit to smaller farms has, in the main, been skewed to the wealthy and people owning large farm size.

In effect while some authors claim credit does not influence adoption, others affirm its usefulness especially to small-scale farmers. Thus the issue about credit and adoption of innovative technology is not categorically settled. But whether credit influences adoption of innovative technology or not, the fact is credit per se does not enhance agricultural development and hence adoption of innovations.



2.4. Integrated Use of Credit

It is a common belief among farmers, extension workers and development agencies that, if only sufficient agricultural credit was made available to farmers then their productive potential could be enhanced. However it is known that the prerequisites for a successful credit system include extension education, agricultural research to discover profitable technologies, and transport facilities to bring inputs to rural areas and to convey farmers' produce to market (Miller, 1977). This implies that agricultural development requires much more than providing additional credit. And that providing credit to small farmers will, by itself, accomplish little in increasing food production and raising farmers incomes. Thus those who place high premium on the need to provide credit to farmers is usually based on the fact that agriculture development involves the adoption by farmers of new, more efficient technology which generally must be purchased. They argue that

few small farmers have the financial resources to make such purchase and the indigenous credit system cannot supply the needed funds on acceptable terms; therefore agricultural modernisation is affected by lack of credit. However as affirmed by Miller (1977), credit becomes useful when proper extension services is in place, appropriate technology is available, inputs and credit are available and timely as well as an efficient marketing system. Unless this pre-conditions for the successful use of credit is available; extending credit to small-scale farmers may be a disservice. They may become burdened with debt obligations with little, if any increase in their incomes from which to repay, while the lenders are faced with a difficult recovery problem. Lele (1975) similarly affirms this integrated approach. In a review of thirteen rural development projects in Africa she affirms the importance of integrating timely credit, active extension service, profitable technology and markets. Miller (1977) agrees on this integration but expresses uncertainty about how to accomplish it. He opines, however, that the initiative may come from the lender, a marketing and processing firm, a supply organisation, or from some arm of government. He concludes by indicating that provided effective integration is the result, its genesis is not particularly important. This integrated approach is in part demonstrated by the S.G. 2000 Agricultural project in Ghana where improved farming technologies, input credit, extension were made available to small scale farmers in selected areas of Ghana. Participation by farmers and extension agents, was very high within a short period of time as farmers yields increased significantly by 2 or 3 times more than those of non-participating farmers did. Tinnermeier (1973) in his work, Technology, Profit, and Agricultural Credit noted that just providing new technical inputs

and credit is not as effective (adoption is slower) as providing input credit and technical assistance. Ongaro (1990) also noted that credit availability and extension contacts were found to be positively and significantly related to maize yields and hence adoption of the recommended maize technology. A sharp contrast is experienced with the Pilot Extension Project under the Agricultural Services Rehabilitation Project (ASRP). Farmers' participation in this programme is not as enthusiastic as expected. Farmers' reluctance to try out the recommended technologies under the ASRP Pilot Project has in part been attributed to inability of the project to supply inputs (World Bank, 1992).

The review so far shows that some factors including extension and credit access are related to the adoption of technologies. Characteristics of the technology and risks associated with it also affect adoption. Personal socio-economic factors are also important. Among these are age, income and level of education, farm size and labour availability. Although age, income, level of education of farmers and extension contact tend to influence adoption, more of extension contact and less of education appears to enhance the knowledge base of these farmers and hence adoption. Farm size as related to adoption of technology is influenced by the characteristics of the technology and institutional setting. Such relationship is dependent on such factors as human capital, credit constraints, labour requirements among others. Labour usage as related to adoption of technologies is influenced by its availability at specific periods of the farming season. Where such scarcity exists access to credit at the appropriate time is likely to enhance its use. Besides farm size and labour use, access to extension as related to adoption of

technologies are also influenced by the availability of extension personnel. While some authors claim credit does not influence adoption and that, even small farmers, given that profitable opportunities for investment in a technology will induce them to mobilize (from whatever sources to which they have access) the relatively small cash requirements for necessary inputs, others affirm the usefulness of credit in enhancing the work of small farmers. Thus one major factor whose relationship with adoption appears not categorically settled is credit. Considering the mixed relationship that is observed in the literature it is necessary to explore the relationships between access to extension and/or credit and adoption of technologies within specific contexts and locations.

CHAPTER 3

METHODOLOGY

3.0. Introduction

A summary of the conceptual framework as well as the nature of information collected is presented below. This chapter also looks at the districts selected for the study, population, sampling procedure and sample size, instrument design, data collection, analysis and limitation of the study.

3.1. Conceptual framework and nature of information collected

The conceptual framework of the study is represented in figure 3.1 in which the farmers' personal socio-economic characteristics and access to credit are shown as intervening between extension access, and adoption of technology. The relationships between the components of this diagram enable a number of questions to be raised.

1. Is farmers' access to extension related to adoption of technology?
2. Is farmers' access to credit related to adoption of technology?
3. Is farmers' access to a combination of extension and credit related to adoption of technology?
4. Is farmers' personal socio-economic characteristics related to extension access, access to credit and adoption of technology?

The nature of information or type of information required for each of the concept and/or variables, sources of information and, methods used in collecting the information are contained in Table 3.1.

Figure 3.1. THEORETICAL FRAME -WORK: ACCESS TO EXTENSION AND CREDIT AND ADOPTION OF MAIZE TECHNOLOGIES

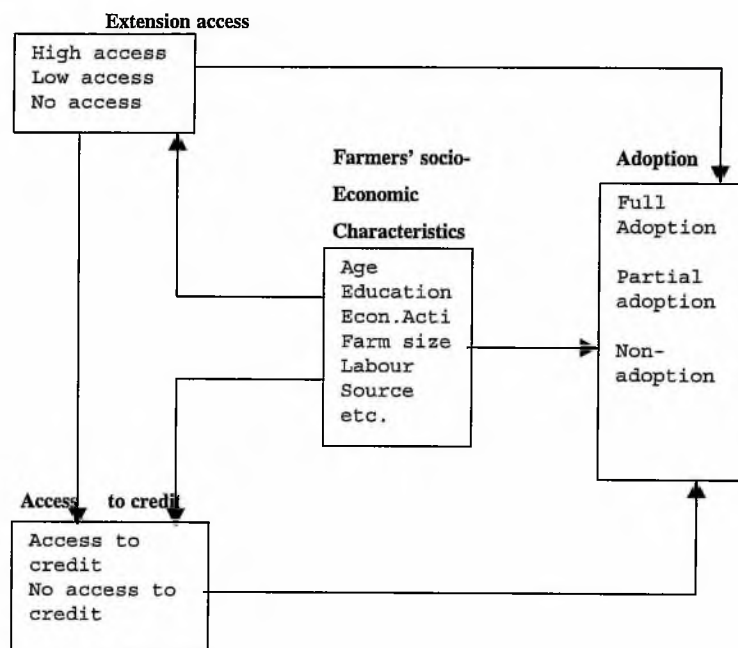


Table 3.1: Main Concepts, Information Required, Sources and the Method used for their Collection

Main Concept	Information Required	Source of Information	Method of Information Collection
Extension access	<ul style="list-style-type: none"> • Contact with Extension worker • Year known ext. worker • Frequency of visits • Time spent • Extension message content received 	<ul style="list-style-type: none"> • Farmers • Documents/Literature 	<ul style="list-style-type: none"> • Individual Interviews • Analysis of Documents/Literature
Access to Credit	<ul style="list-style-type: none"> • Sources of credit 	<ul style="list-style-type: none"> • Farmers • Literature 	<ul style="list-style-type: none"> • Individual interviews • Documents/Analysis of Literature
Adoption	<ul style="list-style-type: none"> • Adoption of impact points 	<ul style="list-style-type: none"> • Farmers • Literature 	<ul style="list-style-type: none"> • Individual interviews • Analysis of Literature
Personal Socio-Economic characteristics	<ul style="list-style-type: none"> . Gender • Age • Education . Marriage • Economic activities . Farming enterprise . Years of farming . Tenancy . Farm size . Labour sources 	<ul style="list-style-type: none"> • Farmers • Literature 	<ul style="list-style-type: none"> • Individual interviews • Documents/Analysis of Literature



3.2. Selected Districts for Study

The study was conducted in thirteen (13) towns/villages in six districts of the twelve administrative districts of the Central Region of Ghana. The study covered farmers who used input credit under Sasakawa/Global 2000 sponsorship and those who did not use Sasakawa Global 2000 input credit in the 1994 - 1995 period in relation to adoption of recommended impact points. The districts and their respective towns/villages where the study was conducted include Assin (Dahomako, Breku), Asikuma-Odoben-Brakwa (Asikuma, Jamra, Kokoso); Agona (Obosomase, Teikrom), Awutu-Efutu-Senya (Ayensuoko, Bawjiase, Kasoa); Gomoa (Brofoyedur), Komenda-Edina-Eguafo-Abrem (Enyinase, Komenda). These districts are important maize producing areas in the Central Region and they represent distinct agro-ecological zones in the region, namely rain forest (Assin, Asikuma-Odoben-Brakwa), moist deciduous forest (Agona, Awutu-Efutu-Senya) and coastal savanna (Gomoa, Komenda-Edina-Eguafo-Abrem). The districts and towns and villages selected were those that have been collaborating with the farmer production plots (F.P.P.) approach to extension and input credit.

3.3. Population

The population of the study consisted of all Farmer Production Plot (F.P.P.) maize farmers who participated in the Sasakawa Global 2000 programme during the 1994-1995 period as well as Non- Farmer Production Plot (NFPP) maize farmers in thirteen (13) villages/towns of the selected six districts. Farmers in the FPP programme are organised into clusters of five or more farmers. The FPP population stood at 104.

3.4. Sampling Procedure and Sample Size

A sample of one hundred and sixty farmers, comprising eighty FPP farmers and eighty non-FPP farmers from the Central Region was drawn using multi-stage sampling technique. The first stage was a random sample of six districts from a total of twelve districts within the Central region. The second stage was a purposive sampling of thirteen villages where the FPP programme was conducted within the six selected districts. The sampling frame for the FPP farmers was prepared from a list of existing FPP farmers (104 farmers) obtained from the Department of Agricultural Extension Services of the Ministry of Food and Agriculture. Eighty farmers who participated in the FPP programme within the thirteen selected villages were purposively sampled. Within the selected villages, a list of twenty maize farmers who had not taken part in the FPP programme (non-FPP) was developed for each village in collaboration with the staff of the Department of Agricultural Extension Services. A corresponding number of non-F.P.P. farmers with little or no access to FPP credit were randomly selected. The purpose of this selection was to enable a comparison of FPP farmers and the NFPP farmers from the general population, to determine differences in their access to credit for the purchase of maize inputs, their contact with extension and the adoption of maize technologies (see Table 3.2).

Table 3.2 Agro-ecological Zones, Selected Districts, Selected Villages/Towns, Farmers who participated in FPP programme, Farmers present at interview

Ecological Zone	District	Villages	Farmers who participated in FPP programme	Farmers present at interview
Rain Forest	Assin	Dahomako	8	5
		Breku	6	5
	Asikuma-Odoben-Brakwa	Asikuma	5	5
		Jamra	8	7
	Kokoso	13	8	
Semi Deciduous	Agona	Teikrom	5	5
		Obosomase	5	5
	Awutu-Efutu-Senya	Kasoa	5	5
		Bawjiase	5	5
	Ayensuoko	10	5	
Coastal Savanna	Gomoa	Brofoyedur	5	5
	Komenda-Edina-Eguafo-Abrem	Enyinase	19	15
		Komenda	10	5
Total	6	13	104	80

3.5. Instrument Design

A survey questionnaire was developed to collect information from FPP farmers and non-FPP farmers (Appendix 1). The questionnaire contained both open-ended and close-ended questions. Areas covered in the questionnaire include socio-economic

characteristics of farmers such as sex, ethnic origin, age, level of education, marital status, economic activities engaged in, years of maize farming, tenancy, sources of labour, capital inputs used, access to credit and its use on capital inputs and farming operations, frequency of contact between extension workers and farmers as well as messages received, reasons and years of adoption of specific technologies by farmers. The questionnaire was pre-tested at Gomoa-Dawurampong and Agona Nyarkrom in February, 1997. After pre-testing the questionnaire, revision were made after consultation with my supervisor; then with colleagues, and other faculty lecturers during a seminar presentation to enhance its reliability as well as checking its content in relationship with the stated objectives of the study. Data was also obtained from official documents of Agricultural Extension Services Department and Sasakawa Global 2000.

3.6. Data Collection Process

The investigator trained two persons in data collection. These persons accompanied the investigator to each of the selected districts. Primary data was collected by interviewing 80 non-FPP farmers and 80 FPP farmers in thirteen villages/towns of the six selected districts representing distinct vegetational zones, namely, forest, semi-deciduous forest and coastal savanna. Data collection was done in the months of May and June, 1997 when farmers were busily engaged in farming activities. Respondents were thus interviewed in the main in their homes.

3.7. Data Analysis: Data Completeness, Consistency and Coding

After collection, the raw data was first checked through. This was done in order to ascertain whether all the required data defined in the questionnaire were really collected. Each of the 160 questionnaires was coded and all questions in the questionnaire, including the open- response answers were coded to come up with a master code list. All the codes were fed into the computer for statistical analysis using Statistical Package for Social Sciences (SPSS) Inc. 1989-1993. Relationships for defined variables were established. The analysis yielded descriptive statistics of frequency counts, percentages, as well as cross- tabulations of variables that enabled the statistical testing of hypothesis. Summaries of responses were presented in tables. In each table, categories of responses were described as “markedly higher percentage” or “markedly lower percentage” under the following descriptive indices. Where the total or mean percentage is between 0 – 33.3% data was described as (i) markedly higher when any of the percentage in the other columns for that row is equal to or higher than two times (2x) the total or mean percentage; and (ii) markedly lower when any of the percentages in the other columns for that row is equal to or lower than one-half times ($\frac{1}{2}x$) the total or mean percentage. Where the total or mean percentage is between 33.4 – 66.7% data was described as (i) markedly higher when any of the percentage in the other columns for that row is equal to or higher than 1.5 times (1.5x) the total or mean percentage; and (ii) markedly lower when any of the percentages in the other columns for that row is equal to or lower than two-thirds times ($\frac{2}{3}x$) the total or mean percentage. Where the total or mean percentage is between 66.8 – 100% data was described as (i) markedly higher when any of the

percentage in the other columns for that row is equal to or higher than 1.25 times (1.25x) the total or mean percentage; and (ii) markedly lower when any of the percentages in the other columns for that row is equal to or lower than four-fifth times ($4/5x$) the total or mean percentage (O. Sakyi-Dawson, personal communication, January 10, 1997).

Chi-square analyses were used as tests for the hypothesis at alpha level of 0.001, 0.01 and 0.05 for each test of significance. Although there has been debate about the use of chi-square in relation to expected frequencies; the practice of leading authorities has been to proscribe the use of chi-square when: (a) in 2 x 2 tables, any of the expected frequencies are less than 5, (b) in larger tables, any of the expected frequencies is less than 1 or more than 20% are less than 5 (Kinnear and Gary, 1992). Thus in effect where in larger tables more than 20% of expected frequency cells had been less than 5 some of the cells were collapsed to meet the chi-square criteria. Thus, response were statistically compared on key variables of personal socio-economic characteristics, access to credit, access to extension service, adoption of technology and type of farmers i.e. farmer production plots (FPP) and non-farmer production plots (non-FPP). Relationship between some significant personal socio-economic characteristics and farmers' access to extension, credit, adoption of maize technology as well as relationship between farmers access to extension, credit and adoption of maize technologies were established.

3.8 Limitation of the study

This research began with an attempt to look at the relationship between extension access and/or access to credit and adoption of maize technologies. It also looked at the relationship between socio-economic characteristics and extension access, credit access and adoption of maize technologies. A limitation of this study was that farmers were asked whether they used a particular credit source on improved maize seed, fertilizer and storage insecticide. This somewhat limited the farmers' response to either using a credit source or not in purchasing inputs without taking into consideration the purpose, generally, to which a credit was put to other than the purchase of specific inputs. This affected interpretation of results.



CHAPTER 4

PERSONAL SOCIO-ECONOMIC CHARACTERISTICS OF FARMER

PRODUCTION PLOT AND NON-FARMER PRODUCTION PLOT

FARMERS AND THEIR ACCESS TO EXTENSION

4.0. Introduction

Farmers come from different socio-economic circumstances that has an effect on the type of farming system developed and the adoption of technologies (Werner, 1993). These circumstances include their access to land, access to family/hired/shared labour, access to cash or credit, off-farm and non-farm employment. This chapter compares the personal socio-economic characteristics of the “farmer production plot” (FPP) and “non-farmer production plot” (NFPP) farmers, their relative access to extension and the knowledge they indicated to have received from the extension workers.

The personal socio-economic characteristics of these groups examined included gender, age, ethnicity, education, marital status, economic activity, years of farming, farming enterprise, year of maize farming, tenancy, farm size and sources of labour. The purpose was to identify the characteristics of each of the two groups and whether there are differences between them. The difference will help determine characteristics that are important to enable further analyses to ascertain whether the selected characteristics are related to farmers' access to extension, use of credit and adoption of maize technologies.

Farmers' extension access was measured by contact with extension workers, years known extension worker, frequency of visits of the farmer, and time spent with extension workers. These were used as a multiple component indicator to establish different levels of access to extension i.e. high and low extension access. The other purpose of the analysis is, to determine whether there are any differences between FPP and NFPP farmers with regards to extension access and knowledge received from extension workers.

4.1. Characteristics of the respondent farmers.

Majority of the farmers were males (82%) and Akans (76.3%). Over half were 40 years or above. A little less than 20% of the farmers had had no education while 23.1% had completed secondary/tertiary education. These indicate that most were either literate or have had up to middle school education. Marriage is the norm in the group with over 90% being married. Over half of the sample were full time farmers. Almost four out of ten of the farmers have had sixteen years or more farming experience. Over 60% are tenant farmers. Maize and cassava are the most important food crop farmed, whilst oil palm and cocoa are the most important cash crops. There is no difference between FPP and Non-FPP farmers in most of the personal socio-economic characteristics except farm size and sources of labour. Farmers with larger farm sizes tending to participate in FPP programme, and those utilising more of family labour not participating. (Table 4.1).

Table 4.1. Characteristics of the respondent farmers.

Variable	Type Of Farmer				TOTAL		χ^2 Results
	FPP		NFPP				
	N	%	N	%	N	%	
Gender							
Male	64	80.0	67	83.7	131	81.9	$\chi^2 = 0.4$; $df = 1$; $0.50 < p < 0.60$ (NS)
female	16	20.0	13	16.3	29	18.1	
Age							
20-39yr	38	47.5	36	45.0	74	46.3	$\chi^2 = 0.1$; $df = 1$; $0.70 < p < 0.80$ (NS)
40yr	42	52.5	44	55.0	86	53.7	
Educ'tion							
No educ.	13	16.3	17	21.2	30	18.8	$\chi^2 = 1.2$; $df = 2$; $0.50 < p < 0.60$ (NS)
Pri./mid.	46	57.5	47	58.8	93	58.1	
Sec/tert.	21	26.2	16	20.0	37	23.1	
Marriage							
Married	76	95.0	72	90.0	148	92.5	$\chi^2 = 1.4$; $df = 1$; $0.20 < p < 0.30$ (NS)
single	4	5.0	8	10.0	12	7.5	
Economic							
Activity							
Full-time farming	45	56.3	43	53.8	80	55.0	$\chi^2 = 0.1$; $df = 1$; $0.70 < p < 0.80$ (NS)
Part-time farming	35	43.7	37	46.2	72	45.0	

Source: Field Survey, 1997

Table 4.1. Characteristics of the respondent farmers.

Variable	Type Of Farmer				TOTAL		χ^2 Results
	FPP		NFPP		N	%	
	N	%	N	%			
Crop of 1 st . Impotence							
Maize	59	73.8	58	72.5	117	73.1	
Oil palm	8	10.0	6	7.5	14	8.8	
Cocoa	4	5.0	7	8.5	11	6.9	
Cassava & others	9	11.2	9	11.8	18	11.2	$\chi^2 = 1.1$; df = 3; 0.75 < p < 0.80 (NS)
Years of maize far'g.							
1-15	47	58.8	56	70.0	103	64.4	
16+	33	41.2	24	30.0	57	35.6	$\chi^2 = 2.2$; df = 1; 0.10 < p < 0.20 (NS)
Tenancy							
Tenant	50	62.5	52	65.0	102	63.8	
landowner	30	37.5	28	35.0	58	36.2	$\chi^2 = 0.1$; df = 1; 0.70 < p < 0.80 (NS)
Farm size							
0.5 – 2ac.	37	46.3	52	65.0	89	55.6	
>2acres	43	53.7	28	35.0	71	44.4	$\chi^2 = 5.7$; df = 1; p < 0.05 *
Lab. sou.							
Hired	73	91.3	60	75.0	133	83.1	
family	7	8.7	20	5.0	27	16.9	$\chi^2 = 7.5$; df = 1; p < 0.01 **

Source: Field Survey, 1997

4.2. Farmer Contact with Extension Workers

Table 4.2 shows farmer contact with extension workers by type of farmer. About 82% of all the respondent farmers have had contact with extension workers. The data reveals that markedly lower percentage of NFPP had contact with the extension worker (64%). Markedly higher percentage of NFPP did not have any contact with extension workers. The relationship between type of farmer and contact with extension worker was statistically very highly significant at the 0.001 level. The significance is due to far more than expected NFPPs having no contact with the extension workers. In effect all FPP farmers tended to have contact with extension workers whilst only six out of ten NFPP farmers had contact with extension workers.

Table 4.2. Farmer Contact with Extension Worker by Type of Farmer

Extension Contact	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Yes	80	100.0	51	63.7	131	81.9
No	0	0.0	29	36.3	29	18.1
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 35.4$; $df = 1$; $p < 0.001$

4.3. Years Known Extension Worker

Over half the respondent farmers (54%) have known their extension workers for at least one year. There is difference between the FPP and NFPP farmers with regards to years they have known the extension workers. This is shown in Table 4.3. The data reveals that markedly lower percentage of NFPP had known the extension worker for more than 5 years. Markedly higher percentage of NFPP had no knowledge of the extension worker. The chi-square value of 43.2 (2df) is significant. This significance is due to far more than expected NFPPs having no knowledge of the extension workers. This indicates that more FPP farmers tended to have known the extension worker for longer period than NFPP farmers.

Table 4.3. Years Known Extension Worker by Type of Farmer

Years Known Extension Worker (years)	Type of Farmer					
	fpp		Nfpp		Total	
	n	%	n	%	n	%
No Knowledge	0	0.0	29	36.3	29	18.1
1 - 5	45	56.2	41	51.1	86	53.8
more than 5	35	43.8	10	12.6	45	28.1
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 43.1$; $df = 2$; $p < 0.001$

4.4. Frequency of Visits

Just over half of the respondent farmers have been visited by the extension workers. The table shows that markedly lower percentage of NFPP had frequent visits from extension workers. The table shows that markedly higher percentage of NFPP respondents had no visits compared to the norm for the sample. Chi-square analysis indicates that there was statistically very highly significant difference between the type of farmer with regards to frequency of visits. This significance is due to far more than expected NFPPs having no visits from extension workers. These are shown in Table 4.4. In effect more NFPP farmers tended to have less frequent visits than FPP farmers do.

Table 4.4. Frequency of Visits by Type of Farmer

Visits Frequency	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Frequent (weekly/bi-weekly)	57	71.3	28	35.0	85	53.2
Not frequent (monthly/occasional)	23	28.7	23	28.7	46	28.7
no contact	0	0.0	29	36.3	29	18.1
TOTAL	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 38.9$; $df = 2$; $p < 0.001$



4.5. Time Spent by Extension Worker with Farmer

On the average most farmers (69%) have received short visit from the extension workers. Even then FPP farmers are visited shorter than Non-FPP farmers are. Markedly lower percentage of NFPP had shorter time spent by the extension worker with them. In addition, none of FPPs indicated that extension workers spent no time with them, whilst markedly higher percentage of NFPP had extension workers spending no time with them. Chi-square analysis shows that there was statistically very highly significant difference between type of farmer and time spent by extension worker with farmers. This significance is due to far more than expected NFPPs having extension workers spending no time with them. These are shown in Table 4.5. This indicates that FPP farmers had extension workers spending more time with them than NFPP farmers.

Table 4.5. Time Spent by Extension Worker by Type of Farmer

Time Spent	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
No time spent	0	0.0	29	36.3	29	18.1
Shorter time (< 90min)	66	82.5	44	55.0	110	68.8
Longer time (> 90 min)	14	17.5	7	8.7	21	13.1
TOTAL	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

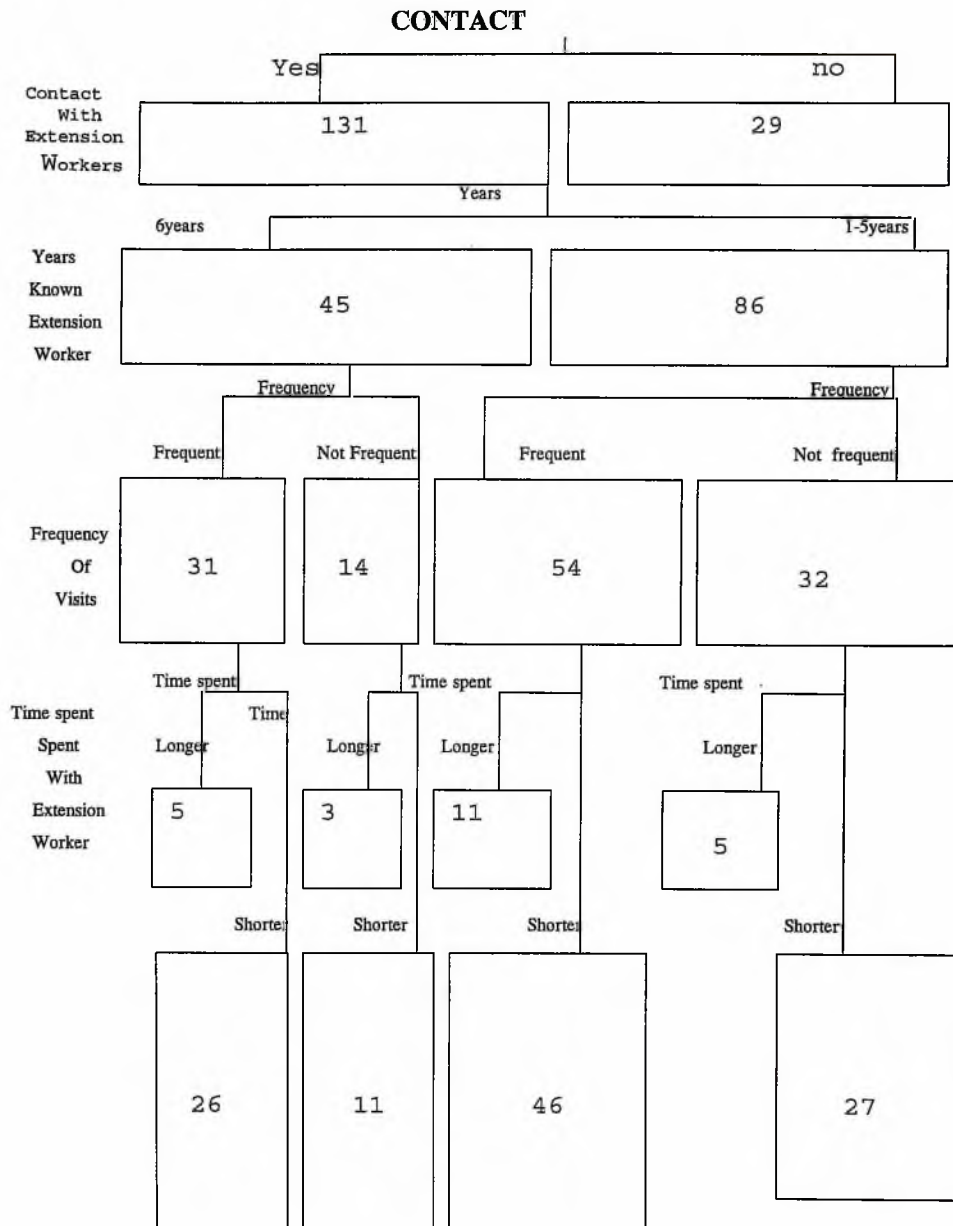
$\chi^2 = 35.7$; $df = 2$; $p < 0.001$

4.6. Pattern of Extension Access

The analysis so far indicates that there is highly significant difference between FPP and NFPP respondents with regards to contact with extension workers, period farmers have known the extension workers, time extension workers spend with farmers and frequency of visits. These indicate that more FPP had more intensive interaction with extension workers than NFPP farmers did.

In order to have a single measure of the farmers' extension access, all the component variables for extension access were integrated. Starting from extension contact, a flow diagram was drawn which integrated the distribution of the farmers with regards to contact, length of period known extension worker, frequency of visits, time spent to give a pattern of access to extension. The flow diagram is shown in Figure 4.1. The frequency distribution of extension access is shown in Table 4.6.

Figure 4.1 ACCESS TO EXTENSION



N.B. Each box contains the number of respondent farmers (see Appendix 111 for details)

Table 4.6. Pattern of Extension access involving all variables

Characteristic	Frequency	Percent
contact /1-5yr./ frequent /short time	46	28.8
no contact	29	18.1
contact /1-5yr/ not frequent / short time	27	16.9
contact /6yr +/- frequent / short time	26	16.2
contact /6yr +/- not frequent/ short time	11	6.9
contact /1-5yr./ frequent / long time	8	5.0
Contact / 6yr +/- frequent / long time	5	3.1
contact /1-5yr/ not frequent ./ long time	5	3.1
contact / 6yr + / not frequent / long time	3	1.9
Total	160	100.0

Source: Field Survey, 1997

In order to use a chi-square test for further analysis, there was re-combination, which stopped at frequency of visit. Further re-definition of extension access was made to fulfil chi-square criteria. Those who had contact with extension for at least one year and had frequent visits were designated "high extension access". Similarly those who had contact with extension for at least one year and had infrequent visits were designated "low extension access" and those with no contact designated as "no extension access". The distribution is shown in Table 4.7. It shows that over half of the sample claimed to have high access to extension while a little over a quarter had low access to extension. One-fifth of the sampled farmers claimed to have no access to extension. In effect four-fifths (4/5) of the sampled farmers had some amount of access to extension.

Table 4.7. Frequency redistribution of extension access

Characteristic	Frequency	Percent
High access to extension (contact/ at least 1yr/ frequent visit)	85	53.1
Low access to extension (contact/ at least 1yr/ not frequent visit)	46	28.8
No access to extension (no contact)	29	18.1
Total	160	100.0

Source: Field Survey, 1997

4.7. Access to extension by Type of Farmer

Over 80.0% of the respondent farmers had access to extension. There is, however, difference between FPP and NFPP farmers with regards to level of access. Markedly lower percentage of NFPP had high extension access. In addition markedly higher percentage of NFPP had no extension access while markedly lower percentage of FPP farmers had no extension access. This is shown in Table 4.8. Chi-square analysis indicated statistically very highly significant relationship between access to extension and type of farmer. The significance is due to far more than expected NFPP farmers who did not have access to extension. This indicates that more NFPP farmers tended to have no extension access. However the data shows that FPP farmers had high extension access than NFPP farmers.

Table 4.8. Access to extension by Type of Farmer

Access to extension	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
high extension access	57	71.2	28	35.0	85	53.1
low extension access	23	28.8	23	28.8	46	28.8
no extension access	0	0.0	29	36.2	29	18.1
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 38.9$; $df = 2$; $p < 0.001$

4.8. Knowledge Farmers' received from Extension Workers

Based on the assumption that knowledge farmers have received from extension workers about maize technologies would be related positively with access to extension, the distribution of farmers responses as to knowledge they indicated to have received from extension workers is determined and shown in Table 4.9.

The messages farmers indicated that they have received on maize cultivation included use of improved maize seeds, planting in lines, fertilizer usage and use of recommended storage insecticide. Together, these have been considered to constitute the full maize package. Awareness or reception of all these constitute the full knowledge of the maize package. Partial knowledge referred to a situation of having knowledge about use of improved seeds together with any one of the others mentioned above. Table 4.9 shows the distribution of farmers with regards to knowledge they

indicated to have received from the extension workers. Although almost three-quarters of the respondent farmers were estimated to have full knowledge, all FPP farmers have full knowledge of what was indicated to have been recommended by extension workers. The data reveals that markedly higher percentage of FPP had full knowledge of maize technologies whilst at the same time markedly lower percentage of NFPP had full knowledge of maize technologies. Besides markedly higher percentage of NFPP had partial knowledge and no knowledge of the maize technologies. At the same time none of the FPP farmers had partial knowledge and no knowledge of improved maize technologies. Chi-square analysis shows there was statistically very highly significant relationship between the type of farmer and their knowledge status of maize technologies at the 0.001 level. This significance is due to far more than expected NFPPs having no knowledge of maize technology package. In effect NFPP farmers tended to have received partial or little knowledge on maize technologies than FPP farmers.

Table 4.9. Knowledge Farmers' received from Extension workers by type of farmer

Knowledge Farmers received from extension workers	Type of Farmers					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Full Knowledge	80	100.0	39	48.7	119	74.4
Partial Knowledge	0	0.0	12	15.0	12	7.5
No Knowledge	0	0.0	29	36.3	29	18.1
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 55.1$; $df = 2$; $p < 0.001$

4.9. Access to Extension and the Level of Knowledge Farmers indicated to have received from extension workers

Table 4.10 shows farmers' access to extension by level of knowledge farmers' indicated to have received from extension workers. In order to meet the criteria for chi-square test, partial and no knowledge were combined (see appendix 11: Table 1 for details). Over 70.0% of the respondent farmers indicated to have received full knowledge from extension workers. However, there was difference between level of extension access and knowledge received. This is shown in Table 5.9. Markedly higher percentage of farmers who had high extension access had full knowledge whilst at the same time markedly lower percentage of farmers who had no extension access are in the full knowledge category. In addition markedly higher percentage of farmers who had no access to extension either had partial or no knowledge whilst at the same time markedly lower percentage of farmers who had high extension access either had partial or no knowledge. Chi-square analysis indicates a very highly significant relationship between access to extension and level of knowledge about maize technologies. The significance is due to far more than expected farmers who had no contact with extension but had partial or no knowledge of the maize technology as well as far less than expected farmers who had high extension access and had partial or no knowledge of the maize technology. This shows that more farmers with no contact with extension had partial or no knowledge of the maize technology compared with very few farmers who had high access to extension and had partial or no



knowledge of the maize technology. It further shows that more farmers with access to extension had full knowledge of the maize technology than those with no access. And that more farmers who had high extension access had full knowledge of the maize technology compared with those who had low access. Thus high extension access is positively related to full knowledge of the maize technology.

Table 4.10. Access to Extension and the Level of Knowledge Farmers indicated to have received from extension workers

Knowledge farmers indicated to have received from extension workers	Access to Extension							
	high extension access		low extension access		No extens access		Total	
	n	%	n	%	n	%	n	%
Full knowledge	80	94.1	39	84.8	0	0.0	119	74.4
Partial or No knowledge	5	5.9	7	15.2	29	100.0	41	25.6
Total	85	100.0	46	100.0	29	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 104.2$; $df = 2$; $p < 0.001$

4.10. Relationship between farm size by access to extension

Table 4.11 shows the relationship between access to extension and farm size. The table shows that there was no marked difference in percentage between the two farm size categories with regards to access to extension. These percentages did not differ markedly from the total mean percentage either. Chi-square analysis indicates no statistically significant relationship between farm size and extension access. This means that size of farm cultivated does not influence farmers' access to extension.

Table 4.11. Farm size by Extension access

Access to extension	Farm size					
	0-2 acres		More than 2 acres		Total	
	n	%	n	%	n	%
high extension access	46	51.7	39	54.9	85	53.1
low extension access	23	25.8	23	32.4	46	28.8
no extension access	20	22.5	9	12.7	29	18.1
TOTAL	89	100.0	71	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 2.8$; $df = 2$; $0.20 < p < 0.30$ (NS)

4.11. Relationship between sources of labour by access to extension

Table 4.12 shows the relationship between sources of labour and access to extension. The table shows that markedly higher percentage of farmers who used family/other labour had no access to extension compared with those who used hired labour. The relationship between sources of labour and level of extension access is statistically highly significant as shown by the chi-square value. The significance is due to far more than expected farmers employing family/other labour and having no contact with extension as well as far less than expected farmers hiring labour and having no contact with extension. These show that more farmers who employ family/other labour had no extension access compared with few farmers who hired labour. In effect the data shows that more farmers who hired labour tended to have extension access than those who used family labour, with more farmers who hired labour having high extension

access. In effect hiring of labour for maize cultivation is related to high extension access.

Table 4.12. Sources of labour by extension access

Access to extension	Sources of labour					
	hired labour		family/other		Total	
	n	%	n	%	n	%
high extension access	75	56.4	10	37.0	85	53.1
low extension access	40	30.1	6	22.3	46	28.8
no extension access	18	13.5	11	40.7	29	18.1
TOTAL	133	100.0	27	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 11.2$; $df = 2$; $p < 0.01$

The results show that more FPP farmers had high access to extension than NFPP farmers. In addition FPP farmers tended to have full knowledge of the recommended maize technology. There was a relationship established between extension access and knowledge farmers indicated to have received from extension workers and sources of labour. This indicates that farmers with access to extension had full knowledge of maize technology with more high extension access farmers' having full knowledge of maize technology than those with low access have. Also more farmers who hired labour had access to extension with more farmers who hired labour having high extension access than those using family or reciprocal sources of labour did. The results indicate no statistical relationship between extension access and farm size. This suggests that farm size does not influence farmers' access to extension. Thus while

high extension access is positively related to full knowledge of maize technology, hiring of labour is positively related to high extension access.

4.12. Conclusion

Farm size and sources of labour were two important factors affecting participation in the FPP programme. Farmers with larger farm sizes tended to participate in the FPP programme whilst those utilising more of family labour did not.

More FPP farmers had high extension access, and fuller knowledge of the recommended maize technology than NFPP farmers did. In addition farmers' access to extension was a determinant of knowledge farmers indicated to have received from extension workers. Farmers with higher access to extension tended to have fuller knowledge of the maize technology. Source of labour but not farm size was a factor influencing farmers' access to extension. Farmers who hired labour tended to have high extension access than those using only family or reciprocal sources of farm labour.

CHAPTER 5

ACCESS TO CREDIT FOR MAIZE FARMING IN 1994/1995

5.0. Introduction

This chapter examines FPP and NFPP farmers access to credit to purchase maize inputs. Farmers access to credit was measured by the source of credit and its use in the purchase of improved seeds, fertilizer and storage insecticides. The purpose is, first, to find sources of credit of FPP and NFPP farmers and its usage on maize inputs and determine if a relationship exist between farmers access to credit to purchase maize inputs on one hand and extension access on the other. Also considered is whether the selected socio-economic characteristics are important determinants of access to credit.

5.1. Sources of Credit in 1994 and 1995 used on Improved Seed by Type of Farmer

Table 5.1 shows sources of credit used on improved seed by type of farmer. The table indicates that all FPP farmers have had loans to purchase improved maize in either 1994 or 1994/1995, whilst none of the NFPP used any loan source. Chi-square analysis shows a statistically very highly significant relationship between sources of credit used on improved seed by type of farmer. This significance is due to far more than expected NFPP farmers not using any credit source to purchase improved seeds as well as far more than expected FPP farmers using a loan source to purchase

improved maize seeds. This indicates that all FPP farmers used credit from S.G. 2000 in purchasing improved seed whilst NFPP farmers did not in the years under consideration.

Table 5.1. Sources of Credit in 1994 and 1995 used on improved seed by type of farmer

Sources of Credit	Type of Farmer					
	FPP		NFPP		Total	
	n	%	n	%	n	%
bank/SG 2000 94/95	70	87.5	0	0.0	70	43.8
bank/SG 2000 94	10	12.5	0	0.0	10	6.2
did not use	0	0.0	80	100.0	80	50.0
TOTAL	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 160.0$; $df = 2$; $p < 0.001$

5.2. Sources of Credit in 1994 and 1995 used on Fertilizer by Type of Farmer

Table 5.2 shows sources of credit used on fertilizer by type of farmer. The table indicates that all FPP farmers have had loans to purchase fertilizer in either 1994 or 1995, whilst none of the NFPP used any loan source to purchase fertilizer. Chi-square analysis shows a statistically very highly significant relationship between sources of credit used on fertilizer by type of farmer. The significance is due to far more than expected NFPP farmers not using any credit source to purchase fertilizer as well as far more than expected FPP farmers using a credit source to purchase fertilizer. This indicates that all FPP farmers used credit from S.G. 2000 source to buy fertilizer whilst NFPP farmers did not in the years under consideration.

Table 5.2. Sources of Credit in 1994 and 1995 used on Fertilizer by type of farmer

Sources of Credit	Type of Farmer					
	FPP		NFPP		Total	
	n	%	n	%	n	%
bank/SG 2000 94/95	69	86.2	0	0.0	69	43.1
bank/SG 2000 94	11	13.8	0	0.0	11	6.9
did not use	0	0.0	80	100.0	80	50.0
TOTAL	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 160.0$; $df = 2$; $p < 0.001$

5.3. Sources of Credit in 1994 and 1995 used on storage insecticide by type of farmer

Table 5.3 represents year credit source used on storage insecticide by type of farmer. The table indicates that all FPP farmers have had loans to purchase storage insecticide in either 1994 or 1995, whilst none of the NFPP used any loan source to purchase storage insecticide. Chi-square analysis shows a statistically very highly significant relationship between sources of credit used on storage insecticide by type of farmer. The significance is due to far more than expected NFPP farmers not using any credit source to purchase storage insecticide as well as far less than expected FPP farmers not using any credit source to purchase storage insecticide. The data however indicates that almost all FPP farmers used credit from S.G. 2000 source to buy storage insecticide whilst NFPP farmers did not in the years under consideration.

Table 5.3. Sources of Credit in 1994 and 1995 used on Storage Insecticide by type of farmer

Sources of Credit	Type of Farmer					
	FPP		NFPP		Total	
	n	%	n	%	n	%
bank/SG 2000 94/95	68	85.0	0	0.0	68	42.5
bank/SG 2000 94	10	12.5	0	0.0	10	6.2
did not use	2	2.5	80	100.0	82	51.3
TOTAL	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 152.2$; df = 2; p < 0.001

5.4. Sources of Credit in 1994 and 1995 Used to pay for Farming Operations

A very small fraction of the over all respondent farmers (6.3%) indicated they borrowed money from either friends or relatives or money lenders to pay for such operations as land preparation, row planting, fertilizer application, weeding and harvesting. This is shown in table 5.4. Chi-square analysis indicates statistically very highly significant difference between the type of farmer and sources of credit used on farm operations. The significance is due to far more than expected NFPP farmers who did not use any credit source on land preparation, row planting, weeding and harvesting. FPP farmers rather did not use credit on all farm operations including fertilizer application. This suggests that majority of farmers used their own sources to pay for such operations.

Table 5.4. Sources of Credit in 1994 and 1995 Used to pay for Farming Operations

Sources of Credit used on farm operations	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Did not use credit on land preparation, planting in lines, weeding, fertilizer application, harvesting	74	92.5	11	13.8	85	53.1
Did not use credit on land preparation, planting in lines, weeding and harvesting	0	0.0	65	81.2	65	40.6
Either used friends or relatives or money lenders on all or some farm operations	6	7.5	4	5.0	10	6.3
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 112.1$; $df=2$; $p < 0.001$

The results so far indicate that there was very highly significant difference between FPP and NFPP respondents with regards to credit source used in the purchase of improved seed, fertilizer and storage insecticides. This indicates that FPP farmers used Sasakawa Global 2000/bank assistance whilst NFPP farmers did not use any credit source in the years under consideration.

Also there was a relationship established between sources of credit in 1994 and 1995 used in paying for farming operation by type of farmer. Majority of the farmers, apart from S.G. 2000 credit source, did not use other credit source on farm operation. This

suggests that majority of the farmers used their own sources for such farm operations.

5.5. Pattern of credit access

In order to have an overview of the 160 farmers use of credit to purchase improved seed, fertilizer and storage insecticide in 1994-1995 period, a diagram to indicate pattern of credit used on these inputs was drawn. The diagram is shown in Figure 5.1 and subsequent frequency distribution is shown in Table 5.5. Data in table 5.5 shows that half of the respondents did not use credit.

Table 5.5 Frequency distribution of pattern of credit use for maize farming in 1994/1995

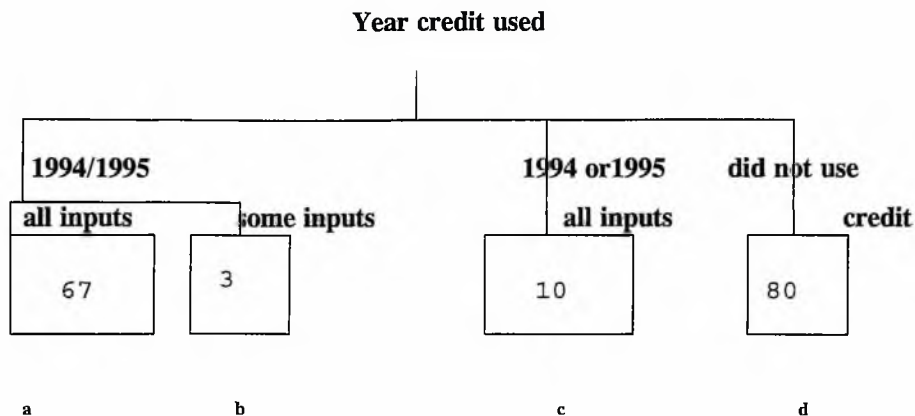
Year Credit Used	Frequency	Percent
Credit used on all inputs in 1994/1995	67	41.9
Credit used on some inputs in 1994/1995	3	1.9
Credit used on all inputs in 1994 or 1995	10	6.2
Did not use credit	80	50.0
Total	160	100.0

Source: Field Survey, 1997

In order to use a chi-square test for further analysis, "credit used on some inputs in 1994/95" was combined with "credit used on all inputs in 1994/95". The distribution is shown in table 5.6.



Figure 5.1. Respondents use of credit in 1994-1995 period in the purchase of improved seed, fertilizer and storage insecticide



- a. Credit used to purchase improved seed, fertilizer, and storage insecticide in 1994/95
- b. Credit used to purchase improved seed plus either fertilizer or storage insecticide in 1994/95
- c. Credit used to purchase improved seed, fertilizer, and storage insecticide in either 1994 or 1995 on all inputs
- d. Did not use credit, however either used own money to purchase or did not use input/s.

5.6. Pattern of credit use (access to credit) for maize farming in 1994/1995

Data in table 5.6 shows that more than two-fifths of the sample used credit on all/some inputs in 1994/1995. This was designated as "high access to credit"; those who used credit on all inputs in 1994 or 1995 were designated "low access to credit", the rest "no access to credit".

Table 5.6 Pattern of credit use for maize farming in 1994/1995

Year Credit Used	Frequency	Percent
High access to credit (Credit used on some or all inputs in 1994/ 1995)	70	43.8
Low access to credit (Credit used on all inputs in 1994 or 1995)	10	6.2
No access to credit (Did not use credit)	80	50.0
Total	160	100.0

Source: Field Survey, 1997

The purpose of this redistribution is to determine whether the selected socio-economic characteristics i.e. sources of labour, farm size; and access to extension are important determinants of access to credit. Table 5.8, 5.9, 5.10 shows these relationships

5.6. Pattern of Credit use (access to credit) for maize farming in 1994/1995 by Type of Farmer

Markedly higher percentage of FPP farmers had access to credit whilst markedly higher percentage of NFPP farmers did not have access to any credit source. This is

shown in table 5.7. Chi-square analysis indicates statistically very highly significant relationship between pattern of credit use and type of farmer. The significance is due to far more than expected NFPP farmers who did not have access to credit as well as far more than expected FPP farmers who had high credit access. Thus while FPP farmers had access to credit, NFPP farmers did not.

Table 5.7. Pattern of Credit use (access to credit) for maize farming in 1994/1995 by Type of Farmer

Pattern of credit use for maize farming	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
high credit access	70	87.5	0	0.0	70	43.8
Low credit access	10	12.5	0	0.0	10	6.2
no credit access	0	0.0	80	100.0	80	50.0
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 160.0$; $df = 2$; $p < 0.001$

5.8. Access to extension by access to credit

The data in table 5.8 shows the relationship between extension access and access to credit. In order to meet the criteria for chi-square, high access to credit and low access to credit cells were combined (see Appendix 11: Table 2 for details). The table shows that markedly lower (negligible) percentage of farmers with no extension access are in the access to credit category. Markedly lower percentage of farmers with high extension access did not have access to credit whilst markedly higher percentage of farmers with no access to extension had no access to credit. Chi-square analysis

indicates statistically very highly significant relationship between extension access and access to credit. The significance is due to far more than expected farmers who neither had extension access nor credit access as well as far more than expected farmers who had high extension access and had access to credit. These indicate that more farmers who had no extension access had no access to credit, while more farmers who had high extension access had access to credit. Thus farmers with high extension access tended to have access to credit.

Table 5.8. Access to extension by access to credit

Access to credit	Access to extension							
	high extension access		Low extension access		no extension access		Total	
	n	%	n	%	n	%	n	%
High/ low access to credit	57	67.1	23	50.0	0	0.0	80	50.0
No access to credit	28	32.9	23	50.0	29	100.0	80	50.0
TOTAL	85	100.0	46	100.0	29	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 38.9$; $df = 2$; $p < 0.001$

5.9 Farm size by access to credit

The data in Table 5.9 shows relative contrast between farm size and access to credit. While more farmers who cropped larger farm size had access to credit more of those farmers who cropped smaller farm size had no access to credit. Chi-square analysis indicates statistically significant relationship between farm size and access to credit. The significance is due to far more than expected farmers who cropped more than 2

acres and had high credit access as well as far less than expected farmers who cropped between 0-2 acres and had high credit access. This indicates that more farmers who cropped large size farms tended to have high credit access.

Table 5.9. Farm size by access to credit

Access to credit	Farm Size					
	0-2 acres		more than 2 acres		Total	
	n	%	n	%	n	%
high credit access	30	33.7	40	56.4	70	43.8
Low credit access	7	7.9	3	4.2	10	6.2
no credit access	52	58.4	28	39.4	80	50.0
Total	89	100.0	71	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 8.3$; $df = 2$; $p < 0.05$

5.10. Sources of labour by access to credit

The data in table 5.10 shows that markedly lower percentage of farmers who used family labour on their maize farm had high credit access. Chi-square analysis indicates that there was highly significant relationship between sources of labour and access to credit. The significance is due to far less than expected farmers who used family labour on their maize farms and had high credit access as well as far more than expected farmers who used family labour on their maize farms and had no access to credit. This shows that fewer farmers who used family labour tended to have high access to credit while more farmers who used family labour had no access to credit.

This suggests that more farmers who hired labour had high access to credit.

Table 5.10. Sources of labour by access to credit

Access to credit	Sources of labour					
	hired		Family/ others		Total	
	n	%	n	%	n	%
high credit access	65	48.9	5	18.5	70	43.8
Low credit access	8	6.0	2	7.4	10	6.2
no credit access	60	45.1	20	74.1	80	50.0
Total	133	100.0	27	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 8.6$; $df = 2$; $p < 0.05$

The results so far indicate that extension access, farm size and sources of labour were important determinants of access to credit. More farmers with high extension access tended to have credit access than those with low extension access. In addition more farmers who cropped larger farm size tended to have high credit access than those with smaller farm size do. Similarly more farmers who hired labour had high credit access than those who used family labour did. These suggest that high extension access is positively related to access to credit. In addition cultivation of larger farm size and hiring of labour is positively related to high access to credit.

5.11. Conclusion

FPP farmers used credit from Sasakawa Global 2000/Bank assistance to purchase

improved seed, fertilizer and storage insecticides whilst NFPP farmers did not use credit. A statistical relationship was found between use of credit on farm operations and the type of farmer. Apart from S.G. 2000 credit source used in the purchase of maize inputs, very few farmers borrowed money to pay for farm operations. This suggests that in the absence of credit programmes, a majority of the farmers used their own sources to pay for the farm operations.

There was a relationship between farmers' access to extension and credit source. Farmers with high access to extension tended to have access to credit from S.G. 2000. In addition, farm size and sources of labour were important determinants of access to credit from S. G. 2000. Farmers with larger farm sizes tended to have higher access to credit for maize farming. Farmers who hired labour also tended to have higher access to credit.

In conclusion FPP farmers used Sasakawa Global 2000 credit assistance to buy maize inputs whilst NFPP did not use credit. Apart from S.G. 2000 credit source used in the purchase of maize inputs, majority of the respondent used their own sources to pay for farm operations. Credit - receiving farmers tended to have high access to extension. In addition, the cultivation of larger farm size as well as the hiring of labour is positively related to higher access to credit.

CHAPTER 6

ADOPTION OF MAIZE TECHNOLOGIES

6.0. Introduction

This chapter examines the adoption of recommended maize technologies especially improved maize variety, fertilizer application, planting in lines and use of storage insecticide. The purpose is, first, to determine any difference between FPP and NFPP farmers with regards to the adoption of these recommended technologies. Secondly to establish the extent and nature of relationship between adoption pattern on one hand and extension access, access to credit, combination of extension access and access to credit, and the selected socio-economic characteristics i.e. farm size, sources of labour, on the other.

6.1. Year of Adoption of Improved Maize Variety

Table 6.1 shows the distribution of year of adoption of improved maize variety such as Okomasa, Obatanpa, Dobidi, Aburotia by type of farmer. Over eight out of ten farmers interviewed adopted the improved maize variety. In order to meet the criteria for chi-square test the “adopted both 1994 and 1995” and “adopted either 1994 or 1995” cells were combined (see Appendix 11: Table 3 for details). The table reveals that markedly lower percentage of NFPP adopted improved maize variety in both 1994 and 1995. In contrast markedly higher percentage of NFPP did not adopt improved maize variety whilst at the same time markedly lower percentage (negligible) of FPP are found in the non-adoption category. Chi-square analysis indicates statistically very highly significant difference. The significance is due to far

more than expected NFPP farmers who did not adopt improved maize variety. These indicate that whilst all FPP farmers adopted improved seed maize six out of ten NFPP farmers did adopt the improved maize variety.



Table 6.1. Year of adoption of improved maize variety by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Adopted both 1994/1995 and adopted either 1994 or 1995	80	100.0	50	62.5	130	81.2
did not adopt	0	0.0	30	37.5	30	18.8
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 36.9$; $df = 1$; $p < 0.001$

6.2. Multiple reasons for adoption of Improved Maize Variety

Table 6.2 displays the results of a multiple response question that solicited farmers' reasons for using improved maize variety. The three most frequently given reasons by FPPs and NFPPs in descending order respectively for using improved maize variety were: high yield; tolerance of drought and early maturity. There was no relative difference between the two groups with regards to the reasons given for adopting improved maize variety.

Table 6.2. Multiple reasons for adoption of Improved Maize Variety

Adoption of Improved Seed	Type of Farmer					
	fpp		nfpp		Total	
	n =80	%	n =50	%	n =130	%
High yield	70	87.5	41	82.0	111	85.4
Tolerance of drought	11	13.8	8	16.0	19	14.6
Early maturity	9	11.3	6	12.0	15	11.5
Very big cob size	4	5.0	4	8.0	8	6.2

Source: Field Survey, 1997

However, reasons for not using improved maize variety were given by NFPPs only.

The three most important reasons given by NFPPs were: they did not have money to buy seeds; did not know of "agriculture" maize; insects (Table 6.3) easily attacked improved seeds. There was marked difference between the two farmer groups with regards to the reasons for non-adoption of improved maize variety.

Table 6.3. Multiple reasons for Non-adoption of improved maize variety

Non-Adoption of Improved Maize Variety	Type of Farmer			
	fpp		nfpp	
	n=0	%	n=30	%
• Have no money to buy	0	0.0	11	36.7
• Did not know of agric. maize	0	0.0	10	33.3
• Easily attacked by insects	0	0.0	8	26.7
• Scarce to obtain	0	0.0	2	6.7
• Low price at harvest	0	0.0	2	6.7
• It's chaffy	0	0.0	1	3.3

Source: Field Survey, 1997

6.3. Year of adoption of planting in lines

Table 6.4 shows data on year of adoption of row planting by type of farmer. About 88.8% of the sampled respondents adopted planting in lines. In order to meet the criteria for chi-square test the “ adopted both 1994 and 1995” and “adopted either 1994 or 1995” cells were combined (see Appendix 11: Table 4). The table shows that markedly higher percentage of NFPP farmers did not adopt row planting while at the same time markedly lower percentage of FPP farmers are found in the non-adoption category. Chi-square analysis shows statistically very highly significant relationship between year of adoption and type of farmer. The significance is due to far more than expected NFPP farmers who did not plant in lines. In effect more FPP farmers adopted row planting than NFPP farmers.

Table 6.4. Year of adoption of planting in lines by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Adopted both 1994/1995 and adopted either 1994 or 1995	80	100.0	60	75.0	140	87.5
did not adopt	0	0.0	20	25.0	20	12.5
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 22.9$; $df = 1$; $p < 0.001$

6.4. Multiple reasons for Adoption of Planting in lines

Table 6.5 displays the results of a multiple response question, which asked farmers' reasons for planting in lines. The three most important reasons among others given by FPPs and NFPPs respectively for planting in lines were increased plants per acre; weeding made easy and fertilizer application made easy. The proportion of respondents claiming specific reasons varied between the two groups as shown in Table 6.5.

Table 6.5. Multiple reasons for Adoption of Planting in lines

Adoption of Planting in lines	Type of Farmer					
	fpp		nfpp		Total	
	n =80	%	n=60	%	n =140	%
• Plants/acre increased	45	56.3	60	100.0	105	75
• Weeding easy	36	45.0	41	68.3	77	55
• Fertilizer application easy	10	12.5	4	6.7	14	10
• Harvest easy	10	12.5	3	5.0	13	9.3
• Land properly utilized	4	5.0	2	3.3	6	4.3
• Easy to replant	2	2.5	1	1.7	3	2.1
• Free air circulation	1	1.3	3	5.0	4	2.9

Source: Field Survey, 1997

However, reasons for not planting maize in lines were given by NFPPs only. Reasons given by NFPP were: they did not have knowledge in row planting; row planting is tedious; and row planting is time wasting. (Table 6.6). There was marked difference between FPPs and NFPPs with regards to the reasons for not planting in lines.

Table 6.6. Reasons for Non-Adoption of Planting in lines

Non-Adoption of Planting in lines	Type of Farmer			
	fpp		nfpp	
	n =0	%	n =20	%
• Have no knowledge	0	0.0	11	55.0
• It is tedious	0	0.0	7	35.0
• Time wasting	0	0.0	2	10.0

Source: Field Survey, 1997

6.5. Year of Adoption of fertilizer use

Table 6.7 shows data on year of adoption by type of farmer. The data shows that markedly higher percentage of FPP farmers adopted fertilizer use in 1994/95 whilst at the same time markedly lower percentage of NFPP farmers adopted fertilizer use in 1994/95. By contrast markedly lower percentage (negligible) of FPP farmers did not adopt fertilizer while markedly higher percentage of NFPP are in the same category. Chi-square analysis shows statistically highly significant relationship between year of adoption and type of farmer. The significance is due to far more than expected NFPP farmers who did not adopt the use of fertilizer. In effect more FPP farmers adopted fertilizer use than NFPP farmers did.

Table 6.7. Year of adoption of fertilizer use by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
adopt 1994/95	70	87.5	8	10.0	78	48.8
adopt 94 or 95	10	12.5	4	5.0	14	8.8
did not adopt	0	0.0	68	85.0	68	42.4
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 119.9$; df = 2; p < 0.001

6.6 Multiple reasons for Adoption of Fertilizer Use

Table 6.8 displays the results of a multiple response question, which solicited farmers' reasons for using fertilizer. Reasons given by FPPs and NFPPs respectively were: it increases yield; promotes early growth. There was no marked difference between FPPs and NFPPs with regards to the reasons given for adoption of fertilizer use.

Table 6.8. Multiple reasons for Adoption of Fertilizer Use


Adoption of Fertilizer Use	Type of Farmer					
	fpp		nfpp		Total	
	n = 80	%	n = 12	%	n = 92	%
• Increased yield	65	81.3	10	83.3	74	81.5
• Promotes early growth	14	17.5	2	16.7	15	17.4
• For bigger cobs	10	12.5	0	0.0	10	10.9

Source: Field Survey, 1997

However, reasons for not using fertilizer were given by NFPPs only. The three most

important reasons given by NFPPs among others were: have no money to buy fertilizer; it is costly and has no knowledge about fertilizer use (Table 6.9). There was marked difference between FPPs and NFPPs with regards to reasons for non-adoption of fertilizer use.

Table 6.9. Multiple reasons for Non-Adoption of Fertilizer use



Adoption of Fertilizer use	Type of Farmer			
	fpp n=0		nfpp n =68	
		%		%
• Have no money	0	0.0	43	53.8
• It is costly	0	0.0	12	15.0
• No knowledge	0	0.0	8	10.0
• Land is fertile	0	0.0	5	6.3
• Fear of failure of rains	0	0.0	2	2.5
• Maize becomes watery	0	0.0	1	1.3

Source: Field Survey, 1997

6.7. Year of Adoption of Storage Insecticide (Actellic 25E.C.)

Table 6.10 shows data on year of adoption of storage insecticide by type of farmer. In order to meet the criteria for chi-square the “ adopted both 1994 and 1995” and “adopted either 1994 or 1995” cells were combined (see Appendix 11: Table 5). The data shows that markedly higher percentage of FPP adopted storage insecticide whilst markedly lower percentage of NFPP adopted storage insecticide. Chi-square value was highly significant indicating difference between year of adoption and type of farmer. The significance is due to far more than expected NFPP farmers who did not

adopt the use of storage insecticide. In effect whilst a little over half of NFPP farmers did not adopt, almost all FPP farmers adopted storage insecticide use.

Table 6.10. Year of adoption of storage insecticide by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Adopted both 1994/1995 and adopted either 1994 or 1995	78	97.0	34	42.5	112	70.0
did not adopt	2	2.5	46	57.5	48	30.0
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 57.6$; $df = 1$; $p < 0.001$

6.8. Multiple reasons for Adoption of Storage Insecticide (Actellic)

Table 6.11 displays the results of a multiple response question, which solicited farmers' reasons for adopting recommended storage insecticide. Reasons given by FPPs and NFPPs respectively were prevents weevil attack and protects maize for higher price. There was no marked difference between FPPs and NFPPs with regards to reasons for adoption of insecticide use.

Table 6.11. Multiple reasons for Adoption of Storage Insecticide

Adoption of Recommended Storage Insecticide	Type of Farmer					
	fpp		nfpp		Total	
	n =78	%	n =34	%	n =112	%
• Prevents weevil attack	73	93.6	29	85.3	102	91.1
• Protects maize for higher price	6	7.4	5	14.7	11	10.9

Source: Field Survey, 1997

However, most of the reasons for not using recommended insecticides were given by NFPPs. The reasons include: have no knowledge, immediately sell harvested maize, and have no money to buy it (Table 6.12). There was marked difference between FPPs and NFPPs relation to reasons given for non-adoption of storage insecticide use.

Table 6.12. Reasons for Non-Adoption of Storage Insecticide

Non-Adoption of recommended Storage Insecticide	Type of Farmer			
	fpp		nfpp	
	n =2	%	n=46	%
• Immediate sales	2	100.0	13	28.3
• Have no knowledge	0	0.0	13	28.3
• Have no money to buy it	0	0.0	10	21.7
• Store maize in husks	0	0.0	5	10.9
• Meant for agric maize	0	0.0	2	4.3
• Maize does not store well	0	0.0	2	4.3
• Processed maize discolours	0	0.0	1	2.2

Source: Field Survey, 1997

Results on adoption of recommended maize technologies by the two categories of farmers i.e. FPP and NFPP, indicate, statistically highly significant relationship. The results indicate that more FPP farmers adopted improved maize variety (38% more FPP farmers than NFPP); planting in lines (25% more of FPP farmers than NFPP); fertilizer (85% more of FPP farmers than NFPP) and storage insecticide (37% more of FPP farmers than NFPP) than NFPP farmers. This suggests that whilst almost FPP farmers adopted the use of improved maize variety, planting in lines, fertilizer and insecticide use, over 60% of NFPP farmers adopted only improved maize variety and planting in lines. Fertilizer use was poorly adopted by NFPP farmers (15%) while only a little over 40% of NFPP farmers adopted storage insecticide use.

6.9. Extent of adoption of the package of maize recommendations

In order to develop a pattern of extent of adoption i.e. full adoption, partial adoption and non-adoption, the recommended maize technologies i.e. improved maize variety, row planting, fertilizer use, storage insecticide, in various combination adopted by the farmers were used to define this pattern. Full adoption involves adoption of four (4) recommendations i.e. improved maize variety, row planting, fertilizer, and storage insecticide in 1994/95.

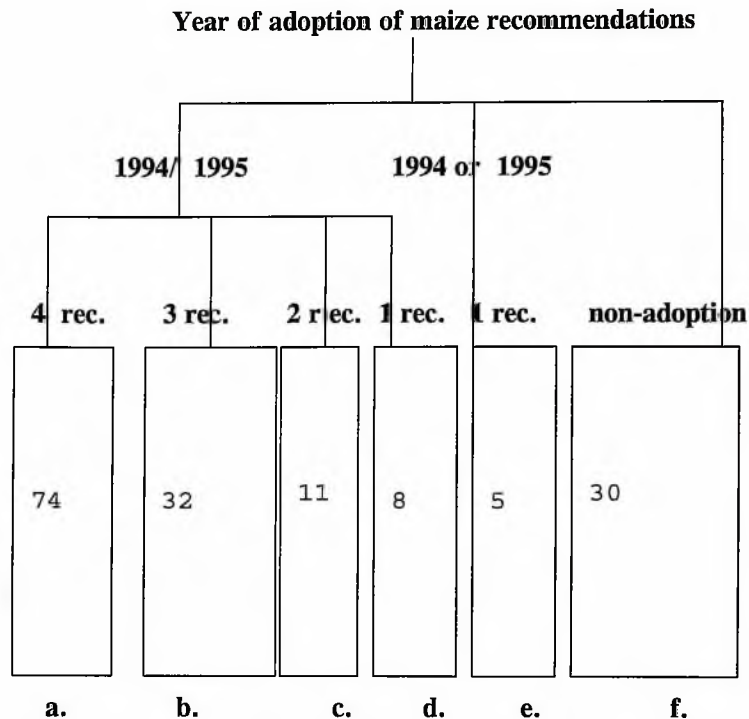
Partial adoption covers adoption of three (3) recommendations in 1994/95 i.e. improved maize variety and any two technologies; adoption of two (2) recommendations i.e. improved maize variety and any one technology in 1994/95; one recommendation (improved maize variety) in 1994/95; and one recommendation

either in 1994 or 1995. The diagram for these categories is shown in figure 6.1 and the frequency distribution of adoption of maize recommendations is shown in Table 6.13. The data in table 6.13 shows that less than one-half of the respondents adopted four recommendations and one-fifth did not adopt any of the recommendations. Frequency distribution of adoption categories based on the re-categorisation of the frequency distribution of adoption of maize recommendations of Table 6.13 is shown in Table 6.14.

Table 6.13. Frequency distribution of Adoption of the package of maize recommendations

Adoption of package of maize recommendations	Frequency	Percent
adopted 4 recommendations in 1994/95	74	46.2
adopted 3 recommendations in 1994/95	32	20.0
adopted 2 recommendations in 1994/95	11	6.9
adopted 1 recommendation in 1994/95	8	5.0
adopted 1 recommendation in 1994 or 1995	5	3.1
non-adoption	30	18.8
Total	160	100.0

Source: Field Survey, 1997

Figure 6.1 ADOPTION OF MAIZE RECOMMENDATIONS

N.B. Each box contains number of respondents

- a. Adopted 4 recommendations in 1994 and 1995 i.e. improved maize variety, row planting, fertilizer, and storage insecticide.
- b. Adopted 3 recommendations in 1994 and 1995 i.e. improved maize variety and two other recommendations; plus one recommendation in either 1994 or 1995.
- c. Adopted 2 recommendations in 1994 and 1995 i.e. improved maize variety and one of above recommendations; plus one or two recommendation in either 1994 or 1995.
- d. Adopted improved maize variety in 1994 and 1995 plus one recommendation in either 1994 or 1995.
- e. Adopted improved maize variety in either 1994 or 1995.
- f. Did not adopt maize recommendations.

6.10 Frequency distribution of extent of adoption

The data in table 6.14 shows the re-categorization of respondents into full adoption, partial adoption and non-adoption based on the range of maize recommendations adopted by them. A little less than one-half of the respondents fall into full adoption; one-third, partial adoption and one-fifth, non-adoption.

Table 6.14 Frequency distribution of extent of adoption

Category	Frequency	Percent
full adoption(4 recommendations)	74	46.2
partial adoption (1-3 recommendations)	56	35.0
non-adoption	30	18.8
Total	160	100.0

Source: Field Survey, 1997

Categorisation of these farmers into full adopters, partial adopters and non-adopters was to determine whether adoption was related to

1. extension access
2. access to credit
3. combination of extension access and access to credit, and whether the selected socio-economic characteristics i.e. farm size, sources of labour are important determinants of adoption of maize technologies. Tables 6.16, 6.17, 6.18, 6.24, 6.25 show these relationships.

6.11. Extent of adoption of package of recommended maize technologies by type of farmer

Less than half of all the respondent farmers fully adopted the package of recommended maize technologies. Markedly higher percentage of FPP farmers fully adopted the package of recommended maize technology whilst markedly lower percentage of NFPP farmers fully adopted the package of recommended maize technologies. In addition markedly higher percentage of NFPP farmers partially adopted the package of recommended maize technologies whilst markedly lower percentage of FPP and NFPP farmers either partially adopted or did not adopt the package of maize innovations. Table 6.15 shows this relationship. Chi-square analysis indicates statistically very highly significant relationship between adoption of innovations and type of farmer. The significance is due to far more than expected FPP farmers who fully adopted the package of maize innovations as well as far less than expected FPP farmers who fully adopted the package of maize innovations. In effect more FPP farmers fully adopted the maize innovations compared with NFPP farmers.

Table 6. 15. Extent of adoption of package of recommended maize technologies by Type of Farmer

Extent of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Full adoption	67	83.8	7	8.8	74	46.2
Partial adoption	13	16.2	43	53.8	56	35.0
Non adoption	0	0.0	30	37.4	30	18.8
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 94.7$; $df = 2$; $p < 0.001$

6.12. Access to extension and extent of adoption of package of recommended maize technologies

Table 6.16 shows data on extent of extension access by extent of adoption of package of recommended maize technologies. The table reveals that markedly lower percentage (negligible) of farmers with no extension access are in the full adoption category. In addition markedly lower percentage of farmers who had high extension access did not adopt the package of recommended maize technologies whilst at the same time markedly higher percentage of farmers who had no extension access are in the non-adoption category. Chi-square analysis indicates a very highly significant difference between extension access and extent of adoption. The significance is due to far more than expected farmers who did not have extension access and did not adopt the package of recommended maize technologies as well as far more than expected farmers who had high extension access and fully adopted the package of recommended maize technologies. These indicate that farmers who did not have extension access did not adopt the package of recommended maize technologies while those who had high extension access fully adopted the package of recommended maize technologies. These suggest that extension access enhances the adoption of the recommended maize technologies with farmers having high extension access fully adopting the package of recommended maize technologies than those with low extension access.



Table 6.16. Access to extension and extent of adoption of package of recommended maize technologies

Extent of adoption	Extension access							
	high extension access		low extension access		No extension access		Total	
	n	%	n	%	n	%	n	%
Full adoption	55	64.7	19	41.3	0	0.0	74	46.2
Partial adoption	22	25.9	20	43.5	14	48.3	56	35.0
Non adoption	8	9.4	7	15.2	15	51.7	30	18.8
Total	85	100.0	46	100.0	29	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 45.4$; $df = 4$; $p < 0.001$

6.13. Access to credit and extent of adoption of package of recommended maize technologies

The relationship between access to credit and extent of adoption of package of recommended maize technologies is shown in Table 6.17. In order to meet the criteria for chi-square test the “low credit access” and “high credit access” cells were combined (see Appendix 11: Table 6 for details). The table shows that markedly higher percentage of farmers who had access to credit fully adopted the package of recommended maize technologies whilst markedly lower percentage of farmers with no access to credit are found in the full adoption category. By contrast markedly higher percentage of farmers with no access to credit partially adopted the package of recommended maize technologies whilst markedly lower percentage of farmers with access to credit are found in the partial and non-adoption category. Chi-square analysis shows there was statistically significant relationship between access to credit

and extent of adoption of package of recommended maize technologies. The significance is due to far more than expected farmers who had access to credit and fully adopted the package of recommended maize technologies as well as far less than expected farmers who had no access to credit but fully adopted the package of recommended maize technologies. This indicates that farmers with access to credit tended to fully adopt the package of recommended maize technologies than those with no access to credit.

Table 6.17. Access to credit and extent of adoption of package of recommended maize technologies

Extent of adoption	Access to credit					
	High/ low access to credit		no credit access		Total	
	n	%	n	%	n	%
full adoption	67	83.8	7	8.8	74	46.2
partial adoption	13	16.2	43	53.8	56	35.0
non adoption	0	0.0	30	37.4	30	18.8
Total	80	100.0	80	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 94.7$; $df = 2$; $p < 0.001$

6.14. Extension and credit access and extent of adoption of package of recommended maize technologies

Table 6.18 shows the relationship between a combination of extension and credit access by extent of adoption of package of recommended maize technologies. The table shows that markedly higher percentage of farmers with access to extension (high and low

extension access) and access to credit fully adopted the package of recommended maize technologies whilst markedly lower percentage of farmers with no access to credit but access to extension (high and low extension access) fully adopted the package of recommended maize technologies. In addition markedly higher percentage of farmers with access to extension (high and low extension access) but no access to credit partially adopted the package of recommended maize technologies whilst markedly lower percentage of farmers with high extension access and access to credit partially adopted the package of recommended maize technologies. On the converse markedly higher percentage of farmers with no extension access and no credit access did not adopt the package of recommended maize technologies whilst markedly lower percentage of farmers with access to credit and extension did not adopt the package of recommended maize technologies. The high number of cells in Table 6.18 with expected values less than 5 makes Chi-square analysis invalid, and therefore the testing for significance is done by further breakdown of Table 6.18. Thus in order to determine the relationship between each of the component columns of “extension access and access to credit” and “extent of adoption of the package of recommended maize technologies by farmers”, all column components except one were collapsed and designated as “others”. The distribution of this breakdown are shown in tables 6.19, 6.20, 6.21, 6.22 and 6.23.

6.18. Extension and access to credit and extent of adoption of package of recommended maize technologies

Extent of adoption	Extension access and access to credit											
	high ext. access - access to credit		low ext. access - access to credit		high ext. access - access to credit		low ext. access - access to credit		no ext. access - access to credit		Total	
	n	%	n	%	n	%	n	%	n	%		
Full adoption	51	89.5	16	69.6	4	14.3	3	13.0	0	0.0	74	46.2
Partial adoption	6	10.5	7	30.4	16	57.1	13	56.5	14	48.3	56	35.0
Non adoption	0	0.0	0	0.0	8	28.6	7	30.5	15	51.7	30	18.8
Total	57	100.0	23	100.0	28	100.0	23	100.0	29	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 104.1$; $df=8$; $p < 0.001$ **6.15. High extension access and access to credit and extent of adoption of package of recommended maize technologies**

Markedly higher percentage of farmers with high extension access and access to credit fully adopted the package of recommended maize technologies whilst markedly lower percentage of others fully adopted the maize technology. In addition markedly lower percentage of farmers with high extension access and access to credit partially adopted or did not adopt the package of recommended maize technologies. These are shown in table 6.19. Chi-square analysis indicates statistically very highly significant difference between a combination of extension access and access to credit, and adoption of package of recommended maize technologies. The significance is due to far more than expected farmers with high extension access and credit access who fully adopted the package of recommended maize technologies as well as far less than

expected “others” who fully adopted the package of recommended maize technologies. These indicate that more farmers with high extension access and access to credit tended to fully adopt the package of recommended maize technologies than the others do.

Table 6.19. High extension access and access to credit and extent of adoption of package of recommended maize technologies

Extent of adoption	High extension access and access to credit					
	high extension access and access to credit		others		Total	
	n	%	n	%	n	%
Full adoption	51	89.5	23	22.4	74	46.2
Partial adoption	6	10.5	50	48.5	56	35.0
Non adoption	0	0.0	30	29.1	30	18.8
Total	57	100.0	103	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 67.5$; $df = 2$; $p < 0.001$

6.16. Low extension access and access to credit and extent of adoption of package of recommended maize technologies

Table 6.20 shows the relationship between low extension access and access to credit by extent of adoption of package of recommended maize technologies. Markedly higher percentage of farmers with low extension access and access to credit fully adopted the package of recommended maize technologies. In addition markedly lower percentage of farmers with low extension access and access to credit did not adopt the package of recommended maize technologies. Chi-square analysis indicates that there was statistically significant difference between a combination of low extension access and access to credit, and adoption of package of recommended maize technologies.

The significance is due to far more than expected farmers with low extension access and credit access who fully adopted the package of recommended maize technologies as well as far more than expected “others” who did not adopt the package of recommended maize technologies. Thus more farmers with low extension access and access to credit tended to fully adopt the package of recommended maize technologies than the others.

Table 6.20. Low extension access and access to credit and extent of adoption of package of recommended maize technologies

Extent of adoption	Low extension access and access to credit					
	low extension access and access to credit		others		Total	
	n	%	n	%	n	%
Full adoption	16	69.6	58	42.3	74	46.2
Partial adoption	7	30.4	49	35.8	56	35.0
Non adoption	0	0.0	30	21.9	30	18.8
Total	23	100.0	137	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 8.4$; $df = 2$; $p < 0.05$

6.17. High extension access and no access to credit and extent of adoption of package of recommended maize technologies

The relationship between high extension access and no access to credit by extent of adoption of package of recommended maize technologies is shown in table 6.21. Markedly lower percentage of farmers with high extension access but no access to credit fully adopted the package of recommended maize technologies. In addition markedly higher percentage of farmers with high extension access but no access to credit partially adopted the package of recommended maize technologies. Chi-square

analysis indicates statistically very highly significant difference between a combination of high extension access and no access to credit, and adoption of package of recommended maize technologies. The significance is due to far more than expected farmers who had high extension access but no access to credit and partially adopted the package of recommended maize technologies as well as far less than expected farmers who equally had a combination of high extension access and no access to credit but fully adopted the package of recommended maize technologies. This indicates that very few farmers who had high extension access and no access to credit fully adopted the package of recommended maize technologies while more farmers who had high extension access and no access to credit partially adopted the package of recommended maize technologies. Thus farmers with high extension access and no access to credit tended to partially adopt the package of recommended maize technologies.

Table 6.21. High extension access and no access to credit and extent of adoption of package of recommended maize technologies

Extent of adoption	High extension access and no access to credit					
	high extension access and no access to credit		others		Total	
	n	%	n	%	n	%
Full adoption	4	14.3	70	53.0	74	46.2
Partial adoption	16	57.1	40	30.3	56	35.0
Non adoption	8	28.6	22	16.7	30	18.8
Total	28	100.0	132	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 14.0$; $df = 2$; $p < 0.001$

6.18. Low extension access and no access to credit and extent of adoption of package of recommended maize technologies

Markedly lower percentage of farmers with low extension access and no access to credit fully adopted the package of recommended maize technologies. In addition markedly higher percentage of farmers with low extension access and no access to credit partially adopted the package of recommended maize technologies. These are shown in table 6.22. Chi-square analysis indicates statistically highly significant difference between a combination of low extension access and no access to credit, and adoption of package of recommended maize technologies. The significance is due to far more than expected farmers with low extension access and no access to credit who partially adopted the package of recommended maize technologies as well as far less than expected farmers with low extension access and no access to credit but who fully adopted the package of recommended maize technologies. These indicate that more farmers with low extension access and no access to credit tended to partially adopt the package of recommended maize technologies while very few farmers with low extension access and no access to credit tended to partially adopt the package of recommended maize technologies.



Table 6.22. Low extension access and no access to credit and extent of adoption of package of recommended maize technologies

Extent of adoption	Low extension access and no access to credit					
	low extension access and no access to credit		others		Total	
	n	%	n	%	n	%
Full adoption	3	13.0	71	51.8	74	46.2
Partial adoption	13	56.5	43	31.4	56	35.0
Non adoption	7	30.5	23	16.8	30	18.8
Total	23	100.0	137	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 11.9$; df = 2; p < 0.01

6.19. No extension access and no access to credit and extent of adoption of package of recommended maize technologies

Markedly lower percentage of farmers with no extension access and no access to credit are in the full adoption category. In addition markedly higher percentage of farmers with no extension access and no access to credit did not adopt the package of recommended maize technologies. These are shown in table 6.23. Chi-square analysis indicates statistically very highly significant difference between a combination of no extension access and no access to credit, and adoption of the package of recommended maize technologies. The significance is due to far more than expected farmers who neither had extension access nor credit access and did not adopt the package of recommended maize technologies as well as far less than expected “others” who equally did not adopt the package of recommended maize technologies. This suggests that more farmers who neither had access to extension nor access to credit did not adopt the package of recommended maize technologies.

Table 6.23. No extension access and no access to credit and extent of adoption of package of recommended maize technologies

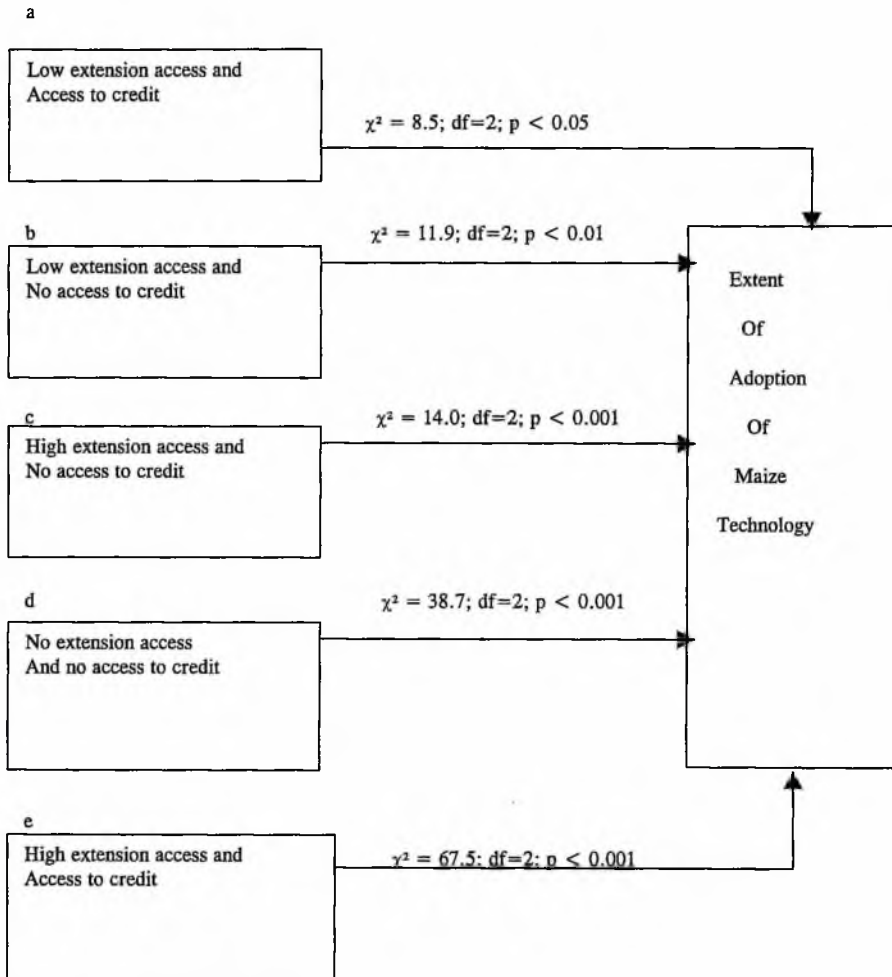
Extent of adoption	No extension access and no access to credit					
	no extension access and no access to credit		others		Total	
	n	%	n	%	n	%
Full adoption	0	0.0	74	56.5	74	46.2
Partial adoption	14	48.3	42	32.0	56	35.0
Non adoption	15	51.7	15	11.5	30	18.8
Total	29	100.0	131	100.0	160	100.0

Source: Field Survey, 1997

 $\chi^2 = 38.7$; $df = 2$; $p < 0.001$

Chi-square strength of each of the column components in relation to extent of adoption of the package of recommended maize technologies is represented in figure 6.2. It shows that high extension access and access to credit had the highest chi-square value with the least being low extension access and access to credit. The results also show that where farmers have no extension access and no access to credit there is no full adoption. More farmers who partially adopted the package of maize innovations either under high or low extension access show the importance of lack of access to credit. This indicates that farmers tended to partially adopt the package of maize innovations when they have access to extension but no access to credit. However, more farmers with a combination of either high or low extension access and access to credit tended to fully adopt the package of maize innovations. These indicate that a combination of extension access and access to credit greatly enhances full adoption of the package of maize innovations. Thus while access to extension and no access to credit results in partial adoption, a combination of extension access and access to credit enhances full adoption of the package of maize innovations

Figure 6.2 Chi-square strength of each of the column components of extension access and access to credit in relation to extent of adoption of package of recommended maize technologies.



6.20. Farm size by extent of adoption of package of recommended maize technologies

The relationship between farm size and extent of adoption of package of recommended maize technologies is shown in Table 6.24. The data shows that markedly lower percentage of farmers who cropped more than 2 acres partially adopted the package of recommended maize technologies. The relationship between farm size and extent of adoption was statistically highly significant. The significance is due to far less than expected farmers who cropped more than 2 acres partially adopting the package of recommended maize technologies as well as far more than expected farmers who cropped more than 2 acres fully adopting the package of recommended maize technologies. These indicate that few farmers who cropped more than 2 acres partially adopted the package of recommended maize technologies while more farmers who cropped more than 2 acres fully adopted the package of recommended maize technologies. These suggest that more farmers with larger farm size fully adopted the package of recommended maize technologies.

Table 6.24. Farm size by extent of adoption of package of recommended maize technologies

Extent of adoption	Farm size					
	0-2 acres		> 2 acres		Total	
	n	%	n	%	n	%
full adoption	32	36.0	42	59.2	74	46.2
partial adoption	40	44.9	16	22.5	56	35.0
non adoption	17	19.1	13	18.3	30	18.8
Total	89	100.0	71	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 10.3$; $df = 2$; $p < 0.01$

6.21. Sources of labour by extent of adoption of package of recommended maize technologies

The relationship between sources of labour and the extent of adoption of package of recommended maize technologies is shown in Table 6.25. The data shows that markedly lower percentage of farmers who used family labour fully adopted the package of recommended maize technologies than those who used hired labour. Chi-square analysis indicates there was statistically highly significant difference in sources of labour by extent of adoption. The significance is due to far more than expected farmers who used family labour and did not adopt the package of recommended maize technologies as well as far less than expected farmers who used family labour and fully adopted the package of recommended maize technologies. This indicates that more farmers who used family labour did not adopt the package of recommended maize technologies while very few farmers who used family labour fully adopted the package of recommended maize technologies. These suggest that more farmers who hired labour tended to fully adopt the package of recommended maize technologies compared with farmers who used family labour.

Table 6.25. Sources of labour by extent of adoption of package of recommended maize technologies

Extent of adoption	Sources of labour					
	Hired		family/others		Total	
	n	%	n	%	n	%
full adoption	69	51.9	5	18.6	74	46.2
partial adoption	44	33.1	12	44.4	56	35.0
non adoption	20	15.0	10	37.0	30	18.8
Total	133	100.0	27	100.0	160	100.0

Source: Field Survey, 1997

$\chi^2 = 12.0$; df = 2; $p < 0.01$

The results indicate that more FPP farmers fully adopted the package of maize recommendations compared with NFPP farmers. There was statistically highly significant relationship between (i) extension access, (ii) access to credit (iii) extension access and access to credit (iv) farm size, (v) sources of labour on one hand and extent of adoption of package of recommended maize technologies on the other. Thus more farmers, who had high extension access, access to credit fully adopted the package of recommended maize technologies than those with low extension access but no access to credit, respectively. In addition, where farmers had no extension access and no access to credit there is no full adoption. More farmers who had either high or low extension access and no access to credit tended to partially adopt the package of maize innovations. These indicate that farmers tended to partially adopt the package of maize innovations when they have access to extension but no access to credit. However, more farmers with a combination of either high or low extension access and access to credit tended to fully adopt the package of maize innovations. These indicate that a combination of extension access and access to credit greatly enhances full adoption of the package of maize innovations. Thus while access to extension and no access to credit results in partial adoption, a combination of extension access and access to credit enhances full adoption of the package of maize innovations.

In addition more farmers who cropped larger farm size (> 2 acres) and more farmers who hired labour tended to fully adopt the package of recommended maize technologies. In effect more farmers who had high extension access, had access to credit, hired labour and cropped larger farm sizes fully adopted the package of recommended maize technologies. Farmers who had extension access and no access to credit tended to partially adopt the package of recommended maize technologies. Farmers who had a combination of extension access and access to credit tended to

fully adopt the package of recommended maize technologies. Thus extension access, access to credit, a combination of extension access and access to credit, farm size and sources of labour were important determinants of adoption of the package of recommended maize technologies.

6.22. Conclusion

More FPP farmers fully adopted the package of recommended maize technologies than NFPP farmers did. Among NFPP farmers' fertilizer was the least utilised (15%) followed by storage insecticide (40%). Reasons given for want of use of storage insecticide and fertilizer included lack of knowledge of its use, lack of money to buy it, and especially for fertilizer, its prohibitive cost. Besides the adoption of these recommended technologies by FPP and NFPP farmers and its accompanying reasons, there was a relationship established between extension access; access to credit; a combination of extension access and access to credit; farm size and sources of labour on one hand and extent of adoption of the package of recommended maize technologies on the other. More farmers who had high extension access; had access to credit; hired labour and cropped larger farm size fully adopted the package of recommended maize technologies. Farmers with access to extension and no access to credit partially adopted the package of recommended maize technologies while farmers with a combination of extension access and access to credit fully adopted the package of recommended maize technologies.



CHAPTER 7

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.0. Introduction:

This chapter discusses the findings of this research in relation to the main and specific research questions raised, and the implications of the findings for policy and further research.

The main research question was, whether access to credit is an important factor for adoption of agricultural innovations in the Central Region of Ghana?

The specific questions are:

- (1) What is the extent of the farmers in the study area's access to extension?
- (2) What is the extent of the farmers in the study area's access to credit, and from which sources?
- (3) What is the level of adoption of maize technologies of the farmers in the study area?
- (4) What is the relationship between access to extension and/or credit and adoption of maize technologies?
- (5) What are the policy and research implications of the relationship?

7.1. Extension access

The role of agricultural extension agencies and personnel is to provide information to the farmers they work with. If farmers are to make use of this information then they should have access to extension. A little over 80.0% of the respondent farmers in the study area had access to extension and had knowledge of the recommended

maize technology. However, there were differences between FPP and NFPP farmers with regards to the level of extension access as well as knowledge the farmers indicated to have received from extension workers. Based on a definition that farmers with high extension access are those who have had contact with extension agents for at least one year and had frequent visits (at least weekly or bi-weekly) and, those with low extension access as farmers who have had contact with extension agents for at least one year and had infrequent visits (at least monthly or occasional) and farmers who had no contact with extension, FPP and NFPP farmers differed on extension access. FPP farmers had high extension access (71.2%) than NFPP farmers (35.0%), ($\chi^2=38.9$; $df = 2$; $p<0.001$). Similarly based on a definition that farmers with full knowledge of the recommended maize technology are those who are aware they have received messages on improved maize variety, planting in lines, fertilizer usage and use of recommended storage insecticide, and partial knowledge of the recommended maize technology as those with awareness of receipt of improved maize variety, together with one of planting in lines, fertilizer usage, use of recommended storage insecticide, and no knowledge as those not aware of the recommended maize technology, it was found that there were differences between FPP and NFPP farmers on knowledge levels. While all FPP farmers had full knowledge of the recommended maize technology package, 48.7% of NFPP farmers had full knowledge of the recommended maize technology ($\chi^2=55.1$; $df = 2$; $p<0.001$). The difference between FPP and NFPP in relation to access to extension and knowledge levels is expected since extension effort at covering all farmers is impossible due to a large extension-farmer ratio of 1:2000 (World Bank, 1992). The analyses on farmers'

extension access and knowledge levels indicate that FPP farmers had high extension access and fuller knowledge of the recommended maize technology compared with the NFPP farmers. The relationship between extension access and knowledge levels indicate that farmers who had high extension access had full knowledge of the recommended maize technology (94.1%), ($\chi^2=104.2$; $df=2$; $p<0.001$). This indicates that farmers with high extension access tend to have full knowledge of the recommended maize technology. This is consistent with findings made by the Ghana Grains Development Project (1991), who found that knowledge gained by farmers was influenced more by extension contact. Similarly, Hiebert (1974) noted that extension effort increases the probability of adoption as the stock of information pertaining to modern production increases. Hussain, Byerlee and Heisey (1994) in a study of the impacts of the training and visit (T&V) extension system on farmers' knowledge and adoption of technology in Pakistan, also noted that extension contact (the quality of contact and not the quantity) increased farmers' knowledge and by implication adoption of technology.

An analysis of the personal socio-economic characteristics of the respondent farmers indicated that farm size and sources of labour were important factors influencing farmers' participation in the FPP programme. Farmers with larger farm sizes (53.7%) tended to participate in the FPP programme than those with smaller farm sizes (65.0%), ($\chi^2=5.7$; $df = 1$; $p<0.05$) while those utilising family labour (25.0%) did not participate ($\chi^2=7.5$; $df = 1$; $p<0.01$). This suggests that the FPP programme tended to support farmers with larger farm size contrary to the programme's

expectation of assisting farmers with smaller farm sizes (Sakyi, Donkor and Tetteh, 1993). In addition farmers who hired labour tended to have high extension access (56.4%) than those using family labour (37.0%), ($\chi^2=11.2$; $df=2$; $p < 0.01$). This finding is consistent with the firm evidence that when left to their own devices, extension workers tend to seek out a minority of better- off farmers (Roling, 1988:66). To reach all type of farmers, the service delivery system must learn how to identify and target specific types of clients within the rural system since farmers do not form a homogeneous population. Roling (1988:69) further notes that homogeneity must always be determined relative to the purpose of the intervention. That is, it is necessary to determine whether farmers are homogeneous enough for a particular purpose.

7.2. Access to credit

In all 50.0% of the respondent farmers had access to credit for purchasing improved maize variety, fertilizer and storage insecticide. This indicates that half of the respondent farmers did not have access to credit. FPP farmers had loan assistance from Sasakawa Global 2000 (S.G. 2000)/Banks to purchase these maize inputs while NFPP farmers claimed they did not use credit for any of these inputs. Thus the S.G. 2000 appear to be an important source of credit to half of the sampled farmers in the study area. Also, this suggests that apart from S.G. 2000, none of the farmers claimed to use other credit sources to buy such inputs. This results is in sharp contrast to claims by several authors that farmers obtain credit from informal sources such as traders, friends or relatives and money lenders to farm (Anaman, 1988; Ghana Grains

Development Project, 1991; Miller, 1977). This non-use of credit offers different interpretations. The indications are that farmers either used their own money to purchase these inputs or did not use the inputs at all. If the latter is the case, it suggests the low use of credit by farmers for maize production in the Central Region. This needs to be specifically examined. In addition, it is probable farmers might have obtained credit for other purpose other than to purchase maize inputs. This observation is affirmed by Ghana Grains Development Project (1991). They note that perhaps more interesting than the source of the loan is the purpose. For in majority of cases, maize farmers take loans not to purchase inputs or hire tractors, but rather to hire labour. There is the need to examine this since traditional approaches to credit delivery tend to see credit needs as mainly productive ones and especially for purchasing new inputs rather than labour hire. Apart from Sasakawa Global 2000 credit source used in the purchase of maize inputs, very few farmers (6.3%) borrowed money from friends or relatives or money-lenders to pay for such farm operations as land preparation, planting in lines, weeding, fertilizer application and harvesting. The implication is that majority of farmers used their own sources to pay for such operations. It only suggests either the farmers did not need the credit or there is lack of access to credit for maize production in the Central Region (MOA, 1994). If the latter is true, then there is the need to provide appropriate sustainable complementary rural finance schemes to alleviate this problem. Farmers can be encouraged to form rotating savings and credit association, or form self-help groups to enhance their ability to access financial services from semi-formal and formal service providers. The low use of credit may also suggest the farmers' inability to articulate their credit

needs or lack of credit sources or the reluctance of the formal (banks) or informal financial agents (such as money lenders, susu collectors) to lend to the small scale farmer. In fact Harford, Jones, Sakyi-Dawson, Sey and Atta-Peters (1998) found a reluctance of both the formal and informal financial agents to lend to the small scale operators in the agricultural sector, and that small scale operators seem to obtain loans from the informal of the informal end of the financial services continuum such as family, input suppliers, traders and a range of community based financial agents with a direct interest in agriculture. They also reported that linkages between the formal financial intermediary and susu collectors, traders to the farmers enhanced small farmers access to financial services. This suggests that the use of family, input suppliers and output traders as credit providers has great potential and need to be explored and strengthened.

There was a relationship established between access to credit and extension access, farm size, sources of labour. Under the FPP programme farmers with high extension access tended to have access to credit (67.1%), ($\chi^2=38.9$; $df=2$; $p<0.01$). This is expected as the FPP programme collaborated with the extension service in providing the relevant technology on maize farming, and the banks and input suppliers to give credit to the participating farmer. One policy option advanced for minimizing the adoption-discouraging effects of credit scarcity is a subsidization of credit to small scale farmers (Braverman and Guasch, 1989). However, the provision of subsidized credit to smaller farms, it has been argued, has been skewed towards the wealthy and people owning large farm size (Huppi and Feder, 1989). The relationship between farm size

and credit in the present study showed that farmers who cultivated larger farm size tended to have high access to credit (56.4%), ($\chi^2=8.3$; $df=2$; $p<0.05$). This finding confirms Lipton's (1978) argument that subsidization of credit does not necessarily circumvent the problem for smaller farms since, in many cases, the larger and more influential farms manage to get the bulk of such credit. It is also consistent with the finding of Weil (1970) who suggested that capital may be more available to large farms so that even though all farms may wish to adopt innovations, larger farms are more likely to do so.

Hiring of labour was related positively to access to credit. Credit provided to these farmers were essentially input credit and that its relationship with hiring of labour suggests the inherent intense labour activities as in planting in lines, fertilizer application and weeding associated with the use of innovative inputs.

7.3. Adoption of maize technologies

A little over 80.0% of all the respondent farmers tended to fully or partially adopt the package of recommended maize technologies. However, there were differences in the level of adoption. Based on definition of full adoption as a situation where a farmer uses improved maize seeds, practises planting in lines, applies fertilizer, and uses recommended storage insecticide, and partial adoption as a situation where a farmer uses improved maize seeds and any one of planting in lines, fertilizer application, and use of recommended storage insecticide, and non-adoption, as farmers who did not use improved maize seeds, planting in lines, fertilizer and recommended storage insecticide, about 47.0% of the farmers fully adopted the package of maize

technologies, while 35.0% partially adopted them. FPP and NFPP farmers differed on adoption levels of the maize technologies. About 80.0% of FPP farmers fully adopted the package of recommended maize technologies compared with 8.8% of NFPP farmers ($\chi^2=94.7$; $df=2$; $p<0.001$). Among the FPP farmers the most widely adopted recommended technology were improved maize variety and planting in lines followed by fertilizer use and storage insecticide. The most widely adopted recommended technology among NFPP farmers was planting in lines followed by improved maize variety, storage insecticide use and the least was fertilizer use. The effect of farm size and sources of labour were profound. Although the literature indicates that age, education, income are important factors affecting adoption of technology (Daramola, 1989; Kumar and Wasnik, 1989; Chandra and Singh, 1992) and by implication membership of extension receiving mechanism, the results of this study shows no relationship between age, education and adoption of technology. However, farm size and sources of labour were found to be related to adoption of the recommended maize technologies. Farmers who cultivated large farm size tended to fully adopt the recommended maize technologies ($\chi^2=10.3$; $df=2$; $p<0.01$). The implication is that larger farm size was found to be positively related to adoption of technology (Parthasarathy and Prasad, 1978). The positive relationship between farm size and adoption of innovations confirms findings from other areas. For instance studies on “A longitudinal analysis of factors influencing technology adoption in Swaziland” (Shields, Rauniyar and Goode, 1993); “Determinants and impact of new technology adoption on tribal agriculture in Bihar” (Chandra and Singh, 1992); “A study of adoption of crop production technologies in progressive and less progressive

villages in Uttar Pradesh” (Kumar and Wasnik,1989) confirm this relationship. In addition, hiring of labour was found to be related to adoption of innovations ($\chi^2=12.0$; $df=2$; $p<0.01$). This is understandable, as use of improved maize technology generally requires more intensive operations: hence increased use of hired labour especially where family labour is limited. In effect farmers with larger farm size, and who can hire labour tended to fully adopt the package of maize innovations.

7.4. Relationship between extension access and adoption

There is positive relationship between extension access and adoption of innovations. Farmers who had high access to extension tended to fully adopt the maize innovation ($\chi^2=45.4$; $df=4$; $p<0.001$). This is consistent with findings of Yaron, Dinar and Voet (1992) in a study on innovations on family farms in the Nazareth Region of Israel; as well as Ghana Grains Development Projects’ (1991) study on maize technology adoption in Ghana. They noted that adoption of innovations was positively affected by extension contact. Extension access thus enhances adoption of innovations.

7.5. Relationship between credit access and adoption

The relationship between access to credit and adoption is that credit-receiving farmers tended to have full adoption compared to farmers with no access to credit ($\chi^2=94.7$; $df=2$; $p<0.001$). This shows that credit enhances adoption. This corroborates studies conducted that affirm the usefulness of credit among small scale farmers in enhancing the adoption of high yielding variety technology where fixed pecuniary costs are not large (Daramola, 1989; Kumar and Wasnik, 1989). Bhalla (1979) also affirms the

usefulness of credit. In a study of Indian agriculture he reported that small and large farms differed in the reasons offered for not using fertilizer in 1970 – 1971. Lack of credit was a major constraint for 48 percent of small farms and for only 6 percent of large farms.

7.6. Relationship between extension access, access to credit and adoption of recommended maize technologies

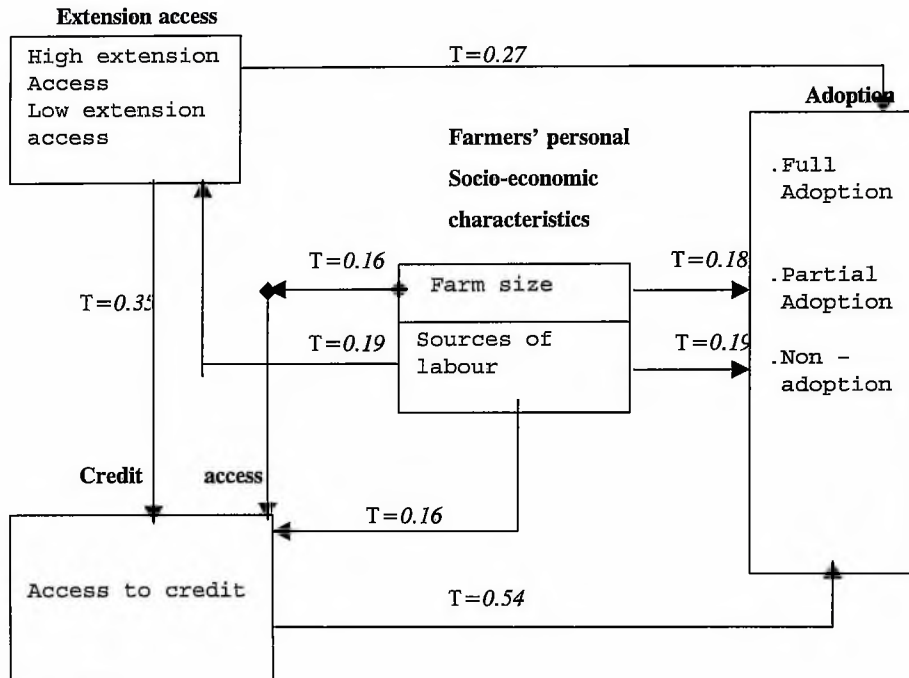
Farmers who did not have access to extension and credit did not fully adopt the innovations. However farmers who had either high (57.1%) or low (56.5%) extension access and no access to credit tended to adopt the innovations partially at ($\chi^2=14.0$; $df=2$; $p<0.001$) and ($\chi^2=11.9$; $df=2$; $p<0.001$) respectively. Thus farmers tended to partially adopt the package of maize innovations when they have access to extension but not credit. This partial adoption may be explained by the fact that farmers have rational choice in adopting technologies; and that they adopt pieces of the package in stepwise fashion rather than the whole (Byerlee and Hesse de Polanco (1986) in Leathers and Smale (1991:734). Tripp, Marfo, Dankyi and Read (1987) as cited in Russell (1987:8) affirm this observation. In a study on adoption of new practices in the Brong Ahafo region of Ghana, they noted that, the farmers clearly prefer a cautious approach involving a stepwise testing of the recommended alternatives, rather than a sudden switch to the complete set of recommended practices. The reasons given for this partial adoption in this study included lack of credit to buy, particularly fertilizer, and lack of knowledge of improved maize variety, planting in lines and use of storage insecticide. This shows that lack of credit is a factor that resulted in partial adoption. This is

consistent with observations made by Byerlee and Hesse de Polanco (1986), which stated that because of capital scarcity and risk considerations; farmers are rarely in a position to adopt complete packages. Similarly, the World Bank (1992) in the National Agricultural Extension Project Document of the Republic of Ghana noted that many farmers within the VORADEP project area could not adopt the extension recommendations as they did not have the resources to purchase the input, particularly fertilizer, which was a key component. Similarly many other studies have found that a majority of small farms reported shortage of funds as a major constraint on adoption of divisible technology such as fertilizer use (Wills, 1972; Franked, 1971; Khan, 1975). However, in this study, even though lack of credit was given as reasons for partial adoption of fertilizer and storage insecticide, 63.0% of non-credit receiving farmers adopted the use of improved maize variety. It only shows farmers willingness to use their own money to buy improved seed based on the benefits to be derived from it. This result is supported by Wague (1988) and Cuevas (1988) who indicated that even small farmers have a significant savings potential, and are capable of mobilising resources when profitable opportunities for investment exist. Schutjer and Van der Veen (1977) cite a number of scholars who point out that the profitability of high yielding variety (HYV) adoption will induce even small farmers to mobilise (from whatever sources to which they have access) the relatively small cash requirements for necessary inputs. Significantly, a combination of either high (89.5%) or low (69.6%) extension access and access to credit resulted in full adoption of maize innovations at ($\chi^2=67.5;df=2;p<0.001$) and ($\chi^2=8.4;df=2;p<0.05$) respectively. Thus a key finding of this study is that combinations of extension access (at high or low levels) and access to credit greatly

enhances full adoption of the package of maize innovations. This is consistent with observations made by Tinnermeier (1973). He noted that just providing new technical inputs and credit is not as effective (adoption is slower) as providing input credit and technical assistance. Ongaro (1990) further noted that credit availability and extension contacts were found to be positive and significantly related to maize yields and hence adoption of maize technologies. The finding shows that credit, in addition to extension is likely to enhance fuller adoption of technologies.

A summary of the inter-relationship between socio-economic characteristics of farmers, extension access, access to credit, and adoption of technology are diagrammatically represented in Figure 8.1. No relationship was observed between farm size and access to extension. However, farmers who hired labour tended to have high extension access. Farmers who cropped larger farm size, and hired labour tended to, have high access to credit and, fully adopt the recommended maize technology. Farmers with high extension access tended to, have access to credit and, fully adopt the maize technology. Farmers with access to credit tended to fully adopt the recommended maize technology. Farmers who had a combination of access to extension and access to credit tended to fully adopt the package of recommended maize technology. The Tschuprow's *T* values show that the relationship between credit and the adoption of a technology is stronger compared with relationship between both extension access and adoption of technology or extension access and credit. This confirms the over-riding importance of credit in adoption.

Figure 7.1 Inter-relationships of extension access, credit and adoption of recommended maize technologies



7.7. Policy implication for extension delivery

The FPP approach tends to favour farmers with larger farms. In addition it tends to favour farmers who can afford to hire labour for their farming operations. This shows that the FPP programme inadvertently tend to work with larger farmers and those who can afford to hire labour to supplement the farm work. This indicates that the very small scale and poor farmers were by-passed by the FPP programme, which ironically is intended for such target beneficiaries. However, the issue of reaching out to these small farmers, and hiring of labour by these farmers for field operation needs further

investigation. A mechanism by which the very poor farmers can be identified and assisted is necessary. For instance, thorough screening of farmers needs to be undertaken to ensure that groups of farmers who are homogeneous i.e. farmers who own almost the same farm size, use their own labour, and genuinely need credit for production activity, are selected. These groups selected will facilitate extension effort and effective and efficient grant and use of credit.

7.8. Policy implication for credit delivery

Results of this study indicated that apart from Sasakawa Global 2000 as a main credit source, very few farmers (6.3%) claimed they used credit from friends, relatives or money lenders. This little credit was used on such farm operations as land preparation, planting in lines, fertilizer application, weeding and harvesting. This means majority of the farmers used their own source to pay for such operations. This low use of credit may also suggest the need for farmers to form rotating savings and credit associations (ROSCA), or self-help groups to enhance their ability to access financial services from semi-formal and formal service providers. Farmers can establish links with the informal of the informal creditors, that is, family, input suppliers and traders. They can access credit from input suppliers by way of obtaining goods on credit, as well as from traders, but this must be based on mutual trust. Afikorah-Danquah (1998) notes that farmers can develop close relationships with traders, so that the trader can have a guaranteed supply when there is scarcity, and the farmer can have a buyer when there is a glut. This process, he notes, is enhanced where the trader provides assistance by way of cash payments, provision of agro-chemical and seed on credit

or by acting as a guarantor to the farmer for obtaining inputs on credit from other dealers.

Again, credit access was related to larger farm size and hiring of labour. These suggest that credit was advanced more to large scale farmers and those who can afford to hire labour. This was contrary to S. G. 2000 documented target beneficiaries who have been indicated to be the very small scale and poor farmers. This means the FPP programme is short of meeting the credit needs of smaller farmers. Thus the issue of finding a credit scheme to meet the needs of the smaller farmer appears not settled.

7.9. Policy implication for extension and credit

By all indication the provision of a combination of extension service and credit to farmers greatly enhances adoption and by implication agricultural development among small-scale farmers. However, the performance of these two activities, extension and credit administration by extension personnel is likely to affect their efficiency in providing education to these farmers. It is thus necessary to have extension programmes that can be complemented with appropriate means of financial service provision. It is recommended that a rural finance programme be established to cater for the needs of small-scale farmers. For instance part of the District Assembly Common Fund for poverty alleviation can be channelled through rural banks, traders, credit unions, susu-collectors, non-governmental organisations (NGOs) and rotating savings and credit associations (ROSCA) to cater for the credit needs of farmers. However, this requires effective and efficient joint consultation and collaboration

between extension and financial service providers to ensure maximum benefits, outreach and repayment of such loans. Such mechanisms, if put in place, are likely to reduce the problem of extension personnel being saddled with loan recovery from defaulting farmers at the expense of providing technical assistance, and at the same time enhance adoption of innovations and agricultural growth.



7.10. Research implication

It became evident in the discussions that some farmers instead of using credit for purchasing capital inputs rather chose to use credit for hiring labour. This is against the traditional concepts of advancing credit for productive needs and especially for purchasing new inputs. It is thus necessary to investigate this phenomenon of farmers using credit for labour hire instead of using credit for the purchase of capital inputs.

The sample used in the study included maize farmers who had input credit from S.G. 2000 and were purposively selected. Also included were those farmers who did not have access to input credit from S.G. 2000 sources but were randomly selected from the population of maize farmers. A limitation of this study was that the first group had contact with extension whilst in the second group, some of the members, randomly selected, did not have contact with extension. To rectify this situation, it is suggested that future research looks either at the two distinct samples i.e. those having input credit assistance, and those not, both purposively selected on the basis of equitable contact with extension. Or a single sample of farmers randomly selected without any predetermined association with a credit source.

Apart from Sasakawa Global 2000 being the main credit source for farmers, majority of the farmers did not use other credit sources in their maize farming activities. This raises a number of issues. It is not clear whether the low use of credit is due to lack of demand for credit or the inability of farmers to articulate their demand for credit. Or is it due to scarcity of sources of credit or the reluctance of the formal (bank) or informal financial agents (such as moneylenders, susu collectors) to lend to the small-scale farmers. However, the fact still remains that the issue of credit needs further investigation particularly in terms of farmers' access to financial services in the Central Region.

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APPENDIX 1

**DEPARTMENT OF AGRICULTURAL EXTENSION
FACULTY OF AGRICULTURE
UNIVERSITY OF GHANA, LEGON**

**INTERVIEW QUESTIONNAIRE ON CREDIT AND ITS IMPACT ON SMALL
SCALE MAIZE FARMING IN THE CENTRAL REGION OF GHANA
(FARMERS)**

INSTRUCTIONS

1. This questionnaire is an attempt to help assess the impact of credit on small scale maize farming. The areas covered are:
 - A. Socio-economic characteristics of the farmers
 - B. Land acquisition
 - C. Labour input
 - D. Capital input
 - E. Access to credit
 - F. Access to Extension Services
 - G. Adoption of impact points
2. Answers will be treated in confidence
3. Thank you.

WILLIAM MINTAH WIAFE

A. SOCIO-ECONOMIC CHARACTERISTICS OF THE FARMER

1. Farmer's Name.....
2. Village.....
3. District.....
4. Sex: Male.....Female.....
5. Ethnic origin.....
6. Age: 1. 15-19yr 2. 20-24yr 3. 25-29yr
4. 30-34yr 5. 35-39yr 6. 40 and above
7. Highest formal education attained (tick where appropriate)
 1. Non-Formal
 2. Primary/ Middle
 3. Secondary/Vocational/Technical
 4. Tertiary
 5. Did not have any school education.
8. Marital status: 1. Married..... 2. Single.....
3. Divorced..... 4. Widow/er.....
9. What economic activities are you engaged in?
 1. Farming only..... 2. Farming + Trading.....
 3. Farming + Artisanship 4. Farming + Salaried Worker.....
 5. Others.....
10. How many years have you been in farming?
 1. 1-5yr 2. 6-10yr 3. 11-15yr 4. 15-20yr 5. 20yr and more
11. How many years now have you been planting maize?
 1. 1-5yr 2. 6-10yr 3. 11-15yr 4. 16-20yr 5. 20yr and more
12. What major crops do you produce, in ranked order, with the most important first. (List maximum of four)
 - 1..... 2.
 - 3..... 4.

13. What major livestock and poultry do you produce, with the most important ranked first.
- 1..... 2.
- 3..... 4.

B LAND ACQUISITION.

14. What is the total land available to you for farming?
1. 1-5acres 2. 6-10acres 3. 11-15acres 4. 16acres and more
15. What is the total size or area of land which is currently cultivated by you?
1. 1-5acres 2. 6.-10acres 3. 11-15acres 4. 16acres and more
16. What percentage of this land you farm on belongs to you?.....
17. If a tenant farmer, in what form do you pay for farming land acquired?
1. Cash 2. Abusa 3. abunu
18. What is the acreage under maize cultivation?
1. 0-2acres 2. 3-5acres 3. 6-8acres 4. 9acres and more

C. LABOUR INPUTS

19. What sources of labour did you use in your maize farming activities in 1994-1995?
1. Family labour(F.L.) 2. Hired labour(H.L.)
4. Own labour(O.L.) 8..Reciprocal labour(R.L.)

Which of the underlisted operations is the respective labour engaged on?

Activity	1.F.L	2.H.L.	4.O.L.	8.R.L.
20. Land preparation				
21. Planting				
22. Weeding				
23. Fertilizer application				
24. Harvesting				

D. CAPITAL INPUTS

25. Which of the underlisted inputs did you use in your maize farming in 1994-1995.

Tick where appropriate.

Inputs	1994	1995
1. Improved seed		
2. Fertilizer		
4. Storage Insecticide		
8. Cutlass		
16.Hoe		
32.Baskets		
64.Sacks		

E. FARMERS ACCESS TO CREDIT

If you used any of the above-mentioned inputs in your maize farming indicate using the following options whether you used 1. your own money to purchase them, 2. borrowed money to purchase them, 3. you did not use the inputs. If borrowed money was used indicate the source from the underlisted source-options.

Purchased inputs	Borrowed, Year, Source					
	1994		1995		1996	
	Own, Borrowed or not	Source if borrowed	Own, Borrowed or not	Source if borrowed	Own, Borrowedor not	Source if borrowed
26. Improved Seeds						
27. Fertilizer						
28. Storage Insecticides						
29. Cutlass						
30. Hoe						
31. Baskets						
32. Sacks						

Sources of Credit:

1. Friends & relatives 2. Money lenders 4. Banks
 8. Sasakawa Global 2000 16. Credit Union 32. Susu collectors
 64. Rotating savings credit union 128. World Vision Int.
 256. Pamscad 512. Marketing/Production Co-op.
 1024. S.E.I.P.

F. Which of the underlisted source-options did you obtain credit for your maize farming operations since 1994.

Activity	Source of credit	Year/s credit obtained		
		94	95	96
33. Land prep.				
34. Planting				
35. Weeding				
36. Fertilizer appl.				
37. Harvesting				

Sources of Credit:

1. Friends & relatives 2. Money lenders 4. Banks 8. Sasakawa Global 2000
 16. Credit Union 32. Susu collectors 64. Rotating savings credit union
 128. World Vision Int. 256. Pamscad
 512. Marketing/Production Coop. 1024. S.E.I.P. 2048. Own

F. EXTENSION CONTACT

38. Do you have contact with extension workers?

1. Yes [] 2. No [] 3. Can't tell []

39. For how long have you known the extension worker?

1. 1 - 5 yrs. 2. 6-10 yrs. 3. 11 years and more

40. How frequent is your contact with the extension worker?
 1. Weekly 2. bi-weekly 3. monthly 4. occasional 5. no contact
41. How much time does the extension worker spend with you?
 1. Less than 30 min 2. more than 30 min 3. less than 60 min
 4. between 60-90 min. 5. more than 90 min.

G. MESSAGES RECEIVED FROM EXTENSION CONTACT

Indicate whether you received messages from the extension worker during a particular operation or use of specific inputs.

Extension Message	Yes	no
42. Use of high yielding varieties of maize		
43. Use of 2-3 seeds per hill		
44. Planting in lines		
45. Planting at recommended spacing		
46. 1st. and 2nd. weed control		
47. Application of fertilizer <u>Type</u> 1. Basal fertilizer(NPK) 2. Sulphate of Ammonia(S/A) 4. Urea <u>Rate</u> 1. NPK at 2bags/acre 2. S/A at 2bags/acre 4. Urea at 1bag/acre <u>Time</u> 1. NPK at 2 weeks 2. S/A or Urea at 6 weeks		
48. Drying of harvested maize before storage		
49. Use of recommended fumigant or storage insecticideeg. Actellic 25E.C. at 5ml./100kg maize		
50. Storage of maize in narrow cribs		

H. ADOPTION OF MESSAGES

Which of the year/s below did you use the following technologies or inputs.

Extension Message	Year/s Technology used			
	before 1994 (state year)	1994	1995	1996
51. Use of high yielding maize varieties				
52. Local seed maize				
53. Use of 2-3 seeds per hill				
54. Planting in lines				
55. Planting at recommended spacing				
56. 1st. and 2nd. weed control				
57. Application of fertilizer <u>Type</u> 1. Basal fertilizer(NPK) 2. Sulphate of Ammonia(S/A) 4. Urea <u>Rate</u> 1. NPK at 2bags/acre 2. S/A at 2bags/acre 4. Urea at 1bag/acre <u>Time</u> 1. NPK at 2 weeks 2. S/A or Urea at 6 weeks				
58. Drying of harvested maize before storage				
59. Use of recommended fumigant or storage insecticide eg. Actellic 25E.C. at 5ml./100kg maize				
60. Storage of maize in narrow cribs				

I. REASONS FOR ADOPTION AND NON-ADOPTION

Extension Message	1. Reasons For Adoption	2. Reasons for non-adoption
61. Use of high yielding varieties		
62. Use of local seed maize		
63. Use of 2-3 seeds per hill		
64. Planting in lines		
65. Planting at recommended spacing		
66. 1st. and 2nd. weed control		
67. Application of fertilizer <u>Type</u> 1. Basal fertilizer(NPK) 2. Sulphate of Ammonia (S/A) 4. Urea <u>Rate</u> 1. NPK at 2bags/acre 2. S/A at 2bags/acre 4. Urea at 1bag/acre <u>Time</u> 1. NPK at 2 weeks 2. S/A or Urea at 6 weeks		
68. Drying of harvested maize before storage		
69. Use of recommended fumigant or storage insecticide eg. Actellic at 5ml./100kg maize		
70. Storage of maize in narrow cribs		

APPENDIX 11

Table 1. Access to Extension and the Level of Knowledge Farmers claimed to have received from extension workers

Level of knowledge farmers claimed to have received from extension worker	Access to Extension							
	high extension access		low extension access		No extension access		Total	
	n	%	n	%	n	%	n	%
Full knowledge	80	94.1	39	84.8	0	0.0	119	74.4
Partial knowl.	5	5.9	7	15.2	0	0.0	12	7.5
No knowledge	0	0.0	0	0.0	29	100.0	29	18.1
Total	85	100.0	46	100.0	29	100.0	160	100.0

$\chi^2 = 163$; df = 4; p < 0.001

Table 2. Extension access by access to credit

Access to Credit	Access to extension							
	high extension access		Low extension access		No extension access		Total	
	n	%	n	%	n	%	n	%
High credit access	51	60.0	19	41.3	0	0.0	70	43.8
Low credit access	6	7.1	4	8.7	0	0.0	10	6.2
No credit access	28	32.9	23	50.0	29	100.0	80	50.0
TOTAL	85	100.0	46	100.0	29	100.0	160	100.0

$\chi^2 = 39.7$; df = 4; p < 0.001

Table 3. Year of adoption of improved seed by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
adopt 1994/95	78	97.5	45	56.2	123	76.9
adopt 94 or 95	2	2.5	5	6.3	7	4.3
did not adopt	0	0.0	30	37.5	30	18.8
Total	80	100.0	80	100.0	160	100.0

$\chi^2 = 40.1$; $df = 2$; $p < 0.001$

Table 4. Year of adoption of planting in lines by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
adopt 1994/95	80	100.0	53	66.2	133	83.1
adopt 94 or 95	0	0.0	7	8.8	7	4.4
did not adopt	0	0.0	20	25.0	20	12.5
Total	80	100.0	80	100.0	160	100.0

$\chi^2 = 32.5$; $df = 2$; $p < 0.001$

Table 5. Year of adoption of storage insecticide by Type of Farmer

Year of adoption	Type of Farmer					
	fpp		nfpp		Total	
	n	%	n	%	n	%
Adopted both 1994/95	76	90.0	31	38.8	107	66.9
Adopted either 1994 or 1995	2	2.5	3	3.7	5	3.1
did not adopt	2	2.5	46	57.5	48	30.0
Total	80	100.0	80	100.0	160	100.0

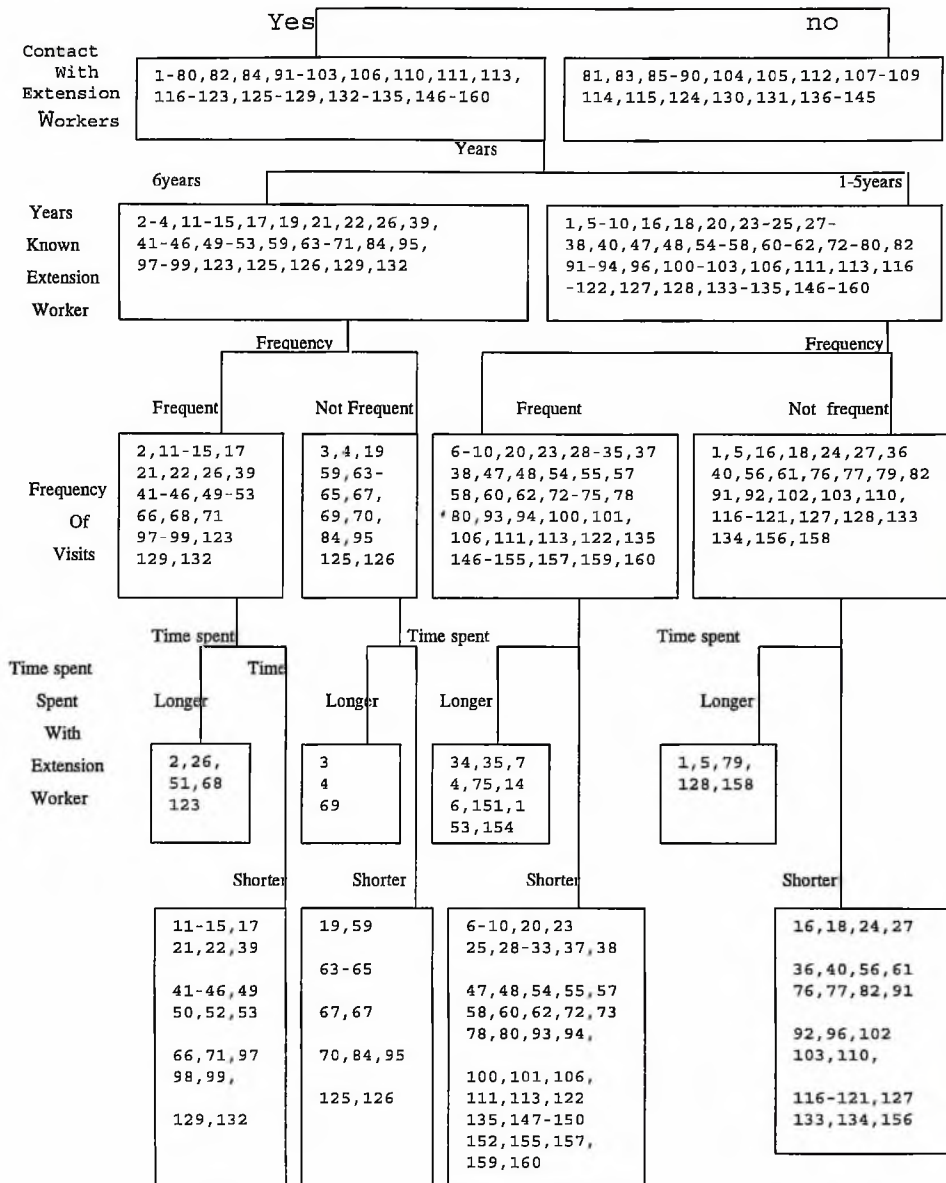
$$\chi^2 = 59.5; df = 2; p < 0.001$$

Table 6. Extent of adoption of maize technologies by access to credit

Extent of adoption	Access to credit							
	high credit access		low credit access		no credit access		Total	
	n	%	n	%	n	%	n	%
Full adoption	66	94.3	1	10.0	7	8.8	74	46.2
Partial adoption	4	5.7	9	90.0	43	53.7	56	35.0
Non adoption	0	0.0	0	0.0	30	37.5	30	18.8
Total	70	100.0	10	100.0	80	100.0	160	100.0

$$\chi^2 = 125.9; df = 4; p < 0.001$$

Appendix 11 ACCESS TO EXTENSION CONTACT



N.B. Each box contains the serial numbers of each respondent farmer