ADOPTION OF MUCUNA (*Mucuna utilis*) AS SOIL MANAGEMENT CROP IN REPUBLIC OF BENIN.

BY

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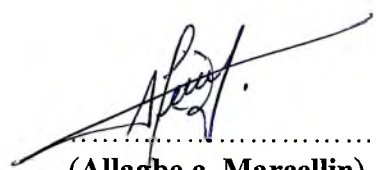
DECLARATION

I, Allagbe Cogou Marcellin,do hereby declare that except for references to other people's work which have been duly cited, this work is the product of my own original research. I also solemnly declare that this dissertation has neither in whole nor in part been presented for another degree elsewhere.



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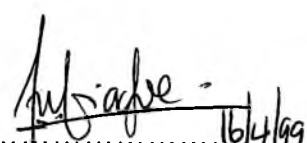

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DEDICATION

To my Mother, my wife and my loving children Tayewo and Kingnide.

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ABSTRACT

Most extension services are actively engaged in promoting new technologies among farmers. Resources are invested in various extensions activities, such as field days or demonstrations, and extension service may undergo considerable reorganization, such as the training and visit system (T & V) (Benor and Harrison 1977). There is a widespread need to place emphasis on monitoring the result of technology transfer and eliciting farmers feedback. Organization responsible for developing new technology need to know if the transfer process is functioning, if their message is being heard. Base on this reasoning I choose to study adoption of Mucuna as soil management crop in Benin.

SG2000 project started extension work on Mucuna as technology for recovery of land invaded by imperata and striga and for improving fertility to over exploited or poor soils in Benin since 1992. The major concerns for the study is: suggest ways in which more farmers could adopt Mucuna as a soil fertility management crop.

The target population for this study was Benin's farmers. Since the time and the means can not permit to work with all of Benin's farmers, one region was selected in each of the ecological zones of the country. In each region five villages were selected using simple random sampling and in each village ten farmers were selected at simple random sampling. To be sure that all our respondents have equal chance to hear about the innovation (Mucuna for soil management and weed control), the selected villages were those in which SG2000 has an extension agent.

Frequencies and percentages were used in respect to demographic data collected. Chi-square, were used to see whether there is a significant difference

between selected regions, or if there is any relationship between adoption and some selected variables or between innovation characteristics and farmers adoption behavior.

This study conducted with the help of five field assistants lead to the findings summarized as follow.

Majority of farmers selected (92 percent) were male, and 8 percent were female. Age of respondents ranges from 20 years old to more than 40. Majority of respondents (51.3%) have more than 40 year old. Average number of children is seven. Majority of farmers (71.3%) are illiterate. Language spoken differ from one area to an other. There are national extension services and NGO's which help farmers to improve their farming conditions.

Analysis of data revealed primarily that there is a significant difference between selected regions as far as adoption of Mucuna is concerned. Because of land availability and efficiency of extension activities Borgou region offers to farmers the best conditions to adopt Mucuna as soil management crop, compared to others selected regions. Chi-square computation revealed that there is a significant difference between the three selected regions with regards to extension activities.

Level of education do not have any significant relationship with adoption of Mucuna therefore this innovation is consider not to be complex. Labor availability has been found to have also a significant relationship with adoption of Mucuna. Other socio-economic characteristics of farmers like: number of children, marital status, age, land origin have no significant relationship with adoption of Mucuna. All the variables used to measure extension influence on adoption of Mucuna have a significant relationship with Mucuna adoption. Participation to meeting organized by VEW, adequacy of training given by VEW, clarity of the extension message for farmers, contact with extension agent were found to have significant relation with adoption of Mucuna.

It was also found that there is no significant difference between selected regions as far as opinion of respondent about importance of the innovation is concerned. Majority of the respondent recognize that fertility of their soil have been improved after Mucuna fallow. They also know that Mucuna is not edible but do not prevent it growing for soil improving. Analysis revealed that there is no significant relationship between Mucuna edibility and its' adoption.The study reveals that disadopters are those who don't have enough land or have problem of labour. Some of them are those who got bad results from their first experience ; their soil have not been improved or Mucuna couldn't irradicate spear grass of their field.

As the study reveals, must of adopters are SG2000 contact farmers. This shows that SG2000 strategy has improve adoption rate of Mucuna in Benin. Strategy use by SG2000 offers good opportunity for farmers to make decision after going through all the decision making process stages.

This study shows that promotion of Mucuna technology need to consider sociological factors, environmental factors, and an adequate extension methodology.

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CHAPTER ONE

1.0.-INTRODUCTION

is chapter is presented under the following headings; (1) background, what is velvetbean (***Mucuna utilis***), use of Mucuna, research problem, research questions, and objectives of the study.

1.1.- BACKGROUND

Sub-Saharan Africa today confronts the greatest challenge of all the developing regions of the world, the sustained production of sufficient food for rapidly increasing populations. Famine and food shortages, arising from declining per capita food production, increasing food imports and climatic conditions, such as drought and parasitic weeds, have placed this region at the center of the world concern (IITA, 1986).

Survey conducted in coastal regions of Benin revealed a general reduction of fallow periods and a considerable increase in cropping periods (Floquet, 1996). Floquet (1996) concluded that land use values (ratio between cropping period and fallow duration) of present bush fallow systems in coastal regions of Benin, are incapable of sustaining crop production at a level adequate to support increasing food demands.

With intensive cultivation and shorter fallow periods, land productivity and crop yields are declining. The situation is compounded by low usage of inorganic fertilizers . Saharan Africa food production declined at a rate of 1.9 per cent per annum while projections of population growth is predicted to double by the year 2000 (FAO, 1990).

In southern Benin the population density is estimated at about 150 to 350 people per Km^2. This is beyond the limit of 25 people per Km^2, which could be supported by the traditional bush fallow/shifting cultivation systems(FAO, 1992).

Replenishment of soil nutrient pools is possible through use of inorganic fertilizers. However inorganic fertilizers have some limitations. Kang *et al.* (1989) noted that continuous application of high rates of mineral nitrogen and phosphate fertilizers lead to rapid soil acidification and high nutrient losses by leaching and runoff. Fertilizer application improves only some soil chemical properties, but does not restore degraded soil physical conditions. Under unfavorable conditions such as extended dry spells, high rainfall intensities, and soil with low organic matter content, the efficiency in inorganic fertilizers can be lower than expected (FAO, 1990).

The rapidly increasing population and dwindling agricultural production, has increased the demand for fuelwood and fodder resources in subtropical regions of West Africa, in general, and in coastal region in particular. This has led to deforestation and decline in soil fertility. Use of fertilizers alone or fertilizers with improved crop varieties have not guaranteed maintenance of soil productivity. Research efforts have been made in recent years to develop sustainable and more efficient production systems by integrating new agroforestry systems.

These innovations have shown many possibilities and advantages such as restoration of the chemical and physical properties of the soil. One of these improved technologies is use of Mucuna for soil fertility management.

Adoption of technological innovations in agriculture has attracted considerable attention among development economists because the majority of the population of less developed countries derives its livelihood from agricultural production and because new technology seems to offer an opportunity to increase production and income substantially.

The introduction of new technologies has met with only partial success, as measured by observed rates of adoption. The conventional wisdom is that constraints to the rapid adoption of the innovations involve factors such as the lack of credit, limited access to information, aversion of risk, inadequate farm size, inadequate incentives associated with land tenure arrangements, insufficient human capital, absence of equipment to relieve labor shortages, chaotic supply of complementary inputs, and inappropriate transportation infrastructure (Gershon, 1985), and poor extension programs.

As past experience shows, immediate and uniform adoption of innovations in agriculture is quite rare. In most cases adoption behavior differs across socio-economic groups and over time. Some innovations are well received, while other improvements have been adopted by only a very small group of farmers. Pressure on land due to population growth has brought about intensification of land use in many Africa countries. The major agronomic problems which limit yield under intensive use of land in Ghana and other countries include weed build-up and decline in soil fertility (GGDP, 1987; GGDP, 1990; Ogungbile, 1992).

According to Food and Agriculture Organization (FAO, 1990) the annual growth of Republic of Benin is estimated at 2.9 percent, and farmers harvest less than 400 kg of maize per hectare specially in the south of the country. Chemical fertilizers and herbicides are effective in solving these problems , but are not affordable to the majority of farmers in Africa.

Aware that the economy of Benin is based on agriculture, the government through its extension services has disseminated and encouraged the development and adoption of Mucuna.

The potential of Mucuna cover crop in controlling weeds (Osei-Bonsu et al., 1993; Versteeg and Koudokpon, 1990) and improving soil fertility (Huller Gale et al., 1986, Triomphe, 1991) is well established.

Mucuna was introduced to farmers in Benin in 1987. Sasakawa Global 2000 (SG2000) project in collaboration with national extension service have been promoting the use of Mucuna through their contact with farmers since 1990 (Houndekon et al., 1996).

Despite the effort made by extension services to promote Mucuna for soil management and weeds control, its adoption has not been popular or uniform across farmers. The farmers have responded differently to the innovation. Some farmers have adopted it whereas others have not. For those who have adopted the proportion of land with Mucuna differs from farmer to farmer. This study seeks to explain the behavior of Benin's farmers with respect to adoption of velvet bean (Mucuna utilis) as soil management crop.

Cover crops are currently considered an important component of sustainable production systems for small farmers in the humid tropics. One such crop currently attracting attention among researchers and farmers is Mucuna.

1.2.- WHAT IS VELVETBEAN (*Mucuna utilis*)

Velvetbean is a vigorous climbing legume originally from China, Malaysia and India. It was at one time widely cultivated as a green vegetable crop (Burkill, 1966; Duke, 1981). Like most of the legumes velvetbean has the potential to fix atmospheric nitrogen through a symbiotic relationship with soil microorganisms. The nitrogen of the air is converted by bacteria rhizobia on the roots of the plant into an available form stored in the leaves, vines and seed (Duke, 1981).

For more than 40 years, farmers in the humid tropics of Mexico and central America have been quietly developing and refining a low-input agricultural technology based on Mucuna (velvetbean). International Research Centers like International Institute of Tropical Agriculture (IITA), National Agricultural Research Institute 'Institut National de Recherche Agricole du Benin (INRAB)' and Non Governmental Organizations (NGOs) are gradually becoming aware of

this technology. These research centers are now developing a collaborative research and extension effort to speed up the process of farmer to farmer diffusion and improve the capacity of farmers and researchers to further develop the technology (Buckles, 1993).

The leguminous cover crop *Mucuna puriens* var. *utilis,* was introduced in Benin in 1987 on the research-managed demonstration field of novel technologies, to address the serious soil fertility decline on the Adja plateau in south of Benin (Versteeg, 1990). However Farmers were, more impressed by its' ability to control the rampant weed *Imperata cylindrica,* and requested seeds for their own experimentation. Even so, a clear soil fertility bonus became highly visible, and this aspect was further experimented by farmers, who had seriously depleted fields (Versteeg, 1990).

Sasakawa Global 2000 project in Benin (SG2000) in collaboration with the national extension services has been promoting the use of Mucuna as soil improment crop through their contact farmer since 1990 (Buckles, 1993). In 1992, all the CARDERS (national extension services) in the different regions of Benin in collaboration with the SG2000 established demonstration plots nationwide.To get more insight into the adoption of the innovation research and development socio-economist in 1993 surveyed 277 farmers in 4 villages, to determine (i) the actual uses of Mucuna in the areas where it was first introduced (ii) the magnitude of Mucuna adoption (iii) the processes which influence the adoption of the Mucuna (iv) the impact of Mucuna on Benin's agriculture and (v) a description of characteristics of zones with favorable conditions for Mucuna adoption. The first finding showed that there was a rather modest percentage of about 40% "confirmed adopters" (defined by farmers using Mucuna twice or more to solve either spear grass, or a soil fertility problem), this figure was nearly twice as high as the confirmed rejecters (defined as farmers who used Mucuna once and did not use it any more). Many farmers still fell in between these two

categories, as they had only started using Mucuna for the first time. Another outcome was that there were three times more farmers who used Mucuna for spear grass control than for soil fertility restoration. A third important result was that most rejection occurred because Mucuna occupied the field during the minor raining season (Versteeg, 1990).

PLOT OF MUCUNA (*MUCUNA UTILIS)*

1.3- USE OF MUCUNA

The leaves of Mucuna contain approximately 2.4 percent nitrogen and can produce 5-6 ton/ha of dry matter with the equivalent of more than 100 kg/ha of nitrogen when grown as cover crop. The use of Mucuna as cover crop and green manure is well establish in several countries. When late maturing varieties of velvet beans are planted without a supporting crop, they produce such a dense growth of vines that weeds, persistent grasses and in many cases tree sprouts are smothered out. More than 20,000 farmers in Honduras and Guatemala currently use Mucuna as a soil improvement crop grown in the major season followed by maize planted through the mulch in the minor season (Buckles, 1993). According to farmers, this practice reduces their labor cost by half during land preparations for minor season planting as the Mucuna crop aggressively controls weeds during the major season and is easily cleared with a cutlass (Buckles, 1993). Agboola (1974) reported that the use of Mucuna in rotation did not gain any wide acceptance despite the wide publicity made by the Ministry of agriculture. The major reasons are as follows:

-There is no immediate returns in terms of cash or food.

-Digging in the heavy green manure annually is difficult with hand tools

-Planting green manure as a soil crop does not fit into the farmer's agricultural system.

However a number of scientist have revealed the importance of Mucuna. The decaying leaves and vines provide nitrogen to the subsequent maize crop and conserve moisture under the mulch layer during the relatively dry part of the minor season. Average maize yields of 3-4 ton/ha were attained on fields with Mucuna, without application of commercially available nitrogen. This compares very favorably with yields of 1.3 ton/ha on plots cropped with maize and cowpeas without nitrogen fertilization. Maize yields with Mucuna were similar to those obtained with recommended levels of fertilization (130 kg/ha). According

to Tracy and Coe (1918). the velvet bean is one of our best soil crop, both for soils which are naturally infertile and those which have become somewhat exhausted by long cultivation. The ability of this plant to make a profitable growth on land so poor that most legumes will not thrive places it among important crops for the south of the republic of Benin where most agricultural land is depleted. In addition to adding at a minimum cost large quantities of vegetable matter to soil, thus making it more retentive of moisture, the nodules on the roots collect a large amount of nitrogen from the atmosphere. Mucuna grows in many areas but does not tolerate waterlogged or acidic (pH of 4.5 or less) soils, very dry conditions or areas with altitudes above 2000 Mt.

In fields with very heavy spear grass infestation, Mucuna can be used as sole crop during the major season to suppress the weeds. It is reported in literature that the Florida Agricultural Experiment Station used velvet bean to irradicate Bernuda grass in severely infested fields (Tracy and Coe, 1918). Vissoh (1994) citing Wilson and Lal reported that, sown at 75 cm x 25 cm spacing, *Mucuna utilis* covers the soil in four to six weeks and suppresses most competing weeds in three months.

Velvet bean is used as a grazing crop for cattle and hogs in autumn and winter in United States. Velvet bean is regarded as a non edible crop. Even though the crop can be consumed in time of famine, but only after boiling with repeated changes of water and the removal of the testa (Purseglove, 1974). The Tropical Products Institutes in London sampled Grains with black, white, green, and gray mottled color and fund them to contain 2.8 to 4.6 percent of amino acid called Levo Dopa. Levo dopa is used in the treatment of Parkinson's disease and other diseases, but may produce a toxic confusional state in humans if it is consumed.

This is why researchers usually say that Mucuna is not edible. However in Ghana Akan people use a non stinging type of velvetbean (local name "Adua apia") as soup thickener, and stews much like Lima bean (Osei-Bonsu and Buckles, 1993).

1.4.- RESEARCH PROBLEM

Aware that the economy of Benin is based on agriculture, the Benin government, through its extension services, has disseminated and encouraged the development and adoption of Mucuna as cover crop. Cover on soil surface is the most effective method of erosion control. Vegetation on the soil surface intercepts raindrops, cuts the velocity of overland flow, and stops the wind from contacting the soil surface. Mulching increases surface roughness, decreases the amount of bare soil available for transport, and helps retain soil moisture.

The potential of Mucuna cover crop in controlling weeds and improving soil fertility is well established (Osei-Bonsu *et al.*, 1993; Versteeg and Koudokpon,*et al.*, 1990). Despite the efforts made by extension services to promote Mucuna for soil management and weeds control, its adoption has not been popular or uniform across farmers. In Benin the farmers have responded differently to the innovation. Some farmers have adopted it whereas others have not. For those who have adopted the proportion of land sown with Mucuna differs from farmer to farmer. Galiba *et al.* (1995) revealed that in the north of Benin the rates of adoption of Mucuna obtained is low while in the south (Mono region) the rate of adoption is high. One of the problems that faces extension is how to enhance the adoption of technologies dissemination to farmers. This study seeks to investigate the adoption of velvet bean (*Mucuna utilis*) as soil fertility management crop in Benin Republic, and suggest ways of enhancing its adoption by farmers.

1.5- RESEARCH QUESTIONS

iven the many benefits that farmers could derive from adopting Mucuna as soil fertility improvement crop, it is important to find out why some farmers have adopted the technology while some have not. It is important to study the characteristics of those who have adopted, and those who have not. these characteristics will be related to the strategies and methods of extension to came out with ways of improving or enhancing adoption.

The research question that this study intends to address is:

- What factors influence adoption of Mucuna as soil management crop by farmers in Benin Republic.

1.6.- OBJECTIVES OF THE STUDY

1.6.1.- Main objective

The main objective of the study is to determine factors that influence adoption of Mucuna in order to suggest ways to improve its adoption.

1.6.2.- Specific objectives

(i). Identify the environmental, and sociological factors that influence farmers to adopt Mucuna as a soil management crop.

(ii). Establish the differences in the adoption rates of Mucuna practices adoption between the different ecological zones of the study area.

(iii). Identify the characteristics of farmers who have adopted and characteristics of those who have rejected Mucuna practices.

CHAPTER TWO

2.0.-AGRICULTURAL EXTENSION ORGANIZATION IN BENIN

Agricultural extension is only on of the elements that can help to promote agricultural development. Agricultural extension activities started in Benin since the colonial period. But its organization, objectives, target group and extension offers have varied from period to period.

As far as agricultural extension in Benin is concerned, two main periods can be distinguished: the period before the establishment of the Centre d'Action Régionale pour le Développement Rural (CARDER) and the CARDER period. CARDER is the regional center for rural development. Its activities cover the six regions of the country.

There are six CARDER in Benin. As a regional development center the CARDER has been and remain more than agricultural extension institutions. It caries out some other functions necessary for an effective and integrated agricultural development, as input supply, and cotton marketing.

2.1.- AGRICULTURE EXTENSION ORGANIZATION DURING THE PRE CARDER PERIOD.

The pre-CARDER period is the period before 1975. During that period two foreign/French collaborating agencies namely the "Compagnie Française pour le Developpement des Fibres et Textiles (CFDT) and the "Société d'Aide Technique et de Cooperation (SATEC)" were in charge of agricultural extension. These two collaborating agencies were mainly interested in cotton production in order to feed French textile industries with raw materials at moderate costs (Tossou, 1995). Apart from the two groups, there were other institutions interested in other crops for raw materials at low cost for industries in Europe.

For example, the "Compagnie Agricole et Industrielle du Tabac (CAITA)" focused on tabacco production and marketing. All the groups are privately owned. In 1972 the revolutionary government stopped their activities in Benin and the locals took over agricultural intervention organizations resulting in the establishment of "Operation de Dévelopement integré (ODI)"

The objectives of this form of intervention in agriculture were to increase agricultural production (crops production, forestry, animal production); to promote food crops (maize, sorghum and rice); to concentrate not only on cotton production as a cash crop but also on groundnut; to promote farmers organizations; and to intensify the functional literacy program in the areas in which cotton is produced. These ODIs are public services. It is on the basis of their objectives that the first CARDER was created in 1975.

2.2.- AGRICULTURAL EXTENSION ORGANIZATION IN THE CARDER

The first CARDER was establish in 1975 in the Mono region and the idea was extended gradually to the other regions. The objectives of the CARDER, are similar to those of the ODIs but include also:

- Organization of the farmers into pre-cooperatives and cooperatives;
- Supply of the farmers with inputs
- Organization of the collection of agricultural products until the farmers organizations are capable of doing; and
- Provision of credit facilities to farmers.

All crops are (theoretically) promoted, although in practice more emphasis is placed on cotton production and service. The CARDERs, also carry out the functions of collecting agricultural products, of supplying and recovering input and credit for agricultural production, the application of the regulations related to

agricultural development, and on farm test of the technologies proposed by the researchers. That is the integrated rural development approach in extension.

The Village Extension Worker (V.E.W) is the representative of the CARDER at village level. He is in charge of the operation of all these functions. He is also in charge of the collection of agricultural statistics, and of some administrative and political responsibilities at village, sub-district and district level (Tossou, 1997). From 1985, the Training and Visit (T&V) system was introduced in the CARDER in order to reorganize the activities of the VEWs.

2.3.- NEW POLICY FOR EXTENSION ORGANIZATION

On the basis of the negative results of application of the T & V system during the first year of its introduction, some supportive tools and new directives were introduced in 1990 in order to improve the situation. These are visits to farmers on a set day, the concentration of the extension activities of a VEW on eight groups of farmers, called "Unite de suivi", and the training of members of a "Unité de suivi" on a training plot held by a contact farmer.

These new supportive tools and directives were reinforced by the objectives of the project for restructuring the CARDER, which was a part of a broader project named "Projet de restructuration des services agricoles" (PRSA). This project was prepared and supported by many donors through the Structural Adjustment Program signed by the government. These new supportive tools for the application of the T & V system and the objectives of the PRSA can potentially improve the relevance and organization of development activities in the country. They also give new orientation to extension activities.

2.4.- QUALIFICATION AND FUNCTION OF EXTENSION PERSONNEL.

Extension personnel are separated into the following three broad categories

(i). local or village Extension Workers who work directly with the clientele.

(ii). Subject Matter Specialists TS/SUP/SOP who are responsible for training and provide technical expertise for VEWs

(iii). Administrative and supervisory staff who are responsible for supervising APV, SOP, TS, and SUP, as well as carrying out the usual functions of administration (including budgeting financial management, program evaluation and policy formation).

TABLE 1.- PERSONNEL OF CARDER (Centre d'Action Régionale pour le Développement Rural)

Regions	Number of staff per categories of personnel					
	RDR	TS	SOP	SUP	APV	TOTAL
ATACORA	8	27	30	29	148	242
ATLANTIQUE	5	26	26	12	84	153
BORGOU	10	17	31	33	178	269
MONO	6	11	24	20	72	133
OUEME	7	25	22	18	97	169
ZOU	9	42	29	27	159	268
TOTAL	45	148	162	139	738	1232

SOURCE: CARDER 1996

KEY:

RDR = Responsable du Developpement Rural (Rural Development Responsible)

TS = Technicien Specialisé (Specialist technician)

SOP= Specialiste en Organisations Paysannes (Specialist in Farmers Management)

SUP= Superviseur (Supervisor)

APV= Agent Polivalent de Vulgarisation (Extension Agent)

2.4.3.-Village Extension Workers (VEW)

The village extension worker under ideal conditions is expected to be a teacher, facilitator, organizer and leader. The VEW is supposed to help farmers to become aware of new research finding and technology, and to adapt new technology to local situation and conditions. The goal is to help farmers move from the awareness stages in the adoption process to the point where they have gained sufficient knowledge, skill, and possibly, changed attitudes to make a decision about the value of the new technology. The local extension worker serves as an educationist and communicator in the process of social and economic change in agriculture, home economics and rural life. The VEW or (APV) is considered as a respected community leader. He is a teacher of adults and youth and is an individual who help clientele to identify their own problems and to find practical solutions. APV have the primary responsibility of working directly with farmers, the farm family, and/or the farm house hold.

2.4.4.-Supervisors (TS, SOP/SUP).

TS, SOP and SUP play an essential role within the extension service. Their task is essentially one of linking APV, with sources of new technology and information (primarily the agricultural research system) as well as feeding back farmer problems to research personnel, for analysis and solution. They receive instruction from RDR. In addition TS, SOP and SUP are expected to help modify research finding to realistic recommendations that will fit the local situation.

2.4.5.-Rural Development Responsible (RDR)

The first categories of staff; Rural Development Responsible (RDR), Administrators and Supervisors are responsible for managing the organization and for giving it leadership and direction. RDR have support staff include persons who are specialists in training, animal production, fishing, social organization, etc. RDR is under a responsibility of DVAOP (Directeur de la Vulgarisation Agricole et de l'Organisation Paysanne) who is one of the staff member of

CARDER direction at the region level. Each CARDER is lead by one General Directors.

2.4.6.-CARDER General Director

He is the organization's (**CARDER**) chief executive officer. The function of the directory is to plan, organize, direct and control the activities of the organization. More specifically the position include responsibility for supervision, personal management salary administration, facilities management, fiscal management, program development and coordination, program execution and program evaluation.

2.5.- EXTENSION TOOLS USED BY CARDER

According to **CARDERs**' staff extension tools are essentially contact group **(GC),** demonstration plot **(PD),** and training program.

2.5.1.-Contact Group (GC)

A contact group contain 8 to 12 farmers who desire to work with the same **APV** and living in the same area.

To be effective an **APV** must work with 16 to 24 contact group per 2 weeks in other words 160 to 240 actives farmers within 15 consecutive days.

2.5.2.-Demonstration Plot (DP)

Extension method used is a result demonstration in a farmer's field. This plot size could be 10 m x10 m or 20m x 20 m.

2.5.3.-Training Program (TP)

Training is organized for each categories of extension agents.

Apart from national extension programs there are also a number of NGO'S with agricultural extension programs. Among these NGO'S there is Sasakawa Global 2000 (SG2000), which plays an important role in the promotion of a number of innovations, using it's own approach to disseminate national research finding.

2.6.- SASAKAWA GLOBAL 2000

The Sasakawa Global 2000 projects is a joint collaboration between Sasakawa Africa Association (SAA) and GLOBAL 2000 Inc. For SG2000 leaders the time has come to make available the untapped achievement of agronomic research. The widening gap between farmer's reality and scientist claims must be bridged. Small-scale farmers must be able to have good, reliable, sustainable economic returns to their efforts. SG2000 has a strong relationships are tied with the Ministry of Rural Development and especially with the departments of extension and farmers Organization. In Benin SG2000 works directly with CARDERs. A simple organization is put into operation, with connection with many partners involved in rural development. Staff of the Ministry are involved in the project on part time or full time basis. Logistics (pick-up trucks or motorbikes) and allowances are provided to the collaborating staff.

The field program is based on a unit named "Production Test Plot" (PTP) were the recommended package is tested against farmer's traditional practices.

This strategy of SG2000 provide farmers many opportunities: First hear about innovation (awareness); seek further information about it (Interest); weigh up the advantage and disadvantages of using it (Evaluation) test the innovation on a small scale (Trial).

These different steps are very important in the decision of adoption or rejection of new ideas.

Each PTP farmer is expected to invite along at least 10 neighboring farmers to form a cluster in order to be exposed to the package and assist in the diffusion process. Farmers receive 100% of input on credit during the first year. The second year, through cooperative action, they must capitalize and finance 50% of their input needs, SG2000 supplies the other half on credit. Graduation occurs the third year.

The technology proposed by SG2000 is a simple agricultural package which results from national and international research. Extension recommendations under the SG2000 activities were: use of improved varieties of seeds (Maize and sorghum), seedling (cassava) row planting, use of fertilizers, improved harvesting and storage, proper preservation and processing of food. One of the important technologies promoted by SG2000 is Mucuna as a technology for recovery of land invaded by imperata and striga and restoration of fertility to overexploited soil.

A CREP (Caisse Rural d' Epargne et de Prêt/ Rural savings and Loan funds) was initiated by SG2000. A CREP brings farmer together with the objective of mobilizing savings first and lending money to members.

Membership fees and social shares were used as criteria to assess group efficiency.

After few years of work many objectives have been reached; yields have increased dramatically, farmers' incomes have improved significantly, use of fertilizers for food crops is widely adopted. The use of Mucuna has become a reality but its adoption has not been popular or popular across farmers.

CHAPTER THREE

3.0.-LITERATURE REVIEW

The purpose of this chapter is to discuss the main sociological explanation which have been offered to account for the adoption of agricultural innovations. These are four identifiable areas within which to study the research question. There are, (1) what is adoption, (2) the adoption process, (3) factors that influence adoption, and (4) stages in decision making process.

3.1.- WHAT IS ADOPTION

For rigorous analysis, a precise quantitative definition of adoption is needed. Such a definition must distinguish between individual (farm level) adoption and aggregate adoption. According to Gershon *et al.* (1985) final adoption at the level of the individual farmer is defined as the degree of use of a new technology in long-run equilibrium when the farmer has full information about the new technology and its potential. This definition corresponds to Schultz's (1964) contention that the introduction of new technologies results in a period of disequilibrium behavior where resources are not utilized efficiently by the individual farm and learning and experimenting lead the farmer toward new equilibrium levels. Note, however, that, when the new technologies are constantly being modified, with some new innovations overlapping, the equilibrium level may flow constantly and never be attained.

According to Gershon *et al.* (1985) in the context of aggregate adoption behavior, the diffusion process is defined as "the process of spread of a new technology within a region. "Aggregate adoption is measured by the aggregate level of use of a specific new technology within a given geographical area or a given population.

3.2.- THE ADOPTION PROCESS

Rogers (1962) difines the adoption process as " the mental process an individual passes from first hearing about an innovation to final adoption"

The adoption process is essentially a decision making process. Research studies in United states of America particularly, have identified a number of stages in the process of adoption. The North Central Rural Sociology Committee has accepted five stages including awareness, interest, evaluation, trial and adoption (Ekong, 1988).

Awareness is the first stage and involves the individual learning of the existence of an innovation. However at this stage he has little knowledge about it. He may have heard about the innovation from other family members, friends, neighbours, the mass media, change agents, sales promoters or local cooperative organization. Depending upon an individual's felt need, he/she may want to go and find out more about the innovation.

Interest stage is the second stage during which the individual seeks more information about the innovation. In this process, he might be assisted by the amount of information accessible to sales agents, professional change agents, mass media, friends, etc.

Evaluation of innovation takes place almost simultaneously with arousal of interest. The individual is not only concerned with the usefulness of the innovation, he/she also considers its direct applicability to the solution of a particular problem, or fulfillment of needs. He/she wants to know how much it costs and how it works, whether there is a guarantee on it or whether the necessary materials are available, etc.

The individual tries the innovation at this stage and if he feels the advantages outweigh the disadvantages, he may go to the next stage of actually trying it. If his evaluation gives negative results however, he will cut off this

interest at this stage and reject the innovation. Trail is the stage during which the individual actually applies or practices the innovation on a small scale.

He may be assisted in the trial by the promoter or change agent who may actually demonstrate how the innovation works and then assist the individual to try it himself. Alternatively the individual might be assisted in trial by friends and neighbours who may have already adopted the innovation. If he feels satisfied by this trial he may decide to continue the use or application of such innovation. This, theoretically completes the process of adoption.

3.3.- FACTORS THAT INFLUENCE ADOPTION

The list of factors that may influence adoption is long. Researchers will want to review this list before planning an adoption study, and decide which factors should be included in their analysis (CIMMYT, 1993). This literature review focused on the following categories of factors such as; socio-cultural factors, personal factors, situation factors, innovation factors, economic factors and agricultural extension factors.

3.3.1.- Socio-cultural factors

We are all members of many social groups or systems. Few decisions can be made without due regard for others who are involved directly or indirectly.

According to Herbert (1965) a person, first of all, belong to a family, whether a son, daughter, father, mother, or other relatives. He/she must conform to the role expectation of the family in other to maintain a position of esteem within the family and respect by society as a whole.

The social context in which the receiver finds himself is a determining factor in exposure, evaluation, and action. More specifically, it is likely that people who are members of certain groups respond differently to same messages compared to those who are not.

3.3.1.1.-Locality

Locality groups are composed of people in a specific geographic area who have developed a feeling of belonging, or togetherness, and who tend to associate with each other more than with outsiders. Sociologist have recognized two such grouping-"neighborhoods" and "communities". Norms regarding the adoption of new farm practices vary greatly. Marsh and Coleman cited by Herbert (1965) found that residing in high adoption neighborhoods made much greater use of all sources of farm information, especially such sources as agricultural agency representatives, farm meetings, and farm bulletins, than those living in low adoption neighborhoods. Also, farmers in high farm practice adoption neighborhoods tended to look to farmers with higher adoption scores than themselves as sources of information, while those living in low adoption neighborhoods tended to look to those about like themselves.

Herbert (1965) citing Ducan and Kreitlow found that people living in heterogeneous neighborhoods from the standpoint of religion and ethnic background were more favorable to new farm and educational practices than people living in homogeneous neighborhoods.

Hoffer found that farm practice adoption rates were higher in community favorable to change than those who were not.

3.3.1.2.-Family

Family size in this context is defined as the number of people who depend on the farmer for their livelihood. Numerous studies have shown that family members often serve as referents or consultants in decisions to adopt new farm and home practices. The farmer's family size can also affect farming strategy. A farmer with a large family is assumed to have more social obligations than the one with a small family size. For example, women with many children in selected area in New York had adopted more new home practices than had older women and those without children (CIMMYT 1993).

3.3.1.3.-Reference groups

According to Herbert, (1965) reference group is a group to which an individual refers when forming an opinion, making a judgment, or deciding to act. In sociology, there has been the tendency to explain innovation adoption within the framework of social network theory. Innovation creates uncertainty since the individual is not fully aware of its benefits and cost and how to operate it. In such situation, the expected utility of the individual adopting an innovation increases if he is in a network of other adopter since he can be offered assistance by those adopters (Coleman,*et al* 1966; Marsden and Podolny, 1990). Besides, individuals in the same network may adopt an innovation within the same time frame because there is the need for them to conform to the fashion of acquaintances or competitors. In this case network offers not necessarily support but the medium through which members compare themselves with each other.

Ekong (1988) in his book "Introduction to Rural Sociology" revealed that studies in United State and Nigeria have shown that communities and neighborhoods that are ethnically and religiously heterogeneous tend to have significantly larger farm practice adoption score than homogeneous one. In fact, when a farmer with a high level of education income and large sized farm lives among low level adopters, he also tends to toe the line of low adoption. In Nigeria farmers would not adopt an innovation which a large number of other farmers within the community do not adopt.

3.3.1.4.-Social status

Rogers (1983) reported about 275 adoption studies of which 68 percent shows a positive relationship between status and adoption. The argument for a positive relationship is that innovation adoption involves capital and risk of loss such that the wealthy, defined as high economic status group can afford to adopt more easily compared with the poor.

3.3.1.5.-Culture

The cultural component of innovation adoption has been stressed by anthropologist. The conventional notion is that an innovation is adopted if it is compatible with the values and norms of society (Foster, 1964; Van den Breemer, 1991). Van den Breemer (1991) has illustrated how in Aouan society (Ivory Coast), the Christians, Moslems and foreigners defied "a religious interdiction" and adopted rice earlier than the natives. Rice was considered sacred by the Aouans. The Aouans began to accept to cultivate rice when their custom which emphasized dominance over other people seemed undermined by the foreigners who become influential due to the wealth they accumulated from rice production.

3.3.2.- Personal factors

The characteristics that fall under personal factors include; age, educational level, and psychological characteristics.

3.3.2.1.-Age

Age is one of farmers ' characteristics that is important to examine during an adoption study. Age may influence adoption in one or several ways. According to CIMMYT (1993) younger farmers are more likely to adopt a new technology than older generation, perhaps because they have been exposed to new ideas than older. Van Den Ban (1957) reported that progressive farmers were young recipients of vocational training in agriculture, were members of farmers organizations and were modern in their mode of living.

According to Akinola (1986) age was inversely related to the probability of participating in the National Accelerated Food Production Project (NAFPP) scheme and number of practices by those who participated. Some studies show highest adoption at middle age. Young farmers who may desire to make changes in farming are not always in position to do so because of capital restrictions or because final decisions may rest with the money lender or with the person who owns the farm.

Obviously, elderly farmers have problems different from middle-aged and younger ones. Elderly people appear less receptive to new ideas and change than younger ones(CIMMYT, 1993).

In contrast Ekong (1988) pointed out that there is no association between age and adoption behavior of Nigerian farmers.

3.3.2.2.-Education

The study of impact of knowledge or human capital on adoption was studied by Schultz (1964). He asserts that changes in the production process as a result of the adoption of innovation enhance the entrepreneurial ability of the farmer since they prompt the farmer to search, analyze and use new information which might not be needed or available in traditional agriculture. The introduction brings risks due to imperfect information and increases the possibility of making mistakes. The farmer with access to improved knowledge will be able to update his initial beliefs about the innovation as well as follow the procedures relating to the use of the innovation and thus adopt the innovation earlier compared to others. Rogers (1983) pointed out that adoption of innovation could be regarded as a managerial concern that requires certain skills which are often gained through education. Clark and Akinbode cited by Ekong (1988) have shown a positive association between literacy and adoption of innovation. According to Herbert (1965) since favorable orientations may be gained outside the schoolroom, correlation between years completed and adoption of farm practices is not always high. Nevertheless, more than eight years schooling is almost associated with higher adoption rates than lesser amounts.

3.3.2.3.-Psychological characteristics

Rationality, mental flexibility, dogmatism, orientation toward farming, and innovation proneness are some psychological characteristics which can also influence adoption of innovation.

All people are or to some degree "set in their ways " and, to a degree, incapable of perceiving pertinent relationships in new situations, or analyzing them in terms of adjustment alternatives, and making satisfactory adjustment to them. A mentally flexible person, on the other hand, is capable of perceiving significant elements in novel situations, of dealing with them mentally, and of making adjustment to them. Exposure to reliable sources of farm information may create a state of rationality which in turn predisposes an individual to the adoption of new practices (Herbert, 1965)

3.3.3.- Situational factors

Availability of land and availability of labour are considered here under a situational factors. In this section, we discuss the problems associated with land availability, and labour availability.

3.3.3.1.-Land availability

Size of farm and or size of enterprise is nearly always positively related to the adoption of new farm practices. Many new technological advances require large scale operations and substantial economic resources for their use. In the study conducted on Thai farmers' characteristics, Gershon *et al.* (1985) found a positive relationship between the fertilizer adoption and farm size.

Williams *et al.* (1984) showed that the larger the farm business in terms of acreage or size of particular enterprise and the more specialized the nature of the farm business, the earlier the farmer tends to adopt new and improved practices.

The importance of land availability in adoption relates to how it enables the farmers to afford the fixed cost involved in adoption of a given innovation. It has been found that a large farm size is positively related to the adoption of irrigation equipment (Gafsi and Roe, 1979).

3.3.3.2.-Labour availability

Some studies have suggested that labour plays an important role in the decision to adopt an agricultural innovation. Labour is directly needed to use the

innovation. In the literature, there has been the tendency to emphasize the importance of labor in terms of its contribution to help the adopter physically manage the innovation, for example, in land preparation, driving tractors, planting seeds and applying chemical input. This is because most of the agricultural innovations introduced require large amounts of labor. For an innovation which requires increased labour, scarcity of labor can lead to non adoption. N'diaye and Sofranko (1988) have shown that, in Zambia, labor shortages prevented farmers from adopting improved seeds. Shortage of labour at peak seasons may mean that many activities can not be carried out in time. This can affect yields and hence income (Arnon, 1989). Innovations have different implications on labour characteristics, some reduce the amount of labour required for growing a crop while others significantly increase it. Adoption of a new technology can lead to changes in labour required measured by; amount of labourers, time required in crop season, and division of labour between men and women. Where adoption is labour intensive, people with limited labour tend not to adopt the innovation because it will reduce their leisure time.

3.3.4.- Economic factors

In this section credit and prices of inputs and output are considered as economic factors.

3.3.4.1.-Credit

Several of the theoretical studies mentioned earlier argue that the need to undertake fixed investments may prevent small farmers from adopting innovation quickly. Credit may be an important factor in determining adoption. If a recommendation implies a significant cash investment for farmers, its adoption may be facilitated by an efficient credit program. Many farmers who do not adopt may complain of a lack of cash or credit as the principal factor limiting their adoption. Some of the theoretical and empirical studies suggest that lack of capital prevents small farmers from adopting innovations, particularly innovations

involving fixed cost. Availability of credit is said to have a positive impact on the adoption of non divisible technology (Gafsi and Roe, 1979).

3.3.4.2.-Prices of out put and inputs

Product prices contribute to determine the nature and scale of production. It is asserted that a higher price for a commodity will attract capital and labor to the firm and encourage the development of technology. Bevan *et al.* (1989) have shown that an increase in coffee price in Kenya helped relax credit constraints of small farmers. Cochrane (1986) has explained the possible reduction in gains from adoption over time as a result of differences in output price. When innovation is first introduced, the initial increase in production resulting from the adoption of an innovation might not be large enough to increase supply, so early adopters will obtain a higher profit by receiving the old price with an increased output.

The price and availability of inputs are important determinants of technology development and adoption.

3.3.5.- Innovation factors

Some innovations are adopted rapidly than others because the farmers perceive them to have different characteristics. It is not the objective characteristics that are important, but rather how the farmers perceive them. A number of studies have analyzed the relationship between characteristics of an innovation and its rate of adoption. Most of these studies came to the conclusion that perceived attributes of innovations are; relative advantage, compatibility, complexity, triability and observability.

3.3.5.1.-Relative advantage

Potential adopters want to know the degree to which a new idea is better than an existing practice. Does the innovation enable the farmer to achieve his goals better or at lower cost than he could previously? Relative advantage, in one sense, indicates the strength of the reward or punishment resulting from adoption

of an innovation. There are a number of sub dimensions of relative advantage: the degree of economic profitability, low initial cost, a decrease in discomfort a savings in time and effort, and the immediacy of the reward. This latter factor explains in part why preventive innovations have an especially low rate of adoption. A preventive innovation is a new idea that an individual adopts in order to avoid the possibility of some unwanted future event. Examples are buying insurance, using auto seat belts, adopting soil-conservation practices, getting innoculations against disease, and adopting contraceptive methods. A lack of observability is also a characteristics of preventive innovations that slows their rate of adoption. Most of the studies on perceived attributes of innovations and their rate of adoption report a positive relationship between relative advantage and rate of adoption (Rogers, 1983).

3.3.5.2.-Compatibility

Compatibility is a degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Clearly, it is very difficult to introduce pig husbandry among Muslims even if it is a very profitable enterprise. An innovation that is more compatible is less uncertain to the potential adopter. An innovation can be compatible or incompatible with socio-cultural values and beliefs, with previously introduced ideas, or with clients needs for innovations. American farmers place a strong value on increasing farm production. Soil conservation innovations are perceived as conflicting with this production value, and generally been adopted very slowly (Rogers, 1983). Many change agents face equally difficult assignments in promoting innovations that run counter to strongly held values.

An innovation may be compatible not only with deeply imbedded cultural values but also with previously adopted ideas. Compatibility of an innovation with a preceding idea can either speed up or retard its rate of adoption. A negative experience with one innovation can damn the adoption of future

innovations. Such innovation negativism according to Rogers (1983) is an undesirable aspect of compatibility. Innovation negativism is the degree to which an innovation's failure conditions a potential adopter to reject future innovations. When one idea fails, potential adopters are conditioned to view all future innovations with apprehension.

One indication of the compatibility of innovation is the degree to which it meets a need felt by the clients. Change agents seek to determine the needs of their clients, and then recommend innovations to fulfill these needs. Change agents must have a high degree of empathy and rapport with their clients in order to assess their needs accurately. When felt needs are met, a faster rate of adoption usually occurs. The compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption (Rogers, 1983).

3.3.5.3.-Complexity

Usually innovations are not adopted because they are not implemented correctly. Some require complex knowledge or skills. Some innovations are clear in their meaning to potential adopters while others are not. Complexity is a degree to which an innovation is perceived as relatively difficult to understand and use. For example, it may be necessary to introduce a package of several relatively simple but related innovations. Each on its own may be easy, but the relationship between them may be difficult to understand. For Rogers (1983), the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption.

3.3.5.4.-Triability

A farmer will be more inclined to adopt an innovation which he has tried first on a small scale on his own farm, and which proved to work better than an innovation he had tried immediately on large scale. The latter involves too much risk. Triability is the degree to which an innovation may be experimented with on

a limited basis. New ideas that can be tried on the installment plan will generally be adopted more rapidly than innovations that are not divisible. The innovation that is triable is less uncertain for the adopter. Rogers (1983) reported that in spite of strong evidence, the triability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption. Many studies support this statement.

3.3.5.5.-Observability

Observability is the degree to which the results of an innovation are visible to others. The results of some ideas are easily observed and communicated to others, whereas some innovations are difficult to describe to others. Farmers learn much from observing and discussing their colleagues' experiences. Their observations are often a reason to start these discussions. Most of the studies in diffusion research come to the point that the observability of an innovation, as perceived by members of social system, is positively related to its rate of adoption.

3.4 -STAGES IN THE ADOPTION DECISION MAKING PROCESS.

The preceeding sections have looked at the stages and factors that influence adoption of innovation. This section now describes the decision making process that are involved at the various stages of the adoption process

Sociologist have observed that individuals accept an innovation at varying times. Rogers (1983) conceptualizes that the individual passes through a multistage decision - making process from the time he first hears about an innovation until he finally adopts or rejects it. This process of decision making is not the same for every body. According to Rogers this decision making process includes the stage of knowledge or awareness, persuasion, decision, implementation (adoption) confirmation and evaluation stage. Based on the time it takes an individual to adopt an innovation Rogers (1962, 1983) revealed that

there are five categories of adopters namely; innovators, early adopters, early majority, latter majority, and laggards.

3.4.1.- Knowledge or awareness stage

The decision making process starts when the potential adopter becomes aware of the existence of an innovation and gains some knowledge about how it works. There are two competing explanations about how the individual learns about an innovation. First, since the individual gains the initial knowledge about an innovation mainly through communication channels that he does not purposely seek, for instance, from sales persons or advertising, becoming aware of an innovation may be seen as accidental (Boahem, 1995). On the other hand the awareness of an innovation does not necessarily come about in a passive way because the passive individual's predisposition may persuade him towards certain communication messages and the possible impact that such messages are likely to have (Hassinger, 1959). In line with this reasoning, the potential adopter actively seeks for information about an innovation in helping to solve a particular problem or need. The validity of each of these explanations depends on the innovation and the social system. In our research, it can be said that becoming aware of Mucuna for soil management, is an endeavor caused probably by the need to improve soil fertility or fight spear grass.

3.4.2.- Persuasion stage

Persuasion is the stage where the potential adopter forms an opinion either favorable or unfavorable about the innovation. In this stage thinking is more effective. Persuasion is related to understanding the perceived risk associated with the innovation or evaluating the consequences of using it (Engels *et al.*., 1987). At the persuasion stage the potential adopter examines the expected loss of switching from the existing technology. The expected benefit of the innovation is influenced by the risk associated with the innovation as well as the cost of investment. The individual will also evaluate the extent to which the adoption of

the innovation will enhance his social approval, (or status). The level of social approval expected from adoption of the innovation may be linked with whether or not the innovation fits into the cultural values of the society. The potential adopter can reduce the perceived risk associated with the innovation by acquiring more information about the innovation.

3.4.3.- Decision stage

The decision stage entails the eventual choice between using or rejecting an innovation. At this stage, the individual may consider the possibility of trying the innovation on a partial basis to determine its relevance to his situation. Institutions and extension agents often speed up the decision process by sponsoring demonstration, example of Mucuna "P.T.P" by SG2000 in Benin. The effectiveness of the demonstration is strengthened if the demonstrators are opinion leaders (Pointius, 1983).

3.4.4.- Implementation stage

This stage occurs when the potential adopter puts the innovation into use. In our research implementation stage is when farmer decides to grow Mucuna in his field for fighting spear grass or/and for improving soil fertility.

The problems that the individual has to deal with at the implementation stage include how to acquire the innovation and its complementary inputs and how to design measures to deal with problems that result from using the innovation. These problems may vary from an individual to another.

3.4.5.- Confirmation stage

Confirmation refers to the process by which the adopter obtains and seeks reinforcement for the adoption decision. There is usually the possibility that the adopter can reverse to earlier practice if the innovation does not meet his expectations, if he is exposed to conflicting messages; if the innovation is not fully integrated into the standard practices; or if the innovation is incompatible with existing lifestyles (Foster, 1964; Paul, 1990).

3.4.6.- Evaluation stage

When the decision is made in favor of the innovation, the innovation is used (implementation stage). If the individual is not confident about his action, he seeks reinforcement (confirmation stage) from reliable sources, and the information he receives can either let him reserve his decision or continue with the innovation.

CHAPTER FOUR

4.0.- METHODOLOGY

This chapter provides a description of area of study and how the data for the study were collected and the nature of data obtained. It also explains the problems encountered in obtaining the data. The following are discussed under this chapter;(a) area of study, (b) sampling procedure, (c) field work, (d) assessment of the field work (e) data analysis technique.

4.1.- AREA OF STUDY

The study covered three of the six regions of the Republic of Benin. Republic of Benin is a country in West Africa which shares common boundaries with, the Republic of Niger in the North, the Republic of Burkina Faso in the North West, the Republic of Togo in the West and Federal Republic of Nigeria in the East; in the South the country is bounded by the Atlantic Ocean.

In the country most people live in rural areas. According to the 1992 general census 1,812,975 inhabitants, which represents more than 80% of the active population are engaged in agricultural activities (INSAE 1993) and their major source of income is agriculture.

The country lies within the tropics. The climate is subtropical; the annual rainfall ranges from 1100 mm to 1500 mm. The annual evapotranspiration is below 1000 mm. The relief show three main geographical zones: The coastal plain, the low land and Atacora mountains.

Three main ecological zones can be considered in the country: North zone characterized by unimodal rainfall, South zone characterized by bimodal rainfall with one minor season and one major season; the center of the country represents the transition zone. In order to have respondents in the three ecological zones one region was selected per zone. Borgou, Mono, and Zou region were selected.

4.1.1.- Borgou Region

Borgou region is located in the northern part of Benin Republic between north latitude 8°.5 and 12°.5. It is the widest region of the country with 51,000 km square.

The climate is sudono- guinean and it becomes progressively sahelo-sudanese at the extreme-north. It is characterized by two seasons. The annual rainfalls ranges from 600 to 1,000 mm with two peacks occuring in August and in September.

Three major types of soil can be distinguish in this region; Niger's valley soils, Kandi sandstone soils, and the granito gneiss socle soils which are more extended and suitable for agriculture.

The vegetation is of Sudan type constituting of large expense of dry-land savanna with light bushes and relatively few trees.

With only 575,000 inhabitants Borgou region represents the least densely populated region of the country. The population density is 12 inhabitants per square kilometers. Borgou peasants agriculture is characterized by shifting cultivation, low investments and low productivity. Most farmers use traditional hand tools. The annual production is dominated by food crops like sorghum, yam, cassava, and millet. The most important cash crop is cotton.

4.1.2.- Mono region

This study was also carried out in Mono region corresponding to the southern-Western part of the country. It covers 3,800 square kilometers or 3.4 percent of the total area of the country.

The Mono region has a semi-equatorial climate characterized by the minor variation of temperature and by two rainy seasons alternating with dry seasons. The average rainfall per annum is around 1,100 mm with peak in July and October.

In the northern part of the region, the soils are the deep clay type with high organic elements and therefore has a high potential for agriculture. In the southern part soils are of a stable structure with dark clay. But all these soils which are suitable have either been under-cultivated or not cultivated at all for technical, social or economic reasons.

The population of the region is around 578,000 inhabitants made up of 31 percent active farmers. This population is young (majority have stayed for less than 15 years in the region). The population density is 150 inhabitants per square kilometers. The pattern of family life is a traditional one. The economy is mainly of a subsistence nature. The annual agricultural production is dominated by food crops like maize and cassava. The most important cash crop are cotton and oil palm.

4.1.3.- Zou region

Zou region is a transition zone between the south and the north of the country. The climate of Zou region corresponds essentially to the transition between the sub-equatorial climate and Sudan-Guinea type. This climate is characterized by a bimodal distribution of rainfall with peaks in June and in September and a period of lower precipitation in August. The annual rainfall is variable, ranging from 1,100 mm to 1,200 mm.

The soils are classified into three groups; "terre de barre"soils, crystalline bed rock soils, vertisoils and hydromorphic soils.

The natural landscape has been destroyed by man's actions. The original forest has disappeared with repeated land clearings, cutting of fire wood, bush

fire, leading progressively to woody savanna . In the southern part of the region the natural oil palm trees are predominant.

The population was estimated to be 691,000 inhabitants. This population is young (majority have stayed less than 15 year in the region) but it is unequally distributed. Zou population is subject to rural exodus and various migratory movements. The population density is 40 inhabitants per square kilometers. In fact, low profitability of agricultural work, family and village social pressure, idealized prospects offered by schooling, induce the withdrawal of agricultural manpower, on either permanent (rural exodus towards cities) or temporary (emigration) basis.A summary of the three study zones are shown in table 2 below.

TABLE 2.- CHARACTERISTICS OF THE STUDY AREAS

	BORGOU	MONO	ZOU
GEOGRAPHY	Northern part of Benin. 51,000 square kilometers	Southern - Western part of Benin.3,800 square kilometers	Transition zone between the south and the north. 18,700 square kilometers
CLIMATE	Sudono - Guinea and sahelo-sudanese	Semi-equatorial	Transition between the sub - equatorial and soudano-guinean
SOIL	SaheloSudanKandi'sandstone granito gneiss socle soils	Deep clayish Dark clay	Terre de barre crystalline,vertisoils, and hydromorphic soils.
VEGETATION	Sudan type		Woody Savannah
POPULATION	575,000 in habitants	578,000 in habitants	671,000 inhabitants.

SOURCE: Inst. Nation. des Stat. in Berger, 1987; survey 1997.

4.2.- SAMPLING PROCEDURE

The procedure of selection of regions, selection of farmers and selection of extension workers is presented in this section.

4.2.1.- Selection of regions

Benin country is divided into three main ecological zones, which are north central, and southern zones. The country is made up of six regions, to be sure that the sample was representative, one region was selected from each zone. Three of the six regions of the country were selected for the study using simple random sampling.

The north zone is divided in two regions Borgou and Atacora. The two regions of that zone were arranged and a serial number were assigned to each. The same serial numbers were written on pieces of paper to correspond to the number of regions (two). The two pieces of paper with the number written on them, were put in a hat and well shuffled. One piece of paper was drawn and constituted the number of the selected region. The piece of paper correspond to Borgou region.

In the central zone there is only one region which is Zou region. In this zone no selection was needed. Zou region was considered as selected.

The southen zone is divided into three regions Atlantic, Mono and Oueme. These three regions of the country were arranged and a serial number were assigned to each. The same serial number was written on pieces of paper to correspond to the number of regions (three). The three pieces of paper with the number written on them, were put in a hat and well shuffled. One piece of paper was drawn and constitute the number of the selected regions.

4.2.2.- Selection of villages

To be sure that all the respondents had an equal chance to hear about Mucuna, only villages in which SG2000 has an extension agent were considered. SG2000 villages were listed and serial numbers were assigned to each. The same serial numbers were written on pieces of paper to correspond to the number of villages. The pieces of paper, with the numbers written on them, were put in a hat and well shuffled. Five pieces of paper were drawn one after the other, after each

draw, the remaining papers were shuffled before another paper is drawn. This process was carried out differently for each of the three regions until the total of five villages were selected for each of selected region.

VILLAGES SELECTED FOR THE STUDY

REGIONS	*VILLAGES*
Borgou	Tourou
	Beterou
	Badekparou
	Sirarou
	N'dali
Mono	Klouekamey
	Ahlassamey
	Adoukandji
	Aplahoue
	Zouzouvou
Zou	Agoua
	Bante
	Cove
	Dassa
	Kpakpassa.

4.2.3.- Selection of farmers

To obtain a representative sample of farmers for the study, ten (10) farmers were randomly selected from each selected village.

The names of farmers provided by the extension agents of the villages were arranged and serial numbers were assigned to each. The same serial numbers were written on pieces of paper to correspond to the number of farmers. The pieces of paper with the number written on them, were put in a hat and well shuffled. The pieces of paper were drawn one after the other, after each draw, the

remaining papers were shuffled before another paper is drawn. This process was carried out until the total ten (10) farmers were randomly selected in each selected village. A total number of 150 farmers (10 x 5 x 3) constituted the respondents sample of the research. In other words, 50 respondents were selected from each region of study.

4.2.4.- Selection of extension workers

All the extension workers of selected villages were interviewed. Since there were only 15 villages selected from the three regions, with one extension worker per village, the 15 extension workers of the selected villages constituted the extension workers sample for this study.

4.3.- FIELD WORK

4.3.1.- Selection and training of field assistants

There were a number of reasons which made it necessary to spend considerable time on selecting and training the field assistants who served as interviewers. First, it was important to recruit assistants who would have time and endurance to visit the farmers who lived in remote villages and also be willing to work at unusual periods, if necessary. Further, it was essential to get the assistants with the required experience and educational training who could translate the questionnaire as precisely as possible into the local languages; Mina, Nagot, Fon, Dendi, Bariba. The questionnaire was drafted in French and it was the duty of the assistants to translate it into the local language. In order to increase the confidence of farmers it was important to select interviewers with whom the farmers could identify, namely assistants from the same ethnic group or locality as the farmer.

In that regards, two assistants were selected in Mono region. One could speak "Mina " (south Mono language) and the second could speak "Adja"(north Mono language). Two assistants were selected in Zou region, one speaks "Fon"

(south Zou) and the second speaks "Nagot " (north Zou). In the north of the country only one assistant was selected because, he could speak both the "bariba" and "Dendi" language spoken in that part of the country. A total of five (5) assistants were selected and trained. The training was conducted by the researcher himself .

During the training, the assistants where briefed on the objectives of the study in order to be clear in their minds the purpose of the study. They where taken through the questionnaire question by question. This was done to ensure that they all obtained similar understanding of the questions. They were also taken through note taking and recording of responses. They were briefed adequately on how to relate well with the respondents to have and sustain their cooperation during the interview sessions. As part of their training the assistants were made to partake in pretesting the questionnaire on some selected farmers.

4.3.2.- The trial interview or pretest.

Twenty trial interviews were done to test the questionnaire and also to ensure that the interviewers had understood the orientation session (training of assistants). In addition, the trial interviews helped us to determine the time needed for an interview and to work out the critical point beyond which the farmer would become ineffective and disinterested in giving reliable answers and where the interview could stop for a while.

Among the measures taken to address some of the problems which arose during the trial interviews were the following: The farmers who were not familiar with the metric system of measurement (hectares) may answer question about farm sizes in other local units (quanti, n'la, ekpa, etc.). Such answers were later interpreted into hectares.

4.3.3.- Data gathering

The data collection instrument was essentially the structured questionnaire. Two types of questionnaires were used to obtain information from respondents,

one for farmers and the other for the extension agents. The questionnaire contained both closed and open-ended questions.

The questionnaires were developed based on the objectives of the study. Several draft copies of the questionnaires were drawn up, reviewed and revised to ensure that they did not only seek answers to the research questions but that they were also valid and reliable. This was done by making the questionnaire available to the supervisor of the study, and to colleagues to read through and offer their criticisms and suggestions.

Basically two types of information were obtained from the farmers, namely information relating to personal characteristics including the economic situation, and information about soil management practices of individual farmers (see appendix 1 for questionnaire).

In addition discussions were held with SG2000 staff and researchers of IITA and National Research Program to identify extension strategy used by SG2000.

4.4.- ASSESSMENT OF THE FIELD WORK

The interviews involving the educated farmers went faster than those involving the farmers with little or no formal education. Some farmers had the tendency to digress from answering the specific questions asked and give account of the history of their farming activities. This prolonged the length of interview to two hours or more, instead of one hour maximum.The farmers' list provided by some extension agents were not current. This resulted in the sampling of some farmers who had died or moved away from their village.

Despite the fact that farmers gave interviewers appointment for interviews, some times they did not make themselves available at the scheduled times. All this limitation prolonged the length of field work.

There are, however some positive indication about the fieldwork. The majority of the farmers did not seem suspicious in answering questions primarily because they believed the research was relevant to them. Further, the study topic was not culturally sensitive. Some of the farmers took the responsibility of explaining the research to other farmers who had some doubts about the research. The local extension agents felt good to help because most of them either fully understood the academic aim of the research or they thought the study would help remind the authorities to improve their working conditions.

4.5.- DATA ANALYSIS

Farmers' decision making regarding a new technology or innovation are often complex. The purpose of this analysis was to try to use a range of statistical procedures to identify the most important factors that influenced adoption.

In this study data collected was coded and computerized using DBASE IV software. SPSS statistical tools helped in the processing of the data. Descriptive and inferential statistics were used in the analysis of quantitative and qualitative data collected. Specifically, frequencies and percentages were used to show the extent of adoption of recommended Mucuna practices. Chi-square (X^2) was employed to measure the relationships between the selected variables or characteristics of farmers and adoption of Mucuna practices . Therefore it was possible to determine the major factors that affected farmer's adoption of Mucuna practices. Also Chi-square (X^2), was calculated to determine whether there were any significant differences between the selected regions as far as selected variables were concerned.

CHAPTER FIVE

5.0-FINDINGS

In this chapter, the major findings of this study are presented. Tables are used to show percentages, frequencies and Chi-square obtained from data analysis.The findings are presented under the following headings: (a) reasons for Mucuna adoption, (b) personal and socio-cultural characteristics of respondents and their relation with Mucuna adoption, and (c) factors to consider in promotion of Mucuna in Benin.

5.1.- REASONS FOR ADOPTION BEHAVIOR

For this study three categories of adoption behavior were considered; Adopters, Non adopters, and Disadopters.

Adopters are farmers who after the initial adoption of Mucuna continue to use it in their farm for soil improving and or for spear grass control.

Non adopters are farmers who have never used Mucuna in their farm for soil improving or for spear grass control.

Disadopters are farmers who after initial adoption of Mucuna in their farm for soil improving or/and spear grass control stopped growing it for these purposes.

Table 3a below reveals that 82 farmers representing 54.67% of the sample were adopters. Forty-six percent of these adopters were in Borgou and twenty-seven were in Zou and twenty-seven in Mono.

Fifty-five respondents had never grown Mucuna in their farm. Forteen percent of them are in Borgou 47.27% in Mono and 38.18% are in Zou. Thirteen of the selected farmers were disadopters.

TABLE 3a.- DISTRIBUTION OF FARMERS ACCORDING TO THEIR ADOPTION BEHAVIOR

	BORGOU	MONO	ZOU	TOTAL
ADOPTERS	38	22	22	82(54.67%)
DISADOPTERS	4	2	7	13(8.67%)
NONADOPTERS	8	26	21	55(36.67%)
TOTAL	50	50	50	150(100%)

SOURCE: FIELD SURVEY 1997

Analysis of table 3b below showed there was a statistically significant difference between regions as far as adoption of Mucuna by farmers is concerned. Chi- square calculated value (13.77) is larger than the table chi-square at 0.001 level.

TABLE 3b.-DIFFERENCE BETWEEN REGIONS AS FAR AS MUCUNA ADOPTION IS CONCERNED

	BORGOU	**MONO**	**ZOU**	χ^2	**P**
ADOPTION	38	22	22	13.77	0.001
NON ADOPTION#	12	28	28		

SOURCE: FIELD SURVEY 1997, Df= 2, P< 0.001
(NON ADOPTION#) represents non adopters and disadopters

To show the region which is responsible of the difference in adoption of Mucuna chi- square was calculated as presented in table 3c below.

Analysis of table 3c revealed that there is a significant difference between Borgou and Mono, also there is a significant difference between Borgou and Zou, but there is no significant difference between Zou and Mono. The difference that

exist between regions as far as Mucuna adoption is concerned is due to Borgou region. Adoption of Mucuna is higher in Borgou than the other selected regions.

TABLE 3c.-DIFFERENCE BETWEEN TWO REGIONS AS FAR AS MUCUNA ADOPTION IS CONCERNED (Borgou/Mono, Borgou/Zou, Zou/Mono).

	Adopters	Disadopters	Non-adopters	X^2	P
Borgou	38	4	8	**14.46****	0.00072
Mono	22	2	26		
Borgou	38	4	8	**10.91****	0.00426
Zou	22	7	21		
Zou	22	7	21	**3.31 n.s**	0.1911
Mono	22	2	26		

SOURCE: FIELD SURVEY 1997
** = *positive significant*
n.s = non significant

5.1.1.-Reasons for Mucuna adoption

Table 4 below shows that there are four major reasons why farmers grow Mucuna in Benin Republic. Fifty-seven percent of respondents mentioned that they grow Mucuna because it is the best method for soil regeneration, while 34%

think that Mucuna technology is the best method for grass reduction. Some respondents have adopted Mucuna only because they have poor land and they need to improve it. Some respondents have adopt Mucuna just because it is easy to grow.

TABLE 4.- REASONS FOR USE OF MUCUNA

REASONS	PERCENTAGE	FREQUENCY
Best method for soil regeneration	57	86
Best method for grass reduction	34	51
Have poor land problem	19.3	29
Easy to grow	0.7	11

SOURCE: FIELD SURVEY 1997
Total of percentages > 100 because of multiple response.

5.1.2.- Reasons of nonadoption Mucuna

TABLE 5.- REASONS WHY SOME FARMERS DO NOT GROW MUCUNA

REASONS	PERCENTAGE	FREQUENCY
Lack of Labor	42.3	64
Poor understanding	40.7	62
Shelters reptiles	27.3	41
Uses not known	24.7	38
Not edible	19.3	30
Lack of seed	15.3	23
Poor market	7.3	11
No interest	4	6
Land not available	4	6
Difficult to grow	2	3
Lack of information	2	3

SOURCE: FIELD SURVEY 1997

Total of percentages >1oo because of multiple response.

According to respondents there are eleven reasons that prevents adoption of Mucuna in the study area. Table 5 above shows reasons why some farmers do not grow Mucuna. These reasons are; Lack of Labor, Poor understanding of the innovation, Mucuna shelters reptiles, Uses not known, Not edible, Lack of seed, Poor market, No interest, Land not available, Difficult to grow, Lack of information. The most important problems are lack of labor and lack of understanding.

5.1.3.- Reasons of disadoption

According to respondents reasons why some farmers stopped growing Mucuna were; Lack of land, Lack of labor, Poor market, Mucuna is not edible, Difficult to harvest. Table 6 below presents a list of reasons why some farmers stopped growing Mucuna and the percentage of respondents per reason given.

TABLE 6.- REASONS WHY SOME FARMERS STOPPED GROWING MUCUNA

REASONS	FREQUENCY	PERCENTAGES
Lack of land	102	68
Lack of labor	40	24.7
Poor market	32	21
Mucuna is not edible	29	19.3
Difficult to harvest	12	8
Field problems	11	7.3
Bad result	11	7.3
Uses unknown	9	6

SOURCE: FIELD SURVEY 1997

Total of percentages >1oo because of multiple response.

5.2.- PERSONAL AND SOCIO-CULTURAL CHARACTERISTICS OF RESPONDENTS AND THEIR RELATION WITH MUCUNA ADOPTION

This section presents Personal and Demographic characteristics of respondents, and the relation of those characteristics with adoption of Mucuna

5.2.1.- Personal characteristics of respondents

Ninety two percent of respondents were males while only 8% were female.

5.2.1.1.-Age

For the purpose of this study two categories of ages were considered. Those respondents more than 30 years old (Age >30) and those respondents less than 30 years old (Age>30) as indicated in table 7.

Table 7 below shows that 125 farmers representing 83.33 percent of the respondents were more than 30 years and about 16.67% respondent were less than 30 years. In Borgou about 31.33% of the respondents from that region were more than 30 years old whilst in Mono and Zou only 26.67% and 25.33% of them respectvely were more than 30 years old.

TABLE 7- DISTRIBUTION OF RESPONDENTS ACCORDING TO THEIR AGE[1,2]

AGE	BORGOU	MONO	ZOU	TOTAL
< 30	.3(2)	10(6.67)	12(8)	25(16.67)
> 30	47(31.33)	40(26.67)	38(25.33)	125(83.33)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE FIELD SURVEY 1997.

[1] *Percentages in brackets*

[2] *Key:* *< 30 = age is less than 30*

> 30 = age is more than 30

$X^2 = 6.70$

$P < 0.01$

Analysis of contingency table showed that there was no statistically significant relationship between age and region, because obtained value of Chi-square is less than the critical values of the chi-square distribution at 0.01 level. In others words age of respondents is not associated with region in the study area.

5.2.1.2.-Martial status

For this study two categories of marital status were considered: married and not married as shown in table 8 below.

Majority of respondents were married. Ninety-four percent were married while the remaining 6 percent were single. In Borgou only 0.66% respondents were not married whilst in Mono and Zou 2.66% were not married.

TABLE 8.- MARITAL STATUS

	BORGOU	MONO	ZOU	TOTAL
Married	49(32.66)	46(30.66)	46(30.66)	141(94)
Not Married	1(0.66)	4(2.66)	4(2.66)	9(6)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE FIELD SURVEY 1997

Percentages in brackets

5.2.1.3.-Level of education

For this study two levels of education were considered. Schooling and no schooling. Those who had received formal education are considered as schooling and those who had not received any formal education as no schooling. The number of respondents per region and per categories are shown in table 9 below.

TABLE 9.- LEVEL OF EDUCATION[1]

	BORGOU	MONO	ZOU	TOTAL
Schooling	16(10.66)	9(6)	18(12)	43(28.66)
No schooling	34(22.66)	41(27.33)	32(21.33)	107(71.33)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE FIELD SURVEY 1997 X^2=4.368, P <0.1, Df=2

Percentages in brackets

Table 9 above shows that very few respondents (28.66 percent), had received formal education (primary or secondary school), while majority of them (71.33 percent) did not have any form of education. In Mono there were 27.33% of respondents who had not received any aducation as 22.66% in Borgou and 21.33% in Zou. Analysis of contingency table showed there was no statistically significant relationship between schooling and region, because obtained value of Chi-square is less than the critical values of the chi-square distribution at 0.10 level. This means that the education level is independent of the region.

5.2.2.- Demographic characteristics of the respondents.

The demographic characteristics that were considered in this study are: number of farms, number of children, kind of labor, and origin of land.

5.2.2.1- Number of farms

Within the three selected regions the number of farms ranged from 1 to 9. But in Borgou the mean was 1.92 and the maximum was six. In Mono and Zou the mean was 2.66 and 2.88 respectively whilst the maximum was nine and seven respectively. In Borgou the number of individual farms is lower than in the other sampled regions.

Data analysis shows that the largest farm size (70 hectares) was in Zou and the smallest (0.30 hectare was in Mono).

5.2.2.2- Number of children

The average number of children per respondent varied from one region tothe other. In Borgou, the average number of children per respondent is 6.70. In Zou and Mono it is 7.80 and 7.46 respectively.

5.2.2.3- Source of labour

This study revealed that there are several source of labour in the study area: Family labour, cooperative labour, hired labour. Majority of farmers in Borgou use family labour, whilst in Mono and Zou majority of farmers use family labour and hired labour, in addition in Zou there are all the other sources of labour but in Borgou there are only two sources of labour: family labour and hired labour.

5.2.2.4- Land ownership

Two categories of land ownership were identified in the study area: inherited land and non inherited land. Inherited lands refers to those lands which were inherited for farming purposes. Non inherited land including lands that were rented, purchased or owned for farming purposes as well as those that are cultivated share holding basis. Distribution of respondents per category and per region is shown in table 10 below. Most of the farmers who owned the lands on which they farmed, acquired it through the cultivation of virgin forest.This type of

land acquisition is rare today but exist in some parts of Zou (North Zou) and Borgou.

TABLE 10.- LAND OWNERSHIP

	BORGOU	MONO	ZOU	TOTAL
Inherited	38(25.33)	24(16)	10(06.66)	72(48)
Non Inherited	12 (8)	26(17.33)	40(26.66)	78(52)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE FIELD SURVEY 1997. $X^2 = 31.41$, Df=2 P< 0.0001

Percentages in brackets

Analysis of contingency table indicated that there was a statistically significant difference between the two sets of categories because obtained X^2 (31.41) is greater than a table chi-square at 0.001 level. In others words source of land for farming differ from one region to other in the study area.

5.2.2.5- Ethnicity

Data collected revealed that, 99.3 percent of the respondents were Beninois and only one (0.7 percent) was a foreigner. Also 49 respondents (33 percent) were not farming in their native locality while 101 farmers (67 percent) were farming in their native village.

5.2.2.6- SG2000 contact farmer Membership

The selected farmers fell into two main categories SG2000 contact farmers and Non SG2000 contact farmers. Table 11 below gives a distribution of the farmers in the two categaries in the region.

TABLE 11.- DISTRIBUTION OF FARMERS ACCORDING TO THEIR CONTACT WITH SG2000

	BORGOU	MONO	ZOU	TOTAL
SG2000 contact farmers	22(14.66)	13(8.66)	31(20.66)	66(44)
Non SG2000 contact farmers	28(18.66)	37(24.66)	19(12.66)	84(56)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997 X^2= 14.54, Df = 2, P< 0.001

Table 11 above shows that 44% of the respondents were SG2000 Contact farmers. Majority of them were in Zou whilst the rest were in Mono. Analysis of contingency table showed there was a statistically significant relationship between the two set of categories because obtained value of Chi-square is greater than the critical values of the chi-square distribution at 0.001 level.

In other words memberships is assumed to be associated with the region. Number of SG2000 contact farmers differ from one region to another. Zou has more SG2000 contact farmers than Borgou who also have more SG2000 contact farmers than Mono.

5.2.3.- Relationship between socio-cultural characteristic of respondents and adoption of Mucuna

Data analysis presented in table 12 below shows that there was no significant relationship between. Level of schooling, marital status, number of children, age, and adoption of Mucuna. However, number of farms owned by respondents had a significant relationship with adoption of Mucuna at P<0.05 level.

TABLE 12- RELATIONSHIP BETWEEN SOCIO ECONOMIC CHARACTERISTIC OF RESPONDENTS AND ADOPTION OF MUCUNA.

	ADOPTERS	NON ADOPTERS	DISADOPTERS	(X^2)	PROBABILIY
Level of schooling					
Literate	**22**	**16**	**5**	**0.750**	**n.s**
Illiterate	**60**	**39**	**8**		
Marital status					
Married	**82**	**53**	**13**	**#**	**#**
Not married	**0**	**2**	**0**		
Age					
<30	**14**	**9**	**2**	**0.029**	**n.s**
>30	**68**	**46**	**11**		
Number of farms					
<2	**47**	**42**	**6**	**6.952***	**0.05**
>2	**35**	**13**	**7**		
Number of children					
<2	**16**	**15**	**4**	**1.548**	**n.s**
>2	**66**	**40**	**9**		

SOURCE: FIELD SURVEY 1997,

Key: *n.s = Non Significant*

** = Significant at 0.05 level*

 # = X^2 not calculate because two cells have 0 respondents

Df =2

5.2.2.7- Level of schooling

The level of education ranges from no schooling to secondary school. Majority of adopters (73.1%) are illiterate whilst 29% have received education in primary school (less than six years of formal education) and only 11% have received education up to secondary school. Study also shows that 37.20% of educated farmers are non adopters. Nevertheless in an interview with extension agents in charge of these study villages they mentioned that it was easier for them to hold discussions with farmers who have had at least some education of primary school. They claimed it was easier and simpler for such farmer to understand what extension agents teach them.

Analysis of contingency table showed there was no statistically significant difference between level of education and Mucuna adoption. Chi- square

calculated value is less than the table chi-square at 0.10 level. So it is assumed that adoption of Mucuna is not associated with level of education.

5.2.3.1- Number of children

Number of children of respondent is not also a significant factor in determining adoption of Mucuna as soil management practices.

Analysis of contingency table showed there was no statistically significant difference between adoption of Mucuna and Number of children. Chi- square calculated value is less than the table chi-square at 0.10 level. So it is assumed that adoption of Mucuna is not associate with number of children

5.2.3.2- Number of farms

Number of farms of respondent is a significant factor in determining adoption of Mucuna as soil management practices.

Analysis of contingency table showed there was a statistically significant difference between number of farms and adoption of Mucuna by farmers. Chi-square calculated value (6.952) is larger than the table chi-square at 0.05. This result shows that adoption of Mucuna in dependent on the number of farms

5.2.3.3- Marital status

Hundred percent of adopters are married will 96% of non adopters are also married. There is no significant relationship between that variable and adoption of Mucuna.

5.2.3.4- Age

Age of the farmers as shown in table 12 above is not significantly correlated with adoption. Majority of adopters (82.93%) are more than 30 years old and majority of non adopters (83.64%) are more than 30 years old

Analysis of contingency table showed there was no statistically significant difference between adoption and age of farmer. Chi- square calculated value is less than the table chi-square at 0.10 level. So it assumed that adoption of Mucuna is not associate with age of farmer

5.3.- SITUATIONAL FACTORS AND THEIR RELATION WITH ADOPTION

This section presents the description of situational factors and the relation of these factors with adoption of Mucuna.

5.3.1. Description of situational factors

The situational factors that were considered are farm size, soil fertility and labour availability.

5.3.1.1 Farm size

As pointed out in the literature review in chapter three, farm size is nearly always positively related to adoption of new farm practices. It is important to know whether there was any difference among regions as far as farm size is concerned.

Table 13 below reveals that 78.66% of respondent's farm size is more than two hectares, but most of this categories of farmers are Borgou and Zou farmers. 21.33% of respondent's farm size is less than 2 hectares and Most of them (13.33%) are Mono farmers.

TABLE 13.- DISTRIBUTION OF RESPONDENT ACCORDING TO THEIR FARM SIZE

FARM SIZE	BORGOU	MONO	ZOU	TOTAL
Less than 2 ha	6(4)	20(13.33)	6(4)	32(21.33)
More than 2 ha	44(29.33)	30(20)	44(29.33)	118(78.66)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997 X^2 =15.01; P<0.001; Df = 2
key: ha= Hectare.
Percentages in brackets

Analysis of contingency table showed that there was a statistically significant relationship between the two set of categories because obtained value of Chi-square is greater than the critical values of the chi-square distribution at 0.001 level. Therefore it is assumed that farm size is associated with region.

5.3.1.2 Labor availability

It can be observed from Analysis of table 14 below that 45.33% of the respondents ascertained that labor is available while 54.66% recognized that labor is not available. Borgou region seems to have problem of labor than other selected regions. Fifty-eight percent of farmers of this region ascertained that labor is not available. But this difference is not statistically different with other regions.

Analysis of contingency table showed there was no statistically significant relationship between the two set of categories because obtained value of Chi-square is less than the critical values of the chi-square distribution at 0.10 level. Availability of labor is not associated with region.

TABLE 14.-DISTRIBUTION OF RESPONDENT ACCORDING TO LABOUR AVAILABILITY

LABOR	BORGOU	MONO	ZOU	TOTAL
available	21(14)	23(15.33)	24(16)	68(45.33)
not available	29(19.33)	27(18)	26(17.33)	82(54.66)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997, X^2 =0.38, Df = 2., P< 0.10

Percentages in brackets

5.3.1.3 Traveling

Table 15 below indicates that 27 farmers (18. percent of respondents) had never traveled out from their villages. Majority of the respondents were cosmopolite. About 82 percent said that they had travelled out from their village within the country or out side the country. Forty percent of farmers in Zou had never travelled from their village against 2% in Borgou and 12% in Mono.

TABLE 15.- DISTRIBUTION OF RESPONDENTS ACCORDING TO FREQUENCY OF TRAVEL

	BORGOU	MONO	ZOU	TOTAL
Have traveled	49(98)	44(88)	30(60)	123(82)
Never traveled	1(2)	6(12)	20(40)	27(18)
TOTAL	50(100)	50(100)	50(100)	150(100)

SOURCE: FIELD SURVEY 1997, X^2 (26.28), Df =2, P< 0.0001

Percentages in brackets

Analysis of contingency table showed there was a statistically significant relationship between the two set of categories because obtained value of Chi-square is greater than the critical values of the chi-square distribution at 0.001 level. This difference results from Borgou region where the observed frequency of farmers who had traveled was higher than expected and Zou region where observed value of farmers who never traveled is higher than expected. So we can conclude that Borgou farmers traveled more than Zou and Mono farmers. Traveling is associated with a region.

5.3.1.4 Categories of tools

Two categories of tools were considered in this study: "manual tools only" those farmers who used only manual tools for farming, and " manual tools with others" are those who used tractors and or animal traction in addition. Number of respondents per category and per region are shown in table 16 below.

The table shows that 87.33% of respondents used manual tools only for farming. Users of other tools such as tractors was not common. Thirty-four

percent of farmers in Borgou used other tools as tractors and animal traction against only 2% in Mono and 4% Zou. This result indicated that Borgou farmers use improved tools than farmers of the others regions (Mono and Zou).

TABLE 16.- NUMBERS OF RESPONDENTS PER CATEGORY OF TOOLS USE

TOOLS	BORGOU	MONO	ZOU	TOTAL
Manual tools only	34(68)	49(98)	48(96)	131(87.33)
Manual tools with others	16(32)	1(2)	2(4)	19(12.66)
TOTAL	50(100)	50(100)	50(100)	150(100)

SOURCE: FIELD SURVEY 1997

Percentages in brackets

5.3.1.5 Awareness of the use of cover crop for soil management.

The data collected shows that in Borgou 84% of the respondents were aware of the use of cover crop for soil management, and that for Zou was 68% However in Mono only 80% of respondent were aware of the use of cover crops. In total 77.33% of respondents were aware of the use of cover crop, whilst 22.67% were not as indicated in Table 17 below

TABLE 17.- DISTRIBUTION OF FARMERS ACCORDING TO THEIR AWARENESS OF THE USE OF COVER CROP FOR SOIL MANAGEMENT

Awareness of the use of cover crop	**BORGOU**	**MONO**	**ZOU**	**TOTAL**
YES	42(28)	40(26.66)	34(22.66)	116(77.33)
NO	8(5.33)	10(6.66)	16(10.66)	34(22.67)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997

Percentages in brackets

5.3.1.6.-Source of information

The study also revealed that the principal source of information is village extension workers (V.E.Ws). Hundred and four (69.33%) farmers recognized V.E.Ws as their principal source of information.

TABLE 18.- DISTRIBUTION OF FARMERS ACCORDING TO THEIR SOURCE OF INFORMATION

Source of information	BORGOU	MONO	ZOU	TOTAL
V.E.Ws	38(25.33)	28(18.66)	38(25.33)	104(69.33)
OTHERS	12(8)	22(14.66)	12(8)	46(30.67)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997

Percentages in brackets

5.3.2.- Relation between situational factors and adoption of Mucuna

5.3.2.1- Labour availability and adoption of Mucuna

Labour availability has no significant relationship with adoption of Mucuna. Table 19 below shows that a total of non adopters said that labour is not available and 89 percent of adopters also said labour is not available. So it assumed that adoption of Mucuna is not associate with labour availability in the study area.

TABLE 19.- LABOUR AVAILABILITY

Labour	Adopters	Disadopters	Nonadopters	TOTAL
Available	9	2	0	11
Not Available	73	11	55	139
Total	82	13	55	150

SOURCE: FIELD SURVEY 1997

5.3.2.2- Soil fertility and adoption of Mucuna

Analysis of contingency for table 20 below shows that majority of respondents who said that their soil fertility is not good are adopters. So it is assumed that adoption of Mucuna is associated with soil fertility in the study area.

TABLE 20.- RELATIONSHIP BETWEEN SOIL FERTILITY AND ADOPTION OF MUCUNA

Soil fertility	Adopters	Disadopters	Nonadopters	TOTAL
Good	14	0	8	22
Not good	68	13	48	128
TOTAL	82	13	55	150

SOURCE: FIELD SURVEY 1997

We can observe from table 20 above that majority of non adopters have confirmed that their soil fertility is not good and majority of adopters also have confirmed that their soil fertility is not good .

5.3.2.3- Source of income

Agriculture is the principal source of income in the three selected regions. Analyses of data shows that 12% of farmers in Borgou have other sources of income apart for farming, whilst this percentage is 36% in Mono, and 38% in Zou as shown in table 21 below.

TABLE 21.- SOURCES OF INCOME

	BORGOU	**MONO**	**ZOU**	**TOTAL**
Farming	44(88)	32(64)	31(62)	107(71)
Others	6(12)	17(36)	18(38)	43(29)
TOTAL	50(100)	50(100)	50(100)	150(100)

SOURCE: FIELD SURVEY 1997; X^2=9.21, Df=2, P< 0.001,
Percentages in brackets

Analysis of contingency table showed there was a statistically significant relationship between the source of income and regions because obtained X^2 (9.21) is greater than the critical values of the chi-square distribution at 0.001 level. Source of income is assumed to be associate with region.

Their is no credit facility for farmers in the study area. For Mucuna cropping only seed is provided by SG2000.

Field survey (1997) revealed that farmers spend about 28000 FCFA to establish one hectare of Mucuna field as indicated in table 22 below.

There is no market to sell the output. Some respondents mentioned that if SG 2000 can assure them that they will come to buy their Mucuna yield every year they will grow Mucuna forever. It may be important to know that Mucuna growing does not need any fertilizer, or chemical.

TABLE 22.- COST OF CULTIVATION OF MUCUNA

Cost/hectare	BORGOU	MONO	ZOU	TOTAL
Mean	28100	29620	26270	28053
Minimum	10000	20000	10000	10000
Maximum	70000	40000	70000	70000

SOURCE: FIELD SURVEY 1997

5.4- INNOVATION FACTORS AND THEIR RELATIONSHIP WITH ADOPTION MUCUNA ADOPTION

Before the study of the relationship between the technological characteristics of Mucuna and adoption, the relationship between some characteristics of Mucuna technology and the selected regions will be presented.

5.4.1.-Relationship between some characteristics of Mucuna technology and the selected regions

In this section opinions of respondents concerning Mucuna as a technology for soil management practices are presented by region according to complexity,

triability, observability and compatibility of the innovation as show in table 23 below.

5.4.1.1-Complexity

Complexity is a degree to which an innovation is perceived as relatively difficult to understand and use.

Eighty-four percent of farmers in Mono against 66% in Zou and 74% in Borgou have found that Mucuna soil management practices is not difficult to understand.

Analysis reveals that there is a significant difference between zones as far as the variable "difficult" is concerned because obtained X2 (8.33) is greater than the critical values of the chi-square distribution at 0.05 level. The number of farmers who said this technologies is difficult is important in Zou than the other two regions. This means that in Zou farmers find it difficult to understand the technology.

Whilst majority of farmers in Borgou and Mono respectively 74% and 84% said that Mucuna is easy to integrate in their farming system,majority of farmers in Zou said that Mucuna is not easy to integrate in their farming system. Analysis of the contingency table showed there was a statistically significant relationship between this variable "Integrate" and selected zones since obtained X^2 (28.07) is greater than the critical values of the chi-square distribution at 0.001 level. Thus we might suspect that the significant X^2 was due largely to Zou farmers.

About the variable "consistent" analysis of contingency table indicated that there is no significant relation between this variable and region since the calculated X^2(3.29) value is less than the critical value, then "consistent" is assumed to be independent of region.

TABLE 23.- RELATIONSHIP BETWEEN SOME CHARACTERISTICS OF MUCUNA TECHNOLOGY AND THE SELECTED ZONES

	BORGOU	MONO	ZOU	TOTAL	DF	X^2
MUCUNA innovation Difficult to understand						
Yes	4	6	15	25(16.66)		
No	46	44	35	125(83.33)	2	8.33*
Total	50	50	50	150(100)		
MUCUNA ,is easy to intagrate in farming system						
Yes	37	42	18	97(64.66)		
No	13	8	32	53(35.33)	2	28.07**
Total	50	50	50	150(100)		
MUCUNA, is consistent with existing cultural value						
Yes	37	32	40	109(72.66)		
No	13	18	10	41(27.33)	2	3.29n.s
Total	50	50	50	150(100)		
MUCUNA can improve soil fertility						
Yes	39	42	43	124(82.66)		
No	11	8	7	26(17.33)	2	0.58n.s
Total	50	50	50	150(100)		
Do you fear MUCUNA						
YES	3	9	32	44(29.33)		
NO	47	41	18	106(70.66)	2	45.2***
Total	50	50	50	150(100)		
Are there Social constraints that prevent MUCUNA growing						
YES	8	7	14	28(18.66)		
NO	42	43	36	122(81.33)	2	3.82n.s
Total	50	50	50	150(100)		

SOURCE: FIELD SURVEY 1997

Key: * =p<o.o5; **=p<0.01; ***=p<0.001, n.s= no significance

For the variable "improved" analysis of contingency table revealed that there is no significant relation between this variable and region since the calculated $X^2(0.58)$ value is less than the critical value at 0.10 level. Then "Improved" is assumed to be independent of region. About fear of use of Mucuna

because it shelters reptiles, reaction of respondents is not the same across the zones.

In Borgou and Mono 78% of respondents said that they don't fear Mucuna but in Zou majority of farmers (58%) said that they fear Mucuna because it shelter reptiles. Chi-square shows a significant difference between zones as far as the fear of Mucuna use is concerned since obtained X2 (45.2) is greater than the critical values of the chi-square distribution at 0.001 level. Thus we might suspect that the significant X^2 was due largely to Zou farmers.

Table 23 revealed that here is no significant relation between the variable "social constraint" and regions, since the calculated X^2 (3.82) value is less than the critical value at 0.10 level. This variable is also independent of region.

5.4.1.2-Triability

A farmer will be more inclined to adopt an innovation which he has tried first on a small scale on his own farm, and which proved to work better than an innovation he has to adopt immediately on large scale. New ideas that can be tried on the installment plan will generally be adopted more rapidly than innovations that are not divisible.

The proportion of field occupied by Mucuna vary from 0% to more than 30% as show in Table 24 below.The proportion of field occupied by Mucuna ranges from 0% to 30%. Only 3.3 percent of farmers grow Mucuna in more than 30% of their farm. Mucuna innovation can be treid at small scale, therefore this innovation is triable.

TABLE 24.- DISTRIBUTION OF RESPONDENTS ACCORDING TO PROPORTION OF THEIR FIELD OCCUPIED BY MUCUNA

% of Farm size	0	0 - 10	11 -20	21 - 30	> 30	TOTAL
Frequency	68	28	42	7	5	150
Percentage	45.33	27.3	28	4.7	3.3	100

SOURCE: FIELD SURVEY 1997

5.4.1.3- Awareness of seed availability

For some respondents Mucuna seed is available, but for others Mucuna seed is not available. Distribution of respondents according to their awareness of seed availability is indicated in table 25 below

TABLE 25.-DISTRIBUTION OF RESPONDENTS ACCORDING TO THEIR AWARENESS OF SEED AVAILABILITY

	BORGOU	MONO	ZOU	TOTAL
Mucuna seed is available	24(16)	19(12.66)	16(10.66)	59(39.33)
Mucuna seed is not available	26(17.33)	31(20.66)	34(22.66)	91(60.66)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997, X^2= 2.72 n.s, Df =2, P< 0.10

Percentages in brackets

Table 25 shows that only 39.33 percent of respondents were aware of Mucuna seed availability. Majority of respondents 60.66 percent were not aware. Majority of respondents (40%) who were aware of availability of Mucuna seed were in Borgou against 28% in Zou and 32% in Mono.

Analysis of contingency table showed that there was no statistically significant difference between regions as far as seed availability is concerned. chi- square calculated value (2.72) is less than X^2 critical value at 0.10 level. Mucuna seed availability is independent of region.

5.4.1.4-Observability

Among the respondents who have adopted Mucuna there are farmers who perceived that after growing Mucuna their soil fertility have been improved whilst other do not see any soil improvement. Distribution of respondents according to their perception after growing Mucuna is showed in table 26 below.

Table 26 reveals that about 87 percent of those of respondents recognized that there is improvement of soil fertility and reduction of grass, after growing Mucuna., whilst 13 percent said that they don't see any improvement.

TABLE 26.- PERCEPTION OF FARMERS AFTER GROWING MUCUNA

	BORGOU	MONO	ZOU	TOTAL
Improvement of soil fertility	35	22	15	72(87%)
No improvement of soil fertility	3	0	7	10(13%)
TOTAL	38	22	22	82(100%)

SOURCE: FIELD SURVEY 1997;

Analysis of contingency table showed there was significant difference between regions as far as perception of farmers after growing Mucuna is concerned. Majority of farmers who grow Mucuna ascertain that their soil fertility have been improved. Perception of farmers after growing Mucuna doesn't vary from one region to another. Respondents recognized that Mucuna has ability to improve soil fertility. So Mucuna innovation is assumed to be observable.

5.4.1.5-Compatibility

Compatibility is a degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Study reveals that majority of respondents (82.66%) have confirmed that Mucuna technology is consistent with their norms. (see table 27) There is no statistical significant different between regions as far as this technology is concerned. Then Mucuna technology is supposed to be a compatible innovation in the study area.

5.4.2.- Relation between perception of Mucuna technology by respondents and adoption behavior

This study reveals difference that exist among farmers according to their perception of the attributes of Mucuna innovations. These attributes are: relative advantage, complexity, compatibility, trialability and observability. Table 27 below presents the proportion of respondents according to their adoption behavior and their perception of Mucuna innovation. In this table we can also observe the relationship between Mucuna technology and its adoption.Whilst 84% of respondent ascertain that Mucuna technology is not difficult to understand only 16% think that this innovation is difficult to understand. Chi-square shows a significant difference between categories of adopters as far as this variable is concerned since obtained X2 (5.7) is greater than the critical values of the chi-square distribution at 0.05 level. Whilst 50.67% of respondents ascertain that Mucuna technology is easy to integrate 49.33% think that this innovation is not easy to integrate in farming activities. Chi-square shows a significant difference between categories of adopters as far as this variable is concerned since obtained X2 (23.9) is greater than the critical values of the chi-square distribution at 0.001 level. Majority of adopters confirmed that it is easy whilst majority of non adopters ascertain that it is not easy to integrate Mucuna in their farming activities.

Majority of adopters agree that Mucuna technology is consistent with their existing values whilst minority of non adopters have the same opinion. Chi-square shows a significant difference between categories of adopters as far as this variable is concerned

TABLE 27.-RELATION BETWEEN PERCEPTION OF MUCUNA TECHNOLOGY BY RESPONDENTS AND ADOPTION BEHAVIOR

	ADOPTERS	DISADOPTER	NON ADOPTERS	TOTAL	Df	X^2	P
MUCUNA innovation Difficult to understand							
yes	18	0	6	24(16)	2	5.7	*
no	64	13	49	126(84)			
MUCUNA is easy to Integrate in farming system							
yes	65	2	7	76 (50.66)	2	23.9	***
no	17	11	48	74 (49.33)			
MUCANA is Consistent with existing values							
yes	75	8	26	109	2	33.2	***
no	7	5	29	(72.66) 41 (27.33)			
Do you know that you lost fertility if you burn MUCUNA field							
yes	67	2	7	76(50.66)	2	69.7	***
no	15	11	48	74(49.33)			
Are there Social constraints that prevent MUCUNA growing							
yes	1	0	4	5 (03.33)	2	#	#
no	81	13	51	145 (96.66)			

SOURCE: FIELD SURVEY 1997

* significant relation at 0.05 level, * *significant relation at 0.01 level, ***significant relation at 0.001 level,

X^2 note calculated

This findings is in accordance with Rogers (1983) who fund that the compatibility of an innovation as perceived by members of social system, is positively related to its rate of adoption .

Majority of farmers who know that they will loose soil fertility if they burn Mucuna field are Mucuna adopters, but in contrast majority of those who don't know are non adopters.

Data analysis reveals that there is no social constraint that prevent Mucuna adoption in the study area. The majority of; adopters, disadopters and non

adopters ascertain that there is no social constraint that prevent them to adopt Mucuna. Only five of the respondents revealed that in there family they dont grow bean.

5.5- EXTENSION FACTORS

In this section the distribution of the farmers according to their participation in extension activities in their locality shall be presented after which the relationship between extension factors and adoption of Mucuna shall also be discussed.

5.5.1.- Distribution of farmers according to their participation in extension activities in their locality.

Table 28 reveals that 112 respondents mentioned that they attend meetings organized by extension agent of their village (locality). Thirty eight farmers which represent 25.33 percent of our sample did not attend meetings organized by extension agents. Those who do not attend extension meeting argued that the extension agents do not invite them for the meetings but rather always invite only their friends. Some said that they were not aware of any meeting organized by extension agent.

We can also notice that majority of respondents (3o%) indicated who that they attend meeting organized by extension agent were in Borgou against only 17.33% in Mono.

Hundred and six respondents have frequent contact with extension agents, majority of them(40%) were Borgou farmers against 34% in Zou region and 26% in Mono.

Analysis of contingency table showed there was a statistically significant difference between regions as far as frequency of contact between extension agent and farmers is concerned. Chi- square calculated value (11.31) is larger than the table chi-square at 0.01 level.

TABLE 28.- DISTRIBUTION OF FARMERS ACCORDING TO THEIR PARTICIPATION ON EXTENSION ACTIVITIES IN THEIR LOCALITY

	BORGOU	MONO	ZOU	TOTAL	X^2 Value
DO YOU ATTEND MEETING ORGANIZED BY V.E.W.s?					
Yes	45(30)	26(17.33)	41(27.33)	112(74.66)	
No	5(3.33)	24(16)	9(3)	38(25.33)	21.22***
Total	50(33.33)	50(33.33)	50(33.33)	150(100)	
HOW OFTEN V.E.W CONTACT YOU					
Often	42(28)	28(18.66)	36(24)	106(70.66)	
Seldom	8(5.33)	22(14.66)	14(9.33)	44(29.33)	11.31**
Total	50(33.33)	50(33.33)	50(33.33)	150(100)	

SOURCE FIELD SURVEY 1997

Analysis of data also shows that there was a statistically significant difference between regions as far as attending meeting by farmers is concerned. Chi- square calculated value (21.22) is larger than the table chi-square at 0.001 level.

A hundred and ten respondents understand what extension agent teach them so, more than 98% of farmers who attend meeting understand what the extension agent teach. Borgou farmers understand extension messages better in contrast with Mono farmers where 46% of them do not understand what extension agents teach. Table 29 shows that in Borgou 42 farmers think that V.E.W behavior influence the way farmers follow his advice, in contrast 32 farmers in Mono and 27 farmers in Zou farmers think that V.E.W behavior do not influence the way farmers follow his advice.

TABLE 29.- DISTRIBUTION OF FARMERS ACCORDING TO THEIR PERCEPTION ON EXTENSION ACTIVITIES IN THEIR LOCALITY

	BORGOU	MONO	ZOU	TOTAL
P1				
Yes	46(30.66)	27(18)	37(24.66)	110(73.33)
No	4(2.66)	23(15.33)	13(8.66)	40(26.66)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)
P2				
Yes	42	18	23	83(55.33)
No	8	32	27	67(44.66)
TOTAL	50	50	50	150(100)
P3				
Yes	42(28)	25(16.67)	28(18.67)	95(63.33)
No	3(2)	19(12.67)	10(6.67)	32(21.33)
No training	5(3.33)	6(4)	12(8)	23(15.33)
TOTAL	50(33.33)	50(33.33)	50(33.33)	150(100)

SOURCE: FIELD SURVEY 1997

key

P1 Do you understand what extension agent teach?

P2 V.E.W behavior influence the way farmers follow his advice

P3 Training that you receive is it adequate?

An other important issue was to know whether training provide by extension workers was adequate. About 95 respondents ascertain that trainee that they have received is adequate. Majority of them is in Borgou (28%). Thirty two (21.33%) respondents said that the trainee is not adequate, majority is in Mono 19 (12.67%) of respondents.

5.5.2.- Relation between extension factors and adoption of Mucuna.

For the purpose of this study, four variables where used to measure relation between extension and adoption. These are:

- Attendence to extension meeting "MEETING"
- Comprehension of extension message for farmers. "UNDERSTAND"
- Is training received adequate? "ADEQUATE TRAINING"
- How often V.E.W contact farmers" EXTENSION CONTACT"

as indicated in table 30 below.

TABLE 30.- RELATION BETWEEN EXTENSION FACTORS AND ADOPTION OF MUCUNA

	ADOPTERS	DISADOPTE	NON ADOPTERS	Df	(X^2)
MEETING					
YES	73	9	30		20.912***
NO	9	4	25	2	(0.001)
UNDERSTAND					
YES	71	10	29	2	19.392***
NO	11	3	26		(0.001)
ADEQUATE TRAINING					
YES	67	6	17	2	36.532***
NO	15	7	38		(0.001)
EXTENSIEEXTENSION CONTACT	69	10	29		16.291***
Often	13	3	26	2	(0.001)
Seldom					

SOURCE: FIELD SURVEY 1997
*** significant at 0.001 level.

Analysis of the table 30 above shows that most of the farmers (73) who had adopted Mucuna participated in meetings organized by extension agents of their locality, whilst majority of respondents(about 65%) who never attended extension meetings were non adopter of the Mucuna technology.

This study has also revealed that there is a high positive significant relationship between comprehension of extension message for farmers and adoption of Mucuna. Majority of adopters (85%) ascertained that they understood what extension agent taught them whilst majority of those who did not understand (60%) are non adopters.

Adequacy of training also had a positive relationship with adoption. Majority of the non adopters were farmers who said that the training that they received was not adequate, and majority of those who adopted ascertained that the training they received was adequate.

Contact with extension agent had a positive relationship with adoption. Majority of non adopter farmers are those who don't have frequent contact with extension agent

5.6.-FACTORS TO CONSIDER IN PROMOTION OF MUCUNA IN BENIN

It was felt by 75% of respondents that Mucuna cultivation could be enhanced by provision of cash credit for hiring labor to supplement family labor. Forty-nine percent of farmers consider that the involvement of government in the marketing of the produce in terms of setting good price and possibly buying produce of farmers, would ease the marketing bottlenecks.

TABLE 31.- FACTORS TO CONSIDER IN ORDER TO PROMOTE MUCUNA

FACTORS	PERCENTAGES(%)
Provision of cash for hired labor	75
Government intervention in Mucuna marketing	49.4
Education on the importance of Mucuna	45.4
Provision of edible Mucuna	8.6
Government should force farmers.	8
Increased seed availability	5.4

SOURCE: FIELD SURVEY 1997

Total of percentages > 1oo because of multiple response.

In the opinion of 45.4% of respondents Mucuna cultivation could be enhanced by education of farmers on the importance of Mucuna. Provision of edible Mucuna was considered by 8% of the farmers. farmers as a way of improving the development of the crop. Increased seed availability was also the concern of about 5.4% of farmers.

CHAPTER SIX

6.0.-DISCUSSION OF FINDINGS

In this chapter, the major findings of this study are discussed under the following heading: (a) selected regions and adoption of Mucuna, (b) influence of sociological and environmental factors on Mucuna adoption, (c) influence of extension factors on adoption of Mucuna, (d) description of each categories of adopters, and (e) Constraints for adoption of Mucuna.

6.1- SELECTED REGIONS AND ADOPTION OF MUCUNA

Chi-square revealed that there is a significant difference between selected regions as far as adoption of Mucuna is concerned . The majority of adopters and the minority of non adopters are Borgou farmers. A possible explanation for the difference between the zones as far as adoption of Mucuna is concerned is due to the difference that exist between zones in term of socio economic characteristics, environmental factors and extension activities. Among the selected regions Borgou is the region were more farmers adopted Mucuna as cover crop. In Borgou land is more available than in other selected regions.

Literature surveyed suggests that size of farm and or size of enterprise is nearly always positively related to the adoption of new farm practices. Gershon *et al.* (1985) found a positive relationship between the fertilizer adoption and farm size. Then land availability in Borgou is a great chance for Mucuna adoption.
Majority of Borgou farmers ascertain the Mucuna innovation is not difficult to understand, and it is consistent with existing value in their locality. According to Rogers (1983), the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption.

In Borgou majority of farmers ascertain that Mucuna innovation is not complex. In the same region, Majority of respondents ascertain that they understand what extension agent teach them. Majority of them also said that training that they have received is adequate.

This shows that extension activity is more effective in Borgou than other regions. Such condition run in favor of better adoption of Mucuna as soil management crop.

6.2.-INFLUENCE OF SOCIOLOGICAL FACTORS AND ENVIRONMENTAL FACTORS ON ADOPTION OF MUCUNA

6.2.1.- Sociological factors and adoption of mucuna

The sociological factors considered for this study were gender, age, marital status, level of education, number of farms, number of children, social status, land availability, and labor availability.

Analysis of result reveals that in the study area extension agents actions are mostly directed toward males instead of females. Such situation cannot favor rapid diffusion of innovation, since the active population of Benin is dominated by female.

This study shows that age, marital status, level of education, number of children do not influence adoption of Mucuna in the study area. This finding is in accordance with Ekong (1988) who pointed out that there is no association between age and adoption behavior. This is in contrast with Van Den Ban (1957) and Akinola (1986) who found that age is inversely related to adoption. This result may be explained in part by the fact that problem of soil restoration is not related to age. Older, middle aged, and younger farmers have the same difficulty when their land is poor and may have similar desire to try an innovation which can help them to solve this problem if this innovation is triable .

It has been pointed out by many social studies that there is a positive association between literacy and adoption of innovation. They found that the more the technology is complex, the more likely it is that education will play a role (CIMMYT 1993). In contrast to this statement this study shows that there is no association between education level and adoption of Mucuna in the study area. This may by explained by the fact that, in the study area formal education is not needed to understand Mucuna technology. It may also be due to the fact that Mucuna technology innovation is simple and easy to understand. Since in this study there is no relation between adoption of Mucuna and educational level of farmer, we can say that Mucuna innovation is not complex. There is therefore no need to try to simplify the technology or to develop alternatives.

The study revealed that farmers who are SG2000 contact farmers are the most important groups of farmers who adopt more Mucuna as soil management crop. This finding is in accordance with Coleman (1966) who found that the expected utility of the individual adopting an innovation increases if he is in a network of other adopters since he can be offered assistance by those adopters. This result shows that contact farmers (SG2000) are the reference group to extension activities in the study area. SG2000 contact farmers have frequent contact with extension agent and also have the opportunity to work with other farmers of their village during the demonstration section . All these conditions may work in favor of adoption of technologies promoted by SG2000. These finding are somewhat in consonant with that of Vissoh (1994) who found in his study that, there is a significant relationship between contact with extension agent and adoption of soil conservation.

Situational factors as land availability, labor availability were studied. The study revealed that land availability have an influence on adoption of Mucuna, this is in accordance with Gafsi (1979) who found that large farm size is positively related to adoption of irrigation equipment.

Land for farming is more available in Borgou than the two regions.A farmer can increase his farm size easily. This situation is in favor of adoption of innovation. In Borgou farmers will be more susceptible for adoption of innovation that requires availability of land than in others regions. This result is in accordance with Williams *et al.* (1984) who highlighted that the larger the farm business in term of acreage or size of particular enterprises and the more specialized the nature of the farm business, the earlier the farmer tends to adopt new and improved practices. This then means that Mucuna may be adopted easily where there is no pressure on land. So in Mono region where there is high demographic pressure on land adoption of Mucuna is not as high as in Borgou.

As for labor availability data analysis shows that in Benin, there are three main sources of labour for farming, namely hired labour, family labour and cooperative labour. Labour is required, among other things, for land preparation, nursing, planting seeds, and general maintenance of farms such as weeding, spraying, pruning and harvesting of crops. N'diayo and Sofranko (1988) have shown that in Zambia, labour shortages prevented farmers from adopting improved seeds. So it would be difficult for poor farmers who don't have money to hire labour to adopt Mucuna for soil management. Labor availability has a positive significant relation with adoption of Mucuna this shows that availability of labour favor adoption of Mucuna in the study area. When labour is scarce adoption of Mucuna is low. This confirm that adoption of Mucuna innovation will be high were labour is available. Probability of adoption increases with labour availability.

6.2.2.- Environmental factors and adoption of mucuna.

Climate, soil fertility and vegetation were environmental factors that were considered in the study.

Analysis of data revealed that climate and vegetation in the three selected regions were favorable for the growth of Mucuna so these environmental factors

did not have any influence on adoption of Mucuna in the study area. As for soil fertility, this study reveals that there is a positive and significant relationship between soil fertility and adoption of Mucuna. Farmers who have poor land tend to adopt Mucuna more than those who don't have any problem of soil fertility. In the area where soil is rich farmers don't need to adopt Mucuna. In the region where the soil is poor and rare the need to improve soil fertility is high . In the case that soil is poor the technology used by farmer to improve his soil fertility vary. If land is available he tends to adopt cover crop technology, but when there is pressure on land farmer will prefer mineral fertilizers. That is why in Mono region soils are poor but adoption of Mucuna is low because demographic pressure is high and in Borgou adoption is high because land is available since demographic pressure is low. In Zou demographic pressure is low but adoption of Mucuna is also low. This means that in this region non adoption of Mucuna is not due to land availability. It may be due to the fact that soil are not poor or it is due to weaknesses of the extension method use to promote Mucuna in this region. The promotion of Mucuna where soil is rich faces a lot of non adoption. It is easy to understand that extension agents should not continue to promote Mucuna where soil is rich, and appropriate extension technology must be use to promote Mucuna.

6.3.- RELATIONSHIP BETWEEN EXTENSION FACTORS AND ADOPTION OF MUCUNA.

Chi-square computation for difference between the three zones with regards to the individual extension visits was significant. These results show that extension activities seem to be poor in Mono region than others. Farmers' participation in extension activities is lower in Mono than in other regions. The study reveals that the best extension activities is in Borgou. It's important to know that in Borgou farmers are very familiar with extension activities because of

cotton production. Cotton is the first cash crop in Benin so the government puts emphasis on its production. Borgou is the cotton belt of the country and that is probably why farmers know the importance of soil fertility in this region. That is why adoption of Mucuna as a cover crop is high in Borgou than other selected regions.

All the extension factors studied have significant and positive relationship with adoption of Mucuna. Farmers who participate frequently in meetings organized by extension agent adopt more than those who don't participate. The more farmers understand what extension agent teaches the more they adopt .The clearer the training given to farmers about Mucuna cropping the more they adopt. The more extension agent contact farmers the more the farmer adopt Mucuna practices. This finding shows that extension is an important factor in Mucuna promotion in the study area. The success of Mucuna promotion depends on the success of extension activities in the region. Farmers who participate in extension activities and have a good understanding of Mucuna management practices adopt more than those who don't participate and don't understand the importance of the practices. As the study reveals, most of adopters are SG2000 contact farmers. This shows that SG2000 strategy has improved adoption rate of Mucuna in Benin. Strategy used by SG2000 offers good opportunity for farmers to make decision after going through all the decision making process stages. The important weaknesses of SG2000 that this study reveals is that training of extension agent do not put emphasis on extension methodologies, V.E.Ws must use to promote technologies.

The study indicated that 32% of Zou farmers don't know about the use of cover crops to improve soil fertility against 20% and 16% respectively in Mono and Borgou. The study also revealed that the second most important reason of non adoption of Mucuna is poor understanding of the innovation after lack of labor. This means that the more farmers are aware of Mucuna technology the

more they adopt Mucuna to improve soil fertility. This result shows the weaknesses of the extension method used to promote Mucuna in the study area Since awareness is a first stage of the adoption process it is sure that farmer who are not aware would not adopt. Extension services must improve their extension methodology to enable majority of farmers to have knowledge about Mucuna technology. The strategy used by SG2000 seems to by good since all the SG2000 contact farmers of the sample are aware of Mucuna technology.

6.4.- CHARACTERISTICS OF EACH CATEGORIES OF FARMERS

Data collected Shows that majority of farmers perceived the relative advantage of Mucuna innovation as beneficial for them. Majority know that they can improve their soil fertility or reduce spear grass when they grow Mucuna.
This study reveals that Mucuna technology is not complex, it is triable, it is divisible, it is observable and it's relative advantage is perceived by farmers. There is therefore a great chance for this technology to be adopted widely. In spite of this great chance adoption of the technology is not uniform across farmers. Three categories of adoption behavior were considered. Adopters, Non adopters, and Disadopters.

6.4.1.- Characteristics of adopters of mucuna

The study revealed that social status, labor availability, land availability, are factors that characterized adopters.

Most of the adopters are head of farmers association or SG2000 contact farmers. Labor availability and land availability are positively and significantly correlated with adoption of Mucuna.

An implication of this finding is that adoption of Mucuna requires labour availability and land availability. Extension agent should not expect that poor farmers who do not have land will adopt Mucuna easily.

It was also realized that having labour, land, and belonging to farmers association or being a SG2000 contact farmer is a chance to adopt Mucuna. In addition, adopters have frequent contact with extension agent, understand his messages, participate in meetings organized by VEW.

In others words a Mucuna adopter is a farmer who has soil fertility problem, land, labor, and has good understanging of Mucuna technology.

6.4.2.- Characteristics of non adopters of mucuna

When a client doesn't have the characteristics of adopters of Mucuna as described earlier he is not a potential adopter.

Majority of the non adopters are those who don't have land and labor or who don't understand the innovation, because they never heard about it or they don't have a skill to understand what VEWs teach them, or they do not participate to meeting organized by VEW, or the extension worker himself don't do his work very well.

This study revealed that factors related to extension activities are very important for adoption of Mucuna

Farmers that do not have any problem of soil fertility do not feel concerned with this technology.

6.4.3- Characteristics of disadopters of mucuna

Majority of disadopters are farmers who don't have enough land or have problems of labour. Some disadopters are those who got bad results from their first experience because of bad training. Their soil have not been improved or Mucuna couldn't irradiate spear grass from their field because the technology was not well implemented.

6.5.- CONSTRAINTS OF ADOPTION OF MUCUNA

This study revealed that the major constraints of Mucuna adoption are; lack of land in Mono region, lack of labor for farmers in general, and lack of understanding because of poor extension service.

A look of agricultural extension organisation in Benin shows some weaknesses. Only 738 VEWs for more than 2 millions farmers in the country. Discussions held with VEWs reveal that they are not satisfied with their working conditions. We notice that they don't have all the means needed for their work. Their average years of schooling is about five years. Discussions with staff show that the training VEWs receive is not adequate. In general they receive per year a few days of training,and this training do not put emphasis on extension methodologies and strategies they may use to promote innovations.

The environmental, sociological, economical, and technical factors that may influence adoption of Mucuna cover crop include:

Agronomic factors; Mucuna is capable of controlling aggressive weeds and improving soil fertility. It is, therefore, likely to be adopted in areas with serious problems of weeds(e.g. spear grass) and/or soil fertility problem.

Land availability; in order to use Mucuna, the farmer will have to sacrifice his land for 1 or 2 seasons as improved fallow. This may be a problem where land is extremely scarce. On the other hand, Mucuna is not likely to be adopted in areas with abundant land because farmers will rather leave the land to natural fallow rather than to invest in Mucuna establishment. Thus, Mucuna has a greater chance of being adopted in areas where land is neither abundant nor too scarce.

Land tenure system; The establishment of Mucuna is a long term investment in land improvement. It entails land preparation, planting and 1 or 2 weeding but its effect is not immediate. Such investment is not likely to be undertaken where there is no security in land ownership.

Length of growing season: A long growing season or a bimodal rainfall regime could permit Mucuna to be planted, such that it will not coincide with food crops and thus reduce pressure on labour and or land. On the other hand, a conflict for labor and or land is likely to occur between Mucuna and food crops in areas with short growing seasons. This may discourage adoption of Mucuna.

Cost of inputs: Adoption of Mucuna as alternative to chemical fertilizers and herbicides is likely to be high where the cost of such chemical input is prohibitive and low where they are affordable to must farmers.

Fire and cattle: The benefits of Mucuna are reduced if the accumulated mulch is destroyed by fire. Any attempt to introduce Mucuna in areas with high incidence of fire must be accompanied by measures to reduce fire incidence. Cattle may graze Mucuna and cause a reduction of its benefits. This may discourage adoption of Mucuna.

Extension service: The use of Mucuna as a cover crop is a complex technology. Therefore, availability of trained extension staff, and appropriate extension method may be a constraint for Mucuna adoption.

Cropping system: It is not possible to inter crop Mucuna with low-statures crops like tomato, cowpea or groundnuts because of its aggressiveness. Mucuna may therefore be used only in rotation with such crops. Mucuna may not be compatible in areas with predominantly mixed cropping systems where some component of crops remain in the field throughout the year. The likely areas of adoption are those with predominantly mono-cropping systems, especially of tall crops.

CHAPTER SEVEN

7.0.-CONCLUSION AND RECOMMENDATION

This study has shown that the adoption of technological innovations in agriculture is a complex process which involves several factors that include personal and soci-cultural factors, situational factors, environmental factors, economic factors, innovation factors and extension factors. This chapter shall consist of conclusion, recommendation and further research needed.

7.1.- CONCLUSION

Based on the findings of this investigation, the following conclusion can be drawn regarding the level of Mucuna adoption in the study area.

Personal and Socio-cultural factors The study showed that adoption of Mucuna is not associated with level of education,number of farm, and age of farmer in the study area. Farmers of any level of education may adopt or may not adopt Mucuna for soil management practices.

Situational factors Land availability, labour availability and soil fertility, where considerd as situational factors in this study. All these factors where found to be associated with adoption of Mucuna. Farmers who have land tend to adopt Mucuna more than those who don't have enough land for farming. Farmers who have labour adopt more than those who don't have labour. Then having labour is an advantage for Mucuna adoption. This result shows that availability of labour favor adoption of Mucuna in the study area. When labour is rare adoption of Mucuna is low. Soil fertility is also an important factor that influence adoption of Mucuna. Farmers who have poor soil adopt more than those who don't have any problem of soil fertility.

Environmental factors This study reveals that Mucuna can be grown in any of the three ecological zones of the country. Environmental conditions of Republic of Benin is favorable for Mucuna. Analysis of data revealed that climate and vegetation in the three selected regions were favorable for the growth of Mucuna so these environmental factors did not have any influence on adoption of Mucuna in the study area.

Economic factors Inspite of the fact that Mucuna growing is not expensive, economic condition of the farmer has an important influence on Mucuna adoption in Benin. Farmers of good economic standing can easily acquire land or hire labour. Such farmers may be able to try Mucuna innovation at any times. Also Mucuna is not an edible crop, because of that only farmers who have enough food can easily adopt it. Mucuna is a cover crop which prevents a farmer to use his land for food crop during a rainy season, so only farmers who have enough land can adopt it easily.

Innovation factors Majority of farmers recognized that Mucuna innovation is not difficult to understand and easy to integrate in their farming system. Also majority of them agree that Mucuna is consistent with existing values, apart from Zou farmers who said in majority that Mucuna is not easy to integrate in their farming system. This is due to poor understanding of Mucuna technology in Zou region.

Extension factors The finding shows that extension is an important factor in Mucuna promotion in the study area. The success of Mucuna promotion depend on the success of extension activities in the region.

Farmers participation in extension activities is lower in Mono than in other regions. The results show that extension activities seem to be poor in Mono region than others. The best extension activities is in Borgou.

Verbal explanations, discussions and demonstration were used by extension agents to train farmers. In addition, the farmers watched or observed the example of other farmers using Mucuna for soil management.

Analysis of data reveals weaknesses on extension method use by some VEWs, since there are some farmers who don't know Mucuna or don't understand what extension agent teach them.

Most of non adopters did not receive much advice on Mucuna practices from extension services.

It was concluded that contact among extension agent and non adopters or disadopters was quite low.

The use of mass media sources including publications and radio broadcast in informing the farmers and dissemination of Mucuna was not popular.

Adoption Three categories of adoption behavior were identified. Adopters, Non adopters, and Disadopters. A possible explanation for the difference between the zones as far as adoption of Mucuna is concerned may be the difference that exist between zones in term of personal and socio economic characteristics, situational factors and extension activities.

Mucuna adopter is an farmer who has soil fertility problem, who has land, labor, and is aware of Mucuna technology.

This study revealed that the major constraints of Mucuna adoption are; lack of land in Mono region, lack of labor for farmers in general, and lack of understanding because of poor extension service.

7.2.- RECOMMENDATIONS

The following recommendations are made based upon the findings of the study, interpretation of the findings, and conclusions.

The promotion of Mucuna where soil is rich face a lot of non adoption. So promotion of Mucuna must be done where there is a real problem of soil fertility or weed infestation.

The results show that most farmers did not visit extension agents to discuss their problems with them. It is therefore suggested that farmers should be involved in planning programs that are designed to help them.

The best thing must be done to improve the adoption of Mucuna in Benin it is essentially to improve extension delivery by:

- Improving the extension workers skills through training on extension methodologies and strategies.

- Increase the number of VEWs. In case that it would be expensive, the opinion leaders strategies may by tried. Opinion leaders well selected, and well trained, can play an important role in diffusion of innovations. This study revealed that most of adopters are SG2000 contact farmers. According to many sociological studies, the need for higher social status is an important reason for adopting an innovation. People may adopt an innovation because of their need of recognition or to maintain leadership role, especially among the higher status people. Innovators would like to maintain their leadership role. such kind of people if well trained may constitute an good alternative for a problem of lack of VEWs.

- Other suggestion is that extension services must put priority on farmers associations and in areas where land and labour are available. Success in such areas will help to convince other farmers who have few chance or less opportunity to try the innovation.

- Lastly, there is no need to make a promotion of an innovation where it is not needed.

In sum SG2000 has played an important role in Mucuna promotion in Benin, because of its PTP strategy. In the study area about 56% of farmers use

Mucuna for soils protection and restoration. To improve this Mucuna adoption rate, PTP approach should be adopted by other extension organizations. Extension services must be more efficient and able to transfer improved technology.

Arising from this investigation, new grounds in which research needs to be carried out are:

- A similar study should be conducted in the remaining regions of the country with a views to improve or strengthen the existing extension method in the country.

- A study on influence of economic factors in adoption of agricultural innovation in the study area should be conducted.

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APPENDIX 1

ADOPTION OF MUCUNA (*Mucuna utilis*) AS SOIL MANAGEMENT CROP IN REPUBLIC OF BENIN

Questionnaire for farmers

1. Name of respondent .....
2. Region..... District: ..... Village.....
3. Nationality of the respondent

   Beninois [ ] others specify .....
4. You reside presently in your home town? .
5. How old are you?

   0- 20 years old [ ]

   21-30 years old [ ]

   31-40 years old [ ]

   40-> years old [ ]
6. What is your marital status?

   Married [ ]

   Separated [ ]

   Single [ ]

   Widow / widower [ ]
7. What is the number of children do you have? .....
8. What are other sources of income apart from farming?.....

   .....
9. What is your level of schooling?

   (a) Primary School [ ]

   (b) Secondary School [ ]

   (c) University [ ]

   Other Please specify .....
10. What are the places you have visited the last five years?

    (a) Inside the country .....

    (b) Outside the country .....
11. Where are you from ?.....
12. Are you planning to move from your actual place of residence?

    YES [ ] NO [ ]

13. What is your actual leadership status?

(a) Head of village [ ]

(b) Member of village council [ ]

(c) Religious leader [ ]

(d) Head of household [ ]

(e) Contact farmer (SG 2000) [ ]

(f) None of the above categories [ ]

14. What are principals crops do you grow in your field? .....

.....

15. What is your objectives when farming?.....

16. What is the land tenure arrangements on your farm?

a) Land inherited [ ]

b) Land rented [ ]

c) Land purchased [ ]

d) Land gift [ ]

e) Land own [ ]

f) Others (specify) .....

.....

17. What is the size of your farm ?.....

18. Which tools do you use for land preparation?

a) Manual tools (hoe, cutlass) [ ]

b) Animal traction [ ]

c) Tractor [ ]

d) Others [ ]

19. What kind of labor do you use?

a) Family labor [ ]

b) Cooperative labor [ ]

c) hired labor [ ]

d) in Law labor [ ]

e) others (specify) .

.....

20. What do you think about availability of labor during the farming season

.....

.....

21. What are the problems you encountered in the farm? .....

.....

.....

22. What is your assessment of the level of soil fertility in your farm?

(a) Good [ ]

(b) Acceptable [ ]

(c) Not bad [ ]

(d) Bad [ ]

(e) Other (specify) .....

.....

23. How many farms have you got? .....

24. What soil management practices do you use in your farm?

(a) Cover crop [ ]

(b) Alley cropping [ ]

(c) Organic fertilizer [ ]

(d) Inorganic fertilizer [ ]

(e) Fallow [ ]

25. If soil management technology used in your farm is not a cover crop, why? (explain)

26. Do you know the use of cover crop as soil management practices?

YES [ ] NO [ ]

27. What soil management practices are used in your village?

.....

.....

28. In your viewpoint among those soil management practices used in your village which is the best?.....

Why?.....

29. According to you what are the factors that determine the use of cover crop as soil management crop?

.....

.....

30. Management technology used in your farm is cover crop, which do you use?

(a) Mucuna [ ]

(b) Mucuna before but not now. [ ]

(c) Others, specify .....

31. If it is not Mucuna, what are the reasons? .....

.....

32. Have you ever heard of Mucuna?

Yes [ ] No [ ]

Where? .....

.....

33. If it is Mucuna, why do you prefer Mucuna? .....

.....

.....

34. When did you started to grow Mucuna? .....

.....

35. Do you perceive Mucuna soil management practice as consistent with the existing values in your village?

Yes [ ] No [ ]

Give reasons .....

.....

36. In your viewpoint is it easier for you to integrate Mucuna in your farming activities?

Yes [ ] No [ ]

Justify your answer .....

37. In your opinion what are indicators that show to farmers the beneficial aspects of Mucuna management practices?

Give reasons.....

38. What change have you notice after growing Mucuna? .....

.....

39. How do you see your field after Mucuna fallow? .....

.....

40. Do farmers recognize that the fertility of their soil have been improved after growing Mucuna?

Yes [ ] No [ ]

How? .....

41. Do you find Mucuna soil management practice difficult to understand?

Yes [ ] No [ ]

Give reasons .....

.....

42. What are soil management practices use in your village?

(a) Cover crop [ ]

(b) Alley cropping [ ]

(c) Organic fertilizer [ ]

(d) Inorganic fertilizer [ ]

(e) Others (specify) .....

.....

43. If soil management technology used in your village is not a cover crop, what is the reasons?.....

44. What soil management practices are used in your farm? .....

.....

45. From which source do you get information on soil management practices.

a) Friends/relatives [ ]

b) Village chief [ ]

c) Extension workers [ ]

d) Mass media [ ]

e) Visit trip [ ]

f) others (specify) .....

.....

46. If soil management technology used in your village is cover crop, which cover crop do you use?

a.) Mucuna [ ]

b.) Other(specify) .....

47. Contact between you and extension agent in your viewpoint is

a) Very often [ ]

b) Often [ ]

c) Seldom [ ]

d) Never [ ]

48. Do you think that the Mucuna soil management practice you receive is adequate?

Yes[ ] No[ ]

Why? .....

.....

49. In your viewpoint what are the factors that influence adoption of Mucuna in your village? .....

50. When growing Mucuna, is there any problem of labour (lack of labour)?.

.....

51 How much growing Mucuna is cost? .....

.....

52. Is Mucuna seed available?

Yes [ ] No [ ]

53. In which proportion do you grow Mucuna in your field?

a) 0 -10% of farm size [ ]

b) 11% - 20% of farm size [ ]

c) 21% - 30% of farm size [ ]

d) more than 30% [ ]

54. Why do you grow Mucuna in this proportion in your field? .....

.....

55. Do you think that next year you will grow Mucuna for ?

Yes [ ] No [ ]

Why? .....

.....

56. Do you use other methods to improve soil fertility in your field?

Yes [ ] No [ ]

a) Why? .....

b) How? .....

57. Do farmer need particular skill before growing Mucuna? .....

.....

58. Do you burn your Mucuna field?

Yes [ ] No [ ]

59. Do you know that by burning you will lost benefit obtained by growing Mucuna

Yes [ ] No [ ]

60. You can't adopt mucus because it is not edible?

Yes [ ] No [ ]

Justify your answer .....

61. Do you fear the use of Mucuna because it shelters reptiles?

Yes [ ] No [ ]

Why? .....

62. Do you often attend meeting organized by extension agent in your area?

Yes [ ] No [ ]

If No why? .....

.....

63. Do you understand what extension agent teach you?

Yes [ ] No [ ]

If No why? .....

64. In your viewpoint is the behavior of extension agent influence the way farmers follow his advises?

Yes [ ] No [ ]

Give reasons .....

65. Are there any sociological factors (values, norms, attitude, believes, taboo) that prevent the use of Mucuna in your village?

Yes [ ] No [ ]

Specify.....

66. In viewpoint what are environmental factors that prevent the use of Mucuna in your area?

Yes [ ] No [ ]

67. Are there any ecological factors that prevent normal development of Mucuna in your village?

Yes [ ] No [ ]

Specify .....

68. In your opinion what must be done to encourage adoption of Mucuna in your village?.....