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**A STUDY OF THE FACTORS RELATED TO THE ADOPTION OF TECHNICAL
INFORMATION ON MAIZE PRODUCTION AMONG SMALL SCALE FARMERS IN
NJORO DIVISION.**

**BY
MAINA F. N. W.**

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**BY
MAINA F. N. W.**

THESIS

**Submitted to the Graduate School in Partial Fulfilment of the
Requirements for Master of Science Degree in Agricultural
Extension
Egerton University.
Njoro**

OCTOBER 1996

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DECLARATION

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Maina

Faith Nicola W Maina

APPROVAL

This Thesis is approved for submission to Graduate School, for the Award of the Degree of Master of Science in Agricultural Extension.



N. J. Kathuri, Ph D

Date 7th Nov, 1996

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ABSTRACT

Great emphasis has been placed on Agriculture in Kenya because of the dominant role the sector plays in the economy of Kenya. Presently, the only avenue that remains to be exploited in the efforts to increase agricultural production is intensification of production. A crop of particular importance in Kenya and that requires intensification is maize.

However, among small scale farmers, partial adoption constrains intensification of production. The purpose of this study was to describe the factors which are related to the adoption of technical information on maize production by small scale farmers in Njoro Division. It is expected that the information obtained from this study will be useful to policy makers, maize researchers and local extension personnel in their efforts of improving maize production in the area.

Many variables influence adoption of modern technologies. However, in this study emphasis was laid on, among other things, farmers' perceptions and social values (namely familism, empathy and scientism) which have received little research attention. Some personal, social and situational variables have also been tackled. All these constituted the independent variables in the study while adoption was the dependent variable.

This study was a descriptive survey. Disproportionate stratified sampling was carried out to select a sample size of 161 farmers for the study. Data were collected by use of a structured questionnaire. Descriptive statistics were used to describe the variables. Inferential statistics namely chi-square and index of correlation were used to find out the relationship between adoption and various variables. Various hypotheses were accepted or rejected at the probability level of 5%.

Significant relationships were found between adoption and awareness of depth of planting, gender, empathy, scientism, size of land holding, commercial orientation, use of credit, urban contact

and some of the farmers' perceptions. It was concluded that provision of extension services should be matched with provision of appropriate research recommendations and development of agricultural related infrastructure in order to ensure that adoption of innovations occurs effectively. Recommendations that arose from this study included the need to: review the pricing policies of inputs and outputs, review the credit facilities available to small scale farmers, increase the yield potential of H500 series by maize researchers and bridge various knowledge gaps identified among the farmers..

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TABLE OF CONTENTS	PAGE
DECLARATION	(i)
APPROVAL	(ii)
COPYRIGHT	(iii)
ABSTRACT	(iv)
ACKNOWLEDGEMENT	(vi)
TABLE OF CONTENTS	(vii)
LIST OF TABLES	(x)

CHAPTER 1

INTRODUCTION

1.1 General background.	1
1.2 Statement of the Problem.	3
1.3 Purpose of the Study.	4
1.4 Objectives.	4
1.5 Hypotheses	5
1.6 Significance of the Study.	6
1.7 Assumptions of the Study.	6
1.8 Limitations of the Study.	6
1.9 Definitions of terms	7

CHAPTER 2

LITERATURE REVIEW

2.1	Role of Maize in Kenya.	9
2.2	Management Practices Associated with Maize Production.	11
2.3	Theoretical Perspective of the Diffusion Process.	12
2.4	Related Research Findings on the Factors that Influence Adoption.	18
2.4	Summary.	20

CHAPTER 3

RESEARCH METHODOLOGY

3.1	Research Design.	21
3.2	Population of the Study.	21
3.3	Sampling.	22
3.4	Instrumentation.	23
3.5	Data Collection Procedures.	23
3.6	Data Analysis.	24

CHAPTER 4

RESULTS AND DISCUSSION

4.1	Introduction.	25
4.2	Description of Adoption.	25
4.3	Description of Awareness Knowledge of Various Maize Innovations.	35

4.4	Description of Personal, Social and Situational Characteristics	37
4.5	Description of Perceptions of Various Innovations	47
4.6	Analysis of Various Hypotheses	48
CHAPTER 5		
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS		
5.1	Summary	58
5.2	Conclusions	62
5.3	Recommendations	63
5.4	Suggestions for Further Research	66
REFERENCES		68
APPENDIX A (QUESTIONNAIRE IN KISWAHILI)		75
APPENDIX B (QUESTIONNAIRE IN ENGLISH)		94

LIST OF TABLES

Table 1: Maize Production by Type of Holding (Percent)	10
Table 2: National Food Requirement for 1996	10
Table 3: Potential Yields of Some Recommended Varieties	12
Table 4: Summary of Inferential Statistics Used	24
Table 5: Distribution of Respondents by Adoption of Hybrid Seed.	27
Table 6: Distribution of Respondents by Adoption of Correct Plant Population.	28
Table 7: Distribution of Respondents by Adoption of Organic Fertilizers.	31
Table 8: Distribution of Respondents by Adoption of Inorganic Fertilizers.	32
Table 9: Distribution of Respondents by Adoption of Pesticides.	33
Table 10: Distribution of Respondents by Adoption of Timely Weeding.	34
Table 11: Distribution of Respondents by Awareness Knowledge of Various Innovations.	36
Table 12: Distribution of Respondents by Personal Characteristics.	38
Table 13: Distribution of Respondents by Social Characteristics	40
Table 14: Distribution of Respondents by Situational Characteristics.	43
Table 15: Distribution of Respondents by per Location Rating Far and Very Far for Various Inputs	46
Table 16: Distribution of Respondents by their Perceptions of Various Innovations	47
Table 17: Farmers' Knowledge of Various Innovations as Related to Adoption Behaviour.	49
Table 18: Personal Characteristics of Farmers as Related to Adoption Behaviour	49
Table 19: Situational Characteristics of Farmers as Related to Adoption Behaviour.	51
Table 20: Social Characteristics of Farmers as Related to Adoption Behaviour.	53
Table 21: Perceptions about Various Innovations as Related to Adoption Behaviour.	55

CHAPTER 1

INTRODUCTION

1.1 General Background.

Agriculture is the most dominant sector in the economy of Kenya. It is a major foreign exchange earner and employs 75% of the total labour force in the country. Agriculture contributes 30% of the gross national product (GNP) in Kenya (GOK 1994a). Consequently, great emphasis has been placed on improving agricultural production.

According to the Kenya 1994-6 Development plan, agricultural growth has in the past emanated from expansion of the area under cultivation and the transition from low to high value agricultural activities. However, potential growth from these two sources is diminishing. Further expansion of land under cultivation is constrained by the low agricultural potential of the remaining land. This land is either of low fertility or too arid to be cultivated without irrigation. The transition from low to high value agricultural activities is constrained by the necessity for food production to keep up with the demands of an increasing population. A focus on food crops is therefore advocated for. At present the key to agricultural growth is therefore, increasing land productivity.

Amon (1989) observed that small scale farmers have great potential in increasing agricultural production in the Least Developed Countries (LDCs), Kenya included. Chitere and Doome (1985) also noted that 85% of the Kenyan people live in the rural areas, most of them in smallholder areas where farm units are only about two hectares. Indeed due to their numbers as well as the large tracts of land they farm, small scale farmers are an important target group in the efforts to increase

agricultural production. However, proper focus on small scale farmers' agricultural production is still to be achieved (Mwale, 1994).

Intensification of Agricultural production calls for development and dissemination of modern technology. Presently, modern maize technologies have been developed and disseminated to a large extent in Kenya (Muchena, 1988). Adoption of the maize technologies by the farmers also affects intensification (Dasgupta, 1989). Leagans (1979) noted that for new technologies to significantly influence agricultural production, the farmers need not only to adopt the technologies but to adopt them correctly and fully. Hunter (1974) also noted that complimentary innovations come in a package and need to be adopted wholly for good results to be obtained. However, Mwale (1994) reported that partial adoption of innovations is a common phenomenon among small scale farmers in Kenya. Consequently, optimal yields are not obtained. Clearly, there is a need to study the issue of partial adoption of innovations closely, hence the need for this study. The innovations that were of interest to this study were maize related and included use of hybrid seed, correct plant population, use of fertilisers, use of pesticides and timely weeding.

Various factors that influence adoption have been documented by several authors. Dasgupta (1989) divides these factors into personal, social, and situational factors. Personal factors considered in the current study included age, education, gender, empathy, scientism, and familism. Social factors included extension and urban contact while situational factors were size of land holding, availability of inputs, availability of credit and commercial orientation. Apart from these factors, the characteristics of innovations as perceived by the farmers also influence adoption behaviour (Lionberger and Gwin, 1982). These were also dealt with in the current study.

Various studies have been conducted in Kenya on adoption of maize related technologies

(Gerhart, 1974; Chitere, 1985; Misiko, 1976; Roling et al, 1973; Mbithi and Kanyongo-Mwale, 1979; Siegfried and Mbugua, 1974; and Amudavi, 1993, among others). However, as Gershon et al (1982) noted, similar innovations experience different adoption patterns in different areas and by different groups of farmers. Since no adoption study has been done in Njoro Division, the findings and recommendations of the research works mentioned may or may not apply to Njoro. Also from the various studies reviewed very little attention has been given to farmers perceptions of the innovations. Perceptions influence adoption behaviour significantly. The studies reviewed did not tackle yet another important set of factors associated with adoption. These are farmers social values which include familism, empathy and scientism.

Njoro Division, the area of study, is composed of six locations namely Njoro, Nesuit, Kihingo, Lare, Ngata and Mau Narok. It is basically a high potential area with good fertile soils and high amounts of rainfall (Blarel et al, 1988). Due to the high altitude of the area which ranges from 1890 to 2190 metres above sea level, the temperatures are cool ranging from 15.7-17.5°C. Njoro has a total area of 338,000 hectares of land. Of this 279,000 hectares is good agricultural land. It is found in the ecological zones 1, 2, 3, 4, and 5. Consequently, a number of crops are grown which include wheat, barley, triticale, potatoes, vegetables, beans and maize (Blarel et al, 1989).

This study sought to describe the adoption patterns of maize technologies in Njoro as affected by various factors.

1.2 Statement of the Problem.

In Kenya there is a need to intensify agricultural production and in particular food production, as arable land continues to diminish due to population pressure on the land (G.O.K 1994a). This fact

is clearly demonstrated in Njoro division where the size of land holdings during the last 20 years has diminished due to a high rate of settlement in the area (Blarel et al, 1988). Intensification of agricultural production is influenced by the adoption behaviour of farmers. As noted earlier, Mwale (1994) reported that partial adoption is a common phenomenon among small scale farmers in Kenya. Blarel et al (1988) and Njoro Division report (1993) indicated that Njoro is no exception to this as regards maize production.

This study focused on maize production in Njoro Division since maize is the most widely grown crop in the area by small scale farmers who occupy 60% of the agricultural land (Blarel et al 1988). Maize is also a staple food in the area. Consequently, the study sought to identify and describe the factors that influence adoption of maize technologies in Njoro Division and hence came up with practical recommendations on how adoption can be enhanced in the area.

1.3 Purpose of the Study.

The purpose of the study was to describe the factors related to adoption of technical information on maize production by small scale farmers in Njoro Division.

1.4 Objectives.

The following were the objectives of the study:

- 1) To determine the extent to which various innovations have been adopted.
- 2) To determine the relationship between adoption and farmers' knowledge of the various innovations.
- 3) To describe the relationship between adoption and farmers' personal characteristics.

- 4) To describe the relationship between adoption and farmers' social characteristics.
- 5) To describe the relationship between adoption and farmers' situational characteristics.
- 6) To describe the relationship between adoption and farmers perception of various innovations.

1.5 Hypotheses

The following were the hypotheses of the study:

- H1 There is no relationship between adoption and farmers' knowledge of various innovations.
- H2 There is no relationship between adoption and the following farmers' personal characteristics:
- a) Age
 - b) Formal education
 - c) Gender
 - d) Level of familism
 - e) Empathy
 - f) Scientism
- H3 There is no relationship between adoption and the following farmers' situational characteristics:
- a) Size of land holding
 - b) Availability of inputs
 - c) Availability of credit
 - d) Commercial orientation

- H4 There is no relationship between adoption and the following farmers' social characteristics:
- a) Extension contact
 - b) Urban contact
- H5 There is no relationship between the farmer perception of innovations and the adoption behaviour.

1.6 Significance of the Study.

This study was designed to describe the factors which influence adoption of maize technologies in the research area. It is expected that the information obtained will be useful to policy makers, maize researchers and local extension personnel in their efforts to improve maize production.

1.7 Assumptions of the Study.

In this study the responses from the farmers were assumed to be honest and true.

1.8 Limitations of the Study.

The research was confined to a division due to time and financial constraints. It was also not possible to study all the factors that are likely to influence adoption in the area due to the two named constraints.

1.9 Definitions of Terms

Adoption refers to the integration of technical information on maize production into a farmer's maize enterprise.

Compatibility refers to the extent the innovations fit into the farmers view about what ought to be, what he does on the farm, and how he does it.

Complexity is the degree to which the innovations are perceived as relatively difficult to understand and use.

Empathy refers to the extent a farmer is able to picture himself in a better situation in maize production as exemplified by his neighbours or friends.

Familism refers to the extent a farmer depends on his family to make crucial decisions as regards the innovations he should use on his maize crop.

Non adoption refers to the none use of the innovation considered in this study.

Observability refers to the degree to which results adopting of an innovation are visible to others.

Partial Adoption refers to the use of innovations in an incomplete manner as well as not using

all the innovations.

Perceptions of the innovation refers to the qualities of the innovation as understood by farmers. These qualities include relative advantage, compatibility, complexity, trialability and observability of the innovations.

Relative advantage refers to the degree to which the innovations are perceived by farmers as superior to the practices they have replaced.

Scientism refers to the belief in science as expressed by the farmers in the study.

Small scale farmers in this study will refer to farmers who own less than 10 hectares of land within the division.

Technical information refers to the information on maize production which is generated by research and passed to farmers through the extension service.

Trialability refers to the degree an innovation can be tried but on a limited scale before deciding to adopt it.

CHAPTER 2

LITERATURE REVIEW

This section reviews literature on the role of maize in Kenya, management practices associated with maize production, theoretical perspective of diffusion process and related research findings on the factors that influence adoption. Important variables as well as possible research gaps in the research area are also identified. Some insight into the research design and methodology is obtained. Also a backdrop for interpreting the results is established.

2.1 Role of Maize in Kenya.

Maize is the most important cereal grain in Kenya and is grown virtually everywhere. In 1981 maize was grown on about 1.23 million hectares of land and this accounted for 38% of the land under crops (Ndambuki, 1988). Small holders are the major producers of maize in terms of area under production, total supply and also labour input while large scale farms account for the major share of officially marketed production (Ndambuki, 1988). This is shown on Table 1.

A major share of the maize produced by small scale farmers is consumed by the producers themselves which further indicates the importance of maize as a staple crop (Ndambuki, 1988).

Table 2 shows the important role maize plays as a food crop in Kenya. This Table indicates clearly that maize as a food crop will in the future continue to be of great importance in Kenya. Muchena (1988) has noted that maize requirement in the sub Saharan Africa (Kenya included) does not match production.

Table 1: Maize Production by Type of Holding (Percent)

	Small farms	Large farms
1. Percentage of the rural population	77	12
2. Area	97	3
3. Proportion marketed	22	75
4. Volume of production	72	22

Source: Towards Self Sufficiency: Proceedings of the Second East, Central and Southern Africa regional maize workshop in Harare Zimbabwe, March 15-21 1987.

Table 2: National Food Requirement for 1996

	Consumption Kg/person/Year Urban	Consumption Kg/person/Year Rural	National food requirements (000 tonnes)
Maize	97.1	125.5	3,232
Millet/ Sorghum	0	19.8	429
Wheat	29.4	10	344
Rice	13.1	1.4	99
Potatoes	14.8	26.4	650
Beans	13.8	14.2	80
Sugar	20.6	10.4	660
Milk	88.6	72.1	2,451
Beef	11.6	6.8	210
Fat	6.6	1.7	71
Vegetables	36.9	20.4	636
Fish	1.9	1.7	47

Source: Kenya Development Plan 1994-6.

This is because food production in these countries has grown at half the population rate. The result

is widespread starvation. This in turn has led to high grain imports which have tripled the debt burden. Evidently efforts to increase maize production in Kenya are of paramount importance.

Ndambuki (1988) further noted that in 1981 maize was estimated to contribute 28% of the total crop production and generated 35% of the employment opportunities in Kenya. From the foregoing discussion it can be concluded that maize holds a key position in Kenya's nutrition, economy and agriculture.

2.2 Management Practices Associated with Maize Production.

KARI supplement (KARI, 1993) indicates that various management practices are associated with good maize yields. These are in order of importance, early planting (at the beginning of rains) on a well prepared seed bed, use of certified seed (correct variety carefully selected for a particular area), and effective weed, pest and disease control. Yields can also be maximized through sowing seeds at correct plant population per unit area (recommended spacing) and making use of good quality fertilizers especially nitrogenous and phosphatic types. Table 3 shows recommended varieties in Kenya and yield potentials of various varieties when all the above practices are carried out. It is important to note that in Njoro division the average productivity of maize is 22 bags/acre (MOA, 1993).

Table 3: Potential Yields of Some Recommended Varieties

Recommended Variety	Yield Potential (Bags/Acre) During the Long Rains	Yield Potential Bags/Acre During the Short Rains
H614	94	-
H622	67	-
H625	96	22
H626	107	-
H632	69	23
H511	44	16
H512	50	18
Katumani Composite	33	12

Source: MOA, 1993.

However, majority of the farmers in the area get below this average (MOA, 1993). This study concentrated on the use of certified seed, weed and pest control, timely weeding, correct spacing and use of fertilizers. This was because there is evidence that adoption levels of these innovations were relatively low in the study area (MOA, 1993).

2.3 Theoretical Perspective of the Diffusion Process.

The theoretical perspective that guided this study is developed from the diffusion paradigm. Rogers (1983) defined diffusion as the process by which an innovation is communicated through certain channels over time, among members of a social system. From the definition, four elements of diffusion can be identified. These are an innovation, communication channels, time and a social system. These elements are identifiable in every diffusion research study and in every diffusion campaign or programme. Dasgupta (1989) noted that though diffusion is the process by which an

innovation spreads within a social system, an innovation however diffuses within a social system through its adoption by individuals or groups. Diffusion and adoption are thus closely interrelated even though they are conceptually distinct. Adoption is defined as the decision to make full use of an innovation as the best course of action available (Rogers, 1983). The following subsections give a brief description of the four elements of diffusion.

2.3.1 Innovation

Rogers (1983) defined an innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. Many new ideas are technological innovations. Consequently, "innovation" and "technology" are often used as synonyms. A technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome (Thompson, 1967). The characteristics of innovations or technologies as perceived by individuals help to explain their different rates of adoption (Lionberger and Gwin, 1982). These characteristics include relative advantage, compatibility, complexity, trialability and observability.

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social-prestige factors, convenience and satisfaction are often important components. It does not matter so much whether an innovation has a great deal of "objective" advantage, what matters is whether an individual perceives the innovation as advantageous. The greater the perceived relative advantage, the more rapid its rate of adoption will be (Fliegel and Kilvin, 1967). Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and

need of potential adopters (Fals Borda, 1960). An idea that is not compatible with the prevalent values and norms of a social system will not be adopted as rapidly as an innovation that is compatible. The adoption of an incompatible innovation requires the prior adoption of a new value system. Complexity is the degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understanding (Singh, 1966). Trialability is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the instalment plan will generally be adopted more quickly than innovations that are generally not divisible. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption as it is possible to learn by doing (Fliegal et al, 1968). Observability is the degree to which the results of an innovation are visible to farmers. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt. Such visibility stimulates peer discussion of a new idea, as friend and neighbours of an adopter ask him or her for innovation - evaluation information (Rogers, 1983). Having noted the importance of the characteristics of innovations in explaining adoption patterns and the relatively scant information available on characteristics of innovations, this study devoted considerable effort in trying to relate the characteristics of innovations to the adoption patterns in the study area.

2.3.2 Communication Channels

Communication is the process by which participants create and share information with one another in order to reach a mutual understanding (Rogers, 1983). Diffusion is a particular type of communication in which information that is exchanged is concerned with new ideas (Lionberger,

1982). This process is composed of (1) an innovation (2) an individual or other unit of adoption that has knowledge of or experience with using the innovation (3) another individual or unit that does not yet have knowledge of the innovation (4) a communication channel connecting the two units, that is, the means by which messages get from one unit to another. Mass media communication channels are often used to inform potential adopters about the existence of an innovation, that is, to create awareness knowledge. Interpersonal channels (face to face exchange between individuals) are more effective in persuading individuals to accept new ideas (Yadiv, 1967).

Effective communication occurs between individuals who are similar in certain attributes, for example, education, beliefs, social status and so on. However individuals can outwardly be very different but still have very effective communication between them. This is explained by the concept of empathy. Empathy is defined as the ability of an individual to project him or her into the role of another (Roger, 1983). High empathy between individuals who are different in many attributes will result in very effective communication. In a way these 'different' individuals are similar in a social-psychological sense (Rogers, 1983). Due to the importance of empathy in communication as exemplified in the preceding discussion, this study looked at the relationship between empathy and adoption in the study area.

2.3.3 Time

Time is an important element in diffusion. It is involved in the diffusion process in three ways. These ways include (1) the innovation - decision process (or the adoption process) by which a individual passes from knowledge of an innovation to its adoption or rejection of the innovation (2) the innovativeness of the adopting unit compared with other members of a system (this gives rise to

adopter categories) and (3) the rate of an innovation's adoption in a system. These three concepts are discussed briefly in the subsection that follow.

The innovation-decision process occurs when an individual passes first from knowledge of an innovation to adoption or rejection of this innovation (Beal and Rogers, 1960). It can be conceptualized in five main steps namely; knowledge, persuasion, decision, implementation and confirmation. Knowledge occurs when an individual (or any other decision making unit) is exposed to the innovations existence and gains some understanding of how it functions. Persuasion occurs when an individual or any other decision-making unit forms a favourable or non-favourable attitude towards the innovation. Decision occurs when an individual or any other decision-making unit engages in activities that lead to a choice to adopt or reject the innovation. Implementation occurs when an individual or any other decision making unit puts an innovation to use. Reinvention is especially likely to occur at implementation stage (Coleman, 1966). Confirmation occurs when an individual or other decision making unit seeks reinforcement of an innovation decision already made, but he or she may reverse this previous decision if exposed to conflicting messages about the innovation (Rogers, 1983; Lionberger, 1982).

Innovativeness is the degree to which an individual or other decision-making unit is relatively earlier in adopting new ideas than other members of a system (Rogers, 1983). Members of a social system can be classified into various adopter categories on the basis of innovativeness. The five categories are; innovators, early adopters, early majority, late majority and laggards. Each of these categorizes have different characteristics as exemplified by various researches on innovativeness (Rogers, 1962). These characteristics include personal variables (for example, age education and empathy); social variables (for example, extension contact, urban contact and exposure to mass

media); situational variables (for example, availability of credit, commercial orientation and size of farms). These characteristics are also used to explain why an individual or other adopting unit has adopted or failed to adopted a certain innovation (Dasgupta, 1989). Some of these personal, social and situational variables of farmers are related to adoption in this study.

Rate of adoption is the relative speed with which an innovation is adopted by members of a social system. It is usually measured as the number of members of the system that adopt an innovation in a given time period. Most innovations have an S-shaped rate of adoption. There is variation in the slope of the "S" from innovation to innovation as well as from one social system to another (Bose, 1966 and Sharma, 1966). These differences are due to varying characteristics of innovations as perceived by the adopters as well as varying characteristics of the adopters.

2.3.4 Social System

A social system is defined as a set of interrelated units that are engaged in joint problem solving to achieve a common goal. The process by which alteration occurs in the structure and function of a social system is referred to as diffusion. When new ideas are invented, diffused and adopted or rejected, leading to certain consequences, social change occurs. The general convention is to use the term diffusion to include both planned and spontaneous spread of ideas. The social system therefore constitutes a boundary within which an innovation diffuses (Rogers, 1983).

In a nutshell critical elements in the diffusion perspective that were of significance to this study are personal, social and situational characteristics of the farmers. Personal characteristics considered in this study were age, gender, educational background, familism, scientism and empathy. Social characteristics considered were urban and extension contact. Situational characteristics included

availability of credit and inputs, farm size, and commercial orientation.

Perceptions of innovations by farmers were also included. These perceptions were considered under various headings that is relative advantage, complexity, compatibility, trialability and observability.

2.4 Related Research Findings on the Factors that Influence Adoption.

As noted earlier Gershon (1983) reported that similar innovations may experience different adoption patterns in different areas and by different groups of farmers. Leagans (1979) further attests to this fact by noting that adoption tends to be specific to particular innovations, individuals and environments. He adds that by recognising and accepting the individuality of each farmer and the uniqueness of his particular circumstance one can understand better how the general principles of adoption behaviour are developed and applied.

These sentiments of the two authors are borne out clearly as one looks at the findings of various researchers. Amudavi (1993) found that there is no relationship between adoption and farm size, extension contact and access to credit. He also found that there is no relationship between adoption and age as well as gender. However, other researchers, for example, Misiko (1976) and Clark (1968) found that there is a positive and significant relationship between adoption and credit availability, extension contact and farm size. Gerhart (1974) found that there is a significant and positive relationship between adoption and credit availability and extension contact. However, just like Amudavi (1993) he, found that there is no relationship between adoption and farm size. Unlike Amudavi (1993) Jha et al (1991) in their study in the Eastern Province of Zambia found that there is a significant and positive relationship between adoption and age as well as gender.

To explain the variability in the findings various researchers have come up with different reasons. Misiko (1976) reported that the positive relationship between adoption and land size was due to the use of credit facilities available only to farmers with over 15 hectares of land. Amudavi (1993) on the other hand reported that the lack of a relationship between adoption and farm size was due to (a) simplicity of the innovations considered (b) high awareness level of the innovations and (c) a lot of influence from neighbours. Misiko (1976) also reported that the positive relationship between adoption and extension contact was due to the role extension agents play in disseminating innovations developed for the farmers. Amudavi (1993) reported that the lack of a relationship between extension contact and adoption in his area of study was due to the high awareness level of the innovations in question. This implies that the farmers knew about the innovations in question. Consequently, the informative role of the extension agent as regards maize innovations in question was not important. Since no adoption study has been done in Njoro Division, this study will aim at finding out where Njoro falls as regards factors influencing adoption and subsequently suggest suitable recommendations to enhance adoption.

Feliciano in a Phillipines set-up as quoted by Byrnes (1966) indicated other factors associated with adoption. These are seen and proven effectiveness of the innovation, novelty of the innovation, ease of doing the practice and compatibility with farmers' needs and goals. It has been noted that though many adoption studies in Kenya acknowledge the importance of these factors (Gerhart, 1974; Roling et al, 1973; Mbithi, 1974 and Amudavi, 1993) not much research has been done on these factors. Consequently, this research study will devote considerable effort to understand farmers' perceptions of the innovations which will include seen and proven effectiveness - observability, ease of doing the practice - complexity, novelty of the innovation - relative advantage,

and compatibility with farmers' needs and goals. These will aid in explaining the adoption patterns found in the area of study.

This study also looked at farmers' values that is familism, empathy and scientism in an effort to explain the adoption patterns. This is a much ignored area of adoption study but it is very important in explaining adoption patterns in many communities (Lionberger, 1982 and Dasgupta, 1989). In the Kenyan studies reviewed farmers' values were not addressed.

Therefore, in conclusion, a more sympathetic understanding of the conditions that influence farmers acceptance of maize related technologies is important as it will facilitate increase in the production of maize as powerfully as the new technologies themselves.

2.4 Summary

From the preceding discussion it can be concluded that maize plays a vital role in Kenya's nutrition, economy and agriculture. Consequently, good maize yields are of paramount importance in Kenya. The latter are associated with various management practices, some of which are a subject of this study. The theoretical perspective that guided this study is developed from the diffusion paradigm. From the definition of diffusion, it can be concluded that diffusion is composed of an innovation, communication channels, time and a social system. These four elements have been discussed in detail. Studies on adoption that have been discussed have shown that adoption tends to be specific to particular innovations, individuals and environments. It was also noted that though many adoption studies in Kenya acknowledge the importance of farmers' perceptions very little research has been done on these factors. Another, much neglected area is farmers' values. The current study has therefore, devoted considerable effort in these two areas.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

This research was a descriptive survey. Descriptive survey entails the studying of a situation as it is in the field as well as attempting to explain why the situation is the way it is (Wiersma, 1986). However, descriptive survey as a research methodology is limited as it is used to study independent variables which have already occurred and are inherently not manipulable by the researcher. Consequently, this leads to less straight forward interpretation of results and ambiguity because independent variables in the natural setting tend to operate simultaneously. In this study the independent variables were carefully selected from related research studies in order to overcome this handicap. Data was collected by use of a structured questionnaire. The questionnaire was composed of direct questions, dichotomous questions as well as a Likert scale for measurement of farmers' perceptions.

3.2 Population of the Study.

The population of Njoro Division was approximated to be 163,218 in 1993 (GOK, 1994 b). Majority of the people in the division are small scale farmers (Blarel et al, 1988). The target population was the small scale farmers within Njoro Division.

Njoro Division was selected because :

- 1) Similar research has not been done in the division.

- 2) Financial and time constraints limited the area of study to a division.
- 3) The division has great potential to increase agricultural production.
- 4) The researcher has some background knowledge about the area.

3.3 Sampling

Disproportionate stratified sampling was carried out. This ensured that there was uniform coverage of the target population (Tuckman, 1978). The strata used were the various locations. This was necessary also because the locations differ considerably in agro-ecological characteristics as well as the distance from input distribution centres.

Kathuri and Pals (1993) recommend that the minimal sample size for survey type of research should be 100 for major subgroups and 20-50 for each minor subgroup. Consequently, a sample size of 161 farmers was used. Other factors considered in choosing the sample size included level of accuracy required, availability of the population, resources available in terms of manpower, funds and time (Tuckman, 1978). The sampling frame was constructed using information from Njoro Division agricultural office. Systematic random sampling was used to select farmers from each location, in order to ensure reasonable representativeness of the small scale farmers population. The selected respondents were distributed as follows: Njoro Location (39), Nesuit Location (17), Kihingo Location (22) Lare Location (40), Mau Narok Location (27) and Ngata Location (16).

3.4 Instrumentation

3.3.1 Development and validation of the questionnaire.

A review of related literature (Misiko, 1976; Amudavi, 1993; Clark 1968, Dasgupta, 1989; and Lionberger, 1982) was conducted to provide the basis for constructing the measuring instrument.

A draft of the questions was then constructed.

3.3.2 Validation of the instrument.

The author first discussed the draft with fellow students and members of staff in the Department of Agricultural Education and Extension. Revision was done accordingly. The questionnaire was translated into Kiswahili which is the common language spoken in the area of study. This was also used for data collection. To ensure that the Kiswahili version of the questionnaire was similar to the English version the Kiswahili version was retranslated into English and revision made accordingly.

Pilot testing was then done using 10 farmers from Molo Division and revision was made accordingly. Molo was used because it is similar to Njoro in many respects. The various revisions done on the original questionnaire ensured that the questionnaire was valid and reliable.

3.5 Data Collection Procedures.

The researcher interviewed the selected farmers following the questionnaire. Each question was read to respondents and the latter's responses recorded. Where respondents were not available the researcher visited the farmsteads a second time. All responses were checked at the end of each day to ensure that the responses were meaningfully recorded

3.6 Data Analysis

The Statistical Package for Social Sciences (SPSS) computer programme was used to analyze data. Objective one was analyzed using descriptive statistics in order to describe the adoption patterns in the area of study. Objectives 2, 3, 4, 5, and 6 were analyzed using inferential statistics. The table below summarises the specific inferential statistics used for each objective in hypothesis form.

Table 4: Summary of Inferential Statistics Used.

Hypothesis	Independent Variable	Dependent Variable	Statistics
1.	Farmer's knowledge	Adoption	Chi-square
2. a)	Age	Adoption	Chi-square
b)	Education	Adoption	Chi-square
c)	Gender	Adoption	Chi-square
d)	Familism	Adoption	Chi-square
e)	Empathy	Adoption	Correlation
f)	Scientism	Adoption	Correlation
3. a)	Farm size	Adoption	Correlation
b)	Size of Maize holding	Adoption	Correlation
c)	Availability of credit	Adoption	Chi-square
d)	Availability of Inputs	Adoption	Chi-square
e)	Commercial orientation	Adoption	Correlation
4. a)	Extension contact	Adoption	Chi-square
b)	Urban contact	Adoption	Chi-square
5.	Farmers' perception	Adoption	Chi-square

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of the study was to describe the factors related to adoption of technical information on maize production by small scale farmers in Njoro Division. The main objective of the study was to describe adoption of selected maize technologies in the area of study and to examine the relationship between adoption and farmers perceptions, personal, social and situational characteristics. The findings of this study are presented and discussed in the following order:

1. Description of adoption.
2. Description of awareness knowledge of various innovations.
3. Description of farmers' personal, social and situational characteristics.
4. Description of farmers' perceptions of various maize technologies.
5. Analysis and testing of various hypotheses.

The general description of the variables of this study is important as it gives a general picture of the area as far as these variables are concerned. The data presented under each topic were based on responses from 161 small scale farmers from the six locations of Njoro Division.

4.2 Description of Adoption

In this section the general description of adoption of maize technologies of the respondents is given. The adoption of each innovation namely use of hybrid seed, correct plant population, use of

fertilizers, use of pesticides and timely weeding are described.

4.2.1. Use of Hybrid Seed

Majority of the respondents (77%) used hybrid seed. Other researchers, for example, Misiko (1976) and Amudavi (1993) have found similar results in other parts of Kenya. Seventy nine percent of the respondents that did not use hybrid maize seed indicated that high prices of hybrid seed were prohibitive (Table 5). This implies that to enable more farmers to plant hybrid maize the question of high prices of hybrid seed has to be addressed. It was important to note that none of the farmers indicated that hybrid maize seed was not available at the shops during the planting season. This shows there is a good supply of hybrid maize in Njoro Division. It was also interesting to note that the most popular hybrid maize seed was H614 which had been adopted by 51% of the farmers (Table 5).

Though H511 and H512 are recommended for Lare Location, no farmers interviewed in Lare used them. This could be due to the higher yields obtained when 600 hybrid series are used particularly during wet years. However, during dry years, the use of the 600 hybrid series in Lare could prove disastrous. This is because the hybrid requires more rainfall than the 500 hybrid series. Consequently, during the dry years (which are quite common in Lare Location) the rainfall available may not be able to sustain the 600 series.

Table 5: Distribution of Respondents by Adoption of Hybrid Seed

	Respondents	
	Number	Percent
Adoption of hybrid seed		
Used hybrid seed	124	77
Did not use hybrid seed	37	23
	----	----
Total	161	100
Reasons for not using hybrid seed		
Hybrid seed is too expensive	29	79
Never heard of hybrid maize	4	11
Other reasons	2	5
No response	2	5
	----	----
Total	37	100
Hybrid seed types used		
H614	63	51
H626 and H625	51	41
Others (H511, H512, H623 and Katumani)	10	8
	-----	-----
Total	124	100

There is need for more research with the 500 hybrid series to make them more competitive with the 600 hybrid series in areas like Lare (Mwale, 1994). This is because the yield potential of the 600 hybrid series is higher than that of the 500 hybrid series even when all the proper management practices are carried out (MOA, 1993).

4.2.2 Correct Plant Population

Ninety eight percent of the respondents intercropped maize with beans, potatoes, peas, and pumpkin (Table 6). The most popular crop intercropped was beans. These findings are consistent with what Blarel et al (1988) found in their study of Njoro Agricultural activities.

Table 6: Distribution of Respondents by Adoption of Correct Plant Population

	Respondents	
	Number	Percent
Intercropping		
Those who intercropped	158	98
Those who did not intercrop	3	2
	----	-----
Total	161	100
Number of seed planted per hole		
1-2 seeds per hole	53	33
3 and over (not recommended)	108	67
	----	-----
Total	161	100
Reasons for planting 3 seeds and over		
In order to get good crop stand	74	68
Used to doing so	20	19
No response	14	13
	----	-----
Total	108	100
Depth of planting		
Used correct depth of planting	100	62
Used the wrong depth of planting	61	38
	----	-----
Total	161	100
Reasons for not using the recommended depth of planting		
To ensure seed germinate when enough moisture is available	11	18
To avoid exposure of seeds to birds		

and adverse environment conditions	26	43
Other reasons	24	39
	----	----
Total	61	100
Spacing		
Used recommended spacing	19	12
Did not use recommended spacing	140	87
No response	2	1
	----	----
Total	161	100
Reasons for not using the recommended spacing		
In order to get a good harvest	35	25
To ensure enough space to plant the intercrop(s)	22	16
Other reasons	37	26
No response	46	33
	----	----
Total	140	100

The spacings recommended by the divisional agricultural office take this into account. To obtain optimum plant population on a piece of land one has to consider the number of plants per hole, correct interrow and intrarow spacings and the depth of planting. Only 33% used the correct number of seeds per hole and hence may have achieved the correct plant population if the spacing and depth was correct (Table 6). Majority (68%) indicated that they planted the wrong number of seeds in order to get a good crop stand having minimized loss of plants which occurs due to poor germination. However, it is important to note that the result is wrong plant populations per unit area. Due to competition for nutrients between plants, optimum yields per unit area cannot be achieved. Farmers need to be educated on this aspect of correct spacing. Sixty two percent used the recommended depth of planting. Most of the respondents (43%) indicated that they used the non-recommended depth

planting because they wanted to ensure that the seeds are not exposed to birds or other adverse environmental conditions (Table 6). This shows a knowledge gap that needs to be bridged. Eighty seven percent of the respondents indicated that they did not use the recommended spacing. The reasons given for this; included the need for a good harvest (25%), the need to ensure enough space for the intercrops (16%) and a variety of other reasons (26%). From the reasons given, it is evident that even in this aspect of plant population per unit area there is a knowledge gap that needs to be bridged among the farmers.

4.2.3 Use of Fertilisers

Fifty percent of the farmers interviewed did not use any organic fertilisers on their maize crop (Table 7). Forty nine percent indicated that manure was not available due to lack of livestock to produce it. This handicap can however, be alleviated if production of other forms of organic fertilisers (for example compost manure) is practised by the farmers. To facilitate this, the extension service could teach on the importance of organic fertilisers and how they are prepared. Forty seven percent used organic fertilisers (Table 7). However, none of the farmers used the recommended amount on their farms. The result is that the benefits of manure are realized only in part.

Sixty eight percent of the respondents used inorganic fertilisers (Table 8). Of the respondents who used inorganic fertiliser only 11% used the recommended amounts of fertilisers per unit area (Table 8). This means the farmers could not obtain the optimum yields as hybrid maize reaches its full potential when other practices including using correct rates of fertilisers are followed.

Table 7: Distribution of Respondents by Adoption of Organic Fertilisers

	Respondents	
	Number	Percent
Use of organic fertilisers		
Did not use any organic fertilisers	80	50
Used organic fertilisers	76	47
No response	5	3
	-----	-----
Total	161	100
Reasons for not using organic fertilisers		
Manure was not available	39	49
Manure was too expensive	4	5
Others	14	18
No response	23	28
	----	-----
Total	80	100

However, of the respondents who used fertilisers 89% did not apply the fertilisers as recommended. That is, they put the fertilisers in the planting hole and did not mix with the soil in the hole prior to sowing the seeds. This practice often leads to damaging the seeds resulting in poor germination. Poor germination leads to poor yields.

Optimum yields could not also be achieved by the 30% who did not use inorganic fertiliser. This is because hybrid maize reaches its full potential yields when fertilisers are applied. Various reasons were given by those farmers who did not use fertilisers. The majority (68%) indicated that the fertilisers were too expensive for them to purchase. This implies that the question of high prices needs to be looked into to ensure that farmers use inorganic fertilizers for their maize crops. Sixteen percent indicated that they preferred to use manure to inorganic fertilisers (Table 8). This shows a misconception that organic fertilisers can substitute inorganic fertilisers.

Table 8: Distribution of Respondents by Adoption of Inorganic Fertilisers

	Respondents	
	Number	Percent
Use of inorganic fertilisers		
Used inorganic fertilisers	109	68
Did not use inorganic fertilisers	49	30
No response	3	2
	-----	-----
Total	161	100
Rates of fertilisers application		
Recommended rate used	12	11
Did not use recommended rates	97	89
	-----	-----
Total	109	100
Method of fertiliser application		
Use of recommended method	12	11
Did not use recommended method	97	89
	-----	-----
Total	109	100
Reasons for not using fertilisers		
Fertilisers are too expensive	33	68
Prefer manure to fertilisers	8	16
Has no knowledge of fertilisers	1	2
Other reasons	2	4
No response	5	10
	-----	-----
Total	49	100

This misconception can be corrected through educating the farmers more on the use of fertilisers. This situation may have resulted from the teaching of various extension agencies which advocate for organic farming. There is need to resolve this conflict with conventional recommendations and advice the farmers accordingly.

4.2.4 Pesticides

Twenty one percent of the respondents indicated they used pesticides (Table 9). However, of these respondents 71% applied the pesticides at the wrong time (Table 9).

Table 9: Distribution of the Respondents by Adoption of Pesticides

	Respondents	
	Number	Percent
Use of Pesticides		
Used pesticides	34	21
Did not use pesticides	126	78
No response	1	1
	-----	-----
Total	161	100
Time of application of pesticides		
Correct time of application	10	29
Wrong time of application	24	71
	----	-----
Total	34	100
Reasons for not using pesticides		
Did not see any pest	91	72
Pesticides are too expensive	21	17
No knowledge of pesticides	3	2
Pesticides were not available	3	2
Uses ash or soil instead of pesticides	3	2
No response	5	3
	-----	-----
Total	126	100

The farmers applied pesticides once they saw the pests already infesting the maize crop. The result is that the maize crop will have already been affected adversely at the time of application and this would be reflected in the lower yields obtained. Majority of the respondents (78%) indicated that they

did not use pesticides. Various reasons were advanced for this. Seventy two percent indicated that they did not use any pesticides because they saw no pests on their maize crop. This shows that the farmers need to be convinced about the need for routine spraying of maize, that is spraying each maize crop at the recommended times with or without observable pests. More teaching by extension workers on this aspect of maize production may be part of the process of convincing these farmers on the need for routine spraying with pesticides.

4.2.5 Timely Weeding

All of the respondents weeded their maize crop twice or thrice using hand weeding method (Table 10).

Table 10: Distribution of Respondents by Adoption of Timely Weeding

	Respondents Number	Percent
Weeded at correct plant height in the two times weeding was carried out	70	43
Weeded at correct plant height once in the two times weeding was carried out	44	27
Did not weed at the recommended plant height at all	45	28
No response	2	1
Total	161	100

However, the time of weeding gave a very different picture. Fifty five percent either weeded at wrong times for both weeding or for at least one weeding (Table 10).

The consequence of untimely weeding is poor yields due to the competition for nutrients that occurs between the weeds and the maize crop. This is made worse by the fact that weeds are more

competitive than maize particularly during the early stages of growth of maize.

4.3 Description of Awareness Knowledge of Various Maize Innovations

Ninety six percent of the respondents were aware of hybrid maize seed (Table 11). However, 91% of the respondents were not aware of the correct depth of planting. Ninety four were also not aware of the correct spacing (Table 11). As noted earlier, correct depth of planting and correct spacing determine the correct plant population. Since majority of the respondents are not aware of correct depth of planting and spacing it follows they do not practice them. Consequently, they may not obtain the optimum yields from their fields because of wrong plant populations. Ninety six of the respondents are aware of fertilizers used for maize production while 52% are aware of pesticides used to control pests in maize. Ninety one percent of the respondents are not aware of timely weeding recommendations (Table 11). Just like correct depth of planting and spacing they may not be practising timely weeding, leading to less than optimum maize yields.

In summary it is important to note that lack of awareness about innovations like correct plant population, pesticides and timely weeding may be a crucial part of what is hindering their adoption. However, for hybrid seed and fertilizers it seems there are factors other than awareness affecting their adoption.

Table 11: Distribution of Respondents by Awareness Knowledge of Various Innovations

	Respondents	
	Number	Percent
Hybrid seed		
Are aware of hybrid seed	155	96
Are not aware of hybrid seed	6	4
	-----	-----
Total	161	100
Correct plant population		
Are aware of depth of planting recommended	15	9
Are not aware of depth of planting recommended	146	91
	-----	-----
Total	161	100
Spacing		
Are aware of spacing recommended	9	6
Are not aware of spacing recommended	152	94
	-----	-----
Total	161	100
Fertilizer		
Are aware of fertilizers	155	96
Are not aware of fertilizers	1	1
No response	5	3
	-----	-----
Total	161	100
Pesticides		
Are aware of pesticides	75	47
Are not aware of pesticides	85	52
No response	1	1
	-----	-----
Total	161	100
Timely Weeding		
Are aware of timely weeding	14	8
Are not aware of timely weeding	146	91
No response	1	1
	-----	-----
Total	161	100

4.4 Description of Personal, Social and Situational Characteristics

4.4.1 Personal characteristics

Various personal characteristics are displayed in Table 12. Familism in the current study was taken to be the extent to which an individual depends on his family and close relations to make important decisions such as whether or not to adopt an innovation. This characteristic was analyzed for each innovation (that is familism as regards to the adoption of hybrid seed, correct plant population, use of fertilizers, use of pesticides and timely weeding). The results of the analysis are displayed in Table 12. The relatively high percentages for use of hybrid seed and fertilisers and correct plant population shows that the level of familism among the respondents is fairly high.

The low percentages for use of pesticides (as far as familism is concerned) may be due to the lack of proper information on pesticides within the family circles thus necessitating information on pesticides be sought elsewhere, for example, from agricultural extension officers and friends.

Scientism in this study referred to the belief that science is important in improving agricultural production. Ninety percent of the respondents indicated that they believed that science was vital in improving production of maize.

Empathy referred to the ability of an individual to project himself or herself into the role of another. Seventy two percent of the respondents showed a high level of empathy while 28% showed medium and low empathy levels. This may imply that many of the farmers in the division are able to emulate beneficial maize practices from other farmers.

Table 12: Distribution of Respondents by Personal Characteristics

	Respondents	
	Number	Percent
Age		
Under 30 years old	34	21
31-40 years old	29	18
41-50 years old	61	38
51 years old and over	36	22
No response	1	1
	-----	-----
Total	161	100
Gender		
Male	41	26
Female	120	74
	-----	-----
Total	161	100
Education		
0 years	39	24
1-4 years	29	18
5-8 years	61	38
9-12 years	26	16
Over 13 years	5	3
No response	1	1
	-----	-----
Total	161	100
Familism		
Hybrid seed		
Consults family	98	61
Does not consult family	63	39
	-----	-----
Total	161	100
Correct Plant population		
Consult family	95	59
Does not consult family	66	41
	-----	-----
Total	161	100
Fertilisers		
Consults family	96	60

Does not consult family	65	40
Total	161	100
Pesticides		
Consult family	42	26
Does not consult family	119	74
Total	161	100
Timely Weeding		
Consults family	42	26
Does not consult family	119	74
Total	161	100
Scientism		
Believe in science	150	93
Unsure	5	3
Does not believe in science	6	6
Total	161	100
Empathy		
High	111	72
Low	50	28
Total	161	100

4.4.2. Social Characteristics

These characteristics are shown in Table 13. Majority of the respondents showed a high level of urban contact. This is shown by the fact that 61% of the respondents were in the urban centres nearest to them at least once per fortnight. Extension contact was assessed using several criteria. These included (a) whether the farmers knew the extension officers, (b) whether the farmers attended the monthly agricultural extension meetings and (c) whether the farmers had attended any other agriculture related meetings. Sixty percent did not know the agricultural extension workers working

in their locations.

Table 13: Distribution of Respondents by Social Characteristics

	Respondents	
	Number	Percent
Urban Contact		
Lives in town	10	6
Visited town(s) once per week	63	39
" " once every fortnight	26	16
" " once every 1-3 months	40	25
" " once every 4-6 months	10	6
" " once every 7-12 months	5	3
Never visited any town	7	4
Total	----- 161	----- 100
Extension Contact		
Know the extension workers	64	40
Do not know the extension workers	97	60
Total	----- 161	----- 100
Attended monthly agricultural extension meetings		
Attended monthly agricultural extension meetings	15	9
Do not attend monthly agricultural extension meetings	146	91
Total	----- 161	----- 100
Reasons for not attending extension meetings		
Did not know when meetings are held	50	40
Was visited by extension workers so did not see need to attend any meetings	6	5
Too busy to attend meetings	21	17
Things taught not relevant	6	5
Other reasons	13	10
No response	29	23
Total	----- 125	----- 100

Ninety one percent of the respondents indicated that they did not attend monthly agricultural extension meetings. Eighty five percent of the respondents also indicated that they did not attend any sort of agricultural meeting. These percentages imply that there was low extension - farmer contact among the respondents. The low extension contact has serious implications where adoption is concerned. Extension workers are change agents who teach the farmers innovations such as the ones considered in this study. It is important to note that farmers need interpersonal communication, particularly from change agents to be convinced to use various innovations (Rogers, 1983). Various reasons were given for not attending meetings by the farmers. Forty percent of the respondents indicated that they did not know when meetings were held. To alleviate this problem, extension meetings may need to be publicized more than is presently the case. This may be important especially in Njoro Division where the extension agency has adopted a group approach under the T and V model. Seventeen percent indicated that they were too busy to attend extension meetings. This may imply that these farmers did not rate extension meetings very highly.

4.4.3. Situational Characteristics

Table 14 displays situational characteristics of the respondents. One of these characteristics is land size. Since the actual size of land holdings were recorded the mean and standard deviation were also calculated. The mean land size was 4.331 acres while the standard deviation among various land sizes was 4.055 acres. Size of land holding has been related to adoption in several studies and influences adoption positively (Dasgupta, 1963 and Aggarwal, 1974).

Commercial orientation was measured by the percentage of produce sold out of what was harvested. Commercial orientation is positively related to adoption as shown by various studies (Kaufman, 1975 and Dasgupta, 1963). Farmers with high commercial orientation have a goal to increase production at lower costs and hence make a profit.

Consequently, these farmers tend to be more receptive to innovative farming ideas than farmers with a subsistence orientation to farming, who primarily consume rather than sell their produce to the market.

Availability of credit was measured by (a) asking the respondents which credit institutions they knew about and (b) rating the credit institutions on a five point scale [easily available (EA), Available (A), Not Sure (NS), Poorly Available (PA), and Not Available (NA)]. Those who did not use any credit facilities for maize cultivation in the year considered (1994) were asked to give reasons why they did not use any credit facilities. Ninety nine percent did not use credit. Various reasons were given by the respondents as is evident from Table 14. Majority (55%) indicated that they did not use credit because they did not need it. However, as it is evident from the adoption scores many farmers did not use the innovations considered fully because they did not have money to purchase inputs. This may show a lack of knowledge on credit use, for improvement of farm production. This may be remedied to some extent through education on credit use. The extension workers can help in this area. Thirteen percent of the respondents indicated that they did not know where to get loans for farming activities. The latter shows the need to educate farmers on various sources of farm credit. ~~Seventeen~~ percent of the respondents were able to rate the availability of credit from Agricultural Finance Corporation (AFC) using the five point scale. The rest did not know the credit facility in question. Of the 17%, 42% indicated that credit from AFC was poorly available. This shows that the question of

Table 14: Distribution of Respondents by Situational Characteristics

	Respondents Number	Percentage
Size of land holding		
0-2 acres	44	27
2-4 acres	53	33
> 6 acres	43	27
No response	21	13
	-----	-----
Total	161	100
Commercial Orientation		
Did not sell produce	48	30
Sold less than 50% of the harvest	62	37
Sold more than 50% of the harvest	33	20
No response	18	13
	-----	-----
Total	161	100
Use of credit		
Used credit	2	1
Did not use credit	159	99
	-----	-----
Total	161	100
Reasons for not using credit		
Did not need credit	88	55
High interest rates	27	17
Requested for a loan but did not get it	2	1
Did not know where to get loans	21	13
Other reasons	21	13
	-----	-----
Total	161	100
Institutions Rated		
AFC	27	17
Commercial banks	10	6
Farmers cooperatives	11	7
Business men	6	4
Private individuals	10	6
Self help groups	6	4
Catholic Mission	3	2

AFC ratings		
Easily available	8	28
Unsure	8	30
Poorly Available	11	42
	-----	-----
Total	27	100

Availability of Inputs

Hybrid Seed		
Near and V. near	124	77
Far and V. far	30	19
Not sure	5	3
No response	2	1
	-----	-----
Total	161	100

Fertiliser		
Near and V. near	125	78
Far and V. far	29	18
Not sure	5	3
No response	2	1
	-----	-----
Total	161	100

Pesticides		
Near and V. near	76	47
Far and V. far	23	14
Not sure	60	38
No response	2	1
	-----	-----
Total	161	100

Farm Implements		
Near and V. near	120	74
Far and V. far	37	23
Not sure	1	1
No response	3	2
	-----	-----
Total	161	100

availability of credit to farmers needs to be addressed. Only 6% were able to rate credit availability

from commercial banks while 7% were able to rate credit from farmers cooperatives. As is evident from Table 14 very few farmers rated the institutions of credit. This implies that a great proportion of the farmers did not know any credit facility that they could use, hence they could not rate the availability of credit.

Availability of inputs was measured by the distance to the trading centres where inputs were bought. Each respondent was asked to rate the distance on a five point scale (very far, far, not sure, near and very near). The responses are displayed on Table 14. The fairly large percentage (37%) who could not rate the distance covered in order to purchase pesticides may imply that many farmers do not use pesticides hence do not know if they are stocked in nearby trading centres or towns. Majority of the respondents (74%) rated the distance covered to obtain farm implements as near or very near.

From the results obtained it is clear that all the inputs considered are available to the farmers with the most available being hybrid seed, fertilisers and farm implements, while pesticides are least available.

Having looked at availability of inputs throughout the division it is important to look at availability of various inputs in each location. This is because availability of inputs in this study is viewed as the distance from the trading centres or towns as perceived by the farmers. The results are shown on Table 15. Njoro, Lare, Kihingo and Mau Narok had very small percentages of farmers rating the distance from shops as "far" and "very far" (Table 15). Nesuit and Ngata Locations, however, had relatively larger percentages of farmers indicating that the distance to the trading centres or towns (where they can obtain inputs) as "far" or "very far". Farmers in Nesuit perceived the distance to be far because there were no public vehicles to ferry the inputs from Njoro (the nearest

Table 15: Distribution of Respondents per Location Rating Far and Very Far for Various Inputs

	Respondents	
	Number	Percent
Njoro Location		
Hybrid Seed	7	18
Fertiliser	6	15
Pesticides	7	18
Farm Implements	6	15
Nesuit Location		
Hybrid Seed	6	35
Fertiliser	6	35
Pesticides	2	12
Farm Implements	7	41
Lare Location		
Hybrid Seed	7	18
Fertiliser	5	13
Pesticides	5	13
Farm Implements	9	23
Kihingo Location		
Hybrid Seed	0	0
Fertiliser	0	0
Pesticides	0	0
Farm Implements	3	14
Mau Narok Location		
Hybrid Seed	6	23
Fertiliser	5	19
Pesticides	4	15
Farm Implements	5	19
Ngata Location		
Hybrid Seed	5	31
Fertiliser	5	31
Pesticides	5	31
Farm Implements	6	38

distributor of inputs to the farmers) to the location. As a result they had to carry the inputs on their

backs or use bicycles. It was also observed that the only road to the location was in a very bad condition. To enhance the availability of inputs in the location there maybe need to improve this road and introduce public service vehicles. In Ngata Location farmers have large farms. Up to 18 acres was recorded in this study. As a result they have to cover greater distances to and from the input markets.

4.5. Description of Perceptions of Various Innovations

Mean rating scores were used to describe farmers' perceptions (Table 16). All the innovations with the exception of pesticides and to a small extent correct spacing, were perceived as observable, compatible, triable not complex and having relative advantages. For example the complexity of hybrid maize, fertiliser application and weeding had mean rating scores of 3.02, 2.56 and 2.48 respectively while complexity of pesticides and correct spacing had mean rating scores of 2.08 and 1.97 respectively.

Table 16: Distribution Of Respondents By Their Perceptions of Various Innovations.

	Mean Rating Score
Complexity	
Hybrid maize cultivation	3.02
Correct spacing	1.97
Fertiliser application	2.56
Pesticide application	2.08
Weeding	2.48
Triability	
Hybrid maize cultivation	2.63
Correct spacing	2.60
Fertiliser application	2.85
Pesticide application	2.17
Weeding	2.96

Observability	
Hybrid maize cultivation	2.58
Correct spacing	2.63
Fertiliser application	2.98
Pesticide application	2.32
Weeding	2.95
Relative Advantage	
Hybrid maize cultivation	2.37
Hybrid maize cultivation	2.72
Correct spacing	2.67
Fertiliser application	2.92
Pesticide application	2.30
Weeding	2.12
Compatibility	
Hybrid maize cultivation	3.12
Hybrid maize cultivation	2.81
Hybrid maize cultivation	2.72
Correct spacing	2.44
Fertiliser application	2.82
Fertiliser application	2.08
Pesticide application	2.17
Weeding	2.65

4.6. Analysis of Various Hypotheses

4.6.1. Hypothesis 1

There is no relationship between farmers' knowledge of various innovations and adoption.

This hypothesis was accepted for all the innovations apart from depth of planting (Table 17). These findings imply that there is a high level of awareness among adopters and non-adopters alike. Consequently, one can conclude that other factors apart from lack of knowledge of various innovations, are influencing adoption behaviour among the farmers. This may not be the case for knowledge of depth of planting. To enhance adoption of depth of planting among non-adopters,

farmers may need to be informed about the recommended depth of planting.

Table 17: Farmers' Knowledge of Various Innovations as Related to Adoption Behaviour

Variable	χ^2	df	r
Knowledge of hybrid maize			0.0004
Knowledge of depth of planting	9.41*	1	
Knowledge of correct spacing			0.002
Knowledge of fertilizers			-0.0001
Knowledge of pesticides	2.56	1	
Knowledge of timely weeding			-0.0002

* Significant at 0.05 level

4.6.2 Hypothesis 2

There is no relationship between adoption and farmers' personal characteristics.

The latter included age, formal education gender, level of familism empathy and scientism. The results are shown in Table 18.

Table 18: Personal Characteristics of Farmers as Related to Adoption Behaviour

Variable	χ^2	df	r^2
Age	0.62	2	
Formal Education	3.12	3	
Gender	6.04*	1	
Level of familism for:			
Fertilizer use	1.97	1	
Hybrid seed use	1.51	1	
Correct spacing	0.13	1	
Pesticide	2.12	1	
Timely weeding	2.07	1	
Empathy			0.249*
Scientism			0.218*

* Significant at 0.05 level

As far as age was concerned the hypothesis was accepted ($\chi^2 = 0.62$). However the middle aged group (that is between 31 - 50 years) showed a greater tendency to adopt the maize technologies considered. This was consistent with various research findings (Aggarwal, 1974; Basran, 1970 and Amudavi, 1993). This general lack of relationship between age and adoption is explained by the fact that the young people are usually not in a position to make decisions about adopting agricultural innovations. It is the middle aged or older people who are heads of households who make such decisions. Even when the head of the household is relatively young he hesitates to make such decisions on his own but consults older kinsmen in farming (Dasgupta, 1989). Old people tend to be traditional and security minded to take the risk of adopting an innovation. It is thus the middle-aged farmers with needed resources and authority as heads of households who adopt new ideas (Dasgupta, 1989).

The hypothesis was also accepted for formal education. $\chi^2 = 3.12$ was not significant. The profitability of adopting high yielding varieties may have stimulated a positive response to the innovations considered regardless of the educational status.

The results indicated that adoption is contingent on gender ($\chi^2 = 6.04$). This may be as a result of a large number of the respondents being women (75%). The large number of women interviewed also reflect large number of women involved in farming in the division.

The level of familism for all the five innovations considered had no significant relationship with adoption. This situation may be due to other factors (for example costs of implementing the innovation) being more important as far as adoption is concerned. Other researchers (for example Moulik et al, 1975 and Bose, 1962) also obtained similar findings.

Empathy was found to have a positive and significant relationship to adoption ($r = 0.218$). The positive relationship is due to the fact that to a certain extent an adopter must be able to project into

the role of other people, in this case, more progressive farmers. Consequently, she/he is able to 'copy' an innovation from farmers within the local social system and also outside the local social system.

Scientism was found to have a positive and significant relationship with adoption ($r = 0.24$). This positive relationship is due to the fact that scientism makes a farmer to trust and rely on ideas and practices developed through scientific research (Dasgupta, 1989). Subsequently, the farmer adopts scientific innovations more readily.

4.6.3 Hypothesis 3

There is no relationship between adoption and farmers' situational characteristics.

The findings are shown in Table 19.

Table 19: Situational Characteristics of Farmers as Related to Adoption Behaviour

Variable	χ^2	df	r
Size of land holding	7.16*	2	
Availability of inputs			
Hybrid seed	0.19	1	
Fertilizer	0.24	1	
Pesticides	2.16	2	
Farm implements	2.47	1	
Use of credit			-0.31*
Commercial orientation	10.78*	2	

* Significant at 0.05 level

The relationship between adoption and size of land holding was found to be significant ($\chi^2 = 7.16$). The general tendency was to have higher adoption with increase of size of land owned. The positive relationship between size of land owned and adoption is due to the fact that owners of large farms have economic resources and can afford to take the risk involved in trying out a new idea, or

practice. This is unlike operators of small land holdings. The latter avoid the economic risks by not adopting an innovation which in many cases requires substantial economic resources and a relatively large sized operation for their adoption. Operators of small holdings do not adopt a new idea until they are thoroughly convinced about its effectiveness and wait until it has been successfully used on the farms of their wealthier neighbours before adopting it (Dasgupta, 1989 and Rogers, 1983).

A chi-square test for the relationship between adoption and availability of all inputs indicated no significant relationship between the two variables. This implies that the inputs considered were readily available to adopters and non adopters alike. One can conclude that other factors for example high prices of inputs may be more important as far as adoption is concerned.

The relationship between adoption and availability of credit was not determined because of the small number of respondents. However the relationship between credit use and adoption was determined ($r = -0.31$). This negative relationship reflects the fact that the use of credit facilities is very important in adoption of agricultural innovations especially among small scale farmers. This importance is due to the fact that most agricultural innovations require substantial economic resources to implement (Mosher, 1966). For small scale farmers who have limited economic resources using credit facilities availability would enable them to adopt various agricultural innovations (Siegfried and Mbugua, 1974).

Commercial orientation and adoption were found to have a significant relationship ($\chi^2 = 10.78$). The general tendency was to have higher adoption with higher commercial orientation. Farmers with high commercial orientation are more receptive to innovative ideas because their goal is to increase their production at a lower cost so that they can compete and make a profit (Dasgupta, 1989). Other studies which have found similar findings include Kaufman et al, 1973 and

Kilvin et al,1971.

4.6.4 Hypothesis 4

There is no relationship between adoption and various farmers' social characteristics.

The latter include extension contact and urban contact. The findings are summarized in Table

20. Extension contact was determined by (a) knowing the local extension worker and (b) the attendance of meetings organized by the extension service. Using chi-square statistics no relationship was found between contact with the local extension officer and adoption.

Table 20: Social Characteristics of Farmers as Related to Adoption Behaviour

Variable	X ²	df
Extension contact		
Knowing local extension officer	0.71	1
Attendance of monthly extension meetings	0.47	1
Attendance of other agricultural related meetings	1.28	1
Urban contact	3.92*	1

* Significant at 0.05 level

Similarly, there was no relationship between adoption and attendance of agricultural extension meetings. This lack of relationship may be due to the high awareness of various maize innovations leading to the informative role of extension being unnecessary at this present time. It also implies that other factors may be more important in determining adoption behaviour. The lack of relationship may also be due to the extension officers concentrating on topics other than maize during their teaching sessions with farmers.

The relationship between urban contact and adoption was found to be significant ($x^2 = 3.92$).

Urban contact here refers to any exposure to urban situations through visits to the urban centres or by the virtue of living in the urban centres. Urban contact has a positive influence on the farmers' consciousness and outlook. Exposure to a wide variety of ideas and information found in the urban centres makes a farmer progressive in outlook. This effect of urban contact plays a significant role in adoption (Dasgupta, 1989 and Majunder, 1966). A farmer with a lot of urban contact is thus more likely to adopt agricultural innovations.

4.6.5. Hypothesis 5

There is no relationship between the farmers' perceptions of innovations and his adoption behaviour.

The findings are summarized on Table 21. There was a significant relationship between adoption and observability of hybrid maize ($x^2 = 9.57$). Observability here refers to the degree the results of an innovation are observable. This relationship is due to the fact that farmers will adopt an innovation they can easily see as effective as opposed to one which they are unable to perceive its benefits (Tripathi, 1974). Unlike observability all the other attributes (namely relative advantages, compatibility, complexity and trialability) had no significant relationship with adoption. This may be because many farmers did not know much about the local varieties ("Githugu") which hybrid maize has replaced. As a result they were unable to compare the two groups on the basis of the other attributes considered.

The relationship between relative advantage of correct spacing and adoption was found to be significant. Relative advantage and adoption are positively related in that if a farmer will make an

economic profit by adopting an innovation he will most likely adopt the innovation. This is consistent with the study by Dasgupta (1989).

Table 21: Perceptions about Various Innovations as Related to Adoption behaviour

Variable	χ^2	df	r
Perceptions on hybrid maize			
Observability	9.57*	1	
Relative advantage	0.17	1	
Relative advantage	0.0032	1	
Relative advantage	0.0005	1	
Compatibility	1.22	1	
Complexity	1.15	1	
Trialability	1.25	1	
Perceptions on correct spacing			
Relative advantage	9.42*	1	
Compatibility	16.08*	1	
Observability	0.66	1	
Complexity	9.99*	2	
Trialability	0.22	1	
Perceptions on Fertilizers			
Relative advantage	0.0001		
Complexity	0.12	1	
Compatibility	0.013	1	
Trialability			0.011
Observability			-0.0002
Perceptions on Pesticides			
Complexity	0.01	1	
Relative advantage	21.14*	1	
Compatibility	11.71*	1	
Trialability	15.45*	1	
Observability	22.37.	1	
Perceptions on weeding			
Observability			-0.0005
Compatibility	0.24	1	
Trialability	3.35	1	
Complexity			-0.0008
Relative Advantage	0.61	1	

* Significant at 0.05 level

The relationship between compatibility of correct spacing was also found to be significant. Since compatibility is perceived in terms of its consistency with existing values it positively affects adoption. There was a significant relationship between adoption and complexity of correct spacing. The general tendency was for the relationship to be negative. Rogers (1983) noted that the complexity of an innovation is generally negatively related to its adoption. Kilvin (1960), Singh (1966) and Petrini (1966) also found a negative relationship between adoption and complexity. In this study there was no significant relationship between adoption and observability. This may be due to the lack of immediate observations that correct spacing will lead to more yields. There was also no relationship between adoption and trialability. This means that the farmers in the area were unable to appreciate the fact that they could try out the correct spacing on a small scale on their farms before adopting it for the whole farm.

There was no relationship between adoption and all the five attributes of fertiliser (namely relative advantage, complexity, compatibility, trialability, and observability). This lack of relationship may be due to the fact that farmers are well aware of fertilisers and their benefits but do not adopt because of other factors, for example, cost of inputs.

There were significant relationships between adoption and four of the attributes of pesticides. These attributes included relative advantage, compatibility, observability and trialability. The adopters unlike non-adopters were able to appreciate that control of pests would result to higher yields (relative advantage). The procedure of applying pesticides was regarded as simple by adopters and hence compatible with the existing practices on the farms. Adopters in most cases applied pesticides on affected plants only and so could appreciate the triable nature of pesticides. Since the results of applying pesticides are immediately observable there was a distinction, in the perception

of the observability of pesticides between adopters and non adopters. There was no relationship between adoption and complexity. Many farmers described correctly the application of pesticides and hence one can conclude that it is not a difficult procedure as far as the farmers are concerned, adopters and non adopters alike. It is important to note that some farmers did not use pesticides but used soil or ash for controlling pests - using similar application procedures.

Many farmers were not aware of the recommended times for weeding and therefore, perceptions for weeding in general terms were determined . There was no relationship between adoption and weeding frequencies. The lack of relationship may be due to the fact that proper weeding frequency (2-3 times) has been as a whole fully adopted (100% of the respondents weeded two to three times). The adoption of the recommended weeding frequencies may also reflect the fact that innovations which do not require any economic inputs are usually more easily adopted.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

In Kenya the only avenue that remains to be exploited in increasing agricultural growth is increasing land productivity. Small scale farmers due to their numbers as well as the large tracts of land they farm, are an important target group in the efforts to increase agricultural production.

However, partial adoption of innovations by small scale farmers has led to low land productivity. Therefore, to address the issue of increasing agricultural production, one must address the issue of partial adoption hence the need for this study.

Various factors influence adoption of innovations. Those of interest to this study were; Personal characteristics (age, sex, formal education, empathy, scientism and familism); Situational characteristics (size of land holding, availability of inputs, availability of credit and commercial orientation); Social characteristics (extension contact and urban contact); and farmers perceptions of innovations.

The study was designed to describe the factors that influence adoption of maize related information among small scale farmers in Njoro Division. The information obtained is expected to assist policy makers, maize researchers and the local extension personnel in their efforts to improve maize production in the division. The specific objectives of the study were:

- 1) To determine the extent to which various innovations have been adopted.
- 2) To determine the relationship between adoption and farmers' knowledge of various innovations.

- 3) To describe the relationship between adoption and farmers' personal characteristics.
- 4) To describe the relationship between adoption and farmers' situational characteristics.
- 5) To describe the relationship between adoption and farmers' social characteristics
- 6) To describe the relationship between adoption and farmers' perceptions of various innovations.

The research was a descriptive survey. Data were collected using a structured questionnaire which was composed of direct questions, dichotomous questions as well as Likert scale for measurement of farmers' perceptions. Descriptive statistics (percentages, means and standard deviations) were used to describe the dependent and independent variables of the study. Chi-square statistics and Pearson's correlation coefficient were used to assess the relationship between adoption and the independent variables.

As far as adoption of various innovations is concerned, it was found that 77% of the respondents used hybrid maize seed. The most important reason for not using hybrid maize seed was high prices of hybrid seed. The most popular hybrid maize seed used was H614. It was found that even though H511 and H512 are recommended for Lare Location no farmers interviewed in Lare used them. This could be due to the higher yields obtained when H600 series are used as compared to the H500 series particularly during wet years.

The majority of the farmers neither used the recommended number of seeds per hole nor the recommended spacing. However, most of the respondents (62%) used the correct depth of planting. Eighty seven percent did not use the recommended spacing. A variety of reasons were cited for these farm practices.

Of the 50% who used organic manures none of them used the recommended rate of the manure on their farms. Various reasons were stated for not using these manures, the main one being scarcity

due to lack of livestock to produce it. Whereas 68% of the respondents used inorganic fertilisers only 11% of these used the recommended rates per unit area. Most of them (89%) also did not apply the fertilisers as recommended. Various reasons were given by those farmers who did not use fertilisers. The main reason was that the fertilisers were too expensive to afford. Sixteen percent indicated that they preferred to use manure to inorganic fertilisers. This shows a misconception that organic fertilisers can substitute inorganic fertilisers. This misconception can be corrected through educating the farmers more on the use of fertilisers.

A very small number (21%) indicated they used pesticides. However, of these respondents 71% applied the pesticides at the wrong time. Most of them (72%) indicated that they did not use any pesticides because they saw no pests on their maize crop.

All of the respondents weeded their maize crop twice or thrice and also used hand weeding on their maize crop. However, the time of weeding gave a very different picture. Fifty two percent weeded at the wrong times for either one or both of the weedings they had carried out.

An analysis of the farmers' awareness of various innovations revealed that; 96% were aware of hybrid maize seed; 91% were not aware of the recommended depth of planting for hybrid maize; 94% were not aware of the recommended spacing for maize; 96% were aware of fertilizer use in maize production; 47% were aware of pesticides used on maize; and 91% were not aware of timely weeding recommendations in maize production.

The analysis of personal characteristics of the respondents showed that majority of the farmers were ; 41 - 50 years of age (38%); attended school for five to eight years (38%); consulted their relatives on issues of hybrid seed (61%), correct plant population (59%) and use of fertilizers (60%). However, very few farmers consulted their relatives on matters pertaining to pesticides (26%) and

timely weeding (26%). Seventy four percent of the respondents were females. Ninety three percent of the respondents indicated that they believed that science was vital in improving production of maize. Most of the respondents (72%) showed a high level of empathy.

As far as the social characteristics of the farmers were concerned it was found that majority (61%) had high urban contact. A large number (60%) did not know the agricultural extension workers working in their locations. Ninety one percent of the respondents indicated that they did not attend monthly agricultural extension meetings while 85% of the respondents also indicated that they did not attend any sort of agricultural meeting (that is agricultural shows, farmers training programmes and so on). Various reasons were given for not attending meetings, the most important reason was not being informed when meetings were held.

As far as situational characteristics were concerned it was found that 60% of the respondents owned up to four acres of land. Thirty percent did not sell any of their maize after harvest. Ninety nine percent did not use credit. Fifty five percent indicated that they did not use credit because they did not need it. However, subsequent evidence showed that many farmers did not use the innovations considered fully because they did not have money to purchase inputs. Credit could then have served as a good option. Very few were able to rate the availability of credit from various sources. This was because they did not know of the existence of the institutions.

It was found that there was no problem with the supply of inputs in the division as a whole. This was shown by the large percentages of the farmers that indicated that the distance to input markets were near or very near. This scenario was repeated for all the other inputs (fertilisers, pesticides and farm implements).

All the innovations with the exception of pesticides and to a small extent correct spacing were perceived as observable, compatible, ~~trialable~~, not complex and having relative advantages. This was verified by the mean ratings for each of the characteristics of the innovations considered.

As far as testing of the hypotheses was concerned significant relationships were found between adoption and knowledge of depth of planting, gender, empathy, scientism, size of land holding; use of credit, commercial orientation, and urban contact. Significant relationships were also found between adoption and various farmers perceptions. The latter included observability of hybrid maize, relative advantage of correct spacing, compatibility of correct spacing, complexity of correct spacing, relative advantage of pesticides, compatibility of pesticides, observability of pesticides, and trialability of pesticides.

5.2 Conclusions

The results from this study indicate that farmers in Njoro Division have adopted certain innovations and neglected others. Most farmers use hybrid maize seed but have not fully adopted correct plant population, fertilizers, pesticides and timely weeding. This has resulted in less than optimum maize harvests per unit area of land. Consequently, there is a need to address the issues related to adoption of maize innovations in the division.

From this study it is clear that high prices of hybrid seed, fertilisers and pesticides have resulted in partial adoption of innovations. The issue of input prices, therefore, needs to be looked into by policy makers. Having observed that maize inputs and output marketing is now operating in liberalized markets this calls for unique measures that take into account the present market situation.

Lack of knowledge of various innovations has also played a significant role in the adoption behaviour of the farmers. This has implications for agricultural extension agencies in the division. Other factors that have influenced adoption in the division include empathy, scientism, size of land holding, credit, commercial orientation, urban contact and various farmers' perceptions. Consequently, ways need to be found to manipulate these factors in order to increase adoption in the area. Empathy, various farmers' perception, commercial orientation and scientism may be improved using farmer education. The size of land holdings may need to be increased by advocating for policies that will lead to land consolidation.

The results obtained from this study have therefore, indicated that the development of a scientific, market orientated agriculture involves many diverse factors and their related variables all of which affect the behaviour of the adopter (the farmer) when accepting innovative methods. Some of the factors are part of the farmer's attitude while the rest impinge on him from his environment.

5.3 Recommendations

Policies which will ensure attractive credit terms, that is, affordable interest rates, affordable collateral and suitable repayment schedules, need to be created. In this study it was observed that the provision of credit enhances adoption. However, quite a number of farmers rated credit availability from the AFC as poor. This has implications for policy makers. There is need to look into ways of creating affordable credit to small scale farmers. Licensing informal money lenders who are within the social set up could be one way of availing credit to these farmers. These money lenders could be opinion leaders, teachers and other prominent society members who have extra money that they can spare and offer as credit to their fellow villagers. Non governmental organisations should also be

encouraged to participate in providing affordable credit to small scale farmers and hence supplement the efforts of AFC.

Researchers need to seek ways of raising the yield potential of the H500 series in order to make the series competitive with the H600 series while retaining it's adaptability to the middle altitude areas. From this study it was found that H511 and H512 are not used in the areas they are recommended for. This as noted earlier is due to the relatively lower yield potential of the H500 series when compared to H600 series in the middle altitude areas particularly during the wet years. Therefore, there is need to raise the yield potential of the H500 series to make them competitive with the H600 series in the middle altitude areas. This will ensure that the farmers use the H500 series where they are recommended and benefit in the process.

Maize research may also need to look into ways of coming up with hybrid varieties similar to H614 which have wide genetic bases. From this research it was found that H614 was the most popular hybrid in the division. This may have been due to it's adaptability to varying climatic conditions and soils as a result of it's wide genetic base. There is need to create more hybrid varieties with a similar characteristic in addition to other advantages such as higher maize yields. These hybrid varieties will be more adaptable to farmer conditions such as climate that tend to vary year after year.

The knowledge gaps identified need to be bridged through farmer education by extension personnel. The knowledge gaps identified in this study included correct number of seeds per hole, correct depth of planting, correct spacing, preparation of various forms of organic fertilizers and their preparation, recommended rates of organic and inorganic fertilizers, correct application of inorganic fertilizers, the need for routine application of pesticides, recommended weeding times and the use of credit in farm production. However, as noted in the findings, the extension contact is very low in the

division. Efforts should, therefore, be made to increase the extension - farmer contact. The local extension personnel should seek ways to fill in the knowledge gaps. Farmer education may also positively influence farmers' scientism levels, empathy levels and perceptions which have been shown in this study to influence adoption significantly.

Other non governmental organisations can also supplement the efforts of the government extension agency. For example, Egerton University being an agricultural instituteⁱⁿ in the area can organise how to reach the farmers with critical information that the latter are lacking. This may be in the form of student's practicals or projects. The division of Research and Extension in conjunction with the Department of Agricultural Education and Extension at Egerton University can look into this proposition and work out the modalities of making it work.

Policies which may lead to larger farm sizes need to be identified and implemented.

The results from this study indicate that size of land holding significantly influences adoption. This implies that policies which will lead to larger farm sizes will enhance adoption. As such it is recommended that such policies be formulated and the existing ones be augmented and fully implemented. An example of policies that may lead to larger farm sizes are those to do with industrialization. Increased industrialization will lead to creation of many jobs which can then absorb most of the people who are at present dependent on Agriculture. As a result there will be less pressure on the land leading to land consolidation. This may be a long term solution to adoption of modern technologies. Socio-cultural barriers will also need to be overcome to ensure that the policies lead to large farm sizes.

There is need to develop technologies which are suitable for small land holdings. Another recommendation that arises from the positive and significant relationship between the land size and

adoption is the need to develop technologies that are more suited to small holdings. This is because the technologies presently recommended to small scale farmers and which are covered in this study require large farm sizes to be beneficial. Some work has been done to this end but a lot remains to be done. This is shown by the fact that none of the technologies suited to small land holdings has been recommended in the division.

There is need to ensure maize marketing channels are efficient. From the study it was found that high input prices are constraining adoption. In this era of free markets where input and output prices are determined by the law of demand and supply, the key to affordable input prices may lie in increased maize profitability. If farmers are able to make good profits after sale of their maize, it follows that the absolute prices of inputs will not be a problem to them. However, for good maize profits to be obtained the marketing channels need to be efficient. Ways of improving the services of the NCPB need to be identified and implemented. Also there is need to look into the possibility of having organized marketing channels funded by private investors to supplement the efforts of NCPB. Increased profitability of maize may then lead to enhanced adoption of innovations.

In summary it is important to note that adoption can occur effectively if the provision of extension services is matched with the provision of appropriate research recommendations and development of agriculture related infrastructure (that is efficient marketing channels and provision of credit).

5.4 Suggestions for Further Research

Further research can be done on the effect of factors other than those considered in this study, on adoption in the area. These factors include; social participation; income; fatalism; and farming

efficiency among others.

Further research on types of credit and credit terms that are most attractive to small scale farmers need to be done. This will go a long way in convincing small scale farmers to use credit in order to adopt all recommended innovation.

The effect of free market conditions on small scale farmers in Kenya needs to be studied in order to get information on how to secure farm income. These studies will show whether government interventions and subsidies are needed to ensure that small scale farmers do not discontinue adoption of vital agricultural innovations and also that they continue to adopt the innovations they have so far not adopted.

REFERENCES

- Aggarwal, B. K. (1974), Socio-economic Context of Differential Development. A case study in Punjab, Journal of Social and Economic Studies, 2:35-46.
- Amudavi, D. M. (1993), Influence of Socioeconomic Factors on Adoption of Maize Related Technologies: the Case of Small Holder Farmers in Hamisi Division (unpublished Masters Thesis), University of Melbourne, Australia.
- Amon, I. (1989), Agricultural Research and Technology Transfer, Elisevier Science Publishers Ltd, London, UK.
- Basran, G. S. (1970), Adoption of New Farm Practices, Journal of Social Research, 11:68 - 101.
- Beal, G. M. and Rogers, E. M. (1960), The Adoption of Two Farm Practices in a Central Iowa Community, Iowa Agricultural and Home Economics Experimental Station Report No. 26.
- Blarel, B. Carter, M. R., Onyango, C. and Wiebe, K. B. (1988), Economic Constraints to Agricultural Productivity in Njoro Division Kenya (Unpublished paper), USAID, Egerton University and Wisconsin-Madison University.

- Bose, S. K. (1962), Peasant Values and Innovation in India, American Journal of Sociology, 67: 52- 60.
- Byrness, F. C. (1966), Some Missing Variables in Diffusion Research and Innovation Strategy, Phillipines Sociological Review vol 14 (1) pp 5
- Chitere, P. A. and Van Doorne, J. H. (1985), Extension Education and Farmers Performance in Improved Crop Farming in Kakamega District, Agricultural Administration vol 18 (2), pp 39-55.
- Clark, R. C. and Akindobe, I. A. (1968), Factors Associated with Adoption, Research Bulletin Ife-Ife University vol 1 (3) pp 5.
- Coleman, J. S. (1966), Medical Innovation: A Diffusion Study, Bobbs- Merrill, New York, U.S.A.
- Dasgupta, S. (1963), Innovation and Innovators in Indian Villages, Man in India, 43: 27-34.
- Dasgupta, S. (1989), The Diffusion of Innovations in Village India, Wiley Eastern Limited, New Delhi, India.
- Fliegal, F. C. and Kilvin, J. E. (1967), The Success or Failure of Agricultural Development Programmes in 108 Indian Villages, Indian National Institute of Community Development

Research Paper Report No. 9 pp 3.

Fliegal, F. C. (1968), A Cross National Comparison of Farmers Perceptions of Innovations as Related to Adoption Behaviour, Rural Sociology, 33: 437-49.

Fals Borda, O. (1960), Facts and Theory of Socio - Cultural Change in a Rural Social System, Bogotta Universidad National de Columbia, Monograficis Sociologicas.

Gerhart, J. D. (1974), The diffusion of Hybrid Maize in Western Kenya, (Unpublished PhD Dissertation), Woodrow Wilson School of Public and International Affairs.

Gershon, F., Jush, R. E. and Zilberman, D. (1982), Adoption of Agricultural Innovations in Developing Countries - A Survey, World Bank Working Papers No 442, International Bank for Reconstruction and Development / The World Bank, Washington, U.S.A.

Government of Kenya (1994a), Kenya Development Plan 1994 - 6 Government Printer, Nairobi, Kenya.

Government of Kenya (1994b), Nakuru Development Plan 1994-6 Government Printer, Nairobi, Kenya.

Hunter, G. (1974), The Choice of Extension Methods for Implementation of Agricultural Development

Policies, IDS Discussion Paper No 212, Nairobi, Kenya.

Jha, D., Hojjati, B. and Vosti, S. (1991), The Use of Improved Agricultural Technology in Eastern Province of Zambia, Adoption of Improved Farm Technology - A Study of Small Holder Farmers in Eastern Province of Zambia, Ed. Celis, R., Mulimo, J. T. and Wanmali, S., International Food Policy and Research Institute, Washington D.C., U.S.A.

Kathuri, N. J. and Pals, D. A. (1993), Introduction to Educational Research, Educational Media Centre (EMC), Egerton University, Njoro, Kenya.

Kaufman, H. F., Avatar, S. and Dasgupta, S. (1975), Villages Upward Bound: A Study of Technological Change in Six Punjab Villages, Calcutta, India.

Kilvin, J. E., Fliegel, F. C., Roy, P. and Sen, L. K. (1971), Innovations in Rural India, Bowling Green State University, U.S.A.

Kenya Agricultural Research Institute [KARI] (1993), Maximizing Maize Production, The Weekly Review October 15 1993, The Weekly Review Ltd., Nairobi, Kenya.

Leagans, J. (1979), Adoption of Modern Agricultural Technology by Small Scale Farm Operators - Interdisciplinary Model for Researchers and Strategy Builders, Cornell University, Ithaca New York, U.S.A.

- Lionberger, H. F. and Gwin, P. H. (1982), Communication Strategies - A Guide for Agricultural Change Agents, Interstate Printers and Publishers, New York, U.S.A.
- Majumder, A.K. (1966), Adjustment Patterns of Adopters and Nonadopters, Journal of Applied Psychology 3: 103.
- Mbithi, P. M. and Kanyongo-Mwale, D. (1979), Local Environment Perceptions and Conservation Practises, In Agricultural Administration 6 (4) pp 229-304.
- Misiko, P. A. M. (1976), Incentives and Disincentives Influencing Farmers in Adoption of Agricultural Innovations: The Case of Bungoma district Kenya (Unpublished Phd Thesis), Cornell University, Ithaca, New York, U.S.A.
- Moulik, T. K. (1975), From Subsistence to Affluence: Social Psychological Aspects of Developmental Change in Delhi Villages, Bombay, India.
- Muchena, S. C. (1988), Opening Address to the East Central and Southern African Regional Maize Workshop: Harare Zimbabwe In Towards Self Sufficiency - A Proceedings of the Second East Central and Southern Africa Regional Maize Workshop Harare Zimbabwe March 15-21 1987, Cimmyt, Harare, Zimbabwe.
- Mwale, S. (1994), Agricultural Sector Liberalization Issues and Options, Unpublished Paper

Presented at the Conference on Market Reforms Agricultural Production and Food Security
June 22-4 1994, Nairobi, Kenya, Egerton University, Njoro, Kenya.

Ndambuki, F. (1988), The Role of Kenya Seed Company in Maize Development in Kenya, In Towards Self Sufficiency - A Proceedings of the Second East Central and Southern Africa Regional Maize WorkShop Harare Zimbabwe March 15-21 1987, Cimmyt, Harare, Zimbabwe.

Ministry of Agriculture, (1993) Njoro Division Report (Unpublished Report).

Rogers, E. M. (1983) Diffusion of Innovations, The Free Press, New York, U.S.A.

Roling, N., Chege, F. and Ascroft, J. (1973), Rapid Development for Kenya's Small Farmers, IDS Discussion Paper No 173, University of Nairobi, Nairobi, Kenya.

Siegfried, S. and Mbugua, E. S. (1974), New Extension Methods to Speed up Diffusion of Innovation, IDS discussion paper No. 193, University of Nairobi, Nairobi Kenya.

Sharma, D. K. (1966), Role of Information Sources and Communication Channels in Adoption of Improved Farm Practices, Indian Journal of Extension Education 2: 143-8.

Singh, R. M. (1966), Characteristics of Farm Innovations Associated with the Rate of Adoption, Guelph, Ontario, Agricultural Extension Report No. 14.

Thompson, J. D. (1967), Organisation in Action, McGraw Hill Publishers, New York, U.S.A.

Tuckman, B. W. (1978), Conducting Educational Research, Harcourt Brance Jovnonich Inc., New York, U.S.A.

Wiersma, W. (1986), Research Methods in Education - an Introduction. Allyn and Bacon Inc Boston U.S.A.

Yadiv, D. P. (1967), Communication Structure and Innovation Diffusion in Two Indian Villages, East Lansing, Michigan State University, Department of Communication Technical Report 2.

APPENDIX A (QUESTIONNAIRE IN KISWAHILI)

Hojaji

Maagizo

Maagizo kwa anayeuliza; Tadhali uliza maswali yote kama unavyokezwa katika maagizo madogo madogo hapa na pale. Weka alama ya (✓) kwa maswali yenye majibu mbali (Machanguo). Kwa maswali yasio na mbali mbali andika majibu kwa nafasi zilizoachwa.

Sehemu ya A

Mtaa

Kijiji

Mume Mke

Sehemu ya B

1. a) Ulitoa wapi mbegu ya mahindi uliopanda mwaka jana?
 - 1..... Nilinunua dukani
 - 2..... Nilinunua sokoni
 - 3..... Nilitumia mwaka huo mwengine
 - 4..... Nilipewa na wizara ya kilimo au shirika lingine
 - 5..... Mahali pengine (Tafadhali taja).....

Ikiwa mkulima alinunua mbegu tafadhali uliza b) na c) la sivyoyote uliza d).

b) Ulinunua mbegu kiasi gani?

c) Mbegu hii ilikugharimu pesa gapi

d) Mbegu uliyopanda mwaka jana ilikuwa ya rangi gani?

1.....Kijani kibichi / samawati

2..... Nyeupe

3.....Majano / Zambarau

4.....Rangi nyingineyo (Tafadhali taja)

e) Ni kwa miaka migapi mfululizo umepanda mbegu uliyopanda mwaka jana?
.....

Ikiwa mkulima alipanda mbegu ya hybrid kama inavyoonyeshwa na rangi ya mbegu aliyoipanda mbegu ya hybrid kama inavyoonyeshwa na rangi ya mbegu aliyoipanda tafadhali uliza (f) la sivyo uliza (g).

f) Ulipanda nambari gani (au zipi) ya mahindi ya hybrid mwaka jana?
.....

Ikiwa mkulima alipanda mbegu ya hybrid kama inavyoonyeshwa na rangi ya mbegu aliyoipanda tafadhali uliza f) la sivyo uliza g)

f) Ulipanda nambari gani (au zipi) ya mahindi ya hybrid mwaka jana?

1..... H511 2.....H512 3.....H613 4.....H614

5..... H622 6.....H625 7.....H626 8.....Katumani

9.....Nambari nyingine yoyote (Tafadhali taja)

g) Umesikia kuhusu mahindi ya hybrid?

1..... Ndio 2..... la

h) Tafadhali eleza unalolijua kuhusu mahindi ya hybrid (USISOME MACHAGUO)

1..... Mbegu ya hybrid ina rangi ya kijani kibichi

2..... Inanunuliwa madukani

3. Inatoa mazao mengi

4..... Jambo liginepo (Tafadhali taja)

Ikiwa mkulima hakupanda mbegu ya hybrid lakini anajua kuhusu tafadhali uliza i)

i) Kwa nini hukupanda mbegu ya hybrid mwaka jana?

1.....Bei ilikuwa juu zaidi

2..... Mbegu haikuweco madukani wakati nilikuwa nikihitaji .

3..... Sababu nyinginezo nyinginezo (Tafadhali taja)
.....

j) Ulipanda ekari ngapi ya mahindi mwaka jana?

k) Ulipanda ekari ngapi ya mahindi ya hybrid mwaka jana? (uliza wakulima wale uliosema walipanda mbegu ya hybrid)

.....
l) Ulipanda ekari ngapi ya mahindi ya sio ya hybrid?

.....
Ikiwa mkulima alipanda mbegu ya hybrid na pia mbegu isiyo ya hybrid uliza.

m) Kwa nini ulipanda mchanganyiko wa mbegu zinginezo? (USISOME MACHAGUO)

1. Ili mbegu aina moja ikitoa haba ingine itoe mazao mazuri aina moja ikitoa mazaohaba ingine itoe mazao mazuri sitapoteza riziki yangu.

2..... Sikuwa na pesa za kutosha kununua kiasi cha mbegu ya hybrid kinachotosha kupanda shambani mwangu.

3..... Sababu nyinginezo (Tafadhali taja)

n) Ulichanganya mahindi yako na mimea mingine?

1..... Ndio 2..... La

Ikiwa jibu la swali (n) ni ndio tafadhali uliza (o)

o) Ulichanganya mahindi na mimea mingine gani?

1.....Maharagwe

2..... Viazi

3. Mimea mingine (Tafadhali taja).....

2. a) Ulipanda mbegu ngapi kwa kila shimo mwaka jana?

1..... Moja

2..... Mbili

3..... Nyingine (Tafadhali taja)

Ikiwa mkulima aliweka kwa kila shimo zaidi ya mbegu mbili tafadhali uliza (b)

(b) Ulipungaza mimea ya mahindi kutoka kwa kila shimo baada ya mbegu kuota?

1..... Ndio 2..... La

Ikiwa jawabu kwa (b) ni NDIO uliza (c)

c) Uliacha mimea mingapi kwa kila shimo?

1.....Moja 2..... Mbili 3..... Nyingine (Tafadhali taja).....

Ikiwa mkulima aliacha zaidi ya mimea miwili ya mahindi kwa kila shimo, tafadhali uliza (d) Ikiwa

hakuacha, uliza (e).

d) Kwa nini uliacha zaidi ya mimea miwili kwa kila shimo (USISOME MAJIBU MBALI MBALI).

1. Nimezoea kufanya hivyo

2..... Sababu nyinginezo (Tafadhali taja).....

.....

e) Tafadhali nionyeshe nafasi uliyoacha kutoka mmea moja had mwingine mwaka jana. (Anayehoji anapima nafasi aliyonyeshwana na mkulima akitumia rula yenye kipimo cha mita moja).

1 25-30 70 Mmea mmoja kwa kila shimo

2..... 25-30 90 Mwea mimea miwili kwa kila shimo

3. Vipimo vingievyo (Tafadhali taja).....

.....

Ikiwa mkuwa mkulima hakufuata kipimo knachopendkewa (Au 1 ama 2) uliza (e). Ikiwa amefuata uliza (g)

(f) Kwa nini ulitumia kipimo ulichonionyesha (USISOME MACHAGUO).

1.....Iliniweze kuchanganya mahindi na mimea mingine

2. Sababu nyingine (Tafadhali taja).....

.....

g) Unajua nafasi inayopendekezwa kwa upanzi wa mahindi na maafisa wa kilimo au utafiti wa kilimo?

1.....Ndio 2.....La

Ikiwa mkulima atajibu NDIO kwa swali g) uliza h). Ikiwa atajibu LA kwa swali g) uliza i).

h) Ni nafasi gani kwa upanzi wa mahindi inayopendekezwa na maafisa wa kilimo au njia zingine za kupata habari ya utafiti wa kilimo?.....

i) Tafadhali nionyeshe takriban kina cha shimo ulichopanda mbegu yako ya mahindi mwaka jana? (Anayeuliza maswali anapima kina (depth) anachoonyeshwa na mkulima kwa rula ya mita moja na kurekodi).

1..... 5-8 cm

2..... Kina keingine (Tafadhali taja).....

Ikiwa mkulima hajafuata kina kinachopendezwa (5-8 cm) tafadhali uliza j), k) na i) Ikiwa amefuta uliza k) na 1).

j) Kwa nini ulipanda mahindi katika kina cha shimo ulichonionysha? (USISOME MACHAGUO).

1.....Ili nihakikishe mbegu zitaota wakati kuna mvua ya kutosha.

2..... Sababu nyinginezo (Tafadhail taja).....

k. Unajua kina (urefu wa shimo) cha upanzi wa mahindi kinachopendekezwa na maafisa wa kilimo au njia zingine za kupata habari ya utafiti wa kilimo?

1..... Ndio 2..... La

i) Maafisa wa kilimo (au utafiti) wanapendekeza kina gani cha shimo ya kupanda mahindi?

3. a) Ulitumia mbolea ya mchanganyiko wa takataka (compost) au samadi kwa upazi wa mahindi yako mwaka jana?

1..... Ndio 2..... La

Ikiwa mukulima hakutumia mbolea ya mchanganyiko wa takataka au samadi muulize b). Ikiwa ulitumia muulize c).

b) Kwa nini hukutumia samoli au mbolea ya mchanganyiko wa takataka? USISOME MACHAGUO).

1.Kulikuwa na upungufu wa mbolea

2..... Mbolea aina hizi zilikuwa na bei ghali sana

3. Sababu nyinginezo (Tafadhali taja)

.....

c) Ulitumia kiasi gani cha samadi au mbolea ya mchanganyiko ya takataka ?

d) Ulipata mbolea ya mchaganyiko wa takataka au samadi wapi?

(USISOME MACHAGUO)

1..... Nilinunua kutoka kwa mkulima mengine

2..... Nilitoa kutoka kwa shamba langu

3..... Mahali penginepo (Tafadhali taja)

Ikiwa mkulima alinunua mbolea tafadhali uliza e)

e) Ulinunua mbolea kwa bei gani?

4. a) Ulinunua mbolea tafadhali "fertilizer" kwa mahindi yako mwaka jana?

1..... Ndio 2.....La

Ikiwa mkulima atajibu La kwa 4 a) tafadhali muulize b). Ikiwa atajibu NDIO muulize c).

b) Kwa nini hukutumia "fertilizer"? (USISOME MACHAGUO)

1. Sina habari kuhusu matumizi ya "fertilizer" katika uzalishaji wa mahindi.

2..... "Fertilizer" ilikuwa ghali

3..... Kulikuwa na ukosefu wa "fertilizer" wakati nilipokuwa ni kihitaji " fertilizer"

4..... Sababu nyingenezo (Tafadhali taja).....

c) Uliweka "fertilizer" kwa mimea yako ya mahindi wakati gani? (USISOME MACHAGUO)

1.....Wakati wa kupanda

2..... Wakati mimea ya ilipofika urefu wa centimita 45 cm.

3..... Wakati mwingineo (Tafadhali taja).....

.....

.....

Ikiwa mkulima aliweka "fertilizer" wakati wa kupanda tafadhali muulize d) - i).

d) Ulitumia aina gani ya "fertilizer" wakati wa kupanda?

(USISOME MACHAGUO)

1....DAP 2.....SSP 3.....DSP 4.....TSP

5..... Aina nyigine ya "fertilizer".....

e) Ulitoa wapi "fertilizer" uliyotumia wakati wa kupanda? (USISOME MACHAGUO)

1..... Nilipewa kutoka dukani

2..... Nilipewa na wizara ya kilimo au msaada kutoka shirika lisilo la kiserikali.

3..... Mahali penginepo (Tafadhali taja).....

.....

.....

Ikiwa mkulima alinunua "fertilizer" tafadhali muulize (f). Ikiwa sivyo muulize h).

f) Ulitumia a kiasi gani cha "fertilizer"?.....

.....

g) Ulinunua fertilizer uliotumia wakati wa kupanda kwa bei gani?

h) Tafadhali nionyeshe vile ulivyoweka fertilizer kwa mahindi yako wakati wa kupanda?

(anayeuliza maswali anaagalia na kuandika)

1..... "Fertilizer" inawekwa kwa shimo la kupanda

2..... "Fertilizer" inawekwa kwa shimo la kupanda na kuchanganyua na mchaga.

3..... Njia nyingineo (tafadhali taja).....

Ikiwa mkulima alitumia "fertilizer" wakati mimea ilikua na kimo cha sentimita 45 tafadhali muulize

j) - o

i) Ulitumia aina gani ya fertilizer wakati mimea ya mahindi ilikuwa na kimo cha sentimita 45, mwaka jana?

1..... ASN 2.....CAN 3.....Nyingineo (Tafadhali taja).....

j) Ulitoa wapi "fertilizer" hii? (USISOME MACHAGUO)

1.Nilinunua kutoka dukani

2..... Nilipewa na wizara ya kilimo au shirika isio ya serekali.

3. Mahali pengine (Tafadhali taja).....

Ikiwa mukulima alinunua "fertilizer" tafadhali muulize i). Ikiwa sivyo muulize m)

k) Ulinunua "fertilizer" hii kwa bei gani?

l) Ulitumia kiasi gani cha "fertilizer" kwa mahindi yako wakati yalikuwa na urefu wa sentimita 45?

m) Tafadhali nionyeshe vile ulivyoweka "fertilizer" kwa mahindi wakati mahindi yako yalikuwa an urefu wa sentimenta 45? (Anayeuliza maswali anafalia na kuandika)

1..... "Fertilizer" inawekwa mashina ya miti

2..... "Fertilizer" inawekwa ikifuata mistari ya mahindi

3..... Njia nyingineo (Tafadhali taja).....

n) Umetumia "fertilizer" wadudu yoyote kwa mahindi yako mwaka jana ?

1..... Ndio 2..... La

5. a) Ulitumia dawa ya wadudu yoyote kwa mahindi yako mwaka jana?

1.....Ndio 2..... La

Ikiwa jibu kwa swali 5 (a) ni La tafadhali uliza b). Ikiwa jibu ni Ndio tafadhali uliza e) f)

b) Kwa nini hukutumia dawa ya wadudu kwa mahindi yako mwaka jana? (USISOME MACHAGUO)

1..... Sikuwaona wadudu wowote

2..... Dawa ya wadudu ilikuwa ni ghali mno

3..... Sikujua ni dawa gani ninahitajika kumumia

4..... Sababu nyinginezo (Tafadhali taja).....
.....
.....

c) Ni wadudu (mdudu) gani uliyewaua kwa mahindi yako mwaka jana?

I..... II

III IV

d) Ulitumia dawa gani kuwaua wadudu uliowataja?

I II

III IV

e) Ulitumia dawa hii wakati gani?

I II

III IV

f) Tafadhali nionyeshe hakuwa na shida na wadudu au hakutumia dawa yoyote ya wadudu.

I

II

III

IV

Ikiwa mkulima hakuwa na shida na wadudu au hakutumia dawa yoyote ya wadudu tafadhali uliza g) -

b)

g) Unajua dawa yoyote ya wadudu inayotumia kwa mimea ya mahindi?

1..... Ndio 2.....La

h) Tafadhali taja au ueleze moja wapo ya madawa unayojua inayotumiwa kwa kuaagamiza wadudu wa mahindi?

.....

6. a) Ulipalilia mahindi yako mwaka jana?

Ikiwa jibu kwa 6.a) ni La tafadhali uliza b).

b) Kwa nini hupalilia mahindi yako mwaka jana?

(USISOME MACHAGUO)

1. Kulikuwa na ukosefu wa wapaliliaji

2..... Nilikosa pesa za kugharimia upaliliaji

3..... Sababu nyingineo (Tafadhali taja

.....

Ikiwa jibu kwa 6.a) ni Ndio tafadhali uliza c) - g

b. Kwa nini hupalilia mahindi yako mwaka jana? (USISOME MACHAGUO)

1..... Ya kemekali 2..... Ya mikono

3. Njia ingine (Tadhali taja)

.....

d) Ulipalilia mara gapi? (USISOME MACHAGUO)

1.....Mara moja 2..... Mara mbili

3.....Mara tatu 4..... Nyingineo (Tafadhali taja)

Ikiwa mkulima ailalilia chini ya mara tatu uliza e)

e) Kwa nini ulipalilia mara uliyotaja? (USISOME MACHAGUO)

1..... Kulikuwa na ukosefu wa wapaliliji

2..... Nilikosa pesa za kugharimia upaliliaji mwengine

3..... Kwekwe uliagamizwa vilivyo baada ya kupalilia mara niliyotaja

4..... Ilikuwa ni vigumu kupalilia zaidi kwa sababu ya mchaganyiko wa mimea mbalibali niliyopanda.

5. Sababu nyinginezo (Tafadhali taja)

.....

f. Ulipalilia mahindi yako wakati gani? (USISOME MACHAGUO)

1..... Mimea ilipokuwa na urefu wa sentimita 5.

2..... Mimea ilipokuwa na urefu wa sentimita 45

3..... Mimea ilipokuwa na urefu wa sentimita 90

4..... Wakati mweginepo (Tafadhali taja)

g) Ni kwa miaka migapi umepalilia katika nyakati ulioyotaja kwa swali d)

Uliza wakulima wote g - i)

h) Unajua mapendekezo ya upaliliaji yanayololewa na utafiti

kupitia maafisa wa kilimo au njia nyingine

1.Ndio 2..... La

i) Tafadhali eliza kwa kifupi kuhusu maagizo haya

7. a) Ulitumia mkopo wowote kwa ukuzaji wa mahindi yako mwaka jana?

1..... Ndio 2.....La

Ikiwa jibu la swali 7. b) ni La tafadhali uliza b). Ikiwa jibu ni Ndio tafadhali uliza c).

b) Kwa nini hukutumia mkopo kwa ukuzaji wa mahindi yako mwaka jana? (USISOME MACHAGUO)

1..... Sikuhitaji mkopo

2..... Malipo ya mkopo (riba) yalikuwa ghali

3..... Nilituma ombi kwa banki au shirika lakini sikufanikiwa kupata mkopo.

4..... Sababu nyinginezo (Tafadhali taja)

c) Ulipata mkopo wako kutoka wapi? (USISOME MACHAGUO)

1..... AFC

2..... Banki za biashara

3. Shirika la wakulima

4..... Mfanyibiashara

5..... Mtu binafsi kwa mfano rafiki au jamaa

6. Kundi la kusaidiana

7..... Kwegineko (tafadhali taja)

Uliza wakulima wote d) e).

d). Unajua mashirika yapi ya kifedha ambayo yanayoweza kukusaidia na mkopo kwa minajili ya kuimarisha uzalishaji mahindi? (USISOME MACHAGUO).

1..... AFC 2..... Banki za kibiashara

3..... Shirika la wakulima

4..... Wafanyibiashara ya bidhaa za kilimo

5.Watu binsfsi kwa mfano marafiki au jamma zako

6..... Njia nyingeneo

e) Kupatikana kwa mikupo kwa wakulima wadogo wa mahindi kutoka kwa mashirika yanayofuata ni (jibu ukitumia vipimo: Rahisi kupatikana - RK; Hupatikana - H; Sina uhakika - SU Hupatikana vigumu, HV; Haipatikani kamwe HK.)

AFC	RK	H	SU	HU	HK
Banki za biashara	RK	H	SU	HU	HK
Shirika la wakulima	RK	H	SU	HU	HK
Wafanyibiashara	RK	H	SU	HU	HK
Watu binasi	RK	H	SU	HU	HK
Kundi la kusaidiana	RK	H	SU	HU	HK

8. Fikiria kuhusu mwendo unaohitaji kwenda ili upate bidhaa za ukuzaji wa mahindi kutoka kwa mfanyibiashara wa karibu. Tumia vipimo mbali kutoka kwa mfanyibiashara wa karibu. Tumia vipimo mbali sana - MS; Mbali - M; Sina uhakika - SU; Karibu - K; Karibu sana - KS; kuelezea mwendo unahotitaji kuenda kupata bidhaa zifuatazo za ukuzaji wa mahindi.

Mbegu ya hybrid	MS	M	SU	K	KS
Fertilizer	MS	M	SU	K	KS
Dawa ya wadudu	MS	M	SU	K	KS
Vifaa,vya ukulima kwa mfano					

9. a) Unamujua afisa wa kilimo katika tarafa hii?

1. Ndio la

Ikiwa jibu ni la uliza b), ikiwa jibu ni ndio uliza c) - d)

b) Jina la afisa wa kilimo katika tarafa hii ni

Ikiwa jibu la uliza (b), ikiwa jibu ni ndio uliza c) - d

c) Ulihudhuria mikutano iliyotayarishwa na afisa wa kilimo katika tarafa hii mwaka jana?

1.....Ndio 2.....La

Ikiwa jibu kwa c) ni ndio tafadhali uliza d)

d) Kwa nini haukuhudhuria mikutano ya kilimo?

e) Ulihudhuria mikutano mara gapi kwa mwezi?

..... 1 23

f) Ulihudhuria mikutano yoyote ingine ya kilimo katika tarafa hii na mahali penginepo mwaka jana?

1..... Ndio 2..... La

Ikiwa jibu la 9. (e ni ndio uliza f).

g) Ulihudhuria mikutano hii mara gapi?

h) Je wewe ni Mkulima unayesaidiana na afisa wa kilimo kufundisha wengine katika tarafa hii?

1..... Ndio 2..... La

10. Ulienda mjini (mijini) mara gapi mwaka jana?

11. Una miaka migapi? (SOMA MACHAGUO)

1..... Chini ya miaka 30

2..... Kati ya miaka 31 na 50

3..... Kati ya miaka 41 na 50

4..... Kati ya miaka 51 na 60

5..... Zaidi ya miaka 61

12 a) Umepata elimu ya shule au kubaru?

1..... Ndio 2..... La

Ikiwa jibu kwa 12. a) ni Ndio ulizo b) au c)

b) Ulisoma shuleni miaka migapi? (SOMA MACHAGUO)

1..... 1-4

2..... Miaka 5-8

3..... Miaka 9-12

4..... Miaka 13-14

5..... Zaidi ya miaka 14

c) Ulisoma ngumbaru kwa miaka mingapi?.....

13. Ulivuna magunia/debe/gorogoro ngapi za mahindi mwaka jana?

14. Uliuza kiasi gani cha mavuno yako ya mahindi ya mwaka jana? (tafadhali sema jibu kwa vipimo vya magunia au madebe au gorogoro).....

15. a) Shamba lako lote ni ekari ngapi?.....

b) Ulikuza mahindi kwa shamba lingine isipo kuwa hii shamba?

.....Ndio La

c) Shamba hilo lingine ni ekari ngapi?

d) Mahindi kwa shamba hiyo ingine ilikuwa ekari ngapi?

16. Ili nikate shauri kuhusu matumize ya bidhaa au njia mpya

zifuatazo katika ukuzaji wa mahindi mimi hujadiliana na (Machaguo ni: 1 - Bibi au Bwana yangu au watoto wangu wakubwa, 2 - Wazazi au ndugu au dada zangu, 3 - Jamaa zangu, 4 - Wasio jamaa

zangu kwa mfano marafiki au jirani, 5 - Wengineo (Tafadhali taja).

Fertilizer	1	2	3	4	5
Mbegu ya hybrid	1	2	3	4	5
Nafasi kutoka inayopendekezwa na maafisa wa kilimo na utafiti	1	2	3	4	5
Upaliliaji unayopendekezwa na maafisa wa kilimo au utafiti	1	2	3	4	5
Dawa za wadudu katika mahindi	1	2	3	4	5

Sehemu ya C

Maagizo: Katika sehemu hii wakulima watasomewa vifungu vya maneno na kuhitajika kujibu - Ninakubaliana kabisa (NK); Ninakubaliana (N); Sina uhakika (SU); Sikubaliani (S); Sikubaliani kamwe (SK).

17. Sayaensi ni muhimu katika uimarishaji wa uzalishaji wa kilimo. NK N SU S SK
18. Kwa hali ya kwaida wakati jirani au rafiki au jamaa wanapoanza kutumia njia mpya ya kuimarisha mavuno ya mahindi katika shamba zao mimi huvutiwa na hutafuta jinsi ya kufanikiwa kama hao. NK N SU S SK
19. Maonyesho ya kilimo yanayovutia hunifanya niwe na hamu ya kufanikiwa katika yale yanaoonyeshwa. NK N SU S SK

20. Mbegu ya "hybrid" inatoa mavuno mengi ya mahindi kwa kila ekari kuliko mbegu ya kienyenji. NK N SU S SK
21. Mavuno yapatikanayo kutoka kwa mbegu ya "hybrid" hayabadilikibadiliki mwaka mmoja au msimu (season) hadi mwengine tofauti na mavuno ya mbegu ya kienyeji. NK N SU S SK
22. Mahindi ya kienyeji hustahimili wadudu na magonjwa kuliko ya "hybrid" na hayahitaji kunyunyiziwa dawa yoyote. NK N SU S SK
23. Ladha ya mahindi ya "hybrid" haipendezi ikilinganishwa na ya mahindi ya kienyeji. NK N SU S SK
24. Ukuzaji wa mahindi ya "hybrid" ni ngumu zaidi ikilinganishwa na mbegu za kienyeji. NK N SU S SK
25. Ni jambo linalowezezana kulinganisha mavuno ya mbegu ya "hybrid" na mavuno ya mbegu ya kienyeji shambani mwangu ili nijue nitatumia aina gani ya mbegu. NK N SU S SK
26. Ukuzaji wa mbegu ya "hybrid" huendelea sambamba na kazi zingine ninazotenda kwa shamba langu. Yaani ukuzaji wa mahindi hutatizi shuguli zangu zingine katika shamba langu. NK N SU S SK
27. Ukuzaji wa mahindi ya "hybird" hunisaidia kuyatimiza mahitaji yangu. NK N SU S SK

28. Matumizi ya mbegu ya "hybrid"

hufanya uzalishaji wa mahindi
kuwa na faida kuliko matumizi
ya mbegu za kienyeji.

NK N SU S SK

29. Matumizi ya nafasi

kinachopendekezwa kutoka mmea
moja hadi mwingine huongeza
kiwango cha faida

NK N SU S SK

30. Matumizi ya nafasi

(kutoka mmea mmoja hadi mwingine)
inayopendekezwa na maafisa wa kilimo
hainitatizi kamwe lakini inapatana na
shuguli ninazotenda shambani mwangu.

NK N SU S SK

31. Matumizi ya nafasi

(kutoka mmea mmoja hadi mwingine)
kinachopendekezwa huongeza mavuno
ya mahindi.

NK N SU S SK

32. Kipimo kinachopendekezwa

kwa upanzi wa mahindi ni vigumu
kukifanya kifaulu.

NK N SU S SK

33. Ni jambo linalowezekana

kulinganisha mavuno ya mahindi
ninapotumia kipimo (kutoka
mmea mmoja hadi mwingine)
kinachopendekezwa na mavuno
ya mahindi ninapotumia vipimo
vingine.

NK N SU S SK

34. Matumizi ya "fertilizer"

katika shamba langu ni ngumu kwa
sababu ya hatua kadha wa kadha

- ninayohitajika kufuata. NK N SU S SK
35. "Fertilizer" huongeza mavuno ya mahindi shambani mwangu. NK N SU S SK
36. Huchukulia matumizi ya "fertilizer" kama sehemu moja inaofaa ya shuguli ninazofanya shambani mwangu. NK N SU S SK
37. "Fertilizer" huweka sumu kwa udongo wangu. NK N SU S SK
38. Matumizi ya "fertilizer" hufanya uzalishaji wa mahindi uwe na faida nyingi. NK N SU S SK
39. Inawezekana kulinganisha mavuno ya mahindi katika sehemu moja ya shamba langu iliyowekwa "fertilizer" na mavuno ya sehemu ingine isiokuwa na "fertilizer". Hii huniwezesha kuamua kama nitatumia "fertilizer" au la. NK N SU S SK
40. Ni vigumu kutumia dawa ya wadudu katika shamba langu kwa sababu ya hatua sizizoeleweka zinazohitajiwa kufuatwa wakati wa kutumia. NK N SU S SK
41. Matumizi ya dawa ya wadudu hufanya uzalishaji wa mahindi kuwa na faida nyingi. NK N SU S SK
42. Huchukulia matumizi ya dawa ya wadudu kuwa sehemu ya yale ninayofanya katika shamba langu. NK N SU S SK
43. Inawezekana kulinganisha mavuno

ya mahindi katika sehemu moja ya shamba langu iliyowekwa dawa ya wadudu na sehemu ingine isiokuwa na dawa hii. Hii huniwezesha kuamua kama nitatumia dawa hizi au la.

NK N SU S SK

44. Nimegudua ongezeko katika mavuno nitumiapo madawa ya wadudu ikilinganishwa na nisipoyatumia.

NK N SU S SK

45. Ninapopalilia mahindi yangu mara mbili au tatu hupata mavuno zaidi na ninapopalilia mara moja au nisipopalilia.

NK N SU S SK

46. Huchukulia upaliliaji wa mahindi mara tatu kama sehemu moja au shughuli muhimu ambazo ni lazima zifanywe katika shamba langu.

NK N SU S SK

47. Inawezekana kuona utafauti katika kiwango cha mavuno ya mahindi napopalilia mara mbili au tatu na wakati ninapalilia mara moja au ninakosa kupalilia

NK N SU S SK

48. Kupalilia mahindi mara tatu katika shamba langu ni rahisi kwa sababu mbinu za kupalilia nitumiazo siyo gumu.

NK N SU S SK

49. Kupalilia mahindi mara mbili kuendelea hadi tatu hufanya uzalishaji wa mahindi kutokuwa na faida kwa sababu hugarimu

pesa nyingi.

NK N SU S SK

Maswali yafuatayo yataulizwa wakulima ambao hutumia madawa ya kuangamiza kwekwe.

50. Ninachukulia matumizi ya
madawa ya kwekwe kama sehemu
muhimu ya yale ninayofanya
shambani mwangu.

NK N SU S SK

51. Matumizi ya madawa ya
kwekwe kulingana na kiwango
kifaacho huongeza mavuno ya
mahindi.

NK N SU S SK

52. Matumizi ya madawa ya
kwekwe ni gumu kwa sababu
ya hatua sizioeleka
zinazohitajika kufuatwa.

NK N SU S SK

54. Matumizi ya madawa ya
kwekwe hufanya uzalishaji wa
mahindi kuwa na faida ya
hali ya juu.

NK N SU S SK

APPENDIX B (QUESTIONNAIRE IN ENGLISH)

Instructions.

Please provide answers to ALL the questions. Fill in those questions without options and tick (✓) the appropriate responses for those questions with options.

Section A

Location

Sub-location

Gender Male Female

Section B

1. (a) Where did you obtain the maize seed you planted last year? (DO NOT READ THE OPTIONS).

1..... Bought it in a shop

2..... Bought it in the market

3..... Used the previous year harvested grain

4..... Obtained it from MOA or an NGO as a donation

5..... Other (please specify).....

If the farmer bought the seed please ask b) and c) otherwise proceed to d)

(b) What is the quantity of seed that you bought?

(c) How much did you pay for the seed?

(d) What was the colour of the seed you planted last year? (DO NOT READ THE OPTIONS)

1..... Green/Blue

2..... White

3..... Yellow/Purple

4..... Other (please specify)

(e) For how many years have you continuously planted the type of seed you used last year?

.....
If the farmer planted hybrid seed as indicated by the colour of the seed she/he planted (in d) above) please ask f) or else go to g).

(f) What number (s) of hybrid seed did you plant last year?

(DO NOT READ OPTIONS)

1..... H511 2.....H512 3.....H613 4..... H614

5....H622 6....H625 7..... H626 8.....Katumani

9....Other (please specify)

(g) Have you heard about hybrid maize?

1..... Yes 2..... No

(h) Please give any characteristic of hybrid seed you know

1..... Green

2..... Bought in shops

3..... Is high yielding

4..... Other(s) (please specify).....

If the farmer did not plant hybrid maize seed but is aware of it please ask (i).

(i) Why didn't you plant hybrid maize seed last year?

1..... Too expensive

2..... Not available in good time

3..... Other reasons (please specify)

(j) How many acres of maize did you plant last year?

(k) How many acres of NON HYBRID MAIZE did you plant last

year? (Ask only those who indicated they planted hybrid maize)

(k) How many acres of NON HYBRID MAIZE did you plant last year (Ask all farmers).....

If the farmer planted both HYBRID and NON HYBRID maize seed

please ask (m)

(m) Why did you plant a mixture of HYBRID and NON HYBRID maize? (DO NOT READ OPTIONS)

1..... To spread the risks in case one type of seed fails

2..... Lack of finances to buy enough hybrid seed

3..... Other (please specify)

(n) Did you intercrop your maize stand with other crops?

1..... Yes 2..... No

(o) If the answer to (n) above is YES please specify which crops you intercropped with ?

1..... Beans 2..... Potatoes

3..... Others (please specify)

2. (a) How many maize seeds did you plant per hole last year?

1..... One 2..... Two

3.....Other (please specify)

If the farmer planted more than TWO seeds per hole please ask (b) and (c)

(b) Did you practice thinning?

1..... Yes 2..... No

(c) If the answer to (b) above is YES how many plants did you leave per stool?

1..... One 2..... Two Other (please specify)

If the farmer left more than TWO plants per hole please ask (d) otherwise proceed to (e)

(d) Why did you leave more than TWO plants per hole?

1..... I have always done so

2..... Other (s) please specify

(e) Please show me at what approximately spacing you planted your maize last year? (Interviewer

proceeds to measure the spacing indicated by the farmer using a metre rule)

1.... 25-30 cm x70cm for 1 plant per hole

2.... 25-30 x 90 for 2 plants per hole

3.... Other (please specify)

If the farmer has not followed recommend spacing (either option 1 or 2 in e) above please as for (f)

(f) Why did you use the spacing you have shown me? (DO NOT READ OPTIONS)

1..... To enable me to intercrop maize with other crops

2..... Other (s) (please specify)

(g) Are you aware of the spacing recommended for maize cultivation by researchers through extension agents of other sources of research information?

1..... Yes 2..... No

If the farmer says Yes to (g) above ask (h) otherwise proceed to (i).

(h) What depth is recommended by the extension agents?.....

(i) Please show me at approximately what depth you planted your maize last year? (Interviewer using a metre rule and record the depth).

1..... 5-8 cm

2..... Other (please specify)

If the farmer has not followed the recommended depth (5-8 cm) please ask (j, k and l)

(j) Why did you plant maize at the depth you have shown me?

(DO NOT READ OPTIONS)

1..... to ensure seeds germinate only when there is sufficient moisture

2..... Other (s) please specify

(k) Are you aware of the depth of planting recommended by research through extension agents or other sources of research information?

1..... Yes 2..... No

(l) What is the recommended depth of planting according to the extension agent or the source of

research information you use?.....

3. (a) Did you use compost / animal waste manure on your maize crop last year?

- 1..... Yes 2..... No

If the farmer did not use compost/ animal waste manure you used?

(b) Why did you not use animal waste manure/compost manure?

(DO NOT READ OPTIONS)

1..... There was scarcity of supply

2..... It was expensive to buy

3..... Other (s) (please specify)

If farmer bought compost/animal waste manure please ask (c)

(c) At what price did you buy the manure?

4. (a) Did you use chemical fertilizer on your maize crop last year?

- 1..... Yes 2..... No

If the farmer says No to (a) above please ask (b)

(b) Why did you not use chemical fertilizers? (DO NOT READ OPTIONS)

1..... I am not aware of the use of chemical fertilizer in maize production

2..... Too expensive to buy

3..... Not available when I needed it

4..... Other (s) (please specify).....

If the farmer says Yes to (a) please ask (c)

(c) When did you apply fertilizer? (DO NOT READ OPTIONS)

1..... At planting time

2..... At plant height of 45cm

3..... Other (s) (please specify)
.....

If the farmer indicates he/ she used fertilizer at planting time please ask (d) and (e).

(e) Where did you obtain the fertilizer from? (DO NOT READ OPTIONS)

1.....Bought it from a shop

2..... Received it from MOA or NGO as a donation

3..... Other (please specify)
.....

If the farmer bought the fertilizer please ask (f) or else proceed to (h)

(f) How much did you pay for the fertilizer?

(h) What quantity of fertilizer did you use on your maize crop during planting

(i) Please show me how you applied the fertilizer at planting stage? (Interviewer observes and records)

1..... Put in the planting hole

2..... Put in the planting hole and mixing with the soil.

3..... Other (please specify(.....
.....

If the farmer indicates that he/she used fertilizer at plant height of 45 cm please ask (j) and (k).

(j) What type of fertilizer did you apply at plant height of 45cm?

(k) Where did you obtain the fertilizer from? (DO NOT READ OPTIONS)

1.....Bought it from a shop

2..... Received it from MOA or NGO as a donation

3..... Other (please specify)

If the farmer bought the fertilizer please ask (l) or else proceed

(l) How much did you pay for the fertilizer?

(m) What quantity of fertilizer did you use on your maize crop at plant height of 45cm?
.....

(n) Please show me how you applied fertilizer at plant height of 45 cm? (Interviewer observes and records

1..... Put at the base of the plants

2..... Put along the rows

3..... Other (please specify)

(o) For how many years have you used chemical fertilizers continuously?

5. (a) Did you use any pesticide on your maize crop last year? 1..... Yes 2..... No

(b) If the answer to (a) above is NO please give the reason why

1..... No pests were observed

2..... Pesticide is too costly

3.....I did not know which to use

4..... Other (please specify)

(c) If the answer to (a) is YES what pest (s) did you control?

(I).....(II).....

(III)..... (IV).....

(d) What type of pesticide did you use?

(I)..... (II).....

(III)(IV)

(e) At what stage(s) did you use the pesticide?

(I)(II)

(III) (IV).....

(f) Please demonstrate how you applied each of the pesticides mentioned above?

.....

(I)

(II)

(III).....

(IV)

If the farmer did not have problems with pests or did not use any pesticide Is) please ask (g)

(g) Are you aware of any pesticide used in maize production? 1..... Yes 2..... No

(h) Please name / describe one pesticide you know which is used to control pests in maize.....

6. (a) Did you weed your maize crop last year?

1..... Yes 2..... No

If the answer to 5 b) above is No please ask b)

(b) Are you aware of the weeding recommendations for maize given by researchers through extension agents or other sources of research information?

If the answer to (b) above is YES ask (c) - f)

(c) What type of weeding did you practices?

1..... Manual 2..... Chemical 3..... Both

d) How many times did you weed?

1.....Once 2.....Twice 3..... Thrice

4..... Other (please specify).....

(e) If you weeded LESS than thrice please give reason (s) why. (DO NOT READ OPTIONS).

1.....Lack of labour

2..... Lack of funds to pay for additional weeding

3..... The weeds were properly controlled with less than two weeding.

4..... More weeding was difficult due to the intercrop

(f) At what stages did you weed your maize crops?

1..... 5 cm plant height

2..... 45 cm plant height

3..... 90 cm plant height

4..... Other (please specify)

(g) For how many years have you weeded at the times indicated in d) above

7. (a) Did you use credit for maize farming last year?

1..... Yes 2..... No

b) If the answer to a) above is NO please give reason (s) why (DO NOT READ OPTIONS)

1..... Credit was no necessary

2..... Credit rates were too high

3..... I applied and did not get credit

4..... Others (please specify)

(c) Which institutions do you know that you can approach to give you credit?

1..... Agricultural Finance Corporation

2.....Commercial banks

3..... Cooperatives

4..... Stockist of farm inputs

5.... Private individuals eg friends and relatives.

6..... Others (please specify).....

If the farmer says Yes to 7 a) please ask (d)

d) Where did you obtain your credit?

1..... AFC

2..... Commercial bank

3..... Cooperative

4..... Private individual eg. relative or friend

5..... Informal group eg. Merry go rounds

6..... Others (please specify)

(e) Please rate the availability of credit from the following institutions for your maize farming.

(key:EA - Easily available, A - available, NS - Not sure, U - Unavailable Agricultural Finance

Cooperation	EA	A	NS	U
Commercial Bank	EA	A	NS	U
Cooperative Bank	EA	A	NS	U
Other(Specify)	EA	A	NS	U

8. (a) Please rate the accessibility of the following inputs for production of maize in your farm in terms of your ability to reach the nearest stockist (Key VF- Very Far, F - Far NS - Not Sure, N - Near , VN - Very near)

Hybrid seed	VF	F	NS	N	VN
Fertilizer	VF	F	NS	N	VN
Pesticide	VF	F	NS	N	VN
Farm Implements	VF	F	NS	N	VN

9. (a) Do you know the local extension worker?

1..... Yes 2.....No

(b) How often did you attend contact group meetings organized by the local extension worker last year?

(c) How often did you attend other agricultural extension meetings, for example, baraza and field days last year?

(d) Are you a contact farmer?

1..... Yes 2..... No

10. How often did you visit town centres last year?
.....

11. How old are you?

1..... Under 30 years old

2..... 31 - 40 years old

3..... 41 - 50 years old

4..... 51 - 60 years old

5..... Over 61 years old

12. (a) Have ever been to school?

1..... Yes 2..... No

(b) If the answer to a) above is YES upto what level?

1..... 1-4 years

2..... 5-8 years

3..... 9-12 years

4..... 13 -14 years

5..... Over 15 years

13. How many sacks/ Debes/Gorogoro of maize did you harvest last year?

14. What proportion of your maize harvest did you sell last year (please give your answer in Gorogoros or Debes or 90 bags that is sacks).....

15. (a) What is the size of your farm?.....

(b) Did you grow maize elsewhere apart from your farm here rented land or another piece of land you own elsewhere)

1..... Yes 2.....No

(c) What is the size of that piece of land?

16. In order to make decisions such as whether or not to use the following innovations I discuss such issues with key: 1 - Wife/Husband 2 - My parents, brothers and sisters 3 - Other relations 4 - Non family members such friends or neighbours

Fertilizers 1 2 3 4

Hybrid seed 1 2 3 4

Pesticide 1 2 3 4

Recommended Spacing 1 2 3 4

Recommended Weeding 1 2 2 4

Section c

In the following section statements will be made and the farmers will express if they strongly agree, are not sure, disagree or strongly disagree SD - Strong disagree.

17. Science is important in improvement

of agricultural production

SA A NS D SD

18. Usually when my neighbour or friend

or relative begins to use a new farming

technique on his/her maize enterprise

I get interested and look for ways

to achieve what she/he has achieved

SA A NS D SD

19. Good Agricultural demonstrations

create in me the desire to achieve

what is being shown

SA A NS D SD

20. Hybrid seed varieties produce more

bags of maize per hectare than local

varieties

SA A NS D SD

21. The yields obtained from hybrid seed
do not fluctuate season after season
unlike yields from local varieties SA A NS D SD
22. Local varieties are more resistant to
pests and diseases than hybrid varieties
and do not need any spraying with
chemicals. This makes me plant local
varieties SA A NS D SD
24. Cultivation of hybrid seed is more
difficult than that of local varieties SA A NS D SD
25. It is possible to compare the yields
on hybrid and local varieties on my
farm before I decide whether or not
to use hybrid seed. SA A NS D SD
26. I regard cultivation of
hybrid varieties other activities[?]
other activities[?] I do on the farm. SA A NS D SD
27. The use of hybrid maize varieties makes
maize production more profitable than
use of local varieties SA A NS D SD
28. The use of recommended spacing
is increases profitability. SA A NS D SD

29. The use of recommended spacing fits well into my daily farming activities (including intercropping where applicable. SA A NS D SD
30. Recommended spacing is difficult to achieve on my farm SA A NS D SD
31. Fertilizer application is difficult to practice on my farm because of the complex steps which need to be followed when applying it. SA A NS D SD
32. Fertilizers increase maize yields from my farm. SA A NS D SD
33. Use of fertilizer in maize cultivation makes maize production profitable SA A NS D SD
34. I regard fertilizer application as part and parcel of other activities I do on my farm. SA A NS D SD
35. Fertilizers are poisonous to soil SA A NS D SD
36. I have observed an increase in maize yield when I use recommend spacing compared with when I use other spacing SA A NS D SD

37. It is possible to compare the effect of fertilizers on maize on part of farm before deciding whether or not to use fertilizers SA A NS D SD
38. Pesticide application is difficult to practise on my farm because of the complex steps followed during application SA A NS D SD
39. Pesticide application makes maize production profitable SA A NS D SD
40. I regard pesticide application what I do on the farm. SA A NS D SD
41. I have observed an increase in yields when I use pesticides to control pests as compared to when I do not. SA A NS D SD
42. Whenever I practice 2-3 weeding on my maize crop the yields obtained are more than when I practice less weeding. SA A NS D SD
43. I regard 3 weeding as part and parcel of the activities that

- should be done on my farm. SA A NS D SD
44. It is possible to see the effect
on maize yields of more weeding. SA A NS D SD
45. Three weeding are easy to achieve on
my farm as the process of weeding
which I practice is not difficult SA A NS D SD
46. More weeding make maize production
less profitable as they involve
more costs. SA A NS D SD
- The following statements will only be presented to those farmers who indicated that they used
herbicides to control weeds on their maize crop.
47. I regard herbicide application
what I do on my farm. SA A NS D SD
48. Application of herbicides at
the required rates results in an
increase in yield of maize SA A NS D SD
49. Application of herbicides at
the required rates results in an
increase in yield on maize SA A NS D SD
50. Herbicide application is
a complex procedure. SA A NS D SD
51. Application of herbicides

results in increased
profitability in my maize
enterprise.

SA A NS D SD