

**FACTORS INFLUENCING ADOPTION OF COFFEE  
PRODUCTION PRACTICES IN KIENI WEST AND MATHIRA  
DIVISIONS OF NYERI DISTRICT, KENYA.**



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BY

**MARTIN MWANGI KAGIRI**

**A Thesis Submitted to the Board of Graduate Studies, Egerton  
University, in Partial Fulfilment of the Requirements for the  
Award of the Degree Master of Science in Agricultural Extension**

**Egerton University.**



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## DECLARATION

I hereby declare that the work presented in this thesis is my original work and has not been submitted in part or other forms for a degree award in any other university .

Martin Mwangi Kagiri


Sign: 

Date: 25<sup>th</sup> August 2004.

## RECOMMENDATION


This thesis has been submitted with our approval as university supervisors.

1. Dr. Chegge Mungai

Sign: 

Date: 25/8/04

2. Prof. C. A Onyango

Sign: 

Date: 25<sup>th</sup> August 2004.

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## Dedication

Dedicated to the entire Mureithi's family, my fiance and friends. To them all, Life goes on.....for academics excellence. The past cannot be changed, but the future is till in your power.

## **Acknowledgement**

I express my sincere gratitude to my supervisors Dr. P Mungai and Prof. C. A Onyango for the invaluable professional and scholarly guidance, insightful criticisms, positive brainstorming and concise technical directives. I am grateful to staff and researchers of Coffee Research Foundation such as Ms. Loiose W. Njeru and Mr. Mbugua J.N; Tegemeo Institute staff and researchers such as Mr. Nyoro J,K Dr. Nguyo and Mr. Ngamba who gave me the background reading materials and technical handbooks to focus my research.

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## ABSTRACT

Smallholder coffee farming picked up after Kenya's independence in 1963. Mathira and Kieni West Divisions recorded recognized differences in coffee produce yet they share similar agro-ecologic conditions. This study sought to determine farmers' adoption of Coffee Research Foundation's recommended production practices and document the factors that have influenced adoption of the practices (beside price fluctuations) by smallholder farmers in Mathira and Kieni West division of Nyeri district. Ex-post facto survey design was used. A sample of 200 coffee farmers was selected. Four strata were formed, two from each division. From each stratum, 50 farmers were randomly. Pre-test of the research instruments was carried out involving Tumutumu coffee farmers. The instruments had a reliability coefficient of 0.7422 using Cronbach alpha coefficient method. Data was collected using validated interview and observation schedules and analysed using both descriptive and inferential statistics set to give results at alpha 0.05 level. Mean adoption of the Coffee Research Foundation recommended practices was 40.8%. Kieni West division had lower adoption (30.46%) while Mathira division had a higher adoption (53.15%). The most poorly adopted coffee production practices were fertilizer application (82% non-adoption), use of Ruiru 11 coffee variety (97% non-adoption) and use of herbicides and pesticide chemicals (97.5% non-adoption). Independent variables which had significant relationship with adoption of Coffee Research Foundation recommended practices were: knowledge of recommended practices, cost of coffee production practices, farmers' education levels and frequency of extension services delivery to farmers. There was a significant difference in adoption between Kieni West and Mathira Divisions. The study concluded that there was need for farmers' advisory services to improve adoption of recommended practices and consequently improve coffee production output. The study therefore recommends improvement in frequency of delivery of extension services to farmers. Policy makers should design strategies of reducing costs of farm inputs make cost of production affordable to coffee farmers.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background information

The history of coffee in Kenya dates back to the colonial era. Nyeri district falls among the major coffee growing Zones in the country due to its favourable moderate climate, with temperature averaging 24°C and rainfall at 1000mm per annum, favourable soil (Olivine basalt and volcanic ash originating soils), which is well drained, and deep reddish brown and fertile.

Coffee is grown throughout the upper midland agro-ecological zones in Kenya which include the main coffee zones and marginal coffee zones. In Nyeri District of Kenya coffee has been grown on the upper zones as a major cash crop since the mid 1960's. It is grown in six out of seven divisions, namely Othaya, Mukurweini, Tetu, Mathira, Kieni West and Nyeri Municipality. Small holder coffee is found in Mathira, Mukurweini, Tetu, Othaya and Kieni West divisions (G.O.K,1993). Growth of the smallholder coffee sector in Kenya has slowed down since late 1970's. The trend has been attributed to erratic export prices, increased input prices, deterioration of internal and external terms of trade, reduction of available land for cash crops due to high population growth and reduced credit, extension, marketing and research services (Karanja, 2002).

Due to the above factors, coffee farmers in most parts of Kenya have lacked incentives, willingness and financial power to maintain high yields. This has led to a sharp curtailment in input usage and adoption of recommended practices (Crandal, 1993). Consequently, coffee production has decreased by an estimated 61% in the past one decade (Karanja, 2002). In a few areas however, production levels have remained high.

Since the problems affecting the coffee sector are relatively uniform, there is a need for case studies to determine causes of observed variations in farmers' coffee outputs which are low in some regions in comparison to other regions of similar agro-ecologic and socio-economic conditions. Such an exemplified region is Kieni West in comparison to Mathira while both are Divisions in Nyeri District.

## **1.2 Statement of the Problem**

Smallholder coffee factories in Kieni West division were reported to be almost dormant due to low coffee output from farmers (MOALD, 2002). Production records showed that the factories had only been receiving dry coffee (Mbuni) since 1997 and remained inactive the rest of the year. But in Mathira division within the same district, farmers' output was still high (MOALD, 2002). It was not known why there was a difference in levels of production of coffee between farmers in Kieni West and Mathira Divisions. The factors influencing adoption of

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coffee production practices by farmers in the two areas needed to be investigated and results be compared and documented.

### **1.3 Purpose of Study**

The purpose of this study was to establish and document how adoption of recommended practices in coffee production had been carried out in Kieni West and Mathira Divisions respectively, in order to explain the difference in farmer output between them. The study shows how agronomic and extension factors other than price fluctuations had influenced adoption of recommended practices.

### **1.4 Objectives of the Study**

1. To determine the relationship between farmers' knowledge of Coffee Research Foundation (CRF) recommended practices on coffee and adoption of the recommended coffee production practices.
2. To determine the relationship between cost of production practices and adoption of the recommended coffee production practices.
3. To determine the relationship between farmers' education level and adoption of the recommended coffee production practices.
4. To determine the relationship between farmers' farm sizes and adoption of the recommended coffee production practices.

5. To determine the relationship between frequency of delivery of extension services to farmers and adoption of recommended coffee production practices.
6. To determine and compare the difference in adoption of recommended coffee production practices between Kieni West and Mathira Divisions.

### **1.5 Hypothesis of the Study**

- H<sub>01</sub> There is no significant relationship between farmer's knowledge of Coffee Research Foundation recommended practices and adoption of the recommended coffee production practices.
- H<sub>02</sub> There is no significant relationship between cost of production practices and adoption of the recommended coffee production practices.
- H<sub>03</sub> There is no significant relationship between levels of farmer's education and adoption of recommended practices.
- H<sub>04</sub> There is no significant relationship between a farmer's farm size and adoption of recommended coffee production practices in Kieni West and Mathira Divisions.
- H<sub>05</sub> There is no significant relationship between frequency of delivery of extension services to farmers and adoption of recommended coffee production practices.
- H<sub>06</sub> There is no significant difference in adoption levels of recommended coffee production practices between Kieni West and Mathira divisions.

### **1.6 Significance of the Study**

The information gathered through this research would provide useful feedback to the coffee researchers to enable them understand the field situation as far as adoption of recommended practices is concerned. The information may further be used by Extension agents and policy makers to enable them design appropriate strategies which would promote coffee farming among small holder farmers especially, where coffee production is low e.g. Kieni West Division.

### **1.7 Assumption of the study**

1. The data obtained from Farmers, Research institutions and Ministry officials were accurate and up to date.
2. The respondents were honest and precise in their response to questions asked during the research.

### **1.8 Limitation of the study**

The research required first hand information from the farmers yet most of them hardly kept written records. The accuracy of the data, wherever necessary depended on farmers' ability to recall and few records in their possession.

## 1.9 Output of the study

1. The research could provide valuable feedback to Coffee Research Foundations and other stakeholders in the coffee sector on levels of adoption of recommendations.
2. The research proposes other areas of study in order to promote adoption of recommendations and subsequently promote increase in coffee production.

## 1.10 Definition of Terms

**Adjacent** :- It means lying near to but not necessarily touching. Adjacent border was used in the study to refer to borders of Kieni West and Mathira Division which lie towards the Nyeri Municipality.

**Adoption**: - Refers to a decision to make continued use of an innovation as the best course of action towards achieving a goal (Adams, 1992). It was used to mean acceptance and continued use of recommended packages in coffee production practices.

**Coffee Production Practices**: - Refers to the custom routines and exercises that are carried out to obtain coffee yield (C.R.F, 2001). It has been used in the text to refer to weed control measures, pruning, fertiliser application, pest and disease control measures and soil and leaf analysis carried out by farmers in coffee production.

**Dormancy:** - State of inactivity, but awaiting further development or activity (Hornby, 2000). It was used to mean lack of coffee processing activity awaiting further intake of coffee to the factory.

**Extension Service Delivery:** - It refers to link between and spreading of farmer education, information or innovation from research to the field (Adams, 1992). It was used in the text to mean the access through which coffee farmers acquired the education and information as a resource in building their trust regarding the enterprise.

**Factors which Influence Adoption:** - Refers to components of an innovation that affect its relative advantage, triability and compatibility to the farmer's practices (Adams, 1992).

The study isolated knowledge of innovations, cost of adoption, farmer education, farm sizes and extension services delivery as significant factors influencing Kenyan farmers (Amudavi, 1993; Mbugua, 1996, Karanja, 2002).

**Knowledge of Recommendations:-** Knowledge is a state of being informed about something (Hornby, 2000). Knowledge of recommendations was used in the study to mean extent to which farmers were informed about the recommended coffee production practices.

**Rate of Adoption:** - Rate refers to standard of reckoning obtained by bringing two numbers or amounts into a relationship (Hornby, 2000). Rate of adoption was used to mean the percentage obtained out of the number of adopters to the total number of farmers for a particular study question.

**Recommended Practices:** - Recommended practices refer to an aspect considered as more favourable or fit for a specified purpose (Hornby, 2000). Recommended practices was used in the study to refer to the packaged and documented information by C.R.F and spoken of as ideal to produce particular coffee yields.

**Smallholder Farmers:** - Kenya's Ministry of Agriculture defines smallholder farmer as one who operates on a farm less than 20 hectares. It was used in the study to refer to all those coffee farmers registered and selling coffee output through coffee co-operatives.

# CHAPTER TWO

## REVIEW OF RELATED LITERATURE

### 2.1 Introduction

This chapter reviews literature related to coffee production technologies and social factors related to the process of adoption and diffusion of innovations among farmers. Agronomic research has been carried out to yield valuable recommendations in coffee production in Kenya. The recommendations have further been translated into terms and measures common to and recognisable by the small-scale farmers. Further, such terms and measures make communication of the innovation to smallholder farmers by change agents easy. Yet from the economic research documentation, Kenya's coffee output at about 65,000 metric tonnes is far below the expected output of about 93,000 metric tonnes (Tegemeo Institute, 1995). It has been attributed to non-adoption and or partial adoption of recommended coffee production practices by farmers.

### 2.2 Adoption of Innovations

Adams (1992) defined an innovation as a new idea, method, practice or technique which provide means of achieving continued increase in farm production and income. Extension workers' role is to encourage farmers to adopt innovations of proven value. Farmers should carry out method-demonstrations and participate in

farmer discussions. Farmers who have benefited from particular experience are likely to present it in a more meaningful and authentic way than a specialist (Adams, 1992). Schlutz showed that smallholder farmers in adopting an innovation were rational (Lugogo, 1983). He suggested that small holder farmers were rational thus allocated their resources efficiently, consistent with their values, goals, resources and constrains. As a form of survival mechanism, farmers' behaviour was governed by attempts to minimise costs and to maximise the expected net gains. In that respect, farmers actual field practice was not a random uptake but a gradual model change which pivoted along expected gains and actual gain experienced over period of time.

Adams definition of adoption is compatible with Schultz's argument. Adoption, according to Adams is not a sudden event but a process. Farmers do not accept innovations immediately but take time to think over and make decisions. An illustrated scheme for explaining the adoption process is four staged as follows (Adams 1992):-

1. Knowledge stage: Individuals learn of the existence of innovation and gain some understanding of its function.
2. Persuasion stage: Individuals form a favourable or unfavourable opinion of the innovation
3. Decision stage: Individuals engage in activities, which lead to choice between adoption and rejection.

4. Confirmation stage: Individuals make final decision to accept or abandon the innovation

### **2.3 Qualities of innovations that influence adoption**

Some of the qualities of an innovation which influence its adoption include the innovation's relative economic advantage, triability, compatibility, complexity and observability (Vago, 1990). The way the potential adopters perceive the qualities of an innovation may differ widely from the actual characteristics of the innovation. The qualities attract the potential adopter only when he/she recognises and perceives them as necessary or favourable. Technologies developed for farmers may have various qualities that influence the farmers' perception and process of decision making regarding acceptance or rejection of the innovation.

#### **2.3.1 Relative advantage**

Potential adopters may regard an innovation as either superior or inferior to the existing technology. Relative advantage refer to the degree to which an innovation is considered superior to the prior technology. It is determined in terms of its efficiency, cost effectiveness or perceived advantage (Vago, 1990). It is often expressed in terms of economic profitability although it can also have other social dimensions such as low initial costs, low perceived risk, saving time and effort. Smallholder farmers place considerable emphasis on short term profitability associated with adoption of an innovation. Adams (1992) suggested that in order to guarantee adoption of a new innovation, its profitability needs to be at least

30% over the previously used practice. Salasya (1999) noted that agricultural technologies may increase yields at research level but not at farmer level. The greater the perceived relative advantage by farmers in regard to an innovation, the higher the probability that farmers will adopt the innovation.

### 2.3.2 Compatibility

Farmers may perceive a new technology as consistent or not consistent with the existing innovations. Compatibility refers to the degree to which an innovation is perceived as consistent with the existing value, past experiences, goals of the farmer and existing farm technology (Vago, 1990; Adams 1992). This quality relates positively to the rate of adoption of an innovation. Technology that is highly consistent with the farmers' existing social-cultural values, beliefs, past experiences, farmers' needs and objectives is likely to be accepted and adopted.

### 2.3.3 Triability

Farmers may wish to experiment with new innovation before they make final decision to fully implement the technology. Triability refers to the degree to which an innovation can be experimented on limited basis to determine its efficiency before actually adopting the innovation on a large scale (Vago, 1990; Adams, 1992). Innovations that can be tried on a limited scale are more likely to be adopted by farmers because they minimise risks to the adopter. Triability of an innovation as perceived by farmers is positively related to its rate of adoption. Technologies that can be separated into smaller units tend to be adopted more easily than those that cannot be separated. Farm inputs such as improved seeds

and farm chemicals (Pesticides and fertilisers) can be bought in small amount that can be tried out on the farm before being fully implemented on large scale (Adams, 1992). Triability of an innovation gives farmers a chance to assess the performance of the innovation themselves under their own conditions, thus reducing the perceived risks and enhancing quick acceptability.

#### 2.3.4 Complexity

Farmers may perceive a new technology as difficult to understand and apply. Complexity refers to the degree to which an innovation is seen as relatively difficult to understand and use in respect to the superceding innovation. The rate of adoption will be slower when members of a particular social system perceive an innovation as complex (Vago, 1990). Most small-holder farmers do not possess the required technical skill necessary to use complex agricultural technologies effectively. Simple and flexible innovations are easily understood by and more preferable to smallholder farmers. Smallholder farmers are more easily influenced by and are likely to adopt simple and flexible innovations such as use of improved seeds and farm chemicals.

#### 2.3.5 Observability

Farmers may easily observe the outcome of some innovations such as new variety of seeds or fruits. Observability refers to the degree to which the results or the characteristics of an innovation are visible as perceived by a member of a particular social system (Adams, 1992). On-farm trial designed to test an

innovation or technology under farmer's conditions are essential for increased rate of adoption of the innovation.

#### **2.4 Diffusion and Adoption of Coffee Innovations**

Research Liaison and Advisory division of C.R.F is responsible for providing linkage between C.R.F and coffee farmers by providing and encouraging continuous contact between the coffee growing community and C.R.F (C.R.F.2001). The function is achieved through visits to smallholder farmers, plantations and related organisations. Besides, the division is mandated to provide a medium of communication of research findings, information and news of direct relevance and interest to the coffee growers, co-operatives, extension workers and the general public. Mass media and group approach are emphasised in support of other extension methods (C.R.F, 2001).

In enhancing diffusion of innovation, Research Liaison and Advisory Division reviews and compiles technical material into technical circulars, handouts and brochures, magazines and newsletters. The Division also organises field days and seminars and co-ordinates the distribution of coffee seeds, manages CRF demonstration plots and encourages their use by the extension staff, societies and farmers as training venues.

Nyoro and Roe (1986) argued that factors inhibiting adoption of C.R.F technical recommendations included poor and delayed payments for cherry, inadequate credit provision, unsatisfactory extension services, non-availability of inputs and seasonal labour shortages. They suggested a need to explore effective ways of overcoming the constraints to improve adoption of recommendations by farmers. The authors further argued that with adoption of the input packages on overall smallholder coffee, an increase in productivity from 567kg/ha clean coffee to 915 kg/ha (61%) would be expected. However, they emphasised that the recommendations were complementary and should be considered as a package rather than in isolation. Yet, improving small holders knowledge of coffee husbandry via extension will not be an effective way of encouraging adoption of improved practices if payments for cherry were poor or inputs not available (Nyoro, 1995). In a study on agro-chemical use in Machakos, Kitulu (1980) found that smallholder farmers used C.R.F recommendations poorly because they operated under certain social-economic constraints, hence they failed to realize the benefits of adoption of innovations. A study on adoption of Ruiru-II coffee variety by Karanja (1993) attributed low adoption level to low coffee prices and attendant problems. The adoption rate was 15% by smallholders and 18% by large estate sector four years after introduction of the variety.

Other studies revealed that low knowledge status about an innovation among non-adopters and subsequent unfavourable perceptions held by the farmers about the

innovation had contributed to low adoption rate (Mbugua, 1996). In his study involving 140 coffee farmers in Kiambu, Mbugua observed a significant relationship between farmers' knowledge about Ruiru-II and adoption of the variety. Also, farm sizes and contact with information sources were found to influence adoption rate since there was significant relationship between those variables. Education level was found to have no influence on adoption of the coffee variety while increased coffee prices were observed to increase the desire to adopt the coffee variety.

## **2.5 Recommended Coffee Production Practices**

The Coffee Research Foundation in Kenya was committed to and responsible for carrying out research on all aspects of coffee, and disseminating the findings to interested parties. C.R.F Agronomy department had produced a Handbook with recommended practices in coffee farming. They included coffee nursery practices, coffee varieties, coffee establishments, methods of weed control, pruning practices, such as types and time of pruning, manure and fertilisers, soil and leaf analysis, coffee diseases and pests and their control and coffee processing practices (C.R.F, 2000).

## **2.6 Factors Related to Adoption of Innovations in Coffee Production**

Several studies carried out on adoption of innovations produce a wide range of factors related to adoption. Studies in economic factors affecting farmers' uptake

of recommendations further provided a focus on hindrances of coffee farmers to adoption of recommended practices.

### 2.6.1 Cost of Adoption

Involvement of Progressive farmers as contact farmers by extension agents was practiced in Kenya, Tanzania and Malawi among other countries of Africa. However, very little benefit of this effort reached masses of small farmers. A study in Kenya's central province showed that concentration of extension efforts on progressive farmers succeeded in influencing only ten to fifteen percent of the farmers. Similar problems were recorded in farmers' schemes in Malawi and Zimbabwe in what was named as master farmer scheme (Adams, 1992).

Karanja (2002), in his study on liberalisation of smallholder agricultural development, observed that prices of smallholders coffee had led to low farmers income and high cost of production. Other studies and reports (Crandall, 1993; CBK, 1994; Tegemeo Institute, 1995) pointed out the high costs involved in adoption of recommended practices to be a strong hindrance to farmers in adopting recommended husbandry practices.

### 2.6.2 Farmer's Level of Education

Various studies showed varied effects of education in influencing adoption of innovations. Farmers' formal level of education did not influence their knowledge

about Ruiru-II, thus it was not related to adoption of the variety (Mbugua, 1996). Voh's study in Nigeria as cited by Mbugua (1996) showed that educational level accounted for only 4% of the total variability in adoption.

However, Amudavi (1993) showed that education level influenced the rate of adoption. He found that among farmers who adopted high yielding varieties of maize, 25% were illiterate, 65% had primary education while 11% had secondary education. Another study on effectiveness of Training and Visit system of extension in Kenya showed that higher education among Kenyan household heads had led to higher and earlier adoption farm practices (World Bank, 1993). Ndiema (2002) found that 59.3% of wheat farmers in Rongai and Njoro divisions of Nakuru District, Kenya had either secondary or tertiary education which had added managerial competence to the farmers and ability to understand, comprehend and respond to new ideas. The above studies suggested that education level influenced awareness and acquisition of information on respective technologies.

### 2.6.3 Farm Size

Mbugua (1996) in a study on adoption of Ruiru-II variety found farm size to be the most significant variable affecting adoption of the coffee variety. The finding was consistent with Kibende, Gunial and Coffin (1990) that farm sizes affected adoption of ox-ploughs in Ethiopia but contrasted with Amudavi (1993) whose

findings showed no relationship between farm size and adoption of maize technology in Western Kenya. Sutti Ortiz as cited by Lugogo (1983) in a study conducted in Columbia found that decisions in food crops appeared to be rather haphazard and disorganised while in cash crops such as tea and coffee, decisions were more organised and extended over time. Karanja (2002) found that in Kenya's small holder farming, there was disproportionate allocation of land and other resources to food crops than cash crops. Most of the farmers in Nyeri owned small pieces of land owing to subdivision (GOK, 1993). In Njoro and Rongai 78.7% of the wheat farmers owned less than twenty hectares of land (Ndiema, 2002).

#### 2.6.4 Knowledge of Innovation

Knowledge and awareness of an innovation reaches the farmers through communication process. A study on farmer's behavioural response by World Bank (1993) indicate positive relationship between contact sources of information and farmers response to change. Communication channels used by farmers have been isolated as mass media from government and commercial sources, personal contacts with Extension Officers and representatives of commercial firms either as individuals or in small groups, and personal contacts with other farmers (Adams, 1992). In Kenya, besides public Frontline Extension Workers support services to farmers, C.R.F through its liaison division promotes farmer education through seminars, provision of technical materials and advise, translating and

disseminating research findings in coffee (C.R.F, 2000). Ndiema (2002) found that farmers who had knowledge and awareness of some selected wheat production technologies varied extensively in adoption of one technology to the other. The knowledge of particular technologies originated from research level. Further, Ndiema found knowledge of technologies to be crucial to potential adopters in decision making regarding the technology.

#### 2.6.5 Extension Services

Study on adoption of Ruiru-II variety in Kiambu revealed that contact with information sources influenced adoption. Most of the adopters (36%) had very high contact with information sources while the non-adopters (29%) had very low contact with information sources. Contact with information source involves extension services. The adopters indicated they had visited C.R.F station in a series of field days organised to launch the coffee variety (Mbugua, 1996). Extension services act as a resource in building farmers trust regarding an innovation. Extension services provide a link between agricultural research and farmers.

Figure 1 shows flow of information from the research institutions to the farmers. Extension workers act as a linkage between researchers and the farmers. They deliver the technologies developed by the research institutions to the farmers and provide feedback from the farmers to the research institutions.

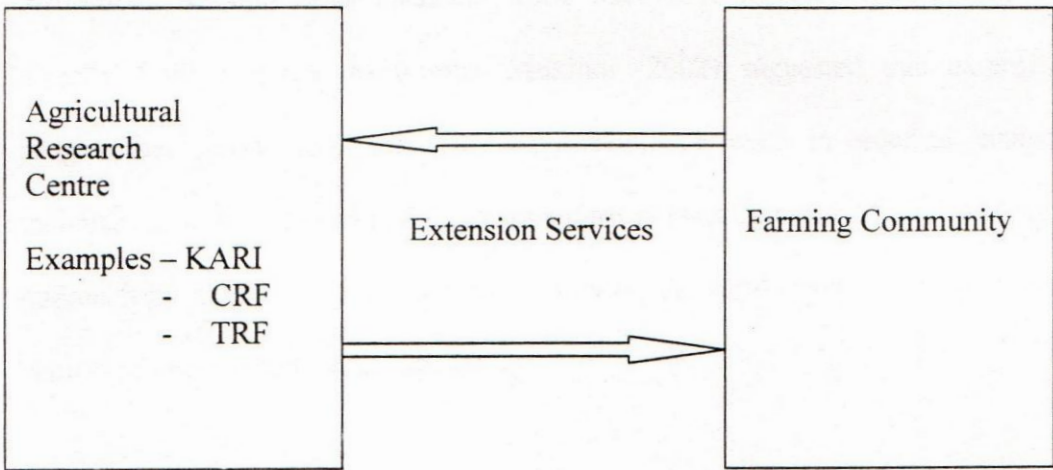


Figure 1: Research -Farmer linkage through Extension Services

Extension services provide a medium for communicating new technologies to farmers and existing problems to research. Technical advice to assist the farmers improve their productivity is also transmitted through extension services. Extension has a role of ensuring that high quality knowledge is present in the farming community. The information help to increase adoption rates by providing knowledge which reduces technical uncertainty. Farmers acquire information regarding an innovation through various sources, then they try to clarify the

information. Extension agents clarify such information to the farmers, and provide any other new and relevant information to the farmers. Ndiema (2002) found that 52% of the wheat farmers in Njoro Division, Nakuru district had got information from their fellow farmers and 32% got the information from extension agents. Majority of the farmers (84%) got the information that had passed from research institutions through other channels while only 10% received the information directly from research institutions. Mukindi (2002) suggested that extension programmes should focus beyond mere subsistence levels in order to enhance increased income earnings and general welfare of target groups. Multidisciplinary approach by extension services towards solving the rural development problems should be encouraged (Mukundi, 2002).

## **2.7 Status of Coffee Production in Kieni West and Mathira**

A total of 78% of Kenya's coffee production was done by the smallholders (CBK, 1994). In Nyeri district, coffees Co-operative Societies played the role of processing, storage and marketing of the commodity. Nyeri district reported licensing of five private coffee factories by 1993/94 financial year. However, none of them was started. The same financial year reported factory development by co-operative societies to be uneventful in terms of construction of new factories and renovation of the old ones (MOALD, 1994).

Kieni West division had two Coffee Co-operative Societies with one coffee processing factory each. Ikumari coffee factory was recorded dormant in 1993. The factory reported dormancy due to inadequate coffee supply from the farmers (MOALD, 1994). Mweiga Farmers Co-operative factory was fully operational up to 1997, and then it also became dormant. In their dormancy state, the factories remain closed for a large part of the year then they received and processed dry coffee (Mbuni) from farmers during specified periods. Dormancy was attributed to inadequate coffee supply from farmers. Later reports (MOALD, 2002) showed that forty percent (40%) of the farmers picked ripe cherry while others waited to pick mbuni. Average yield was recorded as 0.3 tonnes per hectare.

Mathira division with 4290 hectares had the largest area under coffee production in Nyeri district. It had fifteen co-operative societies with a total of thirty six coffee processing factories. Mathira division, among other divisions of Nyeri district reported general decline in field husbandry on coffee. The decline in coffee husbandry affected both the amount and quality of the produce. The report indicated that the farmers had intercropped coffee with potatoes, maize, beans and napier grass. Other farmers were observed to reconsider the neglected coffee farms that had gone out of production bringing them to near normal production. The division reported a commendable coffee output of 2.4 tonnes per hectare (MOALD, 2002).

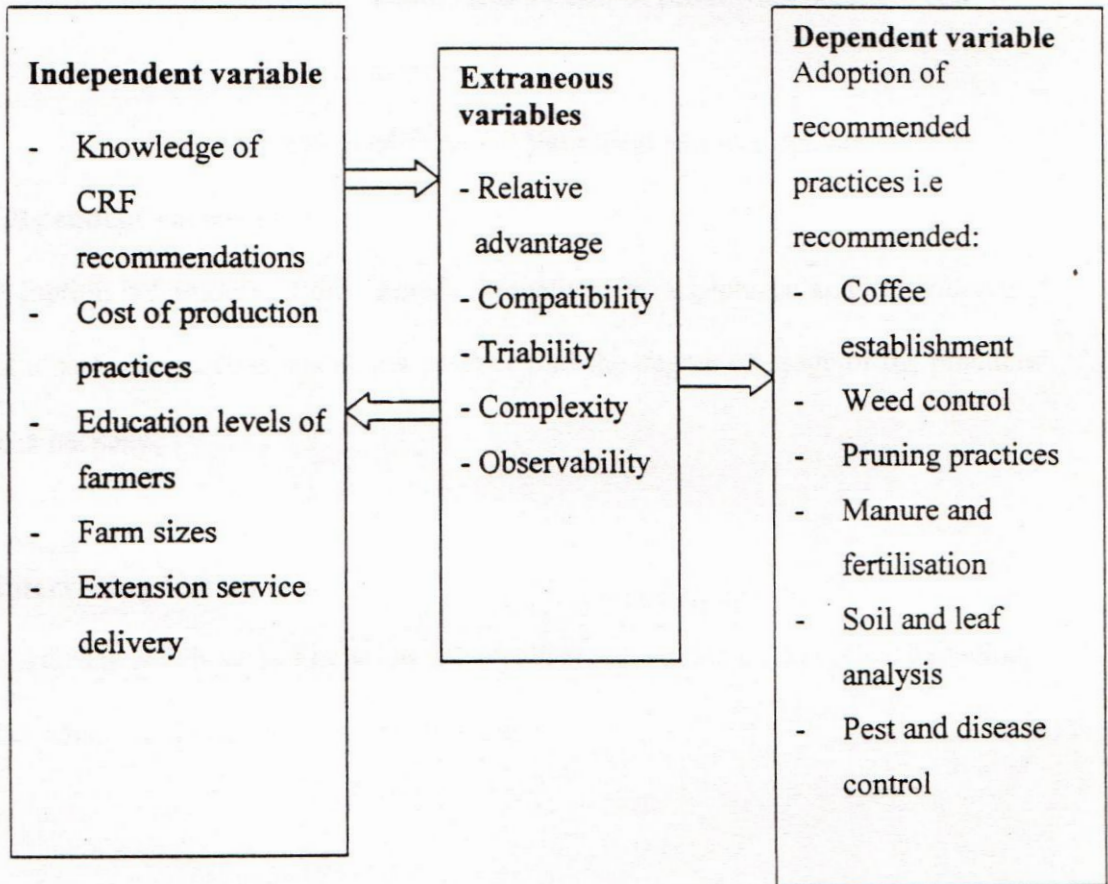
## **2.8 Summary of literature review**

Adoption of innovations by farmers has been widely studied by scholars. However, contradicting outcomes have continuously been generated. New technology introduces into a farming system features which are perceived differently by potential adopters. The features lead to either failure or success in adopting an innovation. Adoption of an innovation is influenced by factors that could be categorised as personal factors of the farmers, social economic factors affecting the farmer in a farming community and technological factors regarding the innovation. Successful adoption may be associated with study of factors influencing particular farming community. The literature reviewed suggested need to investigate factors influencing adoption of technologies such as those developed by institutions like KARI and CRF in order to understand farmers responses.

## **2.9 Conceptual framework**

The underlying theory guiding the development of this conceptual framework was extension theory of adoption. Adoption is influenced by knowledge, education, costs related to innovation, and land size (Lionberger, 1996). Extension services play an important role in influencing adoption of innovation by farmers. Other factors that may also influence adoption of innovations by farmers include knowledge of the innovation and recommended production practices as well as personal psychological difference of individual farmers. Adoption of coffee production practices was identified as dependent variable while selected independent variables identified to guide the study were: knowledge of CRF recommended practices, Costs of adoption of production practices, farmers'

education level, Farmers' farm sizes, extension services delivery and localities of farmers (Kieni West versus Mathira division). Figure 2 shows a conceptual framework developed on the basis of adoption theory discussed above to illustrate factors related to adoption of coffee production practices by smallholder farmers in Kieni West and Mathira divisions.



**Figure 2: Conceptual framework for the study**

The model illustrates factors related to adoption of coffee production by smallholder farmers.

### **Independent variables**

They include:

- Personal factors - farmers knowledge and level of education
- Socio- economic factors - cost of production practices and farm sizes
- Technological factors - Extension services delivery.

### **Dependent variables**

Adoption behaviours of the farmer is actualised by acceptance and continued use of a particular coffee production practice and the degree of usage of the practices as a package.

### **Intervening Variables**

Variables which were known to affect observed outcome (Adoption behaviour) but which could not be seen or manipulated.

# CHAPTER THREE

## RESEARCH METHODOLOGY

### 3.1 Introduction

This chapter describes the sampling procedure for the research and the population involved. It describes the process of data collection, instruments used, organisation and analysis of the data collected.

### 3.2 Research Design

The research was carried out using an ex-post facto survey design with an interview schedule and observation schedule as the instruments for data collection. The design was chosen because the variables studied had occurred and the responses from the farmers were based on passed experiences and observations. The design assures quality data with limited resources where the researcher no control over the respondents as in this study (Tuckman, 1978; Olvem and Abel, 1999).

### 3.3 Location of the Study

The study was carried out in Kieni West and Mathira divisions of Nyeri district in the Central Province of Kenya. The Divisions are medium potential agricultural zones where coffee is grown. The divisions lie between the Aberdare ranges and

the windward side of Mt. Kenya. Mathira Division, with 4290 hectares of land has the largest area under coffee production in Nyeri District. It was also the highest unit producer of coffee in the District with 2.4 tonnes per hectare. Kieni West division on the other hand had recorded poor coffee productivity with only 0.3 tonnes per hectare.

### **3.4 Population of the Study**

The study involved smallholder farmers of coffee in both Kieni West and Mathira divisions. This consisted of a total of 14935 smallholder coffee farmers.

### **3.5 Sampling Procedure and sample**

The target population was the smallholder farmers in Kieni West and Mathira Divisions. Between Kieni West and Mathira Divisions is sandwiched Nyeri Municipality in which large-scale coffee farming is practised. Nyeri municipality was not involved in the study.

Smallholder farmers form co-operatives which manage factories through which they sell their coffee, thus the lists of participant farmers were derived from the factories in which they were registered as members.

The entire population of smallholder farmers in Kieni West and Mathira Divisions was randomly stratified into four strata (to create sub-populations of expected homogeneity) (Kathuri & Pals, 1993; Olvem & Abel, 1999). There were two strata for each Division, one consisting those farmers whose farms bordered Nyeri

Municipality and another consisting of farmers whose farms were farthest from the Nyeri Municipality. The following steps were used to obtain participant farmers:

1. Two sets of sample sizes were created in each Division. Since the two Divisions border by Nyeri Municipality, the first sets referred to as “A” from each Division consist of farmers closest to the Nyeri Municipality. The second sets referred to as set “B” comprised farmers on the far-ends of each Division. Farmers in the central locations of each Division were excluded to create borders between the sub-groups (sets). In Mathira Division, the stratum of farmers bordering Nyeri Municipality delivered their coffee to: Marua; Ruguru; and Karuhi coffee factories. Those farthest from Nyeri Municipality delivered their coffee to: Gikanda; Iria-in; Muga; Gakuyu; and Gatina coffee factories. In Kieni West Division, there were two factories only. Farmers closest to Nyeri Municipality delivered coffee to Ikumari coffee factory while those farthest from Nyeri Municipality delivered their coffee to Mweiga coffee factory.
2. According to Kathuri & Pals (1993) and Olvem & Abel (1999) the minimum sample size for sub-group in survey research is 20 subjects. For this study 50 farmers were selected from each stratum. Proportionate sampling was used to determine the number of farmers selected from each factory. The number of sample farmers derived per factory was determined as follows:

$$n_1 = F_R / T_S \times U$$

Where  $n_1$  = number of farmers derived per factory,

$F_R$  = number of farmers registered in particular factory,

$U$  = number of units required per set (sub-group), and

$T_S$  = Total number of farmers in factories comprising a given set (sub-group)

3. Farmers derived from each factory ( $n_1 + n_2 + n_3 + \dots + n_n$ ) were added to comprise the total sample number of units of respondent farmers ( $N$ ) for the research. A total of 200 farmers derived from ten factories in both Divisions were used as respondents for the study. A minimum of one hundred subjects is recommended as suitable for survey research to give an outcome at 95% level of confidence (Kathuri & Pals, 1993; Olvem & Abel, 1999), but two hundred subjects were preferred to increase internal validity for research.
4. Separate lists of farmers according to their membership in their factories in each sub-group (set) were gathered. Respondent farmers were randomly selected from the lists using a table of random numbers.

Table 1 shows a summary of the number of respondents drawn from each factory. Also indicated are the sub-totals for each stratum (set). Sub-groups (sets) comprised of 50 farmers each. The total number of selected respondents was therefore 200 coffee farmers.

**Table 1. Summary of research population and sample**

<b>Division</b>	<b>No. of Registered farmers</b>	<b>No. of Selected farmers</b>
<b>Mathira division</b>		
<b>Co-ops in Set A</b>		
1. Marua Coffee Farmers	2018	18
2. Ruguru Coffee Farmers	1956	17
3. Karuhi Coffee Farmers	1750	15
<b>Sub-total</b>	<b>5724</b>	<b>50</b>
<b>Co-ops in Set B</b>		
1. Gikanda Coffee Farmers	2147	12
2. Iriaini Coffee Farmers	1700	10
3. Muga Coffee Farmers	3088	17
4. Gakuyu Coffee Farmers	1387	8
5. Gatina Coffee Farmers	509	3
<b>Sub-total</b>	<b>8831</b>	<b>50</b>
<b>Kieni West division</b>		
<b>Co-op in Set A</b>		
1. Ikumari Coffee Farmers	180	50
<b>Co-op in Set B</b>		
Mweiga Co-Op Farmers	200	50
<b>Grand total</b>	<b>14935</b>	<b>200</b>

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### **3.6 Sample**

The sample size was two hundred (200) Coffee farmers from the two Divisions. The number was determined using the recommendations of Kathuri & Pals (1993) and Olvem & Abel (1999) regarding groups and sub groupings in survey research. The sample size was arrived at from a population of fourteen thousand nine hundred and thirty five (14935) so that there would be a ninety five percent (95%) level of confidence. The recommended minimum sample is a hundred (100) subjects for a group and twenty (20) subjects for a sub-group in survey research.

### **3.7 Instrumentation**

The research data was collected by use of an interview schedule and observation schedules. Farmers were visited on their farms. The interview schedule was administered to the selected smallholder farmers on their farms, while observations were made and recorded on the observation schedule in the farmers' coffee fields.

#### **3.7.1 Development and validation of instruments**

The schedules for the research were developed based on objectives of the study. The instruments were scrutinized and found to be content valid by peers, and selected experienced lecturers in the department of Agricultural Education and Extension of Egerton University. Individual coffee experts at Coffee Research

Foundation station made further inputs. All useful comments were effected to improve precision of the schedules.

### 3.7.2 Pre-testing the instruments

Pre-testing was done in Mathira Division involving Tumutumu Coffee farmers. The farmers were excluded from the main study. Twenty farmers (20) were interviewed and practices observed. Results of the pre-test indicated a reliability coefficient of 0.7422 using Cronbach alpha coefficient method. More items were added on extension services delivery, the area that seemed to require information.

### 3.7.3 Measurement of Variables

The main dependant variable for the study was adoption of recommended coffee production practices by smallholder farmers in Kieni West and Mathira Division. Adoption was measured using discrete variable where farmers who practised correct coffee production stipulations were considered as adopters of the recommended technology. Considering the number of scores in respect of the expected range, adoption index was computed to describe level of adoption of a farmer or group of farmers. Independent variables whose influence on adoption of recommended coffee production practices was studied included the following:

#### 3.7.3.1 Knowledge of CRF recommended practices

A series of twelve questions was asked to the farmers. The items covered six areas of coffee production technologies, namely coffee establishment; weed

control; pruning practices; fertiliser and manure applications; soil and leaf analysis; pest and disease control. Based on farmers responses in respect to expected response they were scored as either knowledgeable, uncertain or not knowledgeable.

#### 3.7.3.2 Cost of adoption of coffee production

Farmers were asked questions regarding to the frequency at which an activity was carried out per given memorable period of time. For example:- they were asked to give number of days they picked coffee per month. They were also asked questions regarding costs of production. The responses were recorded and computed through a period of one year to give respective estimated costs of coffee production practices carried out.

#### 3.7.3.3 Farmer's education level.

Farmers were asked the highest level of education attained. They were categorised into "less than primary education," "Primary education," "Secondary education", "College education" and "Higher education". College education referred to any short formal educational course while higher education referred to formal classroom education beyond form four, thus they were treated as separate variables in this study.

#### 3.7.3.4 Extension Services delivery.

Sources through which farmers acquired information were predetermined. The farmers were asked if they got information through each one of them at a time. Where they did, they were asked to describe the frequency of information

acquisition. Discrete variables were used on a Likert scale to rate the frequency of extension services delivery to farmers as either “very often”, “often”, “sometimes”, “Not often” or “Not at all”.

### **3.8 Research data**

#### **3.8.1 Data Collection Procedure**

Legal permission to collect the data was obtained from the Assistant Director, Ministry of Education, Science and Technology Headquarters Office in Nairobi. Copies of the research permit were dispatched to the District Commissioner, District Education Officer and District Agricultural Officer in Nyeri district. To commence the data collection, Divisional Offices were visited by the researcher where Divisional Extension Co-ordinator and Co-operative officers provided the lists of co-operatives, factories and membership. Random numbers were used to select farmers from the factories lists. Directions to travel to the locations of the selected factories were also obtained. A local resident assisted in the location of respondent farmers. The respondent farmers were visited on their farms and interviewed. Observation and recording on the observation schedule of adopted practices was also done on the coffee field for each farm visited.

#### **3 8.2 Data analysis**

The collected data were organised to answer the set objectives and hypothesis of the study. Organisation of the data started with coding of the questionnaire items.

The coded data was then tabulated in spreadsheets. The variables were then designed in the computer SPSS programme. Coded data were entered into the programme for quantitative and qualitative analysis. For qualitative data the findings were summarised to determine the relationship between various variables. For quantitative data, the findings were summarised in tables showing percentages and frequency distributions.

Microsoft Windows statistical package for social sciences (SPSS) was used for data analysis involving both descriptive and inferential statistics. The process of data analysis followed the order of specific objectives and hypothesis of the study. For the descriptive statistics, frequency tables and bar charts were used to present results. Pearson product moment correlation was used to determine relationships for the first five hypothesis. T-test was used to determine if differences existed in hypothesis six. Chi-square was used to describe association between sub-groups in hypotheses six. Table 2 shows a summary of hypothesis variables and analysis procedure for the study.

**Table 2: Summary of analysis procedure for the study**

<b>Hypothesis</b>	<b>Independent Variable</b>	<b>Dependent Variable</b>	<b>Tests and Analysis</b>
H <sub>01</sub> . There is no relationship between a farmer's knowledge of CRF recommended practices and their adoption.	Knowledge of CRF recommended practices	Adoption recommended practices	of Pearson Correlation
H <sub>02</sub> . There is no relationship between cost of production practices and adoption of the recommended practices.	Cost of coffee production practices	Adoption recommended practices	of Pearson Correlation
H <sub>03</sub> . There is no relationship between farmer's education level and adoption of recommended practices.	Farmer's education level	Adoption recommended practices	of Pearson Correlation
H <sub>04</sub> . There is no relationship between a farmer's farm size and adoption of recommended practices.	Farm size	Adoption recommended practices	of Pearson Correlation
H <sub>05</sub> . There is no significant relationship between frequency of delivery of extension services to farmers and adoption of recommended practices.	Extension services delivery	Adoption recommended practices	of Pearson Correlation
H <sub>06</sub> . There is no significant difference in adoption of recommended practice between Kieni West and Mathira divisions.	Kieni West, Mathira	Adoption recommended practices	of T-test Percentages

# CHAPTER FOUR

## RESULTS AND DISCUSSIONS

### **4.0 Introduction**

This chapter presents the results of the study in relation to each objective and hypothesis. The prime purpose of the study was to determine and describe the factors influencing adoption of coffee production practices by small scale coffee farmers in Kieni West and Mathira divisions of Nyeri district in Kenya and how those factors are related to the adoption of the CRF recommended coffee production practices. Alongside the objectives of the research, substantial amount of relevant information was obtained. The study outcomes are presented according to specific objectives and hypotheses of the study.

### **4.1 Adoption of CRF recommended Production practices**

Adoption of CRF recommended practices was the dependent variable for the study. To measure the variable, observation schedule was used. The five coffee production practices (coffee establishment, weed control, pruning practices, fertilizer and manure application, coffee pest and disease control) were broken down into fifteen (15) observable activities of the expected field practices.

The fifteen field practices were observed on farmers' coffee fields and scored as either "adopted" or "not adopted" on the observation schedule. For "adopted" a

score of two (2) was awarded while for “not adopted”, a score of zero (0) was awarded for each of the fifteen practices. So the expected range of the index for any farmer was Zero (0) to thirty (30). The actual range of index however, was zero (0) to twenty six (26), meaning that there was a farmer who had not adopted any of the recommended practices and none of the farmers had fully adopted the CRF recommended practices.

### **Categories of adopters**

Based on the actual adoption range of index (zero to twenty six) adoption was categorised into the following three groups.

**Table 3: Categorical adoption index**

Index range of adoption	Categorical group of farmers
0 to 9	Low adopters
10 to 19	Moderate (average) adopters
20 and above	High adopters

By way of aggregation and analysis, 35.5% of the farmers were low adopters of the CRF recommended production practice, 50% were moderate adopters while 14.5% were high adopters. Figure 3 below shows the level of adoption of CRF production practices in both Kieni West and Mathira divisions.

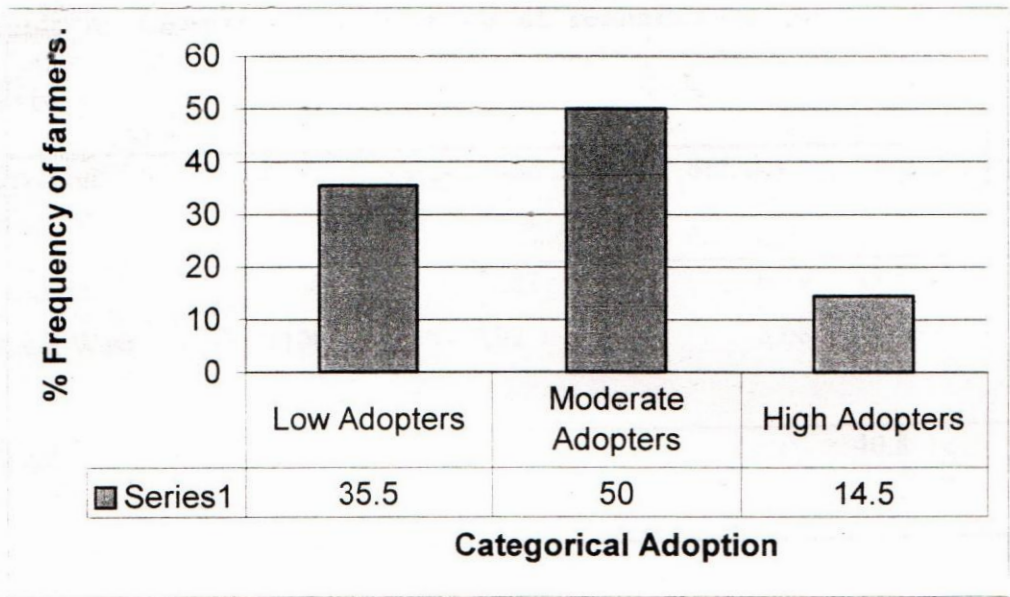


Figure 3: Adoption frequency distribution

Cross tabulation analysis between the two Divisions shows that adoption of CRF recommended production practices in Kieni West Division was low in relation to that of Mathira Division. Within an adoption index range of twenty six (26) Mathira division had an average adoption index of 13.82 while Kieni West had an average adoption index of only 7.92. This implies that there was mean adoption of 53% in Mathira while Kieni West had 30% mean adoption of recommended coffee production practices. Table 4 illustrates the above statements.

**Table 4: Comparison of adoption of recommended practices between divisions**

Division	n	Mean adoption index	Std. dev	Valid percent
Mathira	100	13.82	6.79	53.15
Kieni West	100	7.92	5.68	30.46
Total	200	10.87		40.8

The poor adoption of CRF recommended practices conforms to the wide disparity in Coffee production output between Kieni West and Mathira Divisions. Kieni West recorded only 0.3 tonnes per hectare while Mathira recorded 2.4 tonnes per hectare in the year 2001 /2002 coffee production (MOALD, 2002).

## **4.2 Findings by objectives of the study**

### **4.2.1 Knowledge of recommended practices.**

The first objective sought to determine the relationship between knowledge of CRF recommended practices and adoption of recommended practices by small scale coffee farmers in Kieni West and Mathira Divisions. To measure the level of knowledge of coffee farmers about recommended production practices, a series of questions were asked to farmers covering the five recommendation areas namely; coffee establishment, weed control, pruning, fertiliser and manure

application, soil and leaf analysis, pest and disease control. A three-point Likert scale was constructed to record the farmers' level of knowledge (see appendix A). A total of twelve (12) items were scored. Knowledgeable was awarded a score of 2, Uncertain was awarded a score of 1 and not knowledgeable was awarded zero in the Likert scale. Knowledge index range was computed for each farmer. An index range expected out of the twelve items was zero (0) to twenty four (24) but the actual index range obtained from farmers responses was six (6) to twenty four (24). This means that the farmer who had the lowest knowledge had an index of six while that with the highest knowledge of recommended practices had twenty four (fully knowledgeable). Table 5 presents categorical groups of farmers that were made based on their level of knowledge of recommended production practices.

**Table 5: Categorical knowledge index**

Index Range of Knowledge of Recommendations	Categorical groups of farmer
6 – 11	Low knowledgeable
12 –17	Moderately knowledgeable
18 – 24	Highly knowledgeable

It was found that none of the farmers was not knowledgeable of the recommended practices. Only 8.5% of all the farmers had low knowledge of CRF recommended coffee production practices, 29.5% of all the farmers had moderate knowledge while 62.0% had high knowledge of CRF recommended production practices on

coffee. Mean knowledge of recommendations was 74.8%. Figure 4 provides a summary of the findings.

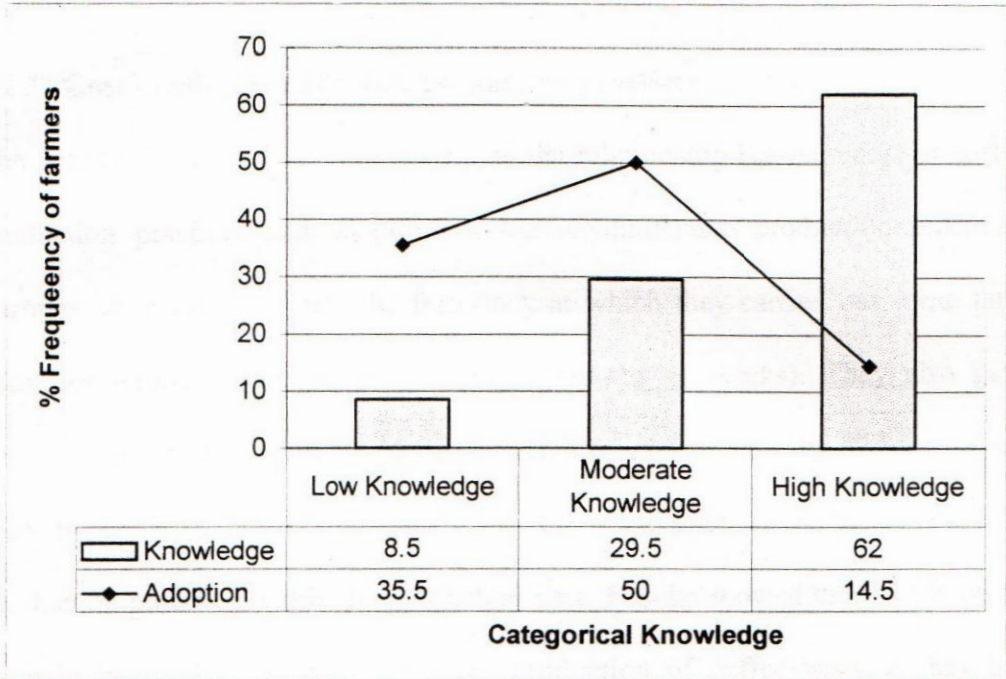


Figure 4: Relationship between Adoption and Knowledge.

There was a positive relationship ( $r=0.447$ ) between knowledge and adoption of recommended production practices. Knowledge of innovation is very essential to potential adopters in decision making. Knowledge and awareness forms the first stage through which potential adopters go through before they finally decide to adopt or reject an innovation. The positive relationship between knowledge of CRF recommendations may have led to the average level of adoption (50% adoption) of CRF recommendations by the farmers. The positive relationship meant that with increase in knowledge, there was increase in adoption of CRF

recommended practices by the farmers. Ndiema (2002) found knowledge of innovations to be important in influencing decision making by wheat farmers.

#### **4.2.2 Cost of adoption of coffee production practices**

The second objective sought to determine the relationship between cost of coffee production practices and adoption of the recommended production practices. Farmers were asked to state the frequency at which they carried out some farm activities within a given period of time (months or weeks). They also gave expenses incurred per given units of the activities carried out. The responses were then translated to reflect activities and costs incurred by farmers in coffee production practices within the production year. Results showed that 11.5% of the farmers incurred no cost at all in the production of coffee because they had abandoned their coffee without both labour attention and material expenses. Average annual cost for the production practices in coffee by the farmers was twenty thousand seven hundred and sixty seven Kenya shillings (Kshs. 20,767.30). Aggregated costs of adoption of production practices were used against the adoption indices to compute Pearson product moment correlation. Table 6 shows summary of the results.

**Table 6: Summary costs of coffee production practices by farmers.**

Minimum cost.	Maximum cost.	Mean cost.
Ksh 0.0	99450.00	20,767.30.

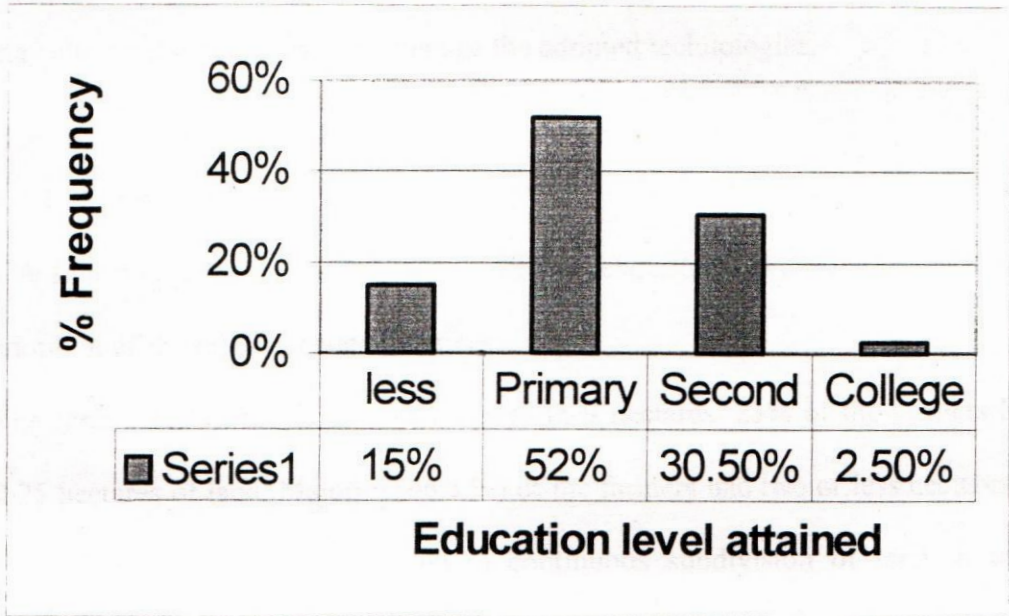
There was a high positive relationship ( $r= 0.644$ ) between costs incurred in production practices and adoption of coffee production practices. The results imply that those farmers who afforded the costs of production practices adopted the production practices, while those who could not afford the costs rejected adoption of the production practices. Wasula (2000) found that farmers failure to adopt agroforestry technologies was related to high costs of adoption of technologies and low incomes. In this study, 100% of the farmers cited family labour to be a component of their production cost in coffee production practices. Labour constrains and low profitability of coffee contributed to 73.5% of the farmers intercropping coffee with other crops. Labour constraints and cost of production technologies influenced farmers' adoption of the technologies (Wasula, 2000; Kamuru, 1998; Maina, 1996).

#### **4.2.3 Farmers education level.**

The third objective sought to determine the relationship between farmers' education level and adoption of recommended coffee production practices.

All the farmers interviewed were literate in at least their mother tongue, Kiswahili or English. Farmers were asked to state the highest level of education attended. The levels of formal education were categorised into five, namely; less than primary education, primary education, secondary education, college education and higher education. The data was ranked and Pearson product moment

correlation computed against adoption of recommended practices. Analysis showed that only 15 % of the farmers had less than primary education. Majority of the farmers (52 %) had primary education, 30.5 % had secondary education and only 2.5 % had College (tertiary) education. None of the farmers had attended higher education. Figure 5 below illustrates farmers education levels.



**Figure 5: Farmers education level in Mathira and Kieni west.**

There was positive correlation ( $r= 0.237$ ) between level of education and adoption of recommended practices. The implication of this distribution would be high utilisation of coffee production technologies. The farmers have average potential to understand technology requirements and appreciate the basic principles. Education increases managerial competence and enhances ability to comprehend

new ideas. Education also enable farmers to access wide variety of information sources. Ndiema (2002) found that farmers' level of education influenced use of technology and therefore related to adoption of technologies. The findings were consistent with those of Amudavi (1993) and the World Bank (1993). The positive correlation obtained in this study suggests that increase in education increased adoption of recommended coffee production practices. The education may also enable the farmers to manage the adopted technologies.

#### **4.2.4 Farm size.**

The fourth objective sought to determine the relationship between farm size and adoption of the recommended practices.

The farm sizes varied from 0.13 hectares to 9 hectares. 23% of the farmers had 0.25 hectares of land. Majority (96.5 %) of the farmers had two or less hectares of land. The small pieces were due to continuous subdivision of land to their offsprings. Figure 6 below illustrates the farm sizes owned by farmers in both Kieni West and Mathira Divisions.

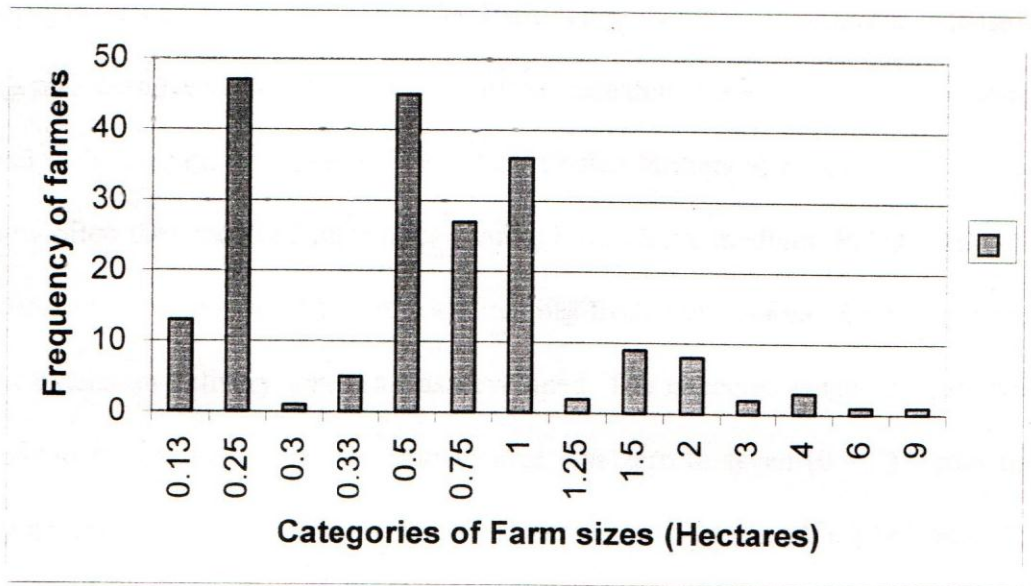


Figure 6: Farm sizes owned by farmers in Kieni West and Mathira

There was slightly negative and insignificant correlation ( $r = -0.012$ ) between farm sizes and adoption of recommended production practices. The correlation was tending to zero. This implied that farm sizes did not influence farmers' decision to adopt or not to adopt the practices. This could be attributed to two factors. One, that coffee was a perennial crop where most of the recommended practices were continuous practices and did not necessarily require a new land to expand on. Two, there was very slight variation in land parcels owned by the farmers.

#### 4.2.5. Extension services delivery

The fifth objective sought to determine the relationship between frequency of extension services delivery to coffee farmers and adoption of recommended practices by the farmers. To measure the frequency of delivery of extension services to farmers, the five main channels of extension and advisory information

services to coffee farmers were identified. They included agricultural extension agents, seminars and field trips, coffee research station at Ruiru, reading materials, farmers co-operative Societies. Coffee farmers were asked to describe how often they received information through the above medium. Responses were recorded on a five-point Likert scale ranging from zero to four. An index range for extension delivery services was developed. The expected range of index was zero to twenty (0 to 20). The actual range was zero to seven (0 – 7). From the range, categorical groups of farmers were formed as shown in table 7 below: -

**Table 7: Extension Services delivery to farmers.**

Range of index for Extension services delivery.	Categorical groups
0 to 7	Poor (low) delivery
8 to 13	Moderate (average) delivery.
14 to 20	High delivery

All the farmers received extension services within the index range of zero to seven, meaning none of the farmers received extension services categorised as either moderate or high. Table 8 illustrates the above statements.

**Table 8: Frequency of extension services delivery to farmers**

Extension services delivery	Frequency (%) No. of farmers
Low delivery	100
Moderate delivery	0
High delivery	0
<b>Total</b>	<b>100</b>

There was a positive relationship ( $r = 0.426$ ) between extension services delivered to farmers and adoption of CRF recommended production practices on coffee. The delivery was low because none of the farmers received services categorised as either moderate or high. The findings concur with Wasula (2002) who found 61.2% of respondents had never received any extension services and only 8.8% received extension services more than once in the year. From the results, increased frequency of extension services to farmers would increase adoption of coffee production practices since a positive relationship existed. 5% of the farmers received extension services from agriculture extension agents, 5% from the radio, 1% from magazines and journals while majority 88.5% received extension information from their friends and other farmers. However, 3.5% indicated that they were not interested with any information about coffee. On the kind of information farmers wished to get, 72% indicated they required information on both marketing and agronomic practices, 23% of the farmers needed marketing information alone and 0.5% of the farmers required agronomic

information alone. 3.5% of the farmers indicated that they did not wish to get any information on coffee.

**Table 9: Media for extension information for the coffee farmers in Kieni West and Mathira**

Medium of communication	% No. of farmers
Min. of Agri. Ext. officers	5
Radio	5
Magazines and journals	1.5
Fellow farmers and friends	88.5
<b>Total</b>	<b>100</b>

#### **4.2.6 Adoption of recommended production practices between Kieni West and Mathira Divisions.**

The sixth objective sought to determine the difference in adoption of recommended coffee production practices in Kieni West and Mathira Divisions. The mean adoption of coffee production practices was 40.8%. This population frequency stands for a mean adoption index of 10.87 in an index range of zero to twenty-six. Table 10 show reflect the adoption comparisons between Kieni West and Mathira division.

**Table 10: Comparative means in adoption of production practices between Kieni West and Mathira division.**

N	Division	Mean	Std. Dev.	Valid percent
100	Mathira	13.82	6.79	53.2
100	K. West	7.92	5.68	30.5
<b>200</b>	<b>Average</b>	<b>10.82</b>		<b>40.8</b>

There was a wide range difference in adoption of coffee production practices between Mathira and Kieni West division. Mathira had a higher adoption level of 53.2% while Kieni West had 30.5%. The very poorly adopted production practices in both divisions were Ruiru II variety which was adopted by only 3% of the farmers, use of herbicide chemicals adopted by only 2.5% of the farmers and use of fertiliser which was adopted by only 18% of the farmers.

#### **Comparing adoption by sets of farmers**

One pair of sets of farmers (Set A farmers) comprised of farmers near the adjacent borders between the two divisions. Set A farmers in Mathira division had mean adoption of 44.3% while corresponding set A farmers in Kieni West division had 35.1%.

Second set of farmers (Set B farmers) comprised of farmers on the far-ends from the adjacent borders between the two divisions. Set B farmers in Mathira had a

mean adoption of 62% while corresponding set B farmers in Kieni West Division had a mean adoption of 25.8 %. Figure 7 shows the results.

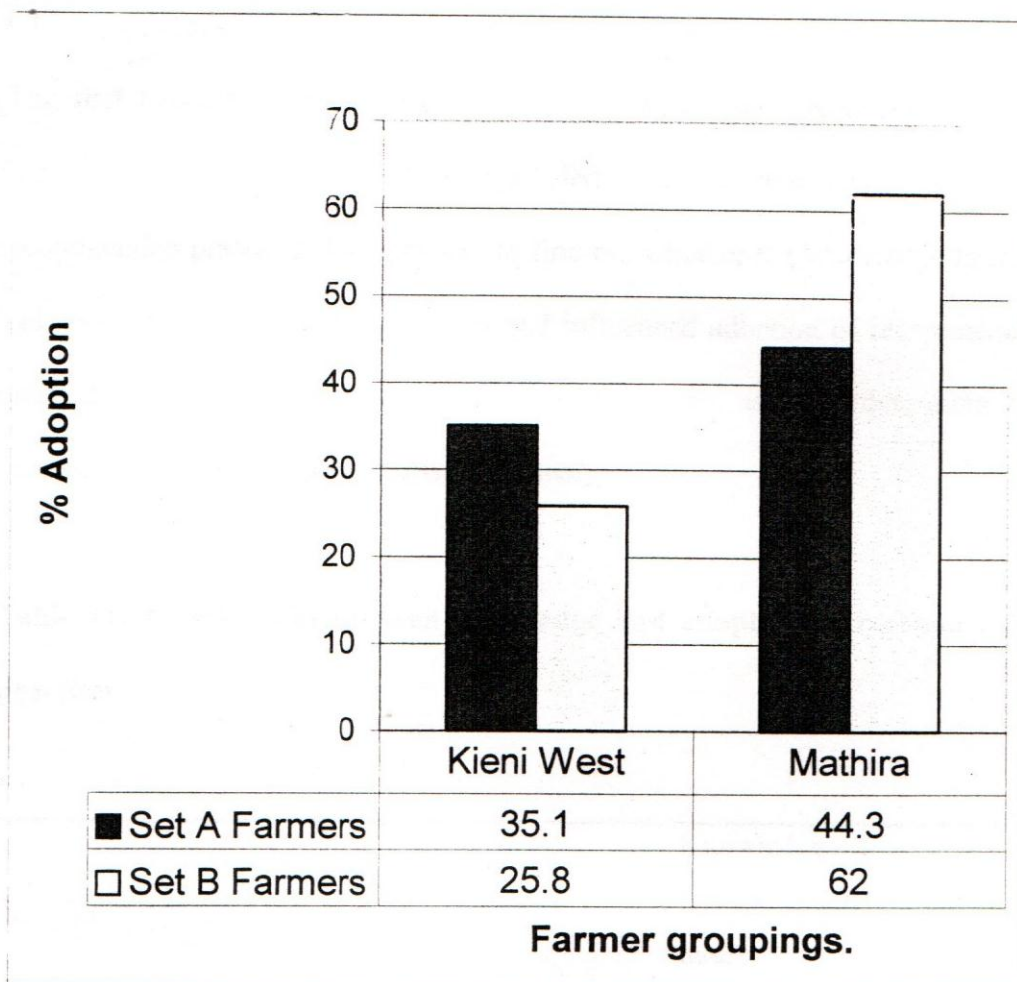


Figure 7: Comparison of adoption by farmer groupings.

There was a difference in adoption levels between Mathira and Kieni West Divisions and also between the corresponding farmer sub groupings across the two Divisions. However, the adjacent sets (Set A) which had adjacent borders had smaller but significant difference in adoption of recommended practices than the farmers in subset B (farmers on the far-ends from the adjacent borders).

### 4.3 Tests of hypotheses

#### 4.3.1 Hypotheses one ( $H_{01}$ )

The first hypotheses stated that there was no significant relationship between farmers' knowledge of CRF recommended practices and adoption of the recommended practices. The aim was to find out whether the knowledge farmers had about the recommended practices had influenced adoption of recommended practices. Pearson product moment correlation was used to determine the relationship. Table 11 show results of the analysis.

**Table 11: Relationship between knowledge and adoption of recommended practices**

		Knowledge of recommended practices index	
Adoption of recommended practices index	Pearson correlation	+0.447	
	N	200	
$r = +0.447$	$df = 198$	$r \text{ critical} = \pm 0.138$	$r \text{ significant at } 0.05$

The Pearson product moment correlation shown in the table 11 shows that there was positive and significant relationship between the knowledge of farmer on

recommended practices and adoption of the recommended practices. It suggests that increase in knowledge led to increase in adoption of the recommended production practices. The findings were consistent with those of Ndiema (2002)

#### 4.3.2 Hypotheses two (H<sub>02</sub>)

The second hypotheses stated that there was no significant relationship between cost of production practices and adoption of the recommended production practices. The aim was to investigate whether there was any significant relationship which existed between the cost incurred on coffee production practices and adoption of the recommended practices. Pearson product moment correlation was used to determine the relationship. Table 12 present the results obtained from the test.

**Table 12: Relationship between costs of production practices and adoptions of the production practices.**

		Cost of production practices	
Adoption of recommended practices index	Pearson correlation		+0.644
	N		200
r=0.644	df=198	r critical = ±0.138	r significant at 0.05

Pearson product moment correlation shown in Table 12 shows that there was a positive and significant relationship (r=0.644) between cost of coffee production

practices and adoption of the recommended production practices. The positive correlation meant that those who afforded the costs of production adopted the recommended practices. The results were in agreement with those of Wasula (2000), Kamuru (1998) and Maina (1996).

#### 4.3.3 Hypotheses three (H<sub>03</sub>)

The third hypotheses stated that there was no significant relationship between the farmers' education level and adoption of the recommended practices. The aim was to find out whether there existed any relationship between education levels attained by coffee farmers in Kieni West and Mathira divisions and adoption of the recommended production practices by the farmers. Pearson product moment correlation was used to determine and describe the relationship. Table 13 presents results obtained from the analysis.

**Table 13: Relationship between education level attained and adoption of production practices by the farmers.**

		Education level
Adoption of recommended practices index	Pearson correlation	+0.237
	N	200
r=+0.237	df=198	r critical = ±0.138
		r Significant at 0.05 level

Pearson product moment correlation shown on Table 13 shows that there was a positive and significant relationship ( $r = 0.237$ ) between education level attained by farmers and adoption of coffee production practices by small-scale farmers in Kieni West and Mathira division. The relationship meant that increase in level of education increased adoption of recommended coffee production practices by the farmers.

#### 4.3.4 Hypotheses four ( $H_{04}$ )

The fourth hypotheses stated that there was no significant relationship between a farmer's farm size and adoption of recommended production practices in coffee by the farmer. The aim was to investigate whether the land sizes owned and managed by a farmer had significant relationship with adoption of the recommended coffee production practices in Mathira and Kieni West divisions. Pearson product moment correlation was used to determine and describe the relationship. Table 14 presents the results obtained from the analysis.

**Table 14: Relationship between adoption and farm sizes**

		Farm sizes	
Adoption of recommended practices index	Pearson correlation	- 0.012	
	N	200	
$r = - 0.012$	$df = 198$	$r \text{ critical} = \pm 0.138$	$r \text{ not significant at } 0.05 \text{ level}$

The results showed that there was a slight and negative relationship between farm sizes and adoption of recommended production practices on coffee by smallholder farmers in Mathira and Kieni West divisions. The relationship ( $r = - 0.012$ ) was less than  $r$  critical ( $r = \pm 0.138$ ) at 0.05 level of confidence and therefore not significant. The farm sizes owned by smallholders coffee farmers in Kieni West and Mathira did not influence farmers' adoption of recommendations. The findings suggest that farmers' decision to adopt or not to adopt the coffee production practices was independent of the farm size owned. The results were not consistent with findings by Ndiema (2002) and Mbugua (1996) but agreed with those of Amudavi (1993). This research findings could be attributed to two factors: One, that the farm holdings by small-scale farmers in Kieni West and Mathira were small with very little variations between farmers. The farm sizes varied between 0.13 hectares to 9 hectares. Average farm size per coffee farmer was 0.70 hectares of land. 96.5% of the farmers owned two or less hectares of land. There was little or no long term decision making such as expanding hectarage of the crop that could be done on the small holdings.

Two, coffee was a perennial crop. The coffee crop was already established. Most of the recommended practices involved continuous management practices that did not necessarily require new land to expand on.

#### 4.3.5 Hypothesis five ( $H_{05}$ )

The fifth hypothesis stated that there was no significant relationship between frequency of delivery of extension services to farmers and adoption of recommended practices. The aim was to determine the media through which extension services reached coffee farmers and to determine the relationship between frequency of delivery of extension services to coffee farmers and adoption of recommended coffee production practices. The study involved smallholder coffee farmers in Mathira and Kieni West division, Nyeri district. Pearson product moment correlation was used to establish and describe the relationship. Table 15 presents the results obtained from the analysis.

**Table 15: Relationship between extension delivery services and adoption of recommended practices**

		Extension services delivery	
Adoption of recommended practices index	Pearson correlation	+0.426	
	N	200	
$r=+0.426$	$df=198$	$r \text{ critical} = \pm 0.138$	$r \text{ significant at } 0.05 \text{ level}$

Pearson product moment correlation in table 15 shows that there was a positive and significant relationship between extension services delivery to farmers and adoption of recommended coffee production practices by the farmers. The

positive relationship implied that those who had frequent contacts with extension services adopted more of the recommended production practices. The results concur with the findings of Mbugua (1996) and Wasula (2000). The results suggest that if more services were extended to the farmers, there was likelihood of improvement of adoption of recommended practices.

#### 4.3.6 Hypotheses six ( $H_{06}$ )

The sixth hypotheses stated that there was no significant difference in adoption of recommended coffee production practices between Kieni West and Mathira divisions. The aim was to investigate the comparative adoption levels between the two Divisions of Nyeri district. T-test was used to determine the differences in adoption levels between divisions and between sets. Chi-square was used to determine relationship between sub-groups (sets) in the Division. The results are presented as follows:

##### 4.3.6.1 Difference between Kieni West and Mathira division

**Table 16: Adoption difference between Kieni West and Mathira Divisions**

Division	n	Adoption of recommended practices			
		Mean	Std dev.	T- value	Probability (2 -tailed;
Mathira	100	13.82	6.79	6.65	0.000*
K. West	100	7.92	5.68		

(\*) Significant at 0.05 level.

$H_0$  not accepted.

There was a significant difference in adoption levels of recommended coffee production practices between Mathira and Kieni West divisions. Mathira division had significantly higher adoption than Kieni West Division. Null hypothesis for no significant difference was therefore not accepted.

#### 4.3.6.2 Differences between sub-groups (sets)

There were four sub-groups (sets) for comparison purposes. Set A comprised of farmers near the adjacent borders between the divisions. T-test analysis of the set 'A' farmers between Mathira and Kieni West division gave the results as presented in Table 17.

**Table 17: Set A farmers ( farmer near the adjacent borders )**

Adoption of recommended practices					
Division	n	Mean	Std dev.	T- value	Probability (2 -tailed)
Mathira	50	11.52	5.47	2.119	0.037*
K. West	50	9.12	5.84		

(\*) Significant at 0.05 level.  $H_0$  not accepted

There was significant difference in adoption levels of recommended coffee productions practices between Set A farmer sub-groupings in Mathira and Kieni West divisions. Mathira's Set A farmers had a mean adoption index of 11.52 while Kieni West had 9.12 within an adoption index range of zero to twenty six. The analysis (Table 17) showed that the difference in adoption of recommended

coffee production practices between the adjacent sets of farmers across the Divisions was significant at 0.05 significance level. Null hypothesis for no significance difference was therefore not accepted.

Set B comprised of those farms that were located on the far-ends from the adjacent borders of the two divisions. Table 18 presents t-test results for the two sets.

**Table 18: Set B farmers (Farmers on far-ends from the adjacent borders)**

Adoption of recommended practices					
Division	n	Mean	Std dev.	T. value	Probability (2 -tailed)
Mathira set B	50	16.12	7.25	7.392	0.000*
K. West set B	50	6.72	5.31		

(\*) Significant at 0.05 level.  $H_0$  not accepted

There was significant difference between Set B farmers in the Divisions (farmers located at the far-ends from the adjacent borders). Mathira Set B farmers had significantly high adoption of the recommended coffee production practices than Kieni West Set B farmers. Null hypothesis for no significant difference was therefore not accepted.

**Chi-square results on categories of adopters of recommended production practices.**

Cross tabulation between the sets in Mathira and Kieni West division was carried out. The aim was to determine adoption of recommended coffee production practices between sets to find out if there was significant association between location of farmers in the Divisions and adoption of recommended practices. The results in Table 19 were obtained from the analysis.

**Table 19: Categories of adopters between Set A and B in Mathira**

		Categorical grouping of adopters		
		Low adopters	Moderate adopters	High adopters
Locality settings of	Set A	60.9%	64.7%	11.5%
farmers in Mathira	Set B	39.1%	35.3%	88.5%
division.		100%	100%	100%
$X^2 = 20.88.$		$df = 2$	$X^2$ critical = 5.99	$n = 100$

The results of chi-square analysis displayed in Table 19 show that there was a significant relationship between the two sets of farmers in Mathira division. The chi-square observed ( $X^2 = 20.88$ ) was higher than critical chi-square ( $X^2 = 5.99$ ) at 0.05 level of significance. Majority of the low adopters (60.9%) were in Set A while majority of the high adopter (88.5%) were in set B. The location of farmers

in Mathira Division influenced their adoption of recommended coffee production practices since there was significant relationship between the two sets.

**Table 20: Categories of adopters between set A and B in Kieni West Division**

		Categorical grouping of adopters		
		Low adopters	Moderate adopters	High adopters
Locality settings of farmers in K. West division	<b>Set A</b>	47.9%	49.0%	100%
	<b>Set B</b>	52.1%	51.0%	0.0%
		100%	100%	100%

$$X^2 = 3.10 \quad df = 2 \quad X^2 \text{ critical} = 5.99 \quad n = 100$$

The results of chi-square analysis as displayed in Table 20 yielded no significant relationship between the two sets of farmers in Kieni West division's adoption of recommended coffee production practices. Chi-square observed ( $X^2 = 3.10$ ) was lower than chi-square critical ( $X^2 = 5.99$ ) at 0.05 level of significance. Therefore adoption of CRF recommended practices were not influenced by location of the farms in Kieni West Division.

#### **4.4 Summary of findings and discussions**

The results of the study illustrate adoption of the recommended coffee production practices by small-scale farmers in Mathira and Kieni West division. Six factors related to adoption of the production practices have been analysed and discussed under respective objectives and hypotheses. Various relationships and differences were quantitatively and qualitatively determined. The results show that there was low adoption of the recommended coffee production practices by coffee farmers in Kieni West in relation to Mathira division. Various factors namely knowledge of recommended practices, cost of production practices, farmers' education level, extension service delivery and farmer localities had significant relationship to have influenced adoption of production practices positively. Farm sizes were found to have had no significant relationship with adoption of recommended practices. This was suggested to be attributable to the very minimal land acreages owned by farmers in respect to the nature of the recommended production practices studied. It was those differences in adoption of recommended practices which had contributed to differences in production levels between the two divisions of Nyeri District .

**Table 21: Summary of results**

	Dependant variable	Independent variable	Test and analysis		Deduction
Obj. 1; Ho1	Adoption	Knowledge	Mean knowledge Index=18	r=0.447	r significant
Obj. 2; Ho2	Adoption	Costs	Mean costs= 20,967	r=0.644	r significant
Obj. 3; Ho3	Adoption	Education level	Mean educ= 8yrs	r=0.237	r significant
Obj. 4 ;Ho4	Adoption	Farm sizes	Mean farm size= 0.70 hectares	r=-0.012	r not significant
Obj. 5 ;Ho5	Adoption	Extension delivery	Mean extension index = 5	r=0.426	r significant
Obj. 6 ;Ho 6	Adoption	Mathira vs. Kieni W	Mathira: mean adoption =13.82 Kieni W: mean adoption =7.92  Mathira: mean adoption set A =11.52 Kieni W: mean adoption set A = 9.52  Mathira: mean adoption set B = 16.12 Kieni W: mean adoption set B = 6.72	t- value=6.65  t- value=2.11  t- value=7.392	t- significant  t- significant  t- significant

on Mathira =53.2% Adoption Kieni West =30.5% Adoption mean =40% r critical =  $\pm 0.138$  All tests at 0.05

significance.

# CHAPTER FIVE

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

### Introduction.

The study sought to determine and document the influence of knowledge, costs of production, farmers' education, farm sizes and frequency of delivery of extension services on adoption of recommended practices in coffee between Kieni West and Mathira Division of Nyeri District, Kenya. This chapter highlights the summary, conclusions and recommendations derived from the research findings.

### 5.1 Summary

An adoption index within the range of zero to thirty was developed. The highest adopter farmer of the recommended coffee production practices attained an adoption index of twenty-six. An average adoption of recommended coffee production practises by the farmers was forty percent (40%). Mathira division had 53.2% adoption while Kieni West Division had 30.5%. The very poorly adopted practices were: establishment of Ruiru II variety (3%), use of herbicide and pesticide chemicals (2.5%), and use of fertilisers (18%).

In an index range for knowledge of recommendations of zero to twenty four, the farmers had a mean knowledge index of 17.95 which was equivalent to 74.8%. Only 8.5% of the farmers were lowly knowledgeable while 62% of the farmers were highly knowledgeable of the CRF recommended production practices on

coffee. There was a significant relationship ( $r = 0.447$ ) between knowledge of recommendation and adoption of the recommendations thus increase in knowledge led to high adoption of the recommended production practices.

Farmers used an average of Kenya shillings twenty thousands seven hundred and sixty seven (Kshs. 20,767) per coffee production year. However 11.5% of the farmers incurred no cost at all since they had abandoned their coffee farms with neither labour nor material expenses. There was significant relationship ( $r = 0.644$ ) between cost incurred on production practices and adoption of the recommended practices. 73.5% of the farmers had intercropped coffee with other crops (mainly food crops) to save on labour and increase profitability of the land.

Majority of the farmers (52%) had primary education, 30.5% had secondary education while 2.5% had tertiary education. Only 15% of the farmers had less than primary education while none of the farmers had higher education. There was significant relationship ( $r = 0.237$ ) between level of farmers' education and adoption of the recommended production practices on coffee thus formal education increased adoption of the recommended production practices in Kieni West and Mathira Divisions.

Farm sizes varied between 0.13 hectares to 9 hectare. Majority of the farmers (23.2%) had 0.25 hectares. 96.5% of the coffee farmers had two or less than two

hectares of land owing to continuous subdivision of land. There was no significant relationship ( $r=-0.012$ ) between farm sizes and adoption of recommended production practices on coffee. Farm size therefore did not influence adoption of recommended production practices in Kieni West and Mathira Divisions.

Extension services delivery to farmers was low. In an index range of zero to twenty for services received by farmers, the highest services received was index seven (low). 100% of the farmers received low extension services in regards to coffee. There was significant relationship ( $r=0.426$ ) between frequency of delivery of extension services to farmers and adoption of recommended production practices in Kieni West and Mathira Division. 5% of the farmers got information regarding coffee production practices from agricultural extension agents, 5% from the radio, 1% from magazines and journals. Majority of the farmers (88.5%) received coffee production information from their friends and fellow farmers. When asked what information regarding they required, 72% of the farmers expressed a wish to get information on both marketing and agronomic practices, 23% wished to get only marketing information, 3.5% indicated that they were not interested in any information on coffee, while 0.5% wished to get information on agronomic practices only.

Mathira had a higher adoption level of recommended production practices on coffee (53%) while Kieni West had lower adoption level (30.5%). The groups of farmers near the borders adjacent to the two divisions had adoption levels of 43.3% for Mathira division and 35.1% for Kieni West division. The groups located on the far-ends of the borders of the two divisions had adoption levels of 62% for Mathira and 25.8% for Kieni West farmers. The data was obtained using validated observation and interview schedules. Analysis was done using both descriptive and inferential statistics in Microsoft windows statistical package for social sciences.

## **5.2 Conclusions**

The following conclusions were derived from the research findings following the objectives and hypotheses of the study.

Knowledge of farmers on recommended coffee production practices had contributed to farmers' use of the recommended production practices. There was significant and positive relationship between knowledge of the recommended production practices and adoption of the production practices. Enhancement of the farmers on the new technologies need to be promoted to increase adoption levels of the technology. The findings of this study were in agreement with findings by other researchers cited earlier under objectives one.

The farmers who could afford to cater for costs of coffee production practices adopted more of the production practices. Costs of coffee production practices had the highest positive relationship with the adoption of the recommended production practices. The farmers who could not afford the cost failed to adopt the recommended practices. The high relationship between costs of production practices and adoption will lead to the fact that as long as the costs are high in reference to returns, adoption of recommended practices will remain low because of inability of farmers to afford it.

Farmers' education level influenced the use of recommended technology and thus it was related to the levels of adoption of recommended production practices. The findings were consistent with other studies acknowledged earlier under objective three.

Farm sizes did not influence the use of recommended technology since farm sizes were not related to adoption recommended production practices on coffee by the smallholder farmers. There was very slight and insignificant relationship between farm sizes and adoption of recommended production practices on coffee as to influence adoption of the recommended practices.

The study concluded that poor delivery of extension services to farmers in regard to coffee crop had contributed to low level of adoption of recommended coffee

production practices. There was significant and positive relationship which indicated that extension services would influence more farmers to adopt the recommended production practices. The extension service delivered should address the farmers' needs. When asked to state the kind of information they required, the large majority of farmers indicated they needed information packages on both marketing and agronomic practices together.

Localities of farmers influenced adoption of the recommended coffee production practices. The geographical locations between the two divisions and also between sub groupings (sets) drew a trend of adoption of production practices. Farmers in Kieni West Division far from the adjacent borders to Nyeri Municipality had the lowest adoption, followed by Kieni West farmers near the borders, then Mathira farmers near the borders while the highest adoption was Mathira farmers far from the adjacent borders. There could be other socio-cultural, socio-economic and socio-political factors between farmers in their local social set-ups which influenced adoption of recommended production practices, and consequently lowered coffee production.

### 5.3 Recommendations

The researcher proposes the following recommendations.

1. Similar studies should be carried out in other coffee growing districts in Kenya to confirm if the trends in adoption are the same.
2. Costs were the major factor influencing adoption of recommended practices. Policy makers should therefore avail market information (noting that majority of the farmers wished to get information on marketing) and improve coffee marketing channels for farmers to sell their output to afford costs of production practices. Policymakers should also make coffee production outputs affordable to farmers.
3. Extension services delivery should be evaluated to make extension information more accessible to farmers.
4. Formal education influenced adoption. Policy makers therefore should provide institutional channels of providing formal short time courses to coffee farmers since most educated people in the community migrate for urban jobs. Such courses would equip the farming community with potential for adoption of new innovations since formal education and knowledge have been found to influence adoption of technologies.

#### **5.4 Recommendation for further research**

1. Study on perceptions of coffee farmers towards agricultural extension agents.
- 2 Study on perceptions of agricultural extension agents towards coffee farmers.
3. Study on perceptions of coffee farmers towards the crop in respect to other crops.
- 3 Effects of continuous decline in farm sizes on coffee production in Mathira Division of Nyeri district, Kenya.

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2. How many times should suckers be removed per year?

K [ ] U [ ] NK [ ]

#### IV. Questions on fertiliser and manure application

1. Which fertilisers should a farmer use in coffee?

K [ ] U [ ] NK [ ]

2. How much manure should a farmer apply per coffee tree?

K [ ] U [ ] NK [ ]

#### V. Questions on soil and leaf analysis

1. When should a farmer take soil for analysis?

K [ ] U [ ] NK [ ]

2. Where should farmers take their soil and coffee leaves for analysis?

K [ ] U [ ] NK [ ]

#### VI. Questions on pest and disease control

1. Which chemicals should a farmer use to control CBD and leaf rust diseases in coffee? K [ ] U [ ] NK [ ]

2. When should a farmer spray coffee to prevent CBD and leaf rust?

K [ ] U [ ] NK [ ]

### C. Cost of adoption

Please try to estimate the following number of activities and their related costs as precisely as possible.

1. a) Do you pick your coffee? Yes. [     ]     No. [     ]
- b) If yes, how many people are involved in the picking per day?  
\_\_\_\_\_
- c) How many days do you pick your coffee per month?  
\_\_\_\_\_
- d) How much is paid in per person per day? Ksh. \_\_\_\_\_
- e) How much do you pay for transport costs from the farm to the factory? Ksh. \_\_\_\_\_
- f) How often do you pick your coffee in one year?
  - Throughout the year     [   ]
  - During 1<sup>st</sup> season only     [   ]
  - During 2<sup>nd</sup> season only     [   ]
  - During both seasons     [   ]
- g) (i) Besides picking, how many other days do you spend per week working on your coffee? \_\_\_\_\_
- (ii) How many other people work in your coffee farm for those non- picking days per week? \_\_\_\_\_
- (iii) How much is paid per person per day? Ksh. \_\_\_\_\_

2. Approximately how much money in Ksh. Do you spend on:

- Fertiliser per one coffee season? \_\_\_\_\_
- Pesticide and herbicide chemicals for your coffee per season?  
Ksh. \_\_\_\_\_

3. What other costs do you incur in your coffee production? Please list them as follows:

- a) Activity \_\_\_\_\_ Cost in Ksh. \_\_\_\_\_
- b) Activity \_\_\_\_\_ Cost in Ksh. \_\_\_\_\_
- c) Activity \_\_\_\_\_ Cost in Ksh. \_\_\_\_\_
- d) Activity \_\_\_\_\_ Cost in Ksh. \_\_\_\_\_

#### D. Extension Service Delivery

1. Do Agricultural extension agents visit your coffee farm?

Yes [ ] No [ ]

If Yes describe how often?

Very often [ ] Not at all [ ]

Often [ ] Sometimes [ ]

Not often [ ]

2. How often do you attend seminars end field trips about coffee production?

Very often [ ] Not often [ ]

Often [ ] Not at all [ ]

Sometimes [ ]

3. How often do you visit the coffee research station in Ruiru?

Very often [ ] Not often [ ]

Often [ ] Not at all [ ]

Sometimes [ ]

4. How often do you receive reading materials on coffee?

Very often [ ] Not often [ ]

Often [ ] Not at all [ ]

Sometimes [ ]

5. Does your co-operative society educate you on coffee production?

Yes [ ] No [ ]

If Yes, describe how often:

Very often [ ] Not often [ ]

Often [ ] Not at all [ ]

Sometimes [ ]

6. How do you get information on coffee farming?

Visiting Agricultural extension officers [ ]

Reading Magazines and journals [ ]

Through the radio [ ]

Through friends and other farmers [ ]

7. What information about coffee could you wish to get?

Marketing [ ]

Agronomic practices [ ]

Both the above [ ]

8. Why do you intercrop coffee with other crops?

Because coffee alone is not profitable [ ]

Shortage of labour [ ]

Both the above [ ]

9. Does intercropping reduce your coffee produce?

Yes [ ] No [ ]

## Appendix B

### (Observation Schedule)

#### E. Adoption of Coffee Production Practices

Observe and tick appropriately whether the farmer has adopted the following practices in his coffee farm:

Innovation	Adopted	Not Adopted
<b>I Coffee Establishment</b>		
1. Ruiru II Coffee variety	[ ]	[ ]
2. Use of benches and terraces against waterlogging	[ ]	[ ]
3. Monoculture – planting of coffee only in its field	[ ]	[ ]
<b>II. Weed Control</b>		
1. Slashing of weeds from the field	[ ]	[ ]
2. Weeding method – cultivating far from the root zone	[ ]	[ ]
3. Killing of weeds on the farm by use of chemicals	[ ]	[ ]
<b>III. Pruning</b>		
1. De-suckering of the coffee bushes	[ ]	[ ]
2. Opening of the coffee bushes	[ ]	[ ]
3. Maintenance of manageable bush heights	[ ]	[ ]

#### IV. Fertiliser and Manure

1. Application of fertiliser around the root zone [ ] [ ]
2. Application of manure around the root zone [ ] [ ]
3. Observe general health and productivity of bushes suggesting maintained soil fertility, use of fertiliser and manure: Present [ ] Absent [ ]

#### V. Coffee Pest and Disease Control

1. Spraying of the coffee bushes – check for traces of chemicals [ ] [ ]
2. Use of mulch between coffee rows [ ] [ ]
3. Observe effectiveness of disease control by checking absence or presence of infected branches, leaves or berries Effective [ ] Not effective [ ]

### CRF Recommended Coffee Production Practices

#### 1. Coffee establishment

- Ruiru 11 is the best variety
- SL 28 & 34 varieties for highland areas
- Seedlings from CRF
- Avoid waterlogged soils
- Spacing 2.74m x 2.74m on slope or 2m x 1m on flat land for traditional varieties; 1329 trees /ha (537 trees/acre)
- 2m x 2m x 1.5 m for Ruiru 11 varieties
- Apply mulch between laws

#### 2. Weed control

Cultural method- fork jembe digging

- Weed slashing
- Mulching

Chemical method- Common recommended weed chemicals include:- Atrazine, Diuron, Simazine, Fluome, Turron, Linuron, Candex, Amitrole, 24- DMCPA, Paraquat, Dalaphon, Actil, Round-up, Fusidale.

- Apply mixtures at start of rains season
- Apply 6 times per year

#### 3. Pruning

- Prune immediately after main crop
- Remove branches touching the ground
- Prune up to 1.5 m to 1.7 m tall.
- Remove suckers and damaged branches
- Do desuckering all times, every 3-4 months

#### **4. Manures and fertilizers**

- Apply nitrogen fertiliser in 3-4 equal splits
- Apply 2 weeks after start of rainy season
- Broadcast around the root area.

Recommend nitrogenous types:

- Ammonium Sulphate Nitrate (ASN) 26% N
- Calcium Ammonium Nitrate (CAN) 26% N
- Ammonium Sulphate (AS) 20-21% N
- Urea
- Do not store fertiliser, use immediately after opening
- Apply manure between rows than dig it in
- Apply much during dry weather
- Use cattle manure, coffee pulp or Napier grass

#### **5. Soil and Leaf Analysis**

- Soil sampling before starting new planting or replanting
- Soil sampling when nutritional or deficiency problems arise
- Do not sample soil when too wet
- Leaf sampling before onset of rains
- Leaf sampling when problems of deficiency occurs
- Sample sent to the C.R.F station
- Sample from both affected and non affected plants

#### **6. Coffee Diseases and Pest and their Control**

- Spray for CBD before onset of rains, first spray by mid-February
- Combine Daconil and copper based fungicides to control both CBD & leaf rust
- Spray against leaf rust during October /November.
- Common recommended sprays: Daconil, Dyrene, Delan, copper based fungicides

- Spray rate at 670 L /ha to 1345 L/ha at (2.74x 2.74) m spacing
- Use resistant varieties of coffee e.g. Ruiru 11
- Prune coffee to reduce foliage
- Cut off unwanted foliage
- Remove foliage touching the ground
- Common recommended pesticide spray: Fnitrothian, Fnthion, decis, Trichlorphon, Fradan, Disulfotan, Smmicidin, against common coffee pests
- Cut off infected branches
- Remove blackening berries
- 

Source: CRF recommendations hand book, 2000

Research permit

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THIS IS TO CERTIFY THAT:

Research permit No. MOEST 13/001/330 139

Prof./Dr./Mr./Mrs./Miss MARTIN MWANGI KAGIRI

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Fee received Shs. 500

of (Address) EGERTON UNIVERSITY

P.O. BOX 536, NJORO

has been permitted to conduct research in

Location,

NYERI

District,

CENTRAL

Province,

on the topic FACTORS INFLUENCING ADOPTION  
OF COFFEE PRODUCTION PRACTICES IN KIENI  
MATHIRA DIVISION, NYERI DISTRICT



for a period ending 30th June, 2004

*M. Kagiri*  
Applicant's  
Signature

*A. G. Kaaria*  
For: Permanent Secretary,  
Office of the Permanent Secretary,  
Ministry of Education

PERMANENT SECRETARY  
MINISTRY OF EDUCATION