AN ASSESSMENT OF THE TRANSFER AND UTILIZATION OF SELECTED AGRICULTURAL INNOVATIONS IN MUSOMA DISTRICT

By

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DECLARATION

I, RAPHAEL MUNANKA WAMBURA, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is a result of my own original work and that it has never been submitted for a degree award in any other University.

Signature :.....

Date : 22/6/1988.

ABSTRACT

The agricultural extension system in Tanzania has come under criticism as being ineffective, in stimulating increased agricultural production. Such criticism has partly focused on the performance of extension workers in rural areas. This study, therefore, sought to determine the availability of suitable innovations to the farmer and to assess the extent of transfer and utilization of such innovations in villages.

The specific objectives of the study were to: take inventory of agricultural extension innovations available to the extension service; investigate the extent of transfer and utilization of agricultural innovations; identify factors contributing to success or failure in the transfer and utilization of agricultural innovations; and recommend guidelines which will facilitate effective transfer and utilization of agricultural innovations.

Data were mainly collected from 23 field extension workers and 160 farmers by use of questionnaires. Other data were obtained through directed discussions of the researcher with 15 selected extension officers and village leaders. Notes in diary form from researcher's observations were also used. Data from each source were examined. Numerical data were summarized in tables by using descriptive statistics of percentages.

The study found out and concluded that agricultural innovations are generally available in forms that vary in terms of the degree to which they can be helpful to the field extension worker and the farmer. There were those that appeared in simplified packages that could be easily utilized by extension workers and farmers, on one hand, and those that were complex and therefore not easily understood. The extent of transfer and utilization of agricultural innovations was found to vary from crop to crop. Some of the constraints to the transfer of such innovations are of extension nature while others are clearly beyond the scope of responsibilities of the extension service.

Finally, the study recommended that: efforts be made to refine agricultural innovations; every extension worker should attend, on regular basis, refresher courses and other professional programmes; and there is need to implement the national agricultural policy (1983) on transport for extension workers.

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CHAPTER 1

INTRODUCTION

Background of the Study

The term "extension education" was first introduced in 1873 by Cambridge University to describe a particular educational innovation of taking the educational advantages of the Universities to the ordinary people where they lived and worked (Kelsey and Hearne, 1963; Maunder, 1972). Within a decade the idea had spread to other institutions in Britain and the United States. The modern concept of "agricultural extension" originated from the United States when it was formally established through the enactment of the Smith - Lever Act in 1914. This act provided the allocation of land to each State to establish a College of Agriculture (Jibowo, 1980).

Nearly all countries in the world today provide some type of educational service to help rural people improve their agricultural productivity and to raise their levels of living. Extension services in the rest of the more advanced countries also had their beginning in this century and in recent decades had developed into powerful forces for economic and social progress. Most newly developed countries established their systems of extension education after World War II with assistance from the more advanced countries and international agencies (Maunder, 1972). Impetus for establishment of extension services in developing countries has come from several causes:

a) the threat of famine has forced governments to take measures to expand food production. b) social unrest among rural people has made it politically imperative to give assistance in bettering their levels of living, c) newly Independent Countries have found that agricultural modernization is a first step towards economic development and freedom from economic dependence upon more powerful and advanced nations, and d) there has been a recognition that rural people who constitute the majority of the population in most countries have a right to equality for advanced and better life (Maunder, 1972).

The system of agricultural extension work in Tanzania (Mainland) that has been practiced and developed over the years is basically run by the government. It is a combination of agricultural advisory services and agricultural extension education. Thus, extension has a slightly different meaning from that persued in England and the United States where the original concepts of extension education and agricultural extension evolved, respectively. It involves attempts to change or influence local people's ways of farming. From as far back as the colonial period, local people were poor and unsophisticated subsistence farmers, growing crops and raising livestock for their own families' living. Although they were illiterate,they were guided by their traditional habits in farming and were notably independent people, with little or no influence from the global economy

(Keregero, 1981).

During colonial time, rural development policy in then Tanganyika focused on export of primary agricultural products namely cotton, sisal and coffee. The policy also sought stability which involved the prevention of famine and unrest, and the maintenance of soil fertility and production levels. Consequently, many by-laws concerning soil conservation, stocking rates and planting of famine crops were enacted (Illife, 1971). Attempts to resettle people in sparsely populated areas and encourage cash crop production through various settlement schemes were also made.

It is during this period that the agricultural extension service originated. It focused largely on small-scale farmers. The agricultural extension service utilized Agricultural Officers and Native Instructors in the Department of Agriculture whose primary function was the enforcement of various agricultural rules and regulations. In order to ensure a high return to effort, the "Focal Point Approach" which concentrated efforts in high potential areas in the Northern and Western parts of the country, was adopted. Generally, farmers reacted negatively to the force applied by colonial administration (Cliffe, 1972). The result was a modification of the

Focal Point Approach, into what was referred to as "Progressive Farmer Approach". This approach focused extension resources on "early adopters", usually the rich, more modern farmers with larger than average farms and greater ability to follow extension advice (Illiffe, 1971). The concentration of agricultural extension service to progressive farmers was unfair because these people had already made some advancement economically and it was the poor farmers who needed this concentrated attention more than anybody else. This approach was also unjust because both progressive and poor farmers paid taxes to support extension services. Thus,the concentration on the progressive farmers created mistrust, jealousy and antagonism between progressive farmers and ordinary or poor farmers. As such,the approach contributed towards widening the gap between the haves and the have-nots, a situation which would later not be tolerated in a country that is striving for socialism and self-reliance (Kauzeni, 1979).

When Tanganyika gained independence in 1961, it abandoned enforcement of the by-laws. Pepole were to be encouraged to move into villages to facilitate self-reliance and development through application of Ujamaa (socialist) principles (Nyerere, 1962). As a result of this, some spontaneous settlements were started allover Tanzania. The pre-independence experience with agricultural extension and settlement led in part to the adoption of a dual development approach in Tanzania.

This was recommended by International Bank of Reconstruction and Development (IBRD) and administered by Israel (Myers, 1973). IBRD recommended a "Transformation Approach" which aimed at modernizing agriculture through planned village settlement schemes with extensive capital investment, trained management personnel and modern technology. Also an "Improvement Approach" which sought to gradually improve traditional agriculture through extension and credit programmes among small - scale farmers and by encouraging cooperative production in villages was adopted (Cliffe and Canningham, 1973).

By mid-sixties the failure of the dual approach was apparent. Most settlement schemes were overcapitalized and poorly planned. They led to the creation of a spoon-fed, dependent and privileged class of farmers who became a source of envy and irritation to the rest of the rural population (DeVries, 1978). The hoped-for demonstration effect also failed to materialize as very few farmers had resources to support the application of what they had learned. The Improvement Approach seems to have been more successful although it also encountered major problems. Since early adopters controlled considerably more resources than the average farmers, the latter could not follow this example (DeVries, 1978). The Improvement Approach contributed to increased rural class differentiation which is a contradiction of the country's present policy which

espouses socialism and equity.

In 1967 Tanzania revisited its development policy, resulting in a restatement of development goals and strategies in the Arusha Declaration. As a result of the Arusha Declaration, Tanzania's Five Year Development Plan (1969 - 1974) adopted the "Frontal Approach" to Ujamaa Development. According to this approach, a whole range of government and political institutions were to be mobilized behind the principles of Ujamaa (Tanzania, 1969). Efforts to educate and politicize the peasants largely gave way to the use of government controlled rewards and pressures, a combination which is also sometimes known as the "Carrot and Stick Approach" to village development (Ndonde, 1975).

In the rise of the Arusha Declaration and adoption of Frontal Approach, extension workers were to give assistance to the development of Ujamaa production. However, as only a minor proportion of agricultural activities took place on communal basis, much of the extension efforts continued to focus on private production. Extension workers remained responsible to the government which provided their salary and the funds for development activities. Recruitment, training procedures and curricula changed very little, if at all. Planning extension activities also continued in a bureaucratic, top-down

fashion (DeVries, 1978).

A major decentralization of the government structure, including the Ministry of Agriculture, was instituted in 1972 in order to bring decision - making closer to the people, facilitate an integral approach and give greater scope to the Party for guiding and controlling development at all levels (Nyerere, 1972).

The Policy of decentralization transferred the administration of extension services from the Ministry of Agriculture to the Prime Minister's Office through Regional Development Directors (RDD's) and District Development Directors (DDD's). This mode of organization proved ineffective since the Ministry of Agriculture which is responsible for agricultural development and which is supposed to provide technical and supervisory services to extension workers, lost control of these workers. On the other hand, the Prime Minister's Office could not provide the necessary technical and supervisory support. The government also experimented with the "Commodity Extension Approach" whereby different Crop Authorities had separate extension services dealing separately with individual crops. This mode of organization despite its positive effects resulted in duplication of efforts and bureaucratic competition (Mattee and Mvena, 1987).

The Task Force on National Agricultural Policy (1982) noted these weaknesses and recommended the re-centralization and consolidation of extension services into one organization.

Currently, agricultural extension in Tanzania is the responsibility of the Ministry of Agriculture and Livestock Development (MALD). The extension service operates at regional, district and village levels. The existing system of village based extension workers who form the backbone of the extension service in Tanzania offers a good basis on which to establish a more effective system for disseminating extension innovations.

Statement of the Problem

The agricultural extension system in Tanzania has come under criticism as being ineffective in stimulating increased agricultural production. This criticism has focused partly on the performance of extension workers in rural areas. Extension workers are perceived as being unable to influence farmers' agricultural practices and thus being ineffective in their job (Mattee and Mvena, 1987).

The then President Nyerere (Daily News, October 21, 1975) once remarked that the Government could sack all agricultural extension workers and that agriculture would not suffer much. This remark is also amplified in his review of Tanzania's ten years after the Arusha Declaration when he made the following observation :

> The truth is that the agricultural results have been very disappointing. Modern results have not been spread very widely. The majority of our traditional crops are still being grown by the same methods as our forefathers used. Towards agriculture and agricultural methods, even our attitudes have not changed much as they need to do (Nyerere, 1977 : 19).

Assessing the extension service in Tanzania, Mawala quotes Raikes as saying :

> One of the most striking facts to emerge from historical study of agricultural development in Tanzania is that, while the extension service has concentrated on intensification of farming practices for the most of the past half century, most of the growth in production has come from acreage expansion. Increased yields have on occasion been an important factor in increased production, but when this is so they have derived from improved varieties or settlement on the new more fertile areas than more intensive husbandry (Mawala, 1982: 19).

Both observations by Nyerere and Raikes are valid in Tanzania and other parts of the world. The most commonly discussed problems of agricultural extension service focus on inadequacies in organization; training and selection of extension personnel; motivation of personnel; choice of extension strategies; and appropriate content of extension programme (Dey, 1978; Tanzania, 1983). These are undoubtedly real problems. However, little attention has been given to periodic assessment of the availability, transfer and utilization of agricultural innovations.

This study, therefore, was intended to concentrate on the innovation dimension. In particular, the study sought to determine the availability of suitable agricultural innovations to the farmer and to assess the extent of transfer and utilization of such innovations in villages.

Objectives of the Study

The specific objectives of this study were as follows:

a) To take inventory of agricultural extension innovations available to the extension service.

b) To investigate the extent of transfer and ultimate utilization of selected agricultural innovations

c) To identify factors contributing to success or failure in the transfer and utilization of agricultural innovations.

d) To recommend guidelines which will facilitate effective transfer and utilization of agricultural innovations.

Based on the objectives above, the following research questions were formulated to guide the data collection process :

a) What agricultural extension innovations are actually available to the extension service in Musoma district?

b) Do farmers receive any advice on selected agricultural innovations from field extension workers or any other source? If so, in what way(s) does that advice reach them?

c) What is the state of farmers with regard to knowledge, trial and adoption of selected agricultural innovations?

d) What are the characteristics of innovations and how do these characteristics affect the transfer and adoption or rejection of selected agricultural innovations ?

Assumptions

This study and the methodology adopted were based on the following assumptions:

a) Agricultural development is a function of agricultural producers, governance, supply, markets, research and extension services and that interaction between and among these factors is necessary.

b) The way innovations are currently created and subsequently communicated may have elements that are inadequate and therefore providing a basis for determining what should be adopted by farmers.

c) Farmers, administrators, politicians and scientists are in need of information concerning the impact of extension service as performed by agricultural extension workers on agricultural production.

Definition of Terms

The following labels will be used frequently in the text and are defined here to provide a common basis for conveying meaning.

Agricultural Extension : In this study the label "Agricultural Extension" will often be shortened as "Extension" for the sake of brevity. Both terms will be used to denote a service or system which assists farm people, through educational means, in improving farming methods and techniques, increasing production efficiency and income, bettering their levels of living, and lifting the social and educational standards of rural life.

Extension Worker: An individual who is fully employed and engaged in extension work in rural communities. The label, as used here, applies to the staff employed by the Ministry of Agriculture and Livestock Development, dealing with crop production.

Field Extension Worker : An extension worker who is working and residing in rural areas. The label, as used here, applies to an individual responsible for extension work in villages where the study was done.

Ujamaa : Ujamaa in the context of Tanzania means family-hood traditionally characteristic of the social relationships that existed in extended family groups of many traditional African societies. It embraces the basic principles of : a) equality, mutual respect and love; b) common obligation to work; and c) collective control of capital goods and land.

Villages : These are centres for implementation of Ujamaa ideology in Tanzania. Their main economic objective is to become as viable and self-reliant as possible.

CHAPTER II

REVIEW OF LITERATURE

Although extension is only one of the many factors contributing to greater agricultural efficiency and development, there is no doubt that effective extension workers can and do speed up the rate of development (Bradfield, 1966). Kauzeni (1979) contends that agricultural production both per unit of land and per unit of labour in villages is low, relative to what could likely be obtained based on modern inputs and husbandry standards. Agricultural production is affected by many factors which are economic, social, political, physical environmental, administrative and technical in nature. These factors operate in various combinations with varying degrees of effectiveness, depending upon the area under investigation. Kauzeni (1979) recommends that in order to improve the effectiveness of agricultural extension approach and extension service as a whole, there is a strong and urgent need to re - examine all aspects of extension service, including: its general role, the linkage with research services and most important extension methods and training programmes. This exercise should aim at making agricultural extension service a better tool for village agricultural development.

Keregero (1981), in a study seeking to identify critical requirements for the job of extension workers in Tanzania, found out that most of the extension activities in villages are initiated by extension workers in response to instructions handed down by superiors. He noted that extension activities most frequently seek educational outcomes and deal more with technological than social matters. The study found contact with clientele to be critical to the job of extension workers and that the primary means of communication by extension workers is face-to-face interaction. The study further revealed that the critical areas of the job of extension workers include : a) diagnosing problems and needs; b) interpreting extension and job policy; c) recognizing unique situations and responding in ways typically beyond the normal repertoire of things covered during training; d) developing group and collective activities; e) conducting intentional premeditated efforts to facilitate changes; f) dealing with identifiable problems and needs of clientele; and g) dispensing technological information and advice.

In a study for participation in agricultural extension and village development activities in Mbeya region, Tanzania, Ponjee (1979) found out that the extension system tends to

favour certain categories of farmers as well as villages. Thus richer, younger and better educated farmers within the surveyed villages had higher levels of extension contact than poorer, older and less educated farmers. More developed villages had higher levels of extension contact than less developed villages. This study showed that group methods are in fact widely used. Even though extension workers stress the use of group methods, they in practice, wind up with more contact with a particular category of individuals. Even with group approaches like meetings or demonstrations, not everyone will attend. So you may still have differential extension contact which is not the fault of extension workers.

However, only a few studies have been conducted in East Africa on the assessment of extension services. For example, Kauzeni (1979) cites Watts (1975) who in his review of extension programmes for small projects based on individual or group interest criticallly examined the effectiveness of the activities of rural extension agencies, nutrition extension, crop extension, livestock extension and general extension programmes. Watts found out that nutritional practices and knowledge were affected more by formal education than by intensity of contact with extension workers. He further observed that although the trend was towards the group approach, many staff had the old attitude of concentrating on few individual

farmers. As a result, some farmers were visited almost monthly. However, the majority were not visited and did not seem to be aware that the services of extension workers were available to them. It was realized that the use of many methods becomes effective as the proportion of rural educated people increases.

Another contribution can be cited from a study by DeVries (1976). He examined maize growing practices in Iringa region, Tanzania, in order to determine the effectiveness of extension in promoting the adoption of improved practices. In this study, DeVries questioned the allegation that extension has failed in its role of encouraging peasants to adopt new farming practices. He was convinced that this failure was due, in large part, to technical constraints, such as lack of necessary inputs, lack of capital and markets, and to "wrong recommedations". So extension may not be to blame in many cases where the farmers have failed to adopt recommended farming practices. According to DeVries, significant differences in adoption rates existed between zones, suggesting that the recommendations were more suited to the high - use zones. He also found that recommendations, particularly those involving high cash expenditure, were followed to a high degree by rich farmers. Farmers with high degree of extension contact in all subgroups were found to be more likely to follow extension recommendations. DeVries concluded that the

effectiveness of extension was a function of a multiplicity of factors and situational constraints.

In a study of coffee cultivation in Tanzania, Saylor (1975) concluded that most of the increased smallholder output was due to new planting and the use of new varieties but not new techniques and thus could not be credited to extension services. In this connection, Saylor pointed out that farmers could reject recommended innovations on rational grounds because they confront a different set of resource constraints than research stations. According to him, rejection may be specifically prevalent where farmers are asked to accept a package of innovations which must be used as a set to achieve expected results. In such a case farmers may use only part of the set and consequently find a reduction rather than increase in their net cash position. If such sets of innovations also entail use of inputs, the chances of partial acceptance and final rejection are further enhanced. This view is shared by Keregero et al (1977) who by way of a case study, examined recommendations with respect to cotton production for the Mara Region Cotton Project. This survey suggested that cotton growers might have resisted adopting extension recommendations because the latter were inappropriate to their situation. Such an observation by Keregero et al is contrary to the generally held view that farmers are stubborn, traditionalists and naive.

Other studies (Sachak, 1977; Tilumanywa, 1977) have likewise demonstrated that farmers have failed to adopt certain extension recommendations because the recommended innovations have been either too costly in relation to available resources on the farm, or incompatible with the prevalent farming system of the area.

According to Lionberger and Chang (1970), in order to arrive at specific adoption decisions, the farmer requires various forms of information. He must first learn of the information; he must have this additional information to evaluate and apply the new technologies. There is also the need for information about the likely consequences to the farmer and to his social status if he accepts the innovations in farming. Add weather, markets, purchasing inputs and outlook information which further complicates the information problem.

Certainly, the extension service as an agency that communicates innovations must be cautious on the various factors that do affect the way innovations are finally accepted (Lionberger, 1963). Rogers and Shoemaker (1971) divide the process of adoption of innovation in four distinct phases: (a) awareness of innovation, b) interest in the innovation, c) trial of the innovation, and d) adoption or rejection of the innovation. They also observe that the level of adoption of innovations depends on the following factors: a) source of information; b) intrinsic characte. -

ristics of the information itself and its appeal to clients (complexity, probability, riskness, compatibility with other activities), c) characteristics of the unit concerned (resources, size, type of activities, degree of specialization), and d) preparation of innovation client.

The agricultural extension system in Tanzania has always been charged with the task of transmitting agricultural innovations from the researchers to the farmers. The major role of the extension system is therefore to facilitate such a link. This is viewed as a three-step-process, passing scientific information in agriculture from the research scientist to the extension worker then to the participating farmer (Hargreaves, 1976). For effective performance of the extension worker it is imperative that he be conversant with the communities at both ends, that is, the research and the farming communities.

A close working relationship with the research system is not a sufficient condition for increased agricultural productivity. The farming community must also be included in the technology development and utilization equation. Farmer education on the use of innovations is an essential ingredient in agricultural development. Farmers cannot successfully adopt a new technology unless they are aware of it and learn how to incorporate it into their farming systems (Swanson, 1984).

The agricultural extension worker does not, however, operate in a vacuum. The extension worker can be positively or negatively affected by the prevailing social, political and economic climate. More specifically, factors such as quality of agricultural research; the degree to which policy and prices support the use of technological adoption;and the effectiveness of the supporting infrastructure, among others, have decisive influence on performance of extension system (Mvena et al., 1986). Uma Lele (1975), on the other hand argues that mere intesification of the extension service may often be futile, unless conscious simultaneous effort is made to : a) impart technological package that is sufficiently profitable at the farm level to provide an incentive for the farmer to adopt innovations; b) train the extension workers to solve the specific but diverse farm - level constraints faced by the farmers; c) develop incentive system to encourage the extension service to perform its task efficiently; d) relieve extension of the heavy burden such as delivering inputs, writing credit applications and chasing credit defaulters; and e) enlist the active participation of the farmers themselves.

The professional and technical competencies of extension workers are probably the most important inputs into any country's extension system. Hardley (1970) . . .

considers the following four questions necessary when planning an effective communication : a) What is the need to be met by the message we are going to transmit? b) What types of communication goals are we trying to reach? Teach skills? Inform people of new method? Persuade people to accept new belief or adopt new techniques? c) What obstacles must be overcome? These can arise from our audience, our own purpose and our limits in time, money and facilities. d) What specific outcomes do we need to obtain to get the general goal we have in mind? This question requires that we be more specific about just what is to be communicated, to whom, in what situation and by what means? Hardley observes that the effectiveness of the message we finally transmit will depend largely on how we answer these questions.

Various studies have assessed the competencies of extension workers and have tried to relate these competencies to extension job performance. The findings have not been encouraging. For example, Hulls (1975) carefully conducted a study of extension workers in Sukumaland. He found that farmers who had received no direct advice were closer to the recommended spacing for cotton than those who were in contact with extension workers. Doubting the findings of his own survey he then conducted an actual field experiment with groups of local farmers, working under the supervision of the field extension worker to introduce the growing of improved composite maize. Once again, he found

that, even when provided with excellent innovations and carefully worked out extension materials, the extension worker made little or no attempt to see that farmers followed the recommendations. Hulls blames this on the inability of the extension worker to effectively plan their work, to communicate recommendations to farmers and their low credibility in front of farmers because of low technical knowledge. Leonard's (1977) study in Kenya also indicated that extension workers are lacking in skills in experimenting with and adapting extension recommendations to local conditions.

The findings of Hulls and Leonard are supported by another study by Mende (1984) who concluded from a study of extension workers in Tanga region that extension job performance was positively related to certain personal characteristics including initiative, knowledge of technical subject - matter, knowledge of extension process and cooperation with others in rural development.

This review of literature attempted to concentrate on the agricultural innovation dimension. In particular, it sought to assess: the availability of suitable innovations to farmers; as well as the extent of transfer and utilization of such innovations in villages. Findings from other studies were reviewed to provide a framework for this study.

CHAPTER III

METHODOLOGY

The Population and Location of the Study

This study sought to collect data on transfer and utilisation of agricultural innovations in relation to selected agricultural practices in cotton and sorghum growing.

Data were collected from 23 field extension workers. The field extension workers were chosen because they are a category of people involved directly in transfer of agricultural innovations at the grassroots level .

In addition, data were collected from 160 farmers who were household heads. Since household heads make day-to-day decisions in the family and are more likely to communicate with field extension workers than any other member of the family, they were considered to be rich sources of data.

In order to validate some of the information given by field extension workers and farmers, qualitative data were collected from 15 respondents. These comprised extension officers who were working at regional and district levels as well as village leaders.

The study took place in four villages, namely: Nyamisisye and Kiabakari in Makongoro division ; and Nyang'oma and Kwibara in Nyanja division. Figures 1 and 2 give locations of Mara region within Tanzania and surveyed villages in Musoma district, respectively.

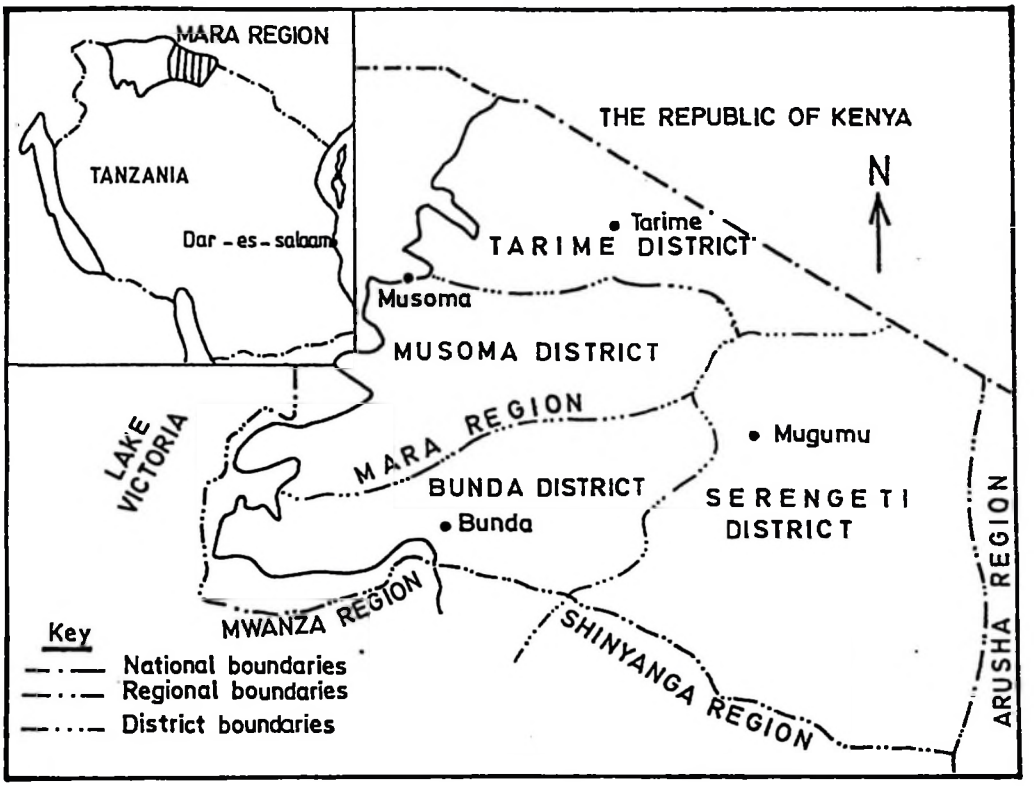
Sampling Procedures

The list of all field extension workers in Musoma district who have gone through a Refresher Course, Certificate Course or Diploma Course in Agriculture was prepared from records kept by the district up to 15th June, 1987. At the time of the study there were 23 such field extension workers out of the 39 who lived and worked with farmers in the field. Initially, it was proposed to use a random sample of 30 field extension workers. Consequently, all 23 field extension workers were involved in the study.

A sample of names of household heads was obtained through application of a multi-stage cluster sampling technique as follows:

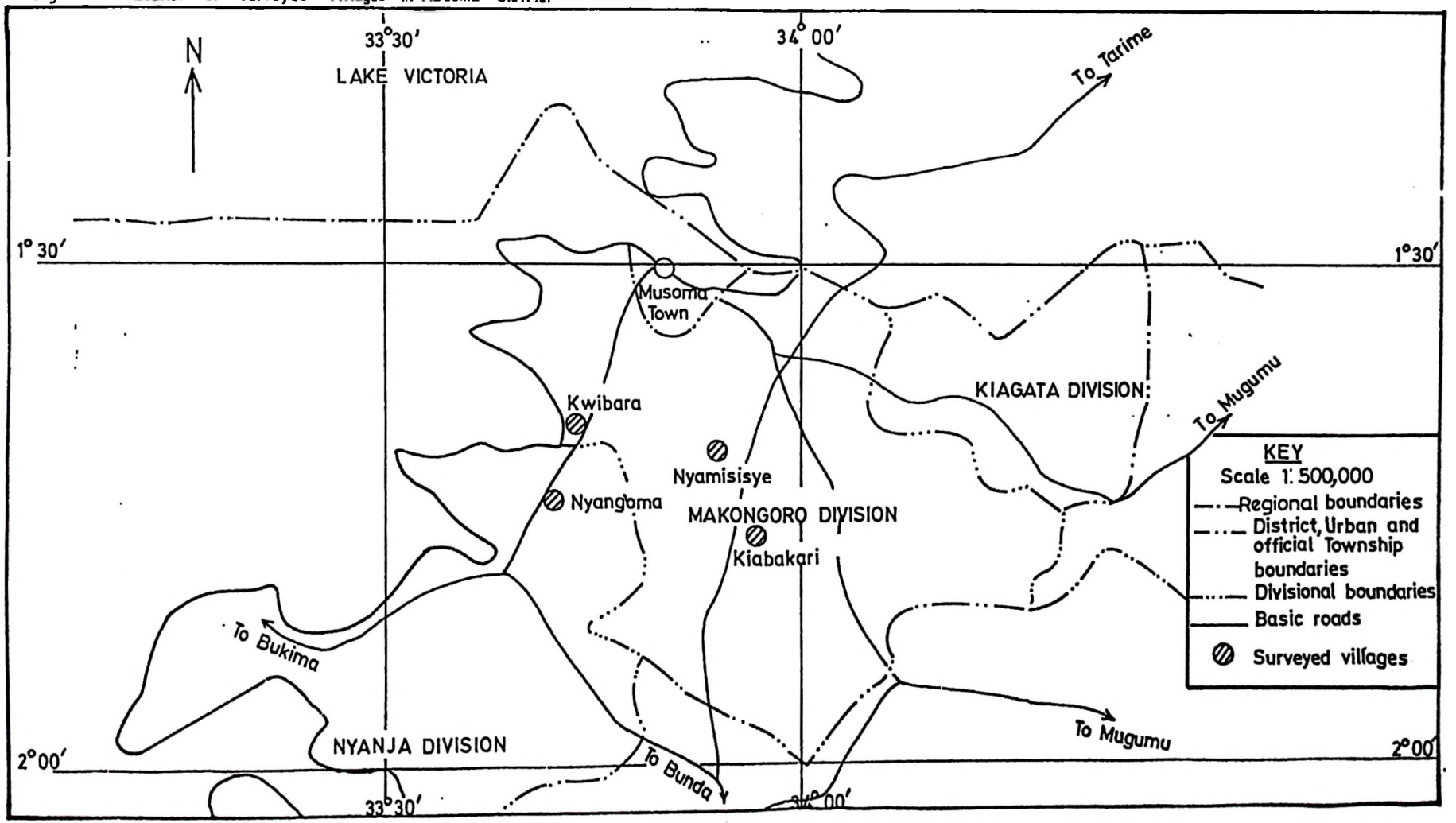
Stage 1 : Purposive sampling of four villages, namely: a) Nyamisisye; b) Kiabakari; c) Nyang'oma, and d) Kwibara. These villages were obtained from a list of 95 villages in the district on the basis of : a) prominence in growing cotton

Figure 1. Location of Mara region Within Tanzania



Scale: Not to scale

Figure 2. Location of surveyed villages in Musoma district



and sorghum, and b) having a field extension worker in the village.

Stage II: Given the researcher's limited time and financial constraints, 40 household heads in each village were involved in the study. A table of random numbers given by Blalock (1972) facilitated the selection of names of 40 household heads from each corrected village list of household heads aged between 30 - 60 years.

Extension officers and village leaders were selected by using a snowball technique: After interviewing a respondent, the researcher asked him/her to recommend other respondents considered very knowledgeable about the transfer and utilization of agricultural innovations. In this way 15 respondents were identified and involved in the study.

Preparation and Testing of Instruments

Data were collected using two types of questionnaires, namely: a) field extension workers' questionnaire, b) farmers' questionnaire and c) researcher's diary.

The field extension workers' questionaire was prepared to measure the following in relation to respondents: a) major field activities, b) efforts in advising farmers,

c) opinions towards farmers with whom they work, d) perceived opinions on farmers' views concerning recommended agricultural practices, e) opinions on recommended and traditional agricultural practices, f) knowledge of implications of selected recommended agricultural practices, g) opinions on problems that constrain the transfer of agricultural innovations and h) perceived views on problems that constrain farmers' adoption of agricultural innovations.

The farmers' questionnaire was prepared to determine the following aspects in relation to respondents a) extent of growing cotton and sorghum, b) views on selected agricultural recommended practices, c) nature of advice from field extension workers or any other source with respect to selected recommended agricultural practices, d) level of continuous use of selected recommended agricultural practices, e) degree of innovativeness with regard to selected recommended agricultural practices for cotton and sorghum growing and f) perceived reasons for their continuous rejection of selected recommended practices for cotton and sorghum growing.

The researcher's diary was used to record information from : a) extension officers and village leaders about the transfer and utilization of agricultural innovations in general, b) research reports and other relevant information from regional and district official files, and c) observation of some cotton and sorghum fields in surveyed villages.

Pretesting

Prior to pretesting of questionnaires, consultantion was sought from Sokoine University of Agriculture subject - matter and research scientists as well as from agricultural professionals who had worked in the field of extension. Their suggestions were incorporated into questionnaires and study design.

Finally, all questionnaires were subjected to careful pretests under field conditions and revisions were made accordingly. In all the 16 items in field extension workers' questionnaire pretested, only one item which involved extension methods was revised. The researcher found that mass method had not been included. Thus the enquiry covered individual, group and mass methods of extension. The researcher, being cognizant of the farmers' difficulties with language, took much care in pretesting the farmers' questionnaire. Schedules for interviewing farmers were carefully tested for convenience of common meaning and adequacy of conceptualization of intended meaning in Kiswahili, for all the 14 items in the farmers' questionnaire. There was no item that was revised or deleted in this case.

Data Collection Procedures

Field work was conducted during the period June to September, 1987 by the researcher. Much care and foresight were given to legitimizing the research in the eyes of the

relevant village leaders,farmers as well as Party and Government leaders in the district. Since the researcher had worked as an Agricultural Officer about two years ago in the district, it was not difficult to establish rapport. The approval and promised support of the District Agricultural Office, village leaders and farmers were obtained prior to conducting any interview.

The researcher attended three monthly district agricultural meetings for all extension workers. This provided him with opportunity for making the research programme known to the field extension workers. After the three meetings, the majority of the field extension workers involved in the study had completed the field extension workers' questionnaires. Of the 23 self - administered questionnaires meant for field extension workers, 20 were properly completed, constituting a return rate of 87 percent. As shown in Table 1, the majority of the field extension workers were of the rank of Agricultural Field Officer IV (AFO IV). Normally these will have had certificate or diploma training in Agriculture. Only one respondent was of the rank of Agricultural Field Officer III (AFO III) which is essentially through promotion by merit from the former. Three were drawn from the rank of Agricultural Field Assistant II (AFA II) and had largely attended a refresher course which is below a certificate course in Agriculture while one respondent came from rank of Agricultural Field Assistant

I (AFA I) which is slightly higher than the former, mostly through promotion by merit.

Table 1 shows that the majority of the field extension workers were male, mainly ranging between 25 - 30 years of age. However, the age distribution of field extension workers reflected their various experiences in extension work.

The researcher resided in each of the four villages. Once settled he developed a list of available household heads from village registration lists and consultation with Party and Government leaders in each village. Eligible respondents were interviewed through guidance of Ten Cell Leaders who introduced the researcher to the respondents. Of the 160 inteviewing schedules meant for household heads, 151 were properly completed, constituting a return rate of 94 percent as shown in Table 2. As far as possible the interviews were conducted in private and lasted for about 1 hour each. When the interviewing was completed in one village the researcher moved to the next, usually spending about two weeks in each village.

Table 1 : Field Extension Workers Studied

Rank	Age in Years								
	25 - 30		31 - 35		36 - 40		41+		
	Male	Female	Male	Female	Male	Female	Male	Female	Total
AFA II	1	-	-	-	2	-	-	-	3
AFA I	-	-	1	-	-	-	-	-	1
AFO IV	9	1	3	-	1	-	1	-	15
AFO III	-	-	-	-	-	-	1	-	1
Total	10	1	4	-	3	-	2	-	20

Table 2 : Household Heads Interviewed

Village	Age in Years						
	30 - 40		41 - 50		51 - 60		
	Male	Female	Male	Female	Male	Female	Total
Nyamisisye	6	2	16	3	10	1	38
Kiabakari	6	-	16	1	10	3	36
Nyang'oma	19	1	10	3	16	-	40
Kwibara	10	2	10	5	10	-	37
Total	41	5	43	12	46	4	151

Table 2 indicates that the majority of household heads were male in each age group. It appears that there was a fair distribution of household heads in different age groups. Such distribution reflected various individual feelings and experiences in the use of agricultural innovations.

Furthermore, data were collected from 15 extension officers and village leaders through directed discussions with the researcher. The researcher also reviewed research records and other relevant information from regional and district agricultural files. It was also necessary to compile data from observation of some cotton and sorghum fields in the surveyed villages. Table 3 gives a summary of the distribution of all respondents involved in the study.

Table 3 : Distribution of All Respondents According to Source of Information

	Respondents		
Source of Information	Male	Female	Total
Field Extension Workers	19	1	20
Household Heads	130	21	151
Extension Officers and Village Leaders	15	-	15
Total	164	22	186

Data Processing and Analysis

Framework for Data Processing and Analysis

In this study the researcher chose to view the transfer and utilization of agricultural innovations as involving two types of people: a) field extension workers who by profession or practice, advocate the acceptance of a given innovation, and b) farmers who are potential users of such innovations. These two types of people must be in communication with one another directly or indirectly for the transfer and utilization of agricultural innovations to take place. To be meaningful, for this purpose, the communication must be in reference to a particular new idea or a practice. Focus on new agricultural practices influenced the kinds of questions about the respondents in the communication process. And provided criteria on which assessment of the transfer and utilization of agricultural innovations was based. The study also attempted to determine whether a new practice, once accepted in optimum manner, had desired effects on the farmers' performance in the field with regard to growing of cotton and sorghum.

This section will be devoted to a discussion of the ways that were used in assembling data and organizing them into forms that could be arranged to address the questions raised in the study. Specifically, the following operations are presented : a) data processing, and b) data analysis.

Data Processing

A major concern in preparing data for analysis was to summarize the data from the bulky field extension workers' questionnaire, farmers' questionnaire and researcher's diary to single sheets of paper. To do this, data were paraphrased while preserving the original details and original meanings as accurately as possible. Data originally reported in Kiswahili were translated into English and those written with obvious grammatical mistakes were corrected.

Data Analysis

Data from all sources in this study were examined. Numerical data were summarized in Tables by using descriptive statistics of percentages to facilitate assessment of the transfer and utilization of agricultural innovations in the area studied. Clues were sought in each source with a view to determining the : a) availability of agricultural innovations to the extension service, b) nature of farmers' advice and adoption of agricultural innovations, and c) factors contributing to acceptance or rejection of agricultural innovations. Specifically, consideration of these aspects led to the following pattern of analysis :

Availability of Agricultural Innovations

Examination of available agricultural innovations to the extension service with regard to cotton and sorghum growing in Musoma district was an important aspect of the analysis. The major purpose was to identify agricultural innovations that are expected to be transferred by the field extension workers and consequently utilized by farmers.

Nature of Farmers' Advice and Adoption of Agricultural Innovations

An important aspect of this analysis was to examine opinions of field extension workers on the way they transfer agricultural innovations. The perceived views of farmers as well as extension officers and village leaders were also examined. Clues were also sought in each case to facilitate the determination of :

a) Extension methods used : Field extension workers' views were analysed to identify extension methods frequently used in advising farmers for each of the selected recommended practices of cotton and sorghum growing.

b) Extent of emphasis given to cotton and sorghum growing : There is a generally held view that field extension workers put more emphasis to cash crops than food crops in Tanzania. To test this, views of field extension workers themselves were analysed in the context of time spent on advising farmers on various aspects of each of the two crops.

c) Extent of use of recommended and traditional agricultural practices : Field extension workers' opinions were examined to determine the extent of use of recommended and traditional practices of cotton and sorghum growing by farmers.

d) Field extension workers' knowledge : In this analysis, the knowledge that the field extension worker was supposed to transfer with regard to the selected recommended practices of cotton and sorghum growing was examined. The correct responses for the selected recommended practices for cotton and sorghum growing were determined from research reports reviewed from official files. This facilitated preparation of a marking scheme and distribution of marks (scores) in all the selected practices for cotton or sorghum growing. Specifically, 20 marks were given to correct responses concerning each of the following practices:

land preparation ; selection and use of improved seed varieties; and proper spacing. Then 10 marks were awarded for :proper weeding; use of chemical fertilizers; use of organic manures; and use of insecticides. This gave a total of 100 marks in all the selected practices for each of the two crops. Information of this nature was considered in this study to be important in understanding the level of knowledge possessed by field extension workers with respect to agricultural innovations they are expected to transfer.

e) Farmers' degree of innovativeness : The main aim of this analysis was to examine farmers' opinions and researcher's observations in order to determine farmers' degree of innovativeness. The questions -- "Do you know anything about . . . ?" "Have you ever used. . . ?" "Are you still using . . . ?" -- were asked to elicit three stages of the adoption process,which are referred to in this study as knowledge, trial and adoption for each of the selected recommended practices of cotton and sorghum growing.

Factors Contributing to Success or Failure of Agricultural Innovations

Opinions from field extension workers and farmers were examined in order to identify factors contributing to acceptance or rejection of agricultural innovations.

This type of information was important in understanding :

a) Problems that constrain the transfer of agricultural innovations : Opinions from field extension workers were examined to seek clues about problems that constrain them in transfer of agricultural innovations.

b) Problems that constrain adoption of agricultural innovations : Opinions from field extension workers were examined in order to determine their perception of the problems that constrain farmers in adopting recommended agricultural practices put forward to them.

c) Opinions of field extension workers on farmers with whom they work.

d) Reasons for farmers' continued rejection of recommended agricultural practices.

Generalizability of Findings

This study was conducted in only four villages. However, it is felt that the findings generated can be generalizable beyond the villages studied and indeed beyond Musoma district and Mara region. This is because the situation from which the findings were derived is not unique to the four villages or Musoma district only. Specifically,

with respect to the provision of extension services: a) the structure in the villages studied reflects that which is prevalent in most villages allover Tanzania; b) cotton and sorghum which were the key referent crops are grown in villages elsewhere in Tanzania; c) the agricultural innovations advocated for the two crops basically apply in other districts as well; d) the extension methods identified in the villages studied are not district - specific but applicable allover the country depending on the situation and e) the variation of the respondents as given in Tables 1, 2 and 3 is sufficiently broad to reflect a regional or national pattern.

It is therefore considered by this study that the implications drawn from the available findings will have direct reference to the villages studied as well as beyond.

CHAPTER IV

FINDINGS AND INTERPRETATIONS

This chapter discusses major findings and interpretations. These will be discussed under the following sections: availability of agricultural innovations to the extension service; nature of farmers' advice and adoption of agricultural innovations; and factors contributing to success or failure of agricultural innovations.

Availability of Agricultural Innovations to the Extension Service

The researcher was interested in finding out whether there are recommended agricultural innovations available to the extension service for cotton and sorghum growing in Musoma district.

The findings from regional and district agricultural official files revealed that there are agricultural innovations that have existed since colonial time. The major source of such innovations was the Western Research Centre, Ukiriguru. Table 4 gives an indication of existing innovations for cotton and sorghum production in the district.

It was also observed that available cotton innovations had been organized in 10 specific recommendations for the extension worker to transfer and for the farmer to use. The

recommendations have been organized in operations as follows:

Table 4 : Existing Agricultural Innovations for Cotton and Sorghum Production

Type of Innovation	Cotton	Sorghum
Early Land Preparation	x[a/]	x
Use of Improved Seed Varieties	x	x
Timely Planting and Proper Spacing	x	x
Fertilizer and Manure Application	x	x
Weeding	x	x
Thinning	x	x
Spraying for Pests and Diseases	x	x
Harvesting	x	x
Grading	x	-
Storage	-[b/]	x
Post-harvest Practices	x	-

a/ available innovations

b/ unavailable innovations

1. Early land preparation.

This operation ought to take place starting in the month of September up to October. The use of tie-ridges is recommended for all types of soils except in black cotton soils.

2. Use of fertilizers.

This calls for the application of Triple Superphosphate (TSP) fertilizer at 50 kg per hectare or 1 tin of Farm Yard Manure (FYM) spread every three walking steps.

3. Timely planting and proper spacing.

Early planting is considered as starting in the middle of November up to the end of December. It is recommended that cotton be planted in pure stands and in proper spacing according to the following specifications:

a) On 150 cm ridge : Plant 2 rows on top of the ridge and leave 45 cm from hole to hole.

b) On 90 cm ridge : Plant 1 row on the ridge and leave 38 cm from hole to hole.

c) On flat cultivation in black cotton soils : Plant in rows, keeping 90 cm from row to row and 45 cm from hole to hole.

4. Use of improved seed varieties.

The recommendation calls for 5 seeds per hole. One tin of seeds is enough for one hectare. The use of seeds from the Primary Cooperative Society guarantees quality control.

5. Weeding.

Early weeding before excessive weed competition is suggested. Weeding properly 2 or 3 times assures effective weed control.

6. Thinning.

Reduce seedlings 4 weeks after planting to 2 seeds per hole. Apply nitrogenous fertilizer (Sulphate of Ammonia, Urea or Calcium Ammonium Nitrate) 6 weeks after planting, at the rate of 50 kg per half hectare.

7. Spraying for pests and diseases.

If cotton has germinated and is properly cared for, spraying is very important. Spraying for cotton ought to start 9 - 10 weeks after planting. It should be continued after every 2 weeks for 6 times. Insecticides used include: Thiodan, Ripcord and U-Kombi.

8. Harvesting.

It is recommended to harvest cotton when the pods have matured and opened completely. If you harvest late, the white colour of cotton could be spoilt by rain, dust or other debris.

9. Grading.

Cotton should be graded properly before selling. Grade A is cotton which is well matured and white. This

grade sells high. Grade B is cotton which is dirty and not well matured and sells low.

10. Post-harvest practices.

This recommendation calls for uprooting and burning of all cotton stalks before 15th September every season. This helps to control Spiny and Red Bollworms.

The findings further revealed that agricultural innovations that are actually available to the extension service on sorghum farming were reported in a complex manner and did not appear to be readily usable. The recommendations were as follows :

1. Land preparation.

It is ideal to make a fairly smooth and weedfree seedbed. Preparation procedures are governed by local conditions.

2. Use of improved seed varieties.

Sorghum has many high yielding varieties and hybrids. The recommended varieties are :

a) Serena : This is an early maturing variety and is ready for harvesting in about 100 days. Plant height does not exceed 1.5 m, has average yield of 2300 kg per hectare and cultivation is best in lowland areas

below 1500 m. It is resistant to pests and diseases and has conical shaped heads with brown seeds.

b) Lulu or Safi : This is an early maturing variety and is ready for harvesting in about 120 days. Plant height does not exceed 1.3 m, has an average yield of about 1800 kg per hectare and does well in low land areas below 1500 m. It is fairly resistant to pests and diseases although it is heavily attacked by birds. It has conical shaped heads with white grains.

3. Time of planting and spacing.

It is recommended to plant early in the season with the first onset of rains in order to take advantage of Nitrogen flush and as a control for certain plant pests such as shootfly. Desired plant population per hectare depends upon the amount of available moisture, fertilizer (Nitrogen) status of the soils and largely upon the variety being grown. Tall varieties need wider spacing than dwarf varieties :

a) Tall varieties - - height above 1.5m.
   i) 90 x 30 cm - single rows
   ii) 150 x 30 cm - double rows

b) Dwarf varieties -- height below 1.5 m

i) 45 x 15 cm - single row

ii) 60 x 15 cm - single row

iii) 75 x 15 cm - single row

iv) 90 x 10 cm - single row

v) 150 x 15 cm - double row

4. Fertilizer application.

It is required to apply all the required phosphate fertilizers and organic manures before planting. The nitrogen fertilizer is split so that half the required rate is applied at the time of planting and the remaining quantity is top-dressed after thinning. Fertilizer application rates are as follows :

a) Nitrogen fertilizer : Application rates range from 40 - 60 kg per hectare of actual Nitrogen depending on fertility of the soil from the following fertilizers :

i) Sulphate of Ammonia - 90 - 287 kg per hectare

ii) Urea - 47 - 110 kg per hectare

iii) Calcium Ammonium Nitrate - 195 - 293 kg per hectare

b) Phosphate fertilizer : Application rates range from 25 - 40 kg per hectare of P_2O_5. The quantity supplying the actual Phosphorus can be available from the following weights of fertilizers :

i) Single Superphosphate - 87 - 174 kg per hectare.

ii) Double/Triple Superphosphate - 43 - 87 kg per hectare

c) Farm Yard Manure (FYM) : Sandy Soils can be improved greatly by spreading 10 - 15 tons of FYM per hectare, repeated every after 4 years. However, 3 tons of FYM applied together with the above recommended fertilizer application give a good yield response.

5. Weeding.

Weeds compete with plants for available moisture and nutrients. Sorghum is a slow starter and weeds must therefore be destroyed 3 - 4 weeks after sowing. The frequency of weeding depends largely upon the nature of infestation but it is recommended to weed 2 - 3 times in order to keep the field in weedfree condition.

6. Thinning.

Thinning to one plant per hole proceeds immediately after weeding. The objective is to effect the correct plant population per hectare. Thinning is usually done 4 weeks after planting.

7. Control of pests and diseases.

The control of pests covers the following :

a) Insect pests.

i) Pests of sown seeds and seedlings include Mole Crickets, Millipedes and Wireworms. They are controlled by seed dressing with Fernasand, Aldrin or Dieldrin at 250 gm active ingredient per 100 kg of seed.

ii) Shootfly: Controlled by early planting in the season, planting resistant varieties such as serena, and spraying Thiodan at weekly intervals for the first 4 weeks.

iii) Armyworms, Cutworms and Grasshoppers: Controlled by DDT 10 percent or 2.5 percent Endrin at 10 - 15 kg per hectare.

b) Pests of stems and leaves : These are largely stalk-borers and are controlled by dusting with DDT 5 percent at the rate of 5 kg per hectare. Plant resistant varieties such as serena and crop sanitation procedures also provide effective control.

c) Pests of panicle : The bollworm belongs to this category, and can be controlled by spraying or dusting with DDT 10 percent at the rate of 2 kg per hectare. Time of planting in relation to build up of the pest on other crops is also a useful control measure.

d) Pests of stored produce :- Common in this category is the Rice Weevil and can be controlled by thoroughly drying grain in the sun after harvesting at 10 - 11 percent moisture content. Proper storage methods also give good results.

The control of diseases deals with :

a) Fungal diseases.

i) Leaf Blight, Grey Leaf Spot, Sooty Stripe, and Downy Mildew : Controlled by crop sanitation and planting of resistant varieties.

ii) Head diseases : Asali disease which can be controlled by good seed selection, crop rotation and deep ploughing.

b) Smuts : The control of Smuts is achieved through destruction of diseased plants before spores are released. Avoidance of growing sorghum in infected land with previous infected sorghum and deep ploughing also provide an effective control.

8. Harvesting.

Time of harvesting depends on type of sorghum variety. Most of the current recommended varieties, such as Serena and Lulu, are ready in 4 months after planting. However, it is important to harvest the sorghum when

the heads are fully dry and can be rubbed out by hand. Sundrying for a few days may also be necessary to bring the grain to acceptable moisture content of about 10 - 11 percent of safe storage. The methods of harvesting involve cutting off heads using a knife. After harvesting, the heads are threshed followed by grain winnowing to remove the chuff in order to obtain clean grain for storage.

9. Storage.

The grain to be stored must be below 13 percent moisture content and after drying should not be exposed unnecessarily to the air during storage as the waxy seed coat is hygroscopic and the moisture content may increase with additional handling if the outside humidity is high.

These findings may be evidence that regional and district agricultural offices have access to information about improved or recommended agricultural innovations based on research from our research stations. However, the study does not provide clues about effective linkages between the research and extension service with regard to cotton and sorghum growing. Evidence suggests that available recommended practices for cotton growing appear to be more simplified and therefore easily usable by the extension service. The recommended practices for sorghum

growing are, however, complex and not so easily understood by farmers, let alone the extension field workers. This observation seems to be in agreement with that of DeVries (1978) who noted that after Tanzania's Independence in 1961, the agricultural extension system serving small-scale farmers continued to focus on export crops on which a series of well established recommendations existed.

It would appear that the elaborateness of the recommended practices for cotton growing reflects the fact that cotton has very much been researched upon. It could also be partly due to the influence of the Mara Cotton Project which was launched in 1972/1973 season. It was administered by Tanzania Cotton Authority (TCA) to supervise the application of recommended practices for cotton growing. These practices were derived from research undertaken by Western Research Centre, Ukirigiru and were supervised by field extension workers.

The lack of refinement on the part of recommended innovations for sorghum growing may partly be a reflection of the extent of research that has been done on the crop, particularly in relation to farmer - oriented husbandry practices. Although Serena and Lulu have been recommended in Tanzania for two decades now, it appears that not much refined research information has been made available to users at regional, district and village levels.

Nature of Farmers' Advice and Adoption of Agricultural Innovations

Based on the list of the innovations identified for cotton and sorghum growing as given in Table 4, the following specific recommended practices were selected for indepth study: a) land preparation, b) selection and use of improved seed varieties, c) proper spacing, d) proper weeding, e) use of chemical fertilizers, f) use of organic manures, and g) use of insecticides.

This study sought to determine the way farmers are advised by field extension workers, the extent of advice and the degree to which farmers adopt the selected recommended practices for cotton and sorghum growing. The two crops are fairly predominant in the study area and are well served by extension service. The following key aspects are addressed under this section : a) extension methods used, b) extent of emphasis given on cotton and sorghum production, c) extent of use of recommended and traditional agricultural practices, d) field extension workers' knowledge, and e) farmers' degree of innovativeness.

Extension Methods Used

An attempt was made to identify extension methods frequently used by field extension workers in advising farmers with regard to selected recommended practices for cotton and sorghum growing. Three categories of methods - - indivi-

dual, group and mass - - were used to solicit field extension workers' responses. Their views expressed in percentages of respondents are given in Table 5.

Table 5 : Extension Methods Frequently used in Relation to Recommended Agricultural Practice (N = 20)

Selected Recommended Agricultural Practice	Individual	Group	Mass
	Percent	Percent	Percent
Land Preparation	20	65	15
Selection and Use of Improved seed Varieties	55	25	20
Proper spacing	30	65	5
Proper weeding	35	60	5
Use of Chemical Fertilizers	30	65	5
Use of Organic Manures	10	60	30
Use of Insecticides	40	50	10
Average	31	56	13

The findings show that, on average, group method was identified as a more frequently used method by 56 percent of the respondents. Individual method was identified by 31 percent of the respondents while mass method was only identified by 13 percent. Furthermore, the most frequently used types of group method were identified to be village meetings and group discussions organized on farms for demonstration purposes. It was also revealed that the individual method

was more used during farm and home visits. Farmers observed that such visits took place when field extension workers were requested for assistance. In addition, individual farmers indicated being in favour of individual method. This was evidenced in their complaints to the researcher that they were not regularly being visited by field extension workers in their farms.

Generally, the findings reveal that group method was most frequently used while individual and mass methods were least frequently used. These findings may be a reflection of Tanzania's policy that people should develop themselves through organized villages and Ujamaa villages. This policy provides priority in terms of Government support, including extension services, to farmers' groups rather than to individuals. This in turn requires group organization and group decision - making which can result only from meetings and other group activities.

However, it appears that individual method was prominently used in relation to selection and use of improved seed varieties. This may be partly explained by the procedure used in collecting recommended cotton seeds from Primary Cooperative Societies by individual farmers. This procedure provides farmers with suitable opportunity for easy access to, and interaction with, field extension workers. In addition, the provision of advice during

home visits offers opportunity for dialogue between farmers and field extension workers on selection and use of improved seed varieties. This practice, unlike others, does not involve field demonstrations and therefore may easily be advocated by field extension workers. Thus findings show that there are agricultural practices in which more frequent use of individual rather than group method is inevitable.

Finally, mass method seems to be important in relation to the use of organic manures as compared to other selected recommended practices. This could be due to the efforts currently being made to create public awareness on the use of "Marejea" (Chrotalaria ochroleuca) as one of the sources of organic manure in Tanzania.

Extent of Emphasis Given to Cotton and Sorghum Farming

The study sought to test the generally held view that field extension workers tend to put more emphasis, in terms of time spent on advising farmers, on cash crop production than food crop production. In Musoma district as is elsewhere in Tanzania, cotton is considered as a cash crop while sorghum is considered as a food crop. In order to test this, field extension workers were asked to indicate whether they spent more time advising farmers on cotton or sorghum production in relation to the selected agricultural practices. The findings are summarized in percentages of respondents as shown in Table 6.

Table 6 : Extent of Emphasis Given to Cotton and Sorghum Farming (N = 20)

Selected Recommended Agricultural Practice	Cotton	Sorghum
	Percent	Percent
Land Preparation	85	15
Selection and Use of Improved Seed Varieties	60	40
Proper Spacing	90	10
Proper Weeding	90	10
Use of Chemical Fertilizers	90	10
Use of Organic Manures	85	15
Use of Insecticides	95	5
Average	85	15

The findings show that, on average, greater emphasis by way of advice given to farmers by field extension workers was put on cotton production than sorghum production. Specifically, 85 percent of field extension workers indicated spending most of their time advising farmers on cotton growing than sorghum growing. These findings may be a reflection of the emphasis that has always been put on cotton production by field extension workers in the area of study since the launching of the Mara Cotton Project.

It appears that field extension workers put relatively less emphasis on advising farmers about selection and use of improved seed varieties for cotton production when compared

to other selected recommended practices. That is, 60 percent compared to 85 percent and above. This may be due to the fact that the farmer is only advised to collect cotton seeds from the nearby Primary Cooperative Society during every planting season. And since the process of seed selection for cotton does not, in reality, involve farmers, there may be a tendency for field extension workers to relax on this practice .

In general, the selected recommended practices for sorghum growing do not get much attention. However, the findings show that the use and selection of improved seed varieties is relatively higher when compared to other practices. This may be an indication that the special emphasis currently being made by the Government on sorghum production is beginning to bear fruits, particularly in relation to the selection and use of improved seed. However, the complexity of the information on sorghum itself may have a deterrent effect on the performance of field extension workers with regard to advising farmers on most recommended practices for sorghum growing.

Extent of Use of Recommended and Traditional Agricultural Practices

The study also sought to determine the extent of use of recommended and traditional agricultural practices for cotton and sorghum growing by farmers. Data on this aspect

constituted the perceptions of field extension workers about the use of recommended and traditional agricultural practices for cotton and sorghum growing by farmers. Their views, expressed in percentages of respondents, are given in Table 7.

The findings reveal that field extension workers, in almost equal proportions, felt that recommended and traditional practices were in use for cotton. This observation is rather surprising in light of the fact that recommendations for cotton growing have been advocated for years in Mara region. One possibility is that recommended practices have, over the years, been reduced to mere slogans due to shortages or lack of inputs and supplies associated with some of the recommendations. Consequently, farmers have, in some cases, had to rely on traditional ways or mere past experience in growing cotton.

On the other hand, about 11 percent as opposed to 89 percent of field extension workers felt that recommended practices were in use for sorghum production. These findings may imply that more work need to be done by the field extension workers in order to gain the confindence of the farmers with regard to use of recommended practices in sorghum growing.

Table 7 : Extent of Use of Recommended and Traditional Agricultural Practices (N = 20)

Agricultural Practice	Cotton		Sorghum	
	Recommended	Traditional	Recommended	Traditional
	Percent	Percent	Percent	Percent
Land Preparation	65	35	20	80
Selection and Use of Improved Seed Varieties	70	30	5	95
Proper Spacing	35	65	-	100
Proper Weeding	50	50	35	65
Use of Chemical Fertilizers	50	50	10	90
Use of Organic Manures	15	85	-	100
Use of Insecticides	70	30	5	95
Average	51	49	11	89

With regard to the use of organic manures, the field extension workers largely (85 percent) felt that traditional practices were being used in cotton production. This is not surprising since fertilizers are difficult to get and farmers traditionally plough vegetation under the soil as a way of enriching the soil with nutrients. The use of Farm Yard Manure (FYM) does not arise becuase greater amounts of input would be required. This is both cumbersome to transport and also in short supply in view of the large acreages involved in cotton production.

The findings also show that there was a high rate of use of recommended practices for cotton production with regard to selection and use of improved seed varieties (70 percent) and use of insecticides (70 percent). This may imply that such inputs are available and most farmers are able to obtain them. Besides, as observed earlier, the question of seed varieties is hardly an individual farmer's problem.

On the other hand, the high rate of use of traditional practices for sorghum growing with regard to proper spacing (100 percent), selection and use improved seed varieties (100 percent) and use of insecticides (95 percent) may imply that farmers are still conservative in the use of such practices. It could also be an indication that the extension service has not made major breakthroughs. As noted by Lionberger and Chang (1970),

farmers are not necessarily more conservative, but they are certainly more cautious. They know what they will get if they follow a traditional method. The moment they change to a new practice, they are moving from a state of security to a state of insecurity. Following this view, in recent years, the extension service in Tanzania has encouraged field extension workers to maintain their own plots for demonstration purposes. This was observed by the researcher in all the four villages studied. Every field extension worker had a demonstration plot on a communal farm in each village, planted with cotton. This was because the Party and Government leaders had directed the villagers in the area of study to plant cotton on communal farm, where agricultural demonstrations were also expected to be practiced. This useful initiative need to be developed further, and even to cover all important crops in each village. In this regard, demonstration plots would be established by contact farmer groups and maintained by groups themselves. The responsibility of the field extension workers should be to use such demonstration plots as centres or laboratories for learning about farming. This implies that if farmers themselves can do it, their neighbours will be more inspired to follow.

Field Extension Workers' Knowledge

In order to determine field extension workers' knowledge of recommended agricultural practices, they were

given specific questions to answer on selected recommended practices for cotton and sorghum growing. Marks (Scores) were assigned to each response. Finally percentage scores were calculated in relation to what field extension workers knew about recommended practices for each of the two crops. The findings are summarized in Table 8.

Table 8 : Field Extension Workers' Knowledge of Recommended Agricultural Practices (N = 20)

Selected Recommended Agricultural Practice	Cotton	Sorghum
	Percent	Percent
Land Preparation	65	48
Selection and Use of Improved Seed Varieties	79	46
Proper Spacing	48	49
Proper Weeding	72	59
Use of Chemical Fertilizers	63	46
Use of Organic Manures	51	54
Use of Insecticides	59	59
Average	62	52

The findings show that, on average, the level of knowledge of recommended practices by all field extension workers studied was slightly higher for cotton farming (62 percent) than sorghum farming (52 percent). The

findings further reveal that field extension workers had adequate knowledge on selection and use of improved seed varieties (79 percent) and proper weeding (72 percent). One would expect that the level of knowledge of field extension workers would be even higher than what has been revealed in this study, due to the level of emphasis given to cotton farming as indicated in Table 6. The relatively low level of knowledge of field extension workers on most of the recommended practices for cotton growing may be a reflection that the package of recommended practices for cotton growing as established by Tanzania Cotton Authority (TCA) is apparently losing ground. It is also possible that updates on recommended practices in the package are not communicated to the field extension workers regularly.

While it has been found in this study that most farmers in Musoma district use traditional practices for sorghum growing, as shown in Table 7, the findings in Table 8 show that the field extension workers, on average, have a fairly satisfactory level of knowledge of recommended practices for sorghum growing (52 percent). This may imply that there are other factors that constrain farmers from using recommended practices for sorghum growing, in addition to the knowledge factor.

On the whole, these findings are in line with Freyhold.'s (1975) view that recommendations in research

stations in Tanzania reach the senior level extension service sporadically, if at all. These may or may not analyse, absorb and remember them. And may or may not pass them on to their field extension staff. He points out that communication between senior staff is often superficial; the latter do not know how much competence and knowledge their field staff have, let alone how they apply the knowledge. In addition, Hulls (1975) noted that even when provided with excellent innovations and carefully worked out extension materials, the field extension worker makes little or no attempt to see that farmers follow the recommendations.

It would appear from these findings that it is necessary for every extension worker to undergo a continuous process of renewal, by attending on regular basis, refresher courses and other similar professional development programmes. Such programmes would : a) continuously update their technical knowledge, b) expose them to new extension methods and techniques, c) increase morale and group spirit, and d) generally provide professional reorientation to their work.

Farmers' Degree of Innovativeness

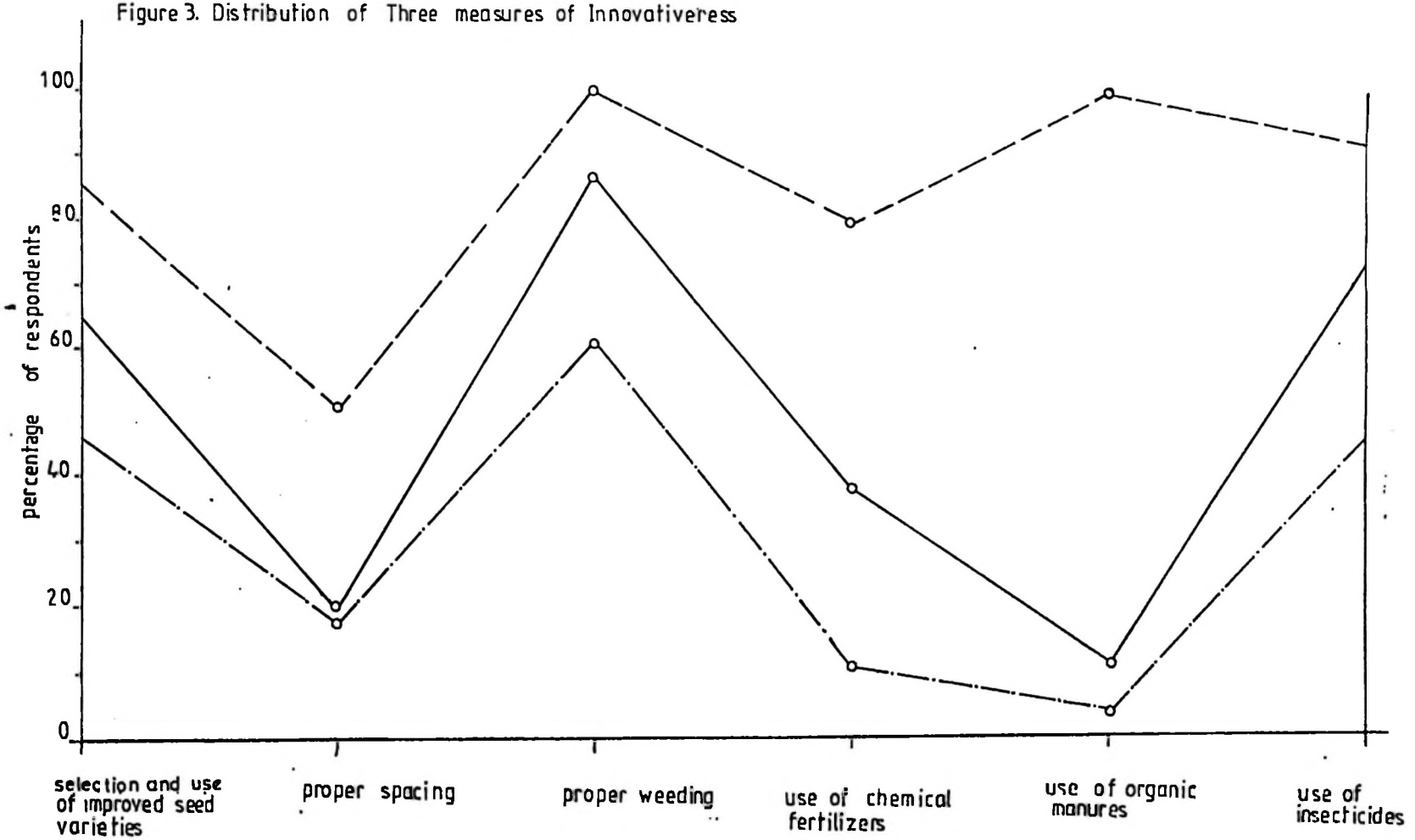
It was felt that a measure of the degree of innovativeness would provide some indication of the extent of utilization of agricultural innovations for cotton and

sorghum production. Three elements of the adoption process namely: Knowledge, Trial and Adoption were chosen in this case. By use of questions posed to farmers, it was possible to determine their degree of innovativeness in terms of the extent to which they had performend in respect to the three elements. The findings as summarized in four villages, are given in Figure 3.

According to Figure 3, a number of observations can be made. Firstly, the level of knowledge acquired by farmers was generally higher than the extent to which trial and adoption were reached. This observation is in line with the principles of the adoption process which portray human beings as progressing from an initial stage of awareness through interest, evaluation, and trial before adopting an innovation. In this case, therefore, one is likely to expect progressively more farmers in the"knowledge " category than in the "trial" and"adoption" categories.

Secondly, it appears that more farmers had scored higher in terms of knowledge, trial and adoption with regard to proper weeding than any other practice for cotton and sorghum production. It can be inferred here that with regard to this practice, extension field workers have done a relatively good job in raising the consciousness of farmers as well as demonstrating its operations and merits to the extent of convincing them to start weeding properly.

Figure 3. Distribution of Three measures of Innovativeness



Thirdly, while farmers seemed to be generally aware of the use of organic manures, they comparatively lagged behind when it came to trial and acceptance of this practice. This might be a reflection of the availability and handling of organic manures. Whereas many people in the area studied do not keep livestock and have access to Farm Yard Manure,the latter is not available in large quantities required for cotton and sorghum growing. In this case, therefore, even if farmers wanted these manures, they could not get them in adequate amounts. Furthermore, even if Farm Yard Manures were available,they have proved to be cumberscme to transport and apply on a large scale. Thus most people rely more on ploughing vegetative materials under than in applying manures.

These findings indicate that the data bear a relationship with what is already known about the adoption process. The implication that may be drawn from these findings is that the successful motivation of farmers is a culmination of a series of distinct phases. These involve awareness of a new opportunity, the generation of interest in it, consideration of its suitability, its trial examination and finally its adoption into farm practice. Each group of farmers and each phase of adoption tend to require a particular behaviour and rejection can occur at any time. Good field extension workers will,therefore, adjust their approach to farmers in light of this sequence.

That is, field extension workers always need to first learn what stage of adoption the farmers are in. Based on this they can then operate in accordance with the stage reached. In this way the field extension workers may communicate to farmers at different levels.

Factors Contributing to Success or Failure of Agricultural Innovations

The major interest of the researcher in this section was to identify factors contributing to success or failure of agricultural innovations. The following areas were covered under this section : a) problems that constrain the transfer of agricultural innovations, b) problems that constrain adoption of agricultural innovations, c) opinions of field extension workers on farmers with whom they work, and d) reasons for farmers' continued rejection of recommended agricultural practices.

Problems that Constrain the Transfer of Agricultural Innovations

An analysis of the problems that constrain field extension workers in transferring the selected recommended practices for cotton and sorghum growing was carried out. The findings are given in Table 9.

Table 9 : Constraints to Transfer of Agricultural Innovations

Constraint	Field Extension Workers	
	NO	Percent
Poor Transport Facilities	10	50
Involvement in Many other Duties	4	20
Lack of Incentives	3	15
Others	3	15
Total	20	100

Data revealed that the major constraint for field extension workers in transferring agricultural innovations was poor transport facilities. This was revealed by 50 percent of all the respondents. Involvement in many other duties in addition to extension role was identified by 20 percent of the respondents while lack of incentives to provide good service was identified by 15 percent of the respondents.

A category labelled "others" was established to describe constraints which were not identified by many. This category included : a) lack of specialist support, thus relying on own resources; b) lack of necessary inputs, such as credit and marketing facilities; and c) interference from village leaders.

In Musoma district, as is the case in Tanzania as a whole, transport facilities are a persistent constraint in the extension system. The researcher noted that while the village secretaries possess bicycles obtained through the Party, the field extension workers did not have any. Yet each extension worker in the villages studied was expected to cover 5 to 6 villages as opposed to the village secretary who had only one village to cover. The Party had excelled in alleviating the transport constraint and it is high time the extension service emulated the action taken by the Party to provide bicycles to their staff as stipulated in the National Agricultural Policy (1983).

Involvement in many other duties additional to normal extension duties of field extension workers appears to affect the quality of the work of the field extension workers. Contrary to the job descriptions for field extension workers that appear on paper, far too little time is actually spent on advising farmers on husbandry practices. For example, Ndedya (1982) noted that field extension workers have to sit on different committees, attend adult literacy and different compaigns. With these many additional tasks, there may be dilution of efforts, poor competence and unwarranted interruptions.

Field extension workers are likely not to have incentive to provide good service if they lack transport, suitable accommodation, proper working tools, supportive technical services and training facilities. Also lack of necessary extension inputs, such as credit and marketing facilities may make an extension programme unsuccessful. In this case farmers inevitably blame field extension workers for not being able to make available to them such inputs. This situation could reduce the effectiveness of field extension workers.

The problem of interference from village leaders arises from the fact that village leaders occasionally engage themselves in extension work. This seems to arise from two factors: a) failure of field extension workers to define their roles clearly and follow them through, and b) current policy that encourages Party and Government leaders to engage actively in extension activities to reinforce the efforts of field extension workers. The researcher noted that this has created a lot of confusion concerning distribution of responsibility and authority in the surveyed villages.

Problems that Constrain Adoption of Agricultural Innovations

An analysis of the perceptions of field extension workers on the problems that constrain farmers in adopting recommended agricultural practices put forward to them

inputs which must be purchased, these findings indicate a notable recognition that the farmers have no funds to pay for these inputs. It appears that the Credit Institutions, such as : a) Cooperative and Rural Development Bank (CRDB), b) National Bank of Commerce (NBC) and Cooperative Unions which are expected to provide loans to farmers, especially small - scale operators, have not been effective enough in providing necessary credit to farmers. In some cases these institutions have been blamed for their lengthy bureaucratic and commercial procedures which work in disfavour of small farmers.

In addition, in many cases, despite farmers' willingness to adopt new technology, adoption has been impaired by sheer unavailability of certain essential inputs on the market. For example, the researcher noted that insecticides which are not available to farmers had been recommended for use on sorghum production in all the villages surveyed. Thus while it is not the direct role of field extension workers to make inputs available to farmers, their work is greatly affected by unavailability of such inputs.

The researcher also noted that most farmers are still illiterate. However, there were also signs that the Universal Primary Education (UPE) programme launched a decade ago in Tanzania has influenced educational levels of farmers. Thus in future, the extent of illiteracy will

The findings show that most field extension workers (90 percent) felt that the farmers with whom they worked were friendly and cooperative. Considering that field extension workers must be interested in farmers and in their way of life, these findings may be an indication that there is good understanding and cooperation between field extension workers and farmers. Without such understanding and cooperation, there is likely to be ineffective communication which can result into ineffective extension services.

However, the high proportion (65 percent) of farmers who did not adopt what they were advised may be a reflection that field extension workers have not been successful in convincing most farmers to adopt innovations despite such farmers being cooperative. The implication that can be drawn from these findings is that field extension workers need to put their messages across in a simple and convincing way so that most farmers can easily adopt them.

Furthermore, most (85 percent) of the field extension workers felt that farmers were hard to convince and that they needed practical demonstrations. This observation tends to indicate a notable recognition that if field extension workers really need to get their messages across to farmers, they ought to be more practical oriented. As well as knowing the technology of farming, they should know how to enable farmers to learn and, therefore, adopt what is

passed on to them. In other words, field extension workers must teach by showing in order that farmers can learn by doing.

Reasons for Farmers' Rejection of Recommended Agricultural Practices

It was felt that an understanding of farmers' reasons for rejecting agricultural innovations would provide some clues on the extent of acceptance or rejection of agricultural innovations. Five intrinsic characteristics of innovations and appeal of innovations to farmers were used. Farmers' responses to structured questions involving these characteristics were analysed. The findings summarized in percentages of respondents for each of the recommended practices for cotton (C) and sorghum (S) growing are shown in Table 12.

The findings show that, on average, there are only slight variations in the proportion of farmers rejecting recommended practices for cotton, when compared to those of sorghum growing, with regard to each of the intrinsic characteristics of innovations. These findings appear to be contrary to those given in Table 6, where it was shown that field extension workers tended to put more emphasis on advising farmers on cotton production than sorghum production. This may be an indication that such efforts have not made any significant impact on farmers'

Table 12 : Farmers' Reasons for Rejecting Recommended Agricultural Practices (N = 151)

Selected Recommended Agricultural Practices	Practices previously used are better		Inconsistence with past experience		Difficulty in Technology		Not easily Triable		Not easily Observable	
	C	S	S	S	C	S	C	S	C	S
Land preparation	66	93	19	37	4	10	25	24	23	36
Selection and Use of Improved Seed Varieties	85	82	7	20	3	11	9	12	25	28
Proper Spacing	84	76	11	16	5	9	11	18	23	32
Proper Weeding	92	93	49	15	15	16	24	20	23	25
Use of Chemical Fertilizers	41	44	94	89	89	96	93	96	34	58
Use of Organic Manures	65	62	56	53	56	53	68	70	68	66
Use of Insecticides	6	13	95	97	98	96	93	97	46	48
Average	61	66	47	46	38	41	46	48	35	40

acceptance or rejection of recommended practices.

The findings further reveal that the farmers felt that the previously used practices for cotton and sorghum growing were better than recommendations regarding: selection and use of improved seed varieties; proper spacing;and proper weeding. This means that the recommended practices are not perceived to have obvious advantages over the old and, therefore have less relevance to needs of farmers in their prevailing situation. Specifically, 85 percent and 82 percent of the farmers rejected selection and use of improved seed varieties for cotton and sorghum growing, respectively. In case of cotton, this may be due to the fact that farmers are required to collect recommended cotton seeds in each planting season from the nearby Primary Cooperative Societies, and therefore they may tend to ignore further advice on the practice. On the other hand, despite the widespread of farmers' disatisfaction with recommended sorghum varieties of Serena and Lulu, little progress has been made towards developing suitable replacements, as observed by the researcher in the surveyed area. This might have been the reason why most farmers were still using their traditional sorghum varieties. Furthermore, 84 percent of the farmers rejected use of proper spacing for cotton growing when compared to 76 percent of the farmers who rejected the same practice on sorghum growing. Considering that the use of proper spacing for cotton and sorghum growing has been

tried at different levels for more than a decade now, these findings may mean that farmers might have tried the use of proper spacing and remained unconvinced. This could particularly be due to a high demand for farmers' labour involved in use of the practice. In addition, 92 percent and 93 percent of the farmers reject use of proper weeding for cotton and sorghum growing, respectively. This may also be due to problems of labour constraints as well as "blanket recommendations" advocated by field extension workers. For examples, it was noted by the researcher that recommendations on proper weeding had not been experimented in the context of farmers' experience in order to convert them to recommendations applicable specifically to their area.

The findings also revealed that farmers' failure to use chemical fertilizers for cotton and sorghum is due to such a recommendation being inconsistent with past experience; technologically complex; and not easily triable. In particular, 94 percent and 89 percent of the field extesion workers felt that the practice, when applied on cotton and sorghum growing, respectively, was inconsistent with past experience. This means that the use of chemical fertilizer is not compatible with prevalent values and norms of the farmers' social system. This may be the reason for most farmers not having bothered to learn how to incorporate the use of chemical fertilizers into their farming system. It was also noted by the researcher that farmers resisted using chemical

fertilizers because they encourage weed growth in their farms, which entails additional labour on the farmers' part in weeding.

On the other hand, 89 percent and 96 percent of the farmers felt that the practice was technologically complex in cotton and sorghum growing, respectively. This means that recommended use of chemical fertilizers requires farmers to develop new skills and understanding. Considering the low level of knowledge on the farmers' part, it appears that use of chemical fertilizers is not readily understood by most farmers and therefore it is most likely to be accepted more gradually.

Data also reveal that 93 percent and 96 percent of the farmers indicated that the practice for cotton and sorghum growing, respectively, was not easily triable. This means that the farmers found it difficult to experiment the use of chemical fertilizers on limited basis. In this case the researcher noted that the field extension workers had not provided opportunity for farmers to try use of chemical fertilizers on their own farms, and this is why farmers felt it was not easily triable.

Furthermore, the findings also show that farmers felt that their failure to use insecticides in cotton and sorghum growing was due to such practices being : inconsistent with past experience; difficult in technology; and not

easily triable. Specifically, 95 percent and 97 percent on the farmers felt that the practice, when applied to cotton and sorghum growing, respectively, was inconsistent with the past experience. This also means that such a practice is new and has not been properly incorporated in most farmers' farming systems. Data also reveal that 98 percent of the farmers felt that the technology associated with the practice was difficult. About 97 percent of farmers felt the same for sorghum growing. This implies that the use of insecticides for cotton and sorghum production is complex in view of the present low level of education of the farmers. In addition, 93 percent and 97 percent of the farmers thought that the practice is not easily triable for cotton and sorghum, respectively. In this case the researcher also found that farmers had not been provided with opportunities to demonstrate the use of insecticides on their farms, as was the case in the use of chemical fertilizers.

These findings may generally imply that the various characteristics of innovations such as : relative advantage, compatibility, complexity, triability and observability appear in this study to contribute to different rates of acceptance or rejection of agricultural innovations.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The aim of this chapter is to provide a summary of the study, particularly in regard to its purposes and objectives; methodology; and major findings. Subsequent conclusions, recommendations and suggestions for further research will also be presented.

Summary

The agricultural extension system in Tanzania has come under criticism as being ineffective in stimulating increased agricultural production. This criticism has partly focused on the performance of extension workers in rural areas. Extension workers have been perceived as being unable to influence farmers' agricultural practices and thus being ineffective in their job.

The most commonly discussed problems of agricultural extension service centre around inadequacies in organization, training and selection of extension personnel, as well as choice of extension strategies and appropriate content of extension programmes. However, little attention has been given to periodic assessment of the availability, transfer and utilization of agricultural innovations.

This study, therefore, was intended to concentrate on the innovation dimension. In particular, the study sought to determine the availability of suitable agricultural innovations to the farmer and to assess the extent of transfer and utilization of such innovations in villages.

Purposes and Objectives

This study had a major purpose of assessing the availability, transfer and utilization of agricultural innovations in Musoma district, as a basis for understanding the impact of the extension service, as performed by extension workers, on agricultural production.

The specific objectives were :

a) To take inventory of a agricultural extension innovations available to the extension service.

b) To investigate the extent of transfer and ultimate utilization of selected agricultural innovations.

c) To identify factors contributing to success or failure in the transfer and utilization of agricultural innovations.

d) To recommend guidelines which will facilitate effective transfer and utilization of agricultural innovations.

Methodology

The study mainly involved 23 field extension workers in Musoma district and 160 farmers from 4 villages in the district. The villages studied were : Nyamisisye, Kiabakari, Nyang'oma and Kwibara. A multi-stage cluster sampling technique was applied to obtain a sample of 40 farmers who were household heads from each village. Furthermore, 15 extension officers and village leaders were selected through snowball technique. That is, an interviewed respondent was asked by the researcher to recommend other respondents considered very knowledgeable about the transfer and utilization of agricultural innovations.

Data were collected using two types of questionnaires and researcher's diary. The types of questionnaires used were : field extension workers' questionnaire and farmers' questionnaire. All the questionnaires were subjected to careful pretests under field conditions and revisions were made accordingly.

Field work was conducted during the period June to September, 1987 by the researcher. He administered 23 questionnaires to field extension workers, out of which 20 were properly completed, constituting a return rate of 87 percent. The researcher had to reside for about 2 weeks in each of the 4 villages. In each village, he interviewed household heads. Of the 160 interview schedules admini-

stered for household heads, 151 were properly completed, constituting a return rate of 94 percent.

To validate some of the information given by field extension workers and farmers, data were also collected from : a) 15 extension officers and village leaders; b) research reports and other relevant information from official files; and c) researchers' observation of some cotton and sorghum fields in surveyed villages.

Data from each source were examined. Numerical data were summarized in tables by using descriptive statistics of percentages.

Findings

The findings from the study are summarized in the sub-sections that follow:

1. Availability of Agricultural Innovations to the Extension Service.

The study found that recommended agricultural innovations, by and large, are available in files at regional and district agricultural offices, in the form of research reports. Available cotton innovations were simplified into 10 specific recommendations for the extension worker to disseminate and farmers to use. On the other hand, available sorghum innovations were reported in a more complex manner and did not appear to be readily understandable and usable by the farmer.

2. Nature of Farmers' Advice and Adoption of Agricultural Innovations.

a) On average,56 percent of field extension workers identified group method as the most frequently used by them. In addition, 31 percent and 13 percent of the field extension workers identified themselves as frequently using individual and mass methods, respectively.

b) About 85 percent of field extension workers indicated spending most of their time advising farmers on recommended practices for cotton growing, as opposed to 15 percent who had spent their time on recommended practices for sorghum.

c) About 51 percent of the field extension workers reported that recommended practices for cotton were used by farmers as opposed to only 11 percent with regard to use of recommended practices for sorghum growing. In sorghum growing the use of traditional practices was more prominent than the use of recommended practices.

d) On average, the level of knowledge of the selected recommended practices by all field extension workers studied was slightly higher for cotton farming (62 percent) than sorghum farming (52 percent).

e) The level of farmers' knowledge was generally higher than the extent of trial and adoption, in that order, for all selected recommended practices for cotton and sorghum growing. In addition, the levels of knowledge, trial and adoption were highest with regard to proper weeding than for any other practice. However, while the level of knowledge about the use of organic manures was highest, the extents of trial and adoption for the same practice were relatively lowest.

3. Factors Contributing to Success or Failure of Agricultural Innovations.

a) The constraints which were identified as impairing the transfer of agricultural innovations by field extension workers were : poor transport facilities; involvement in many other duties in addition to extension role; lack of incentives to provide good service; lack of specialist support; lack of necessary inputs; and interference from village leaders. However, the most important constraint was lack of transport facilities.

b) The problems that constrain adoption of agricultural innovations by farmers were identified to be: lack of agricultural credit; unavailability of certain essential inputs; low level of farmers'

education; time pressure on farmers' part; and traditionalism on part of the farmers. From this list, lack of agricultural credit was identified as a major constraint, followed by a closely related factor- - unavailability of certain essential inputs.

c) In the views of field extension workers, their clientele were friendly and cooperative and were appreciative of what they were advised. While some were not quick to adopt what they were advised, there were also others who were hard to convince and therefore needed practical demonstrations.

d) On average, there were only slight variations in proportion of farmers rejecting recommended practices for cotton growing when compared with those for sorghum growing. Some farmers (76 percent and above) perceived previously used practices for cotton and sorghum growing to be better than the recommendations regarding: selection and use of improved seed varieties; proper spacing; and proper weeding. In addition, most farmers (89 percent and above) felt that their failure to use chemical fertilizers and insecticides for cotton and sorghum growing was due to such recommendations being: inconsistent with past experience; technologically complex; and not easily triable.

Conclusions

Data on the availability, transfer and utilization of agricultural innovations for cotton and sorghum farming have been presented through the analysis of documentary evidence, respondents' views, and researcher's observations. The two crops were selected as sample crops which are currently receiving more than proportionate attention from the extension service in Musoma district. The popularity of cotton farming is partly due to the influence of the Mara Cotton Project which was launched in 1972/73 season in Mara region. On the other hand, the Government is currently laying emphasis on sorghum farming as one of the most important drought resistant food crops in Musoma district.

Based on the findings of the study, conclusions will be made about : 1) availability of agricultural innovations to the extension service; 2) the extent of transfer and utilization of agricultural innovations; and 3) factors contributing to success or failure in the transfer and utilization of agricultural innovations.

1. The extension service appears to have an inventory of extension innovations to disseminate for cotton and sorghum farming. Cotton innovations are more simplified while those of sorghum, which has just received prominence, are more complex for extension

workers to transfer and farmers to use. In general, it would seem that, for all other crops, innovations are available,but in forms that are not easily understandable or transferable to farmers. It would seem that such innovations need to be further refined.

2. a) The transfer of agricultural innovations from District Agricultural Offices to farmers generally takes the form of advice. Field extension workers tend to advise farmers mainly through group and individual methods. The field extension workers appear to be more knowledgeable about cotton farming than sorghum farming. They tend to give more emphasis on advising farmers about cotton production than sorghum production. This appears to be a result of efforts made to encourage cotton production through the Mara Cotton Project. Thus, in general, the extent of transfer of agricultural innovations tends to vary from crop to crop, depending on emphasis given by the Government in favour of a particular crop.

b) Nevertherless, there is evidence for some degree of success in the transfer of agricultural innovations in the district. The findings clearly reveal that some farmers have been able to go through three important stages of the adoption process - -

knowledge, trial and adoption.

c) The transfer of agricultural innovations is, generally, hampered by poor transport facilities; involvement in many duties in addition to extension role; lack of incentive to provide good service; lack of necessary inputs; and interference from village leaders.

3. a) The study has shown that farmers prefer to utilize innovations which are perceived to be better than those that were previously used; consistent with past experience; simple to apply; triable; and observable.

b) Successful utilization of agricultural innovations appears to be hampered by lack of agricultural credit; unavailability of certain essential inputs; low level of farmers' education; time pressure on farmers' part; and traditionalism on part of the farmers.

Judging from the trends set by cotton and sorghum and relating these to other crops being grown in the district, it can be stated that : i) Agricultural innovations are generally available although in forms that vary in terms of the degree to which they can be helpful to the field extension worker and the farmer; ii) The

extent of transfer and utilization of agricultural innovations varies from crop to crop. Some of the constraints to the transfer and utilization of such innovations are of extension nature while others are clearly beyond the scope of responsibilities of the extension service.

Recommendations

This section provides guidelines derived from this study which ought to facilitate the operation of extension services by the Ministry of Agriculture and Livestock Development more effectively.

a) The simplicity and clarity of available innovations for cotton growing seems to represent an exception rather than the rule. On the other hand, the complexity of innovations for sorghum growing seems to represent the real situation at present. That is, innovations for all other crops do not appear to be adequately refined. It is therefore recommended that efforts be made to refine agricultural innovations into simplified packages of practices that can be easily understood and disseminated to farmers. This calls for closer links among research, training and extension organizations.

b) The use of extension workers' plots as demonstration plots definitely has positive effects. However, it appears that farmers will benefit more if demonstrations are carried out in their own plots. It is therefore recommended that field extension workers should set up, demonstration plots on communal farm, block farms and contact farmers' farms. Such plots should be maintained by farmers themselves, rather than field extension workers. The responsibility of the field extension workers should be to use such demonstrations as centres or laboratories for learning about farming.

c) In view of the fact that agricultural innovations have been changing with changing technology, the need for refresher courses for field extension workers cannot be overemphasized. Every extension worker should undergo a continuous process of renewal, by attending, on regular basis, refresher courses and other similar professional programmes. Such programmes would : continually update their technical knowledge, expose them to extension methods and techniques, increase morale and group spirit, and generally provide professional re-orientation to their work. The Ministry of Agriculture and Livestock Development could conduct such programmes in its own Training Institutes or use the Institute of Continuing Education at Sokoine University of

Agriculture which has adequate facilities and resources for that purpose.

d) Transport has appeared to be a major constraint in the transfer of agricultural innovations. In view of the fact that the National Agricultural Policy (1983) provides for Government to re-introduce a system of providing loans for extension workers to purchase bicycles and motor cycles, there is need to implement this policy.

Suggestions for Further Research

This study has not exhausted all aspects concerning the availability, transfer and utilization of agricultural innovations. It is clear that a lot more work needs to be done. Three suggestions are therefore made concerning specific areas that should be further studied.

a) To undertake case studies on the process of acquisition of information by extension workers from the regional and district agricultural offices. The major purpose of this study would be to find out if extension workers are offered opportunity to retrieve information on agricultural innovations from research stations and to process it adequately for use by farmers.

b) To undertake studies on interaction between field extension workers and farmers. The major purpose of this study would be to elicit more reliable clues about communication behaviours of field extension workers and farmers during the process of innovation transfer. The Participant - As - Observer Technique could be useful in seeking data in such a study.

c) To undertake similar case studies concerning the availability, transfer and utilization of agricultural innovations in several other selected districts in Tanzania. The major purpose of such studies would be to explore the depth, validity and utility of farmers' knowledge of agricultural innovations. Such studies would enable Ministry of Agriculture and Livestock Development to have inventory and get a true picture of the transfer and utilization of agricultural innovations.

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APPENDIX 1

LIST OF EXTENSION OFFICERS AND VILLAGE LEADERS ENGAGED IN THE DIRECTED DISCUSSION

1. P.B. Barie - Regional Agricultural Development Officer, Mara Region.

2. Three Officers from Regional Agricultural Development Office, Mara Region, namely :

   a) H.G. Kanyangemu - Agricultural Officer III
   b) A.K. Isakwi - Agricultural Field Officer I
   c) G. Mbelwa - Agricultural Field Officer IV

3. D.M. Rugangila - District Agricultural Development Officer, Musoma District.

4. Two Officers from District Agricultural Office, Musoma District, namely :

   a) S.O. Dome - Agricultural Field Officer II
   b) O. Gagiri - Agricultural Field Officer IV

5. Two Village Leaders from each of the villages studied, as follows :

   a) Nyamisisye - Village Chairman and Village Secretary
   b) Kiabakari - Village Chairman and Village Manager
   c) Nyang'oma - Village Chairman and Village Secretary
   d) Kwibara - Village Chairman and Village Secretary

APPENDIX 2

LIST OF VILLAGES IN WHICH RESPONDENT FIELD EXTENSION WORKERS WERE BASED

Division	Ward	Village
Kiagata	Buswahili	Kwisaro
	Nyamimange	Kyankoma
Makongoro	Buhemba	Muryaza
	Buruma	Isaba
	Butiama	Bisarye
		Butiama
	Makongoro	Mukirira
	Nyankanga	Nyankanga
	Butuguri	Mmazami
	Kukirango	Nyamisisye
		Kiabakari
Nyanja	Bwasi	Bwasi
	Kiriba	Nyang'oma
	Kigera	Kigera
	Nyambono	Saragana
	Bukumi	Makojo
	Tegeruka	Kwibara
	Suguti	Wanyere
	Murangi	Murangi
	Rusoli	Bukima

APPENDIX 3

FIELD EXTENSION WORKERS' QUESTIONNAIRE

Confidential Date :

Introduction

The objective of this research is to get some information on the impact of extension services in Musoma district. We are asking for your cooperation in this exercise and we assure you that your responses will be treated in strict confidence.

1. Village_____ Ward_____ District_____
2. Field Worker No. _____; Age (yrs) _____ Sex (M/F)
3. School Education _____(yrs), Completed_____ (yr)
4. Pre-service Education_____ (type and yr)
5. In-service training: Number of times attended _____
   Last time attended_____(month & yr)
6. Length of tenure_____(yrs), Positive/Rank_____
7. Indicate the major field activities in which you have been engaged : _____

8. Below is a list of extension methods.
   Put (x) against one method you frequently use in advising farmers in the following agricultural field practices:

Practice	Extension Methods		
	Individual	Group	Mass
- Land Preparation			
- Selection and Use of Improved Seed Varieties			
- Proper Spacing			
- Proper Weeding			
- Use of Chemical Fertilizers			
- Use of Organic Manures			
- Use of Insecticides			

9. Put (X) against the crop in which you put more emphasis in terms of time spent on advising farmers in relation to agricultural practices indicated.

Practice	Type of Crop	
	Cotton	Sorghum
- Land preparation		
- Selection and use of improved seed varieties		
- Proper spacing		
- Proper weeding		
- Use of chemical fertilizers		
- Use of organic manures		
- Use of insecticides		

10. What are your opinions towards the farmers with whom you work?

Statement	Opinion				
	SA*	A	UD	DA	SD
- They are friendly and cooperative					
- They appreciate what they are advised and are quick to adopt.					
- They appreciate what they are advised but are not quick to adopt					
- They are hard to convince by words, they need practical demonstrations					

* (SA) = Strongly Agree; (A) = Agree ; (UD) = Undecided; (DS) = Disagree; (SD) = Strongly disagree

Table 11 : What are your opinions on farmers' views concerning recommended agricultural practices?

Statement	Recommended Practices													
	Land preparation		Selection and use of improved seed varieties		Proper spacing		Proper weeding		Use of chemical fertilizers		Use of organic manures		Use of insecticides	
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
- Do you think farmers understand you?														
- Do farmers want to change from using traditional practices to recommended practices?														
- Do farmers know how to change?														
- Are they able to change?														

12. What are your views about traditional and recommended practices in regard to cotton and sorghum farming?

a) Cotton

Practice	Traditional		Recommended	
	Mostly used	Not mostly used	Mostly used	Not mostly used
- Land preparation				
- Selection and use of improved seed varieties				
- Proper spacing				
- Proper weeding				
- Use of chemical fertilizers				
- Use of organic manures				
- Use of insecticides				

b) Sorghum

Practice	Traditional		Recommended	
	Mostly used	Not mostly used	Mostly used	Not mostly used
- Land preparation				
- Selection and use of improved seed varieties				
- Proper spacing				
- Proper weeding				
- Use of chemical fertilizers				
- Use of organic manures				
- Use of insecticides				

c) Why do you think some farmers do not mostly use recommended practices ?

13. What do the following practices imply as currently used in cotton and sorghum farming ?

a) Cotton :

i) Land preparation _____

ii) Selection and use of improved seed varieties_____

iii) Proper spacing _____

iv) Proper weeding _____

v) Use of chemical fertilizers _____

vi) Use of organic manures _____

vii) Use of insecticides _____

b) Sorghum:

i) Land preparation _____

ii) Selection and use of improved seed varieties___

iii) Proper spacing _____

iv) Proper weeding _____

v) Use of chemical fertilizers _____

vi) Use of organic manures _____

vii) Use of insecticides _____

14. Have you often provided opportunity for farmers to try the following practices in cotton and sorghum farming ?

Practice	Cotton		Sorghum	
	YES	NO	YES	NO
- Land preparation				
- Selection and use of improved seed varieties				
- Proper spacing				
- Proper weeding				
- Use of chemical fertilizers				
- Use of organic manures				
- Use of insecticides				

15. List problems that make it difficult for you to adequately transfer innovations to farmers.

16. List the problems that make it difficult for farmers to adopt the recommended innovations put forward to them.

APPENDIX 4

FARMERS' QUESTIONNAIRE

Confidential Date : _____

Introduction

This research is intended to find out effectiveness of our extension services. The fundings will help to improve the extension services. Your cooperation will make the findings more realistic and therefore more useful.

You have been specifically chosen among the farmers of this village to provide us with information about the village agriculture. There is no passing or failing in this exercise.

The information obtained from you will not be told to anyone but will only be used to find out ways to improve the agricultural extension service in the village.

1. Village _____ Ward _____ District _____
2. Farmers' No. _____ Age (yrs) _____ Sex _____(M/F)
3. a) School Education _____(yrs), Completed_____(yr)
   b) Other form of Education (specify) _____
4. Were you born in this village? _____

5. Do you grow the following crops? _____

   a) Cotton _____ (YES/NO)

   b) Sorghum _____ (YES/NO)

6. Have you ever received advice from a Bwana Shamba on the following crops:

   a) Cotton _____ (YES/NO)

   b) Sorghum _____ (YES/NO)

7. I would like to hear your views on some of the following agricultural practices involving cotton and sorghum

   a) Land preparation :

      i) What means do you use in preparing land for planting crops ?

Land Preparation Means	Cotton		Sorghum	
	YES	NO	YES	NO
- Handhoe				
- Ox-plough				
- Tractor				

   b) Selection and use of improved seed varieties

      i) Do you know anything about selection and use of improved seed varieties? _____ (YES/NO)

      ii) If Yes, for which of the following crops have you ever used improved seed varieties?

         1. Cotton : Variety _____

         2. Sorghum : Variety _____

iii) If not, why have you not ever selected and used improved seed varieties in :

1. Cotton?_____
2. Sorghum?_____

c) Proper spacing :

i) Do you know anything about proper spacing of crops? _____(YES/NO)

ii) If Yes, for which of the following crops have you ever used proper spacing ?

1. Cotton : Spacing _____
2. Sorghum : Spacing _____

iii) If not, why have you not used proper spacing in :

1. Cotton?_____
2. Sorghum?_____

d) Proper weeding :

i) Do you know anything about times of weeding of crops? _____ (YES/NO)

ii) If Yes, how many times do you weed the following crops ?

1. Cotton : number of times of weeding _____
2. Sorghum : number of times of weeding _____

iii) If not, why don't you practice the required number of times of weeding in :

1. Cotton ? _____
2. Sorghum ? _____

e) Use of chemical fertilizers :

i) Do you know anything about chemical fertilizers?

_____(YES/NO)

ii) If Yes, mention the type of fertilizer you have ever used in each of the following crops:

1. Cotton _____

2. Sorghum _____

iii) If not, why have you not used chemical fertilizers in:

1. Cotton? _____

2. Sorghum ? _____

f) Use of organic manures :

i) Do you know anything about organic manures?_____ (YES/NO)

ii) If Yes, mention the type of organic manure you have ever used in :

1. Cotton : _____

2. Sorghum : _____

iii) If Not, why have you not used organic manures in :

1. Cotton ? _____

2. Sorghum ? _____

g) Use of insecticides:

i) Do you know anything about insecticides?_____ (YES/NO)

ii) If Yes, mention the type of insecticides you have ever used in :

1. Cotton _____

2. Sorghum _____

iii) If Not, why have you not used insecticides in :

1. Cotton ? _____

2. Sorghum ? _____

8. Have you ever received advice from a Bwana Shamba or other source on the following agricultural practices involving cotton and sorghum farming ?

a) Cotton

Agricultural Practice	YES		NO	Cannot remember
	Bwana Shamba	Someone else (specify)		
- Land preparation				
- Selection and use of improved seed varieties				
- Proper spacing				
- Proper weeding				
- Use of chemical fertilizers				
- Use of organic manures				
- Use of insecticides				

b) Sorghum

Agricultural Practice	YES		NO	Cannot remember
	Bwana Shamba	Someone else (specify)		
- Land preparation				
- Selection and use of improved seed varieties				
- Proper spacing				
- Proper weeding				
- Use of chemical fertilizers				
- Use of organic manures				
- Use of insecticides				

9. a) If Yes in No. 8 above, through which ways were you advised on agricultural practices?

i) Face - to - face _____(YES/NO)

ii) At a meeting _____ (YES/NO)

iii) Other ways (specify) _____ (YES/NO)

b) If No in No. 8 above would you accept advice on agricultural practices if opportunity were provided?

_____(YES/NO)

10. If you were advised face-to-face by a Bwana Shamba, which of the following statements correctly describes the major reason for his farm/home visit :

    a) Comes on request for assistance _____(YES/NO)
    b) Comes when there is an invasion of pests or any other problem _____(YES/NO)
    c) Comes when planning a campaign_____(YES/NO)
    d) Comes when intending to use our farm for demonstration _____(YES/NO)
    e) Any other reasons (specify) _____

11. If you were advised through meetings, in which way(s) was the new idea presented?

    a) Dialogue _____ (YES/NO)
    b) Directive _____ (YES/NO)
    c) Prescription _____ (YES/NO)
    d) Demonstration _____ (YES/NO)

12. Indicate whether you still apply the following recommended Agricultural Practices for cotton and sorghum farming.

Recommended Agricultural Practice	Cotton		Sorghum	
	YES	NO	YES	NO
- Land preparation				
- Selection and use of improved seed varieties				
- Proper spacing				
- Proper weeding				
- Use of chemical fertilizers				
- Use of organic manures				
- Use of insecticides				

13. Which of the following statements accurately describes the major reason for your continued rejection of the following improved practices for cotton and sorghum farming ?

a) Cotton

Recommended Agricultural Practice	Practices previously used are better		Inconsistence with past experience		Difficult in technology		Not easily triable		Not easily observable	
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Land preparation										
Selection and use of improved seed varieties										
Proper spacing										
Proper weeding										
Use of chemical fertilizers										
Use of organic manures										
Use of insecticides										

b) Sorghum

Recommended Agricultural Practices	Practices previously used are better		Incosistence with past experience		Difficult in technology		Not easily triable		Not easily observable	
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Land preparation										
Selection and use of improved seed varieties										
Proper spacing										
Proper weeding										
Use of chemical fertilizers										
Use of organic manures										
Use of insecticides										