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Constraints to Adoption of Recommended Multiple Cropping Systems and Implications of their Non-Adoption to Rural Poverty in Enugu State

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CONSTRAINTS TO ADOPTION OF RECOMMENDED MULTIPLE CROPPING SYSTEMS AND IMPLICATIONS OF THEIR NON-ADOPTION TO RURAL POVERTY IN ENUGU STATE

A RESEARCH PROJECT REPORT SUBMITTED FOR THE DEGREE OF MASTER OF SCIENCE (M.Sc) IN AGRICULTURAL EXTENSION

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CERTIFICATION

Ochiaka, Joseph Sunday a postgraduate student in the department of Agricultural Extension with Registration number PG/M.Sc/96/14272, has satisfactorily completed the requirements for course and research work for the master of science (M.Sc) degree in Agricultural Extension.

The report herein is original and has not been submitted in part or full, for any other diploma or degree of this University or any other University. We accept it as conforming to the required standard.

.....
Dr. E.M. Igbokwe
Supervisor

Date

.....
Dr. M.C. Madukwe
Head of Department

Date

Dedication

This work is dedicated to

ALMIGHTY GOD

from whom all good things come.

ACKNOWLEDGEMENT

Success in life is not gotten on a platter of gold, but rocked in the craddle of difficulties and pillowed on hardships. It is on this premise, that I record my profound and immortal gratitude to the Council for the Development of Social Science in Africa (CODESRIA) for granting an award to my thesis – Constraints to adoption of recommended multiple cropping systems and implications of their non-adoption to rural poverty in Enugu State.

I sincerely thank the Executive Council of Council for the Development of Social Science in Africa (CODESRIA) for extending the grant to indigent postgraduate students like me, as it will go a long way in encouraging students from low income households to continue to pursue higher graduate studies in the social sciences and related fields.

May the good Lord continue to guide and direct you in the discharge of your duties.

OCHIAKA, JOSEPH SUNDAY
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ABSTRACT

The research work was designed to ascertain the constraints to the adoption of recommended multiple cropping systems and the implication of their non-adoption to poverty situation in Enugu State.

Specifically, the objectives were to determine the difference in crop yield between the recommended multiple cropping system and the traditional intercropping systems, examine the income differentials between the adopters and non-adopters, determine the level of poverty between the adopters and non-adopters and finally identify the constraints to the adoption of the recommended multiple cropping systems.

Contact farmers in Awgu and Nsukka agricultural zones of Enugu State made up the population. Two hundred farmers constituted the sample. While one hundred was the adopters of the recommended cropping systems, the other hundred was those who did not adopt the systems. Structured interview schedules were used to collect the data. The data were analyzed through the use of frequency, percentages, mean scores, T-test and multiple repression.

The results showed that 52% of the farmers were of the range of 41-60 years, while 12.50% had no primary education, majority (50%) had primary school education. The main source of farm labour was the family, while the major source of income were from personal savings and friends and neighbours.

Distribution of differential mean crop yield showed that the combined biological yields of all the component crops in the alternate row system out-

performed those of single-row planting and farmers traditional intercropping system.

Household size, annual farm income, annual income from other sources, credit availability were found to be positively related to the rate of adoption of the multiple cropping systems. It was also discovered that the adopters had higher total farm cash income, total non-farm cash income, amount of saving in cash in the house, amount of saving in terms of land, seeds, livestock, fertilizer, and bicycles.

Unawareness of the multiple cropping systems, lack of improved planting materials, low education on the part of the contact farmers, lack of agro-chemicals, lack of fund, and high cost of inputs were found to be constraints to the adoption of the multiple cropping systems. Scarcity of improved rice seeds like ITA 315, 257, scarcity of improved cassava cultivars like TMS 30572, 30555, disruption of growth and development of rice at the furrow by erosion, high demand for agro-chemicals to treat cassava/rice pests and diseases were found to have significantly contributed to the low rate of adoption of cassava/rice cropping patterns.

The following environmental-related factors - evolution of pests, evolution of diseases and poor soil fertility had affected the rate of adoption of the systems. The contact farmers were of the opinion that they had cordial relationship with the agricultural extension agents. There was no significant difference in the level of perception of constraints between contact farmers in Awgu and Nsukka agricultural zones of Enugu State.

The following recommendations were made.

1. Diagnostic survey in On-farm Adaptive research (OFAR) of Agricultural

Development Programme should be evaluating the cropping systems periodically. This will help detect areas of problems and provide immediate solutions.

2. The contact farmers who adopt technologies should be motivated by organising prize giving days, where letters of commendations will be given to them.

3.

3. The farmers should be encouraged to form co-operatives to enhance their capital saving strength and ability borrow from formal financial institutions.

4. The farmers should be encouraged to embrace the Adult literacy programme as this will help them understand the technologies transferred to them by the agricultural extension agents.

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CHAPTER ONE

INTRODUCTION

1.1 Statement of Problem

Nigeria's economy is still predominantly agricultural inspite of the great efforts, in industrial development in recent years. The sector still holds a strategic position that today, as in the past, the development of the overall economy greatly hinges upon its improvement (Okorie, and Ebo; 1990). In recognition of the traditional importance of agriculture, concerted efforts are made towards the development of the sector in Nigeria. The results of these efforts are the achievement of agricultural growth rate of 3.5% per annum and an appreciable rise in both hectarage and agricultural output (CBN, 1992, F.O.S 1995).

The significant strand in Agriculture has been made possible by agricultural development strategy being pursued through Agricultural Development programmes in each state of the federation. The Agricultural Development programmes (ADPS) were designed to improve the traditional systems of agricultural production. They have the primary role of teaching, advising and informing the farmers about improved technologies, that are beneficial to them (Unamma, 1989).

The technology-transfer process adopted by the ADPS is usually through the use of small pot Adaptive Technique (SPAT). The technique emphasize planting patterns, using improved crop varieties, recommended fertilizer rates and application of desirable cultural practices (Ene, 1989) The extension agents use the

technique to convince the farmers of the superiority and efficiency of new technologies over the traditional cropping system. However each state ADP is autonomous and the type of technology developed and transferred is dependent upon the ecological setting and the socio-cultural practices in the state concerned.

In line with the agricultural development policy of the country, Enugu state Agricultural Development programme was established. The efforts of the programme culminated in the development of different crop based technologies mixed cropping systems, these include yam/cassava/maize/melon alternate row, cassava/maize, cassava/vegetables, Yam-minisett/maize, cassava/groundnut and cassava/upland rice. These mixtures are recommended because according to Enugu state Agricultural Development (ENADEP 1994), they ensure reasonable balanced diet, reduces pests and diseases, enhances effective productivity per unit land, attract higher farm income, encourage proper soil management and enhances poverty alleviation.

In spite of the inherent advantages of the mixed cropping systems especially Yam/cassava/maize/melon and cassava/upland rice which research have shown to be better suited to the state (Enugu state ADP 3rd quarter report (1994), and in spite of the efforts of the extension agents of Enugu state Agricultural Development programme, the adoption of these cropping systems has not been successful. This posed a great worry because technological development without adoption is a wasteful venture since the efforts are not translated into reality.

The concern of this study was therefore, to ascertain the constraints to the adoption of the two multiple cropping systems and analyzed the implication of their non-adoption to rural poverty in Enugu state.

1.2 Objectives of the Study

The aim of the research was to ascertain the various factors militating against the adoption of the recommended mixed cropping systems yam/cassava/maize/melon and cassava/upland rice and examined the implications of their non-adoption to poverty situation in Enugu State.

The specific objectives were to

(i) determine the difference in crop yield per hectare between Yam/cassava/maize/melon/cassava/rice and traditional intercropping systems

(ii) examine the income differentials between the adopters and non-adopters

(iii) determine the level of poverty between the adopters and non-adopters in terms of income and material possession

(iv) ascertain the constraints to adoption of the multiple cropping systems in the state

(v) make recommendations that will enhance the adoption of the cropping systems and alleviate rural poverty.

1.3 Hypotheses

1. There was no significant difference in the type of cropping systems and crop yield per hectare of adopters and non-adopters.

2. There was no significant difference in income levels and material possession of adopters and non-adopters.

1.4 Significance of the Study

The ultimate test of success for technological development and transfer is the extent of adoption of such technology by the end users. Rural sociologists, agricultural extension personnel, planners and others engaged in rural research will find the findings of this research worthwhile and valuable.

The study provided useful bench-mark data which will be used in formulation of policies that will not only enhance the adoption of crop based technologies, but other technologies of Agricultural Development programmes. The adoption of the technologies no doubt will increase farm income and reduce rural poverty among our farmers.

CHAPTER TWO

LITERATURE REVIEW

Over 90% of Nigeria's rural labour force is engaged in agriculture and related activities and agriculture accounts for about 75% of annual income of the rural households (Ijere, 1992, Okorji 1988, Phillips, 1995).

Development of agriculture and it's contribution to farmers' income in particular, and development of rural sector in general, depend to a large extent on farmers adoption of improved technologies like the yam/cassava/maize/melon and cassava/rice. The cropping systems are helpful to the farmers because they ensure maximum use of land, control pests and diseases, crop diversification in case of crop failure, enhances phased harvesting and provide reasonable soil cover. These will in turn increase rural farmers output and thereby reduce rural poverty among the small scale farmers (Anuebunwa, 1989).

Furthermore, effective adoption of multiple cropping systems especially Yam/cassava/ maize/ melon and cassava/rice would result in increased output and income earned by the farmers and consequently an improvement in their general welfare. Increased productivity and income of the rural farmers would enable them develop rural areas. (Okorji, Arua 1992). Provision of strategies to overcome the constraints to the adoption of the two multiple cropping systems have been shown to result to increased farm productivity and profitability, rural development and

poverty alleviation of the farmers. For instance, development of many rural areas in Oyo state, Nigeria has been attributed largely to the effect of adoption of International Institute for Tropical Agriculture (IITA) improved technologies transferred to farmers through their farming systems research network (IITA 1989, Kwatia 1986, Hahn 1988).

In a study of the economic analysis of Yam/cassava/maize/melon as influenced by different intercropping arrangements and crop populations in Orlu, Imo state Agricultural Development programme, it was discovered that the Yam/cassava/maize/melon alternate row has the highest profit (Unamma, Anuebunwa, 1989).

Isife, (1996) quoting Enugu state Agricultural Development programme (1994), noted that the adoption rate of technologies that are recommended to farmers in the state show that some technologies have high acceptance rate of adoption than others. He listed Yam/cassava/maize/melon alternate row and Cassava/upland rice multiple cropping systems as those having low rate of adoption.

On factors influencing adoption of innovations generally, Nweke and Akorhe (1983), were of the opinion that before a transfer programme is embarked upon, the technology must be tested not only for financial profitability but also for suitability to the farmers circumstances and needs. Such qualities or attributes of innovation that influence adoption have been outlined by Lionberger and Gwin (1982) as, relative advantage compatibility, complexity, traibility and observability

of the new technology. They explained that in general, the greater the relative advantage of a new practice over an old one, and the more compatible the new one is with existing practices and beliefs, the more likely farmers are to adopt it quickly.

Similarly, Uwaka (1980), pointed out that the acceptance of an element (innovation) by a receiving culture depends primarily upon the immediate utility and potentials of the element to that culture, while integration (adoption) is determined by compatibility of the element with existing value systems and forms of social organisation. It has also been shown that level of formal education, farming experience, size of farm, use of mass communication media, frequency of agents contacts, participation in voluntary organisation socio-economic status and age of farmers influence the rate of adoption of improved technology (Clark and Akinbode 1986, Pachivo and Ashby, 1986).

The removal of the identified constraints to mass adoption of the cropping systems will achieve the objectives of transforming traditional Agriculture, improvement of welfare of rural farmers by increasing their purchasing power and development of Nigeria's rural areas.

There should be the role expected of the Agricultural extension agents of the Agricultural Development programme, if the farmers were to adopt the cropping systems. Adoption of agricultural innovation is also a function of the ability of an extension worker to guide a farmer from an awareness stage to adoption stage, which very much depends on his training in technical agriculture and extension

methodology (Obibuaku and Harsh, 1993, Alao, 1971, Mijindadi and Njoku, (1986). The adoption of an innovation is also related to the degree to which the farmers perceive the innovation to be profitable. It was also confirmed that farmers are profit responsive and as such will adopt any innovation that is profit oriented. Consequently, it was discovered that the use of low yielding disease susceptible local cassava cultivar (otupam) was identified, as one major constraint to increased cassava production in Nsukka and Awka Agricultural zones of Anambra state (Ikeorgu, 1985). Anuebunwa (1989), noted that new practices which are perceived as the most profitable and least risky, are most readily accepted by farmers. All these go to show that the profitability of an innovation/technology is a predictor of its adoption.

2.2 Theoretical Consideration

The concern of agricultural extension is to help improve farming, and consequently improve the economic conditions and standard of living of rural farmers, through learning and acceptance of new and improved farm practices. In other to solve problems of the rural farmers in adopting improved technologies, an approach known as Farming System Research (FSR) was evolved to strengthen linkages between farmers and researchers and to emphasize research under actual farm conditions. According to Unnamma (1988), the aim is to integrate the efforts of research and extension in identification of major agricultural production constraints and to develop alternative production technologies. This will be done to

meet the needs and capabilities of farmers without destroying the natural resource base of the agro-ecological zone. He equally stated that three things must happen, if our farmers must move into higher and improved levels of agricultural technologies: firstly, arrangement must be made to introduce improved technologies, Secondly, the technologies must be transmitted to the farmers and thirdly, they must be willing and able to adopt and use the technologies. Three principal actors are involved in the process - the agricultural researchers who develop improved technologies, the extension agents who transfer technologies to farmers and the farmers who are expected to use the technologies.

The schema presented below shows the linkages between the Extension agency represented by Enugu state Agricultural Development Programme which is involved in the `sourcing' of technologies from research through the in - house monthly Technologies Review meetings (MTRMS), and that of the technologies from the Agricultural Development programme which are transferred to farmers. The technologies in this model are Yam/cassava/maize/melon alternate row and cassava/rice multiple cropping systems. The third linkage is that of the contact farmers who are the ultimate users from where it will trickle down to other non-contact farmers.

The last linkage are the contact farmers, Agency, cropping systems and environmental related constraints which are preventing the contact farmers from adopting the multiple cropping systems. If the constraints of the adoption of the cropping systems are removed, one would think of not only massive adoption of the cropping systems but also available improved cultivars of the cropping

combinations in the rural areas. This will improve the purchasing power and rural poverty will be reduced in the rural areas.

The feedback mechanism will ensure that the constraints will be channelled to appropriate research institutes for modification to enhance adoption of the multiple cropping systems. The various linkages are briefly discussed below.

(i) Extension Agency. The extension agency in the schema is the Agricultural Development programme, which is concerned with collecting, and interpreting technologies from research institutes and disseminating validated technologies to farmers through it's extension agents. The agency gets technologies through the Monthly Technology Review Meeting (MTRM). This is a monthly workshop designed to strengthen the linkage between research and extension in order to provide relevant technologies to the farmers. Members of the MTRM ensure that problems in the field which are identified either during the premonthly technology review meeting, farm visits are relayed to relevant research organisations for solutions and clarifications. In this process, research technologies are tailored to the specific needs and capabilities of the farmers.

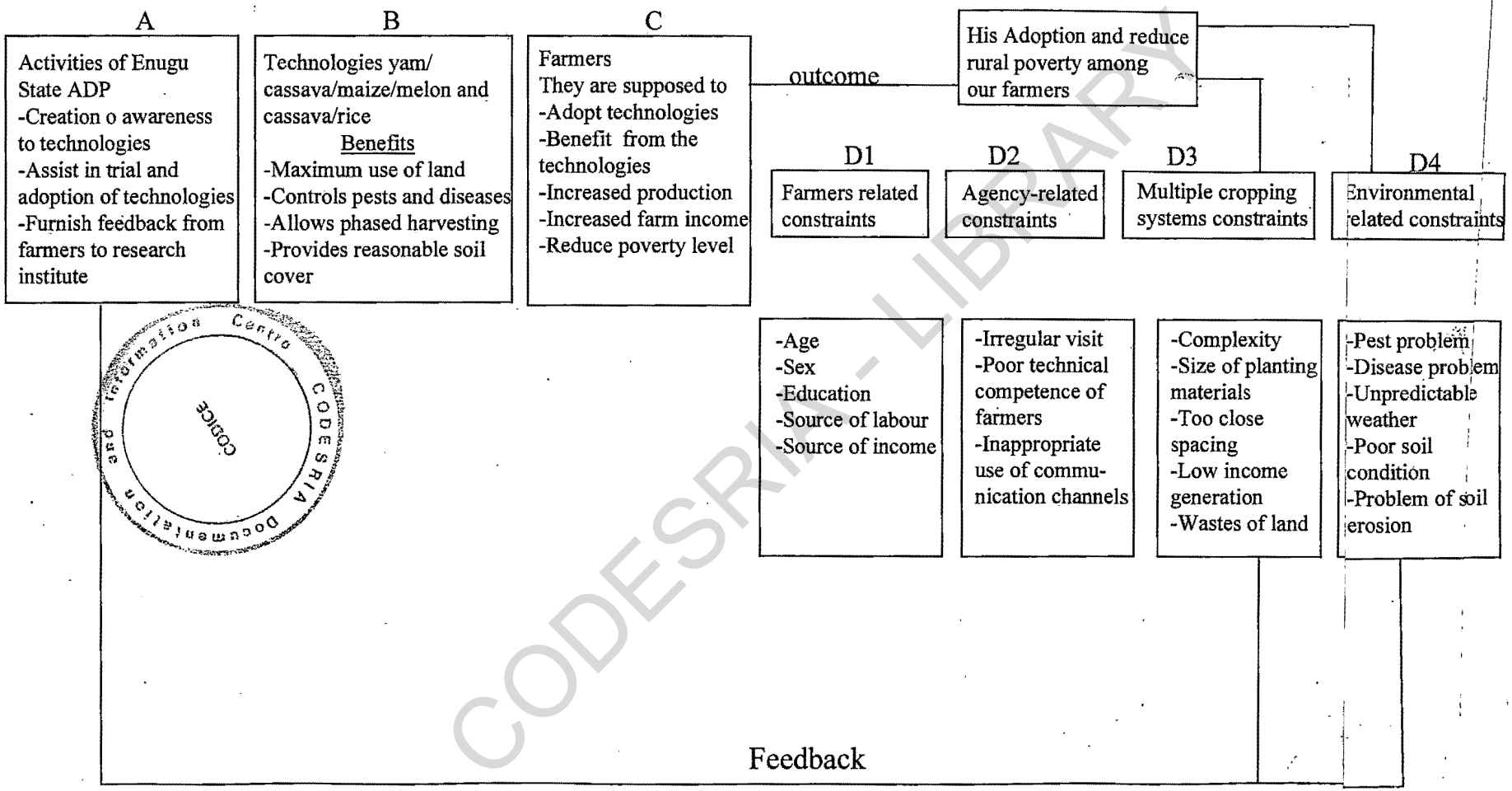
The Agricultural Development programme creates awareness of the technologies, ensures effective communication and diffusion of the technologies, assists in trial and adoption of the technologies by farmers, identifies and selects contact farmers, and ensures that feedback from them are relayed to the relevant research institutes.

(ii) Technology Systems: In the present research work, these include

Yam/cassava/maize/melon alternate row and cassava/ Rice. These are the output from the research institutes then to the Extension Agency. Technologies that would be easily adopted by farmers should be simple, technically feasible and economically viable at the village level (Anuebunwa, 1989). The technologies should be low input technology whose seasonal labour requirement should not compete, but complement the other farm activation and the resource requirements. The multiple cropping systems play vital roles if adopted. These includes helping to ensure maximum use of land, control pests and diseases endure crop diversification in case of crops failure, facilitates vertical and horizontal variation, thus allowing cultivation of crops adopted to light and shade alike, enhance phased harvesting and provide reasonable soil cover, ensure balanced diet and use of improved varieties. All these will go a long way in reducing rural poverty among our farmers, if they adopt the multiple cropping system.

(iii) Farmers system: The ultimate users of technologies from the Extension agency are the farmers - made up of contact farmers and on - farm adaptive research farmers. According to Ikeorgu (1989), research in itself is useless to development context if it is not properly extended to the farmers. In most cases, policies and research failed to recognise the large stock of scientific knowledge embedded in small-scale farmer acquired through process of inter-generational transfer of farming skills based on trial and error methods. The contact farmers are supposed to be: aware of the cropping system technologies, adopt the technologies, benefit from the adoption of the technologies, increased production, increased farm income and furnish feedback to Agricultural Development programme for onward transfer to the appropriate research institutes for modifications.

FIG. 1 SCHEMATIC REPRESENTATION OF THE CONSTRAINTS TO ADOPTION OF THE MULTIPLE CROPPING SYSTEMS



CHAPTER THREE

METHODOLOGY

3.1 Area of Study

This study was conducted in Enugu state of Nigeria. Enugu state is one of the thirty-six states that make up Nigeria. The state was carved out in 1991 from the former Anambra state.

The state is situated on much of the highlands of the Awgu, Udi and Nsukka hills and the rolling lowlands of Ebonyi River basin to the East, and Oji-River basin to the west. The state is bounded by Abia and Imo states in the South, Benue and Kogi states in the East and Anambra in the west.

The state covered an estimated land area of 525 square kilometres. The area have an average rainfall of about 1500 mm to 2000mm annually and a mean temperature of about 30^{oc} (Introduction to Enugu state 1994, Government House Document) .

Endowed with a fertile land and a good climatic condition, agriculture is the major industrial activity in the state. The state is divided into three agricultural zones Awgu, Enugu and Nsukka. Aninri local government Area from Awgu zone and Uzo-Uwani local government Area from Nsukka zone were purposively selected for the research work because of the high level of agricultural activities going on there.

3.2 Population of the Study

The population of the study were all the contact farmers in Enugu State. Four communities were randomly selected from the two local government Areas purposively selected for the research. The sample size was two hundred contact farmers made up of one hundred adopters and one hundred non-adopters of multiple cropping systems.

3.3 Instrument for Data Collection

The instrument used for data collection was a structured interview schedule. This was developed from 9 questions asked contact farmers not used for the research and from personal field experience of the researcher.

3.4 Data Collection

The researcher and ten trained enumerators administered the structured interview schedules to the contact farmers.

The data were based on selected personal characteristics of the contact farmers such as age, gender, marital status, household size, highest educational qualification, sources of farm labour, sources of income. It also contained contact farmers and extension Agency-related factors which the contact farmers perceived as constraints to the adoption of the multiple cropping systems. They were also examined on the yield differentials between the Yam/cassava/ maize/ melon alternate row and cassava/Rice and the traditional intercropping system. There was

also an examination of the income levels of adopters and non-adopters. They were equally requested to rate the possession of material and income of adopters and non-adopters.

A four point likert type interview scale was utilized to determine the degree to which the factors affect the rate of adoption of the cropping systems. They were weighted as follows.

Very high degree	3
High degree	2
Little degree	1
No contribution	0

Any interview schedule item which had a mean response value of 1.50 or above was regarded as a major constraint, while any item which had a mean value less than 1.50 was regarded as a non-contributor constraint.

3.5 Data Analysis

Data obtained were analyzed by the use of descriptive statistics such as means, frequencies, percentages.

Multiple regression techniques was used to determine the relationship between the adoption of the cropping systems and the crop yield per hectare.

$$A = F(X1, X2, X3, X4, X5, X6, X7, X8, X9, X10)$$

Where A= the adoption index measured by the intensity of adoption where intensity of adoption is defined as the proportion of a farmers farmland devoted to

multiple cropping systems-Yam/cassava/maize/melon and cassava/rice.

X1 = House/stock size (No in the Household)

X2 = Herd/ stock size (No of animals)

X3 = Yield per hectare

X4 = Annual Farm Income

X5 = Annual Farm income from other sources

X6 = Farm size (in hectares)

X7 = Credit availability

X8 = No of Hoes

X9 = No of matchets

X10= Household possession such as house-type, radio, bicycle and furniture. The apriori expectation was that some independent variables would positively affect the rate of adoption of the multiple cropping systems. The independent variable were strictly chosen to minimise the effect of multicollinearity which normally arise in multiple regression.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Personal Characteristics of the Farmers

The personal characteristics of the farmers discussed are age, gender, marital status, house-hold size, highest educational qualification, sources of farm labour, sources of income.

Age of the Farmers

Forty-one percent of the farmers were of 21-40 years age bracket, while 52.00% were between 41-60 years old. Only seven percent of the farmers were above 60 years.

4.1.1 Table 1 Distribution of Farmers by age

N=200

Age (Years)	%
21 – 30	20.00
31 – 40	21.00
41 – 50	33.00
51 – 60	19.00
Above 60	7.00
Total	100.00

The implication of this was that majority (52.00%) of farmers were much older. The relative older age of the farmers was likely to have contributed to the low rate of adoption of the multiple cropping systems.

Gender of the Farmers

Majority (76%) of the contact farmers were males. This showed that the male contact farmers were more involved in the multiple cropping systems of Yam/cassava/maize/melon alternate row and cassava/ Rice.

4.1.2 TABLE 2 Distribution of farmers by gender

N=200

Gender	%
males	76.00
females	24.00
Total	100.00

This finding supports that of Ohuegbe, (1989) which stated that although women make a major contribution towards increased food production, they hardly got involved in yam dominated cropping patterns and hardly did they benefited from extension services.

Marital Status of the Farmers

The data in Table 3 show that while 72.50% of the contact farmers were married, 27.50 were single

4.1.3 TABLE 3 Distribution of Farmers by Marital Status

N=200

Marital status	%
married	72.50%
single	27.50%
Total	100.00

Highest Level of Educational Attainment of the Contact Farmers

Table 4 indicates that 12.50% of the farmers had no primary education, 25.00% of them had in complete primary school education. While 22.50% of them attended and completed secondary school education, 15.00% of them attained a level a little above secondary school. The category were Nigeria Certificate in Education (NCE), Bachelor of Science (B.SC) holders. The implication of this is that majority of the farmers had primary school education. The extension agents have to apply extension strategy and methods that can effectively stimulate the senses of seeing and touching by the farmers.

4.1.3 TABLE 4 Distribution of Farmers by the Highest Level of Educational Attainment

N=200

Highest level of Educational attainment	%
No primary school	12.50
Incomplete primary school	25.00
Completed primary school	25.00
Incomplete Secondary school	5.80
Completed Secondary school	16.70
Others	15.00
Total	100.00

Household Size of the Farmers

Entries in Table 5 show that 70.84% of the farmers had household size of 0-5, while 29.16% had household size of 6-8 whereas 8.33% had above 9 household size.

4.1.5 TABLE 5 Distribution of Farmers by Household size

N=200

Household size	%
0 – 2	33.34
3 – 5	37.50
6 – 8	20.83
9 and above	8.33
Total	100.00

Source of Farm Labour

Data in Table 6 indicate that most (75.00%) of the contact farmers had family labour, 20.80% used hired labour, while 4.20% relied on their personal labour.

4.1.6 TABLE 6 Distribution of Farmers by Score of farm labour

N=200

Source of Farm labour	%
Family labour	75.00
Hired labour	20.80
Personal labour	4.20
Total	100.00

Sources of Income

Data presented in Table 7 show that majority (70%) of the contact farmers had their major source of income from their personal savings and friends and neighbours, while (10%) had the co-operative societies as their source, 20% had the Isuzu (Thrift saving) as their source of income, none had any amount from the banks.

4.1.7 TABLE 7 Distribution of farmers by the source of income

N=200

Source of Income	%
Personal savings	50.00
Friends & neighbours	20.00
Co-operative societies	10.00
Isuzu (thrift savings)	20.00
Banks	00.00
Total	100.00

The implication of the finding showed that most of the contact farmers did not get financial assistance from formal financial institutions like the banks. This will not be unconnected with the complex collaterals which the banks demand from the contact farmers.

4.1.8 TABLE 8 Distribution of differential per hectare of Yam/cassava/maize/melon alternate row and cassava/Rice and traditional intercropping system.

Cropping system	Yam	cassava (c)	maize (c)	Melon (c)	Gain %
		t/ha			
single row	4.74	9.84	1.74	0.12	0.8
Alternate row	14.50	13.64	9.60	4.50	8.2
Farmers method (traditional inter cropping System	3.64	7.15	0.67	0.11	-

Data presented in Table 8 showed that single row and alternate-row multiple cropping systems out-performed the farmers practice by 0.8% and 8.2% respectively. The yield of the base crop, Yam was better in single and alternate row than the farmers practice, so was cassava (13.64) maize (9.60), melon (4.50). The component crops in the alternate row arrangement was apparently better than those of other intercropping arrangements.

4.1.9 Table 9 Distribution of the respondents according into income differentials as a result of adopting or not adopting the multiple cropping systems.

		Adopters	Non-Adopters
I	Total farm cash income	₦10,500.00	₦4,000.00
Ii	Total farm non-cash income	₦8,000.00	₦2,500.00
Iii	Total non-farm income	₦5,000.00	₦2,000.00
Iv	Total non-farm non-cash income	₦6,000.00	₦6,000.00
v	How much of your farm income did you save in the last farming season	₦13,000.00	₦6,000.00
vi	Amount of savings with saving institutions	-	-
vii	Amount of savings kept in cash in the house	₦4,000.00	₦1,000.00
viii	Amount of savings in financial instruments (bonds, shares etc)	-	-
Ix	Amount of saving in kind - land, seeds, livestocks, fertilizer	₦12,000.00	₦6,000.00
x	Bicycles (No)	1	-
xi	Vehicles (No)	-	-
xii	Motor cycles (No)	1	-

Data presented in Table 9 above shows the differential income status of adopters and non-adopters of the multiple cropping systems. The data show that the adopters had on aggregate a greater income than those farmers who did not adopt the

multiple cropping systems. The data show that except in amount savings with saving institutions, Amount of savings in financial instruments (bonds, shares etc) where both the adopters and non-adopters had nothing, the adopters had a greater income and were likely to have a greater purchasing power. The implication of this was that, the adopters were mostly likely to have a better standard of living than the non-adopters.

4.1.10 Summary of Regression on factors influencing Adoption of multiple cropping systems-yam/cassava/maize/melon and cassava/rice
Table 10

S/No	Explanatory variable	Regression coefficient	T-Ratio
1	Household size	0.039	1.986
2	Herd/stock size	-0.014	0.003(NS)
3	Yield/stock size	-0.012	0.016(NS)
4	Annual farm income	0.024	4.107xx
5	Annual income from other source	0.038	-2.420xx
6	Farm size (hectare)	-0.015	-2.836xx
7	Credit availability	0.042	1.834xx
8	No of Hoes	-0.015	-2.945(NS)
9	No of matchets	-0.001	0.012(NS)
10	Household possession such as house type, radio, bicycle and furniture	-0.003	0.018 (NS)

*Significant at 5 percent
* Significant at 1 percent
* Intercept - 0.192
* R2 - 0.244
* F - 5. 818xx
NS - Not Significant

The result of the linear multiple regression analysis on contact farmers adoption of the yam/cassava/maize/melon and cassava/Rice is presented in Table 9

The co-efficient of household size (X1) is positive and significant at 1 percent, showing direct relationship with adoption. This is in consonance with our apriori expectation, that the number of adult agricultural workers in a farmer's household is expected to ease labour constraint, thereby enhancing the adoption process.

The co-efficient of herd/stock size was negative. This sign is contrary to our apriori expectation and implied that the inverse relationship existed between herd/stock size and the intensity of adoption of the multiple cropping systems which is our dependent variable.

The co-efficient of yield per hectare was also negative which implies that there existed an inverse relationship between the yield per hectare and adoption of the multiple cropping system.

The co-efficient of Annual farm income (X4) was positive and significant at I percent, showing direct relationship with adoption. This is consonance with our priori expectation that rural finance would boost the adoption of innovations. This was because, the adoption of new innovations would result in purchasing improved inputs.

The co-efficient of annual farm income from other source (X5) was also positive and significant at I percent. This implied a direct relationship between annual farm income from other sources and adoption.

The co-efficient of farm size (hectare) (X6) was positive and significant at I percent. This implied that there was a direct relationship between the independent variable and dependent variable - adoption.

The co-efficient of credit availability percent (X7) is positive and significant at 1 percent. This showed a direct relationship between the variable and adoption. This was expected because improved technology adoption sometimes were cost-effective.

In contrast, no significant relationship seemed to exist between the intensity of adoption of yam/cassava/maize/melon alternate row and cassava/rice and such factors as herd/stock size, yield per hectare, no of hoes, no of matchets, household possession such as housetype, radio, bicycle, and furniture

Constraints to Adoption of the Multiple Cropping Systems

Perhaps, one of the most readily visible attributes of the rural farmers' pattern of production is the large number of crops grown. This is to guard against crops failure. However, the crops are planted in scattered positions. Even through the adoption of yam/cassava/rice cropping systems will ameliorate the shortcomings of the old systems, they have not been massively adopted. Factors that constrain their adoption are categorized into contact farmers, Extension-Agency, the multiple cropping systems and environmental related factors.

4.1.11 Table 11 Distribution of Farmers by their perceived constraints.

Constraint	Constraint mean (X) scores	
	System I	System II
	Yam/cassava/melon mean (X) score	Cassava/rice mean (X) score
Unawareness of the multiple cropping systems	1.62	1.067
Improved planting materials like cassava cuttings, seed yams and rice seeds	1.92	2.11
Low level of education	2.17	2.17
Agro-chemicals	2.14	2.18
Fund	2.47	2.45
High cost of inputs	2.19	2.45
Time	1.19	1.18
Unavailability of labour	1.41	1.15
Land tenure problems	1.44	1.09
Motivation like letters of commendations praises the farmers	1.07	0.84
Grand mean (X)	1.61	1.57

Entries in Table 11, show that unawareness of the multiple cropping system (1.62), lack of improved planting materials such as cassava cuttings, seed yams (1.92), low level of education (2.17), agrochemicals (2.14), fund (2.07), and high cost of inputs 2.19, were considered constraints for the adoption of yam/cassava/maize/melon alternate row, while improved planting materials: including cassava cuttings and rice seeds (2.11), low level of education (2.17) agrochemicals (2.18), funds (2.45), high cost of inputs (2.45), were considered constraints to adoption of cassava/Rice. The grand means X of 1.61 for Yam/cassava/maize/melon alternate row and X 1.57 for the cassava/Rice cropping systems show that out of the ten items listed,

seven had been identified as major constraints to the adoption of the technologies. The extension outfit may have to provide inputs at subsidized prices and have to adequately motivate it's field staff for optimum output. The findings show that unawareness of the multiple cropping systems. Improved planting materials like cassava cuttings, seed yams, rice seeds, low level of education on the part of the farmers, agro-chemicals, fund and high cost of inputs were considered significant factors that constrained the massive adoption of the multiple cropping systems. The high grand mean values showed that most of the items were significantly contributory to low rate of adoption of the cropping systems.

4.1.2 Table 12 Distribution of farmers by Extension Agency-related constraints

Constraint	Constraint mean (x) scores	
	System I Yam/cassava/maize melon (X) score	System II Cassava/ Rice (X) score
Irregular visit of extension agents to farmers	1.80	1.76
Technical competence on the part of Extension agents	0.87	1.15
Non-involvement of contact farmers in decision taking and planning of the systems	1.84	1.70
Inappropriate use of communication channels skills by Extension agents	0.84	0.91
Irregularity of extension agents at sub-circle meetings	1.82	1.50
Non-organisation of field days by extension agents	1.8	1.63
Periodic training for contact farmers	1.72	1.66
Good working relationship will the farmers	0.95	1.07
Grand mean (X)	1.40	1.42

The findings show that irregular visits of extension agents to farmers, non-involvement of contact farmers in decision-taking and planning of the systems,

irregularity of extension agents at subcircle meetings and periodic training for contact farmers contributed significantly to low rate of adoption of the cropping systems.

The extension agency has the duty to ensure that extension agents follow strictly the Training and visit extension delivery system. There is so much to gain in increasingly involving the farmers in planning technologies. Ayichi (1995), asserted that only research results evaluated and validated by the farmers themselves should be transferred to them.

4.1.13: Table 13 Distribution of Farmers by their perceived multiple cropping system yam/cassava/maize/melon alternate row related constraints.

System 1

Constraints	Constraint mean (X) score
Too close spacing involved in the system	1.30
Non-uniform sprouting of the yam	0.63
Overshadowing of the late sprouting yams by the cassava component especially Tms 30572	0.90
Staking material for the yam	1.64
Small size of the planting materials	1.40
Wastes of land after harvesting of yams	1.70
High demand for agro-chemicals	1.85
High demand for organic and in organic fertilizers	2.39
The laborious nature of the system	1.59
Grand mean X	1.49

The table above shows a grand mean (X) of (1.49). The grand mean value is below the cut off mean point. This showed that multiple cropping system

yam/cassava/maize/melon alternate row related factors did not significantly contribute to the low rate of adoption of the cropping system

4.1.14 Table 14 Distribution of Farmers by their Perceived Multiple Cropping System Cassava/Rice Related Constraints

System 11

Constraints	constraint mean score (X)
Scarcity of improved rice like ITA 315, 257	2.07
Scarcity of improved cassava cultivars like Tms 30572,30555	1.87
Disruption of growth and development of rice at the furrow by erosion	1.71
High demand for agro-chemicals to least cassava/rice pests and diseases	1.91
The complexity of the practices involved	1.16
High demand for storage facilities	1.15
Low income generation conflict with the people's culture.	1.27
Grand mean (X)	1.53

Data in Table 14 reveal that out of eight itemised constraints, scarcity of improved vice seeds like ITA 315, 257 12.071 scarcity of improved cassava cultivars like Tms 30572, 30555 (1.87) disruption of growth and development of rice at the furrow by erosion 91.71) and high demand for agro-chemicals to treat cassava/rice pests and diseases (1.91) were found to have significantly contributed to the low rate of adoption of cassava/rice cropping pattern.

The table also shows a grand mean (X) of 1.53 for the cassava/rice cropping system. The high grand mean is an indication that the inherent attributes of the cassava/rice cropping pattern is contributory to low rate of adoption of cassava//rice.

Environmental - Related Constraints

Data in Table 14 below show that out of eight environmental related constraints, only evolution of pests (1.53) evolution of diseases (1.51), and poor soil fertility (1.64), had significant influence on the adoption of the two multiple cropping systems- yam/cassava/maize/melon alternate row and cassava/rice.

4.1.15 Table 15 Distribution of Farmers by Environmental Related Constraints

Constraints	Constraints	mean (x)
	Yam/cassava/maize/ melon alternate row	Cassava/rice
Evolution of pests	1.53	1.53
Evolution of diseases	1.51	1.51
Irregular rainfall	1.17	1.16
Poor soil theft	0.38	0.45
Lack of motorable feeder roads	0.96	0.91
Problem of soil erosion	0.95	0.87
Fire out-break (especially during dry season)	0.61	0.45

The issue of pest attack in the cropping system is evident, because as earlier revealed in this research, there were not always agro-chemicals such as his apronplus to treat the yam seeds, cassava cuttings, maize and melon seeds before planting them. It has been suggested that for pest control in cassava cuttings with 0.1% solution of Rogo 40 (Dimethoate) or perfection and application of carbon furg (furadan) at 2.5kg per hectare are recommended. For the yams, where beetles, crickets and termites are endermic, dusting of yam setts with a carbonate insecticide such as carbosultan (marshal) are recommended. (Enugu State Agricultural Development Programme, 1995) Damages caused by pests and disease to crops

have always been a great problem to farmers. Ajisebutu (1983), reported that₦ 1.8 million worth of cassava was lost to the mealybug between 1980 and 1983 in Nigeria.

Farmers Perception on the Degree of Relationship Between them and the Agricultural Extension Agents

According to Table 16, the relationship between the contact farmers and the agricultural extension agents was fair.

4.1.16 Table 16 Distribution of farmers perception of the degree of relationship between them and the agricultural extension agents N=200

Degree of Relationship	%
Good	33.33
Fair	55.00
Poor	11.67
Total	100.00

The data show that there was/were good relationship(s) between the contact farmers and the extension agents. This kind of good relationship was very necessary, so as to facilitate the agricultural extension agents technology-transfer process.

Farmers Opinion on the Need to Modify the Multiple Cropping Systems

Data presented in Table 16, show that majority (75.83%) of the respondents were of the opinion that the multiple cropping systems should be modified to enhance mass adoption of the cropping systems. This will go a long way in

reducing rural poverty among the farmers in the state when majority of the farmers adopt the multiple cropping systems, it is likely that their yield will increase thereby increasing their purchasing power which invariably will reduce drastically rural poverty among the farmers.

4.1.17 Table 17 Distribution of farmers opinion on the need to modify the multiple cropping systems. N=200.

Need for modification of the systems	%
Need to modify the cropping systems	75.83
There is no weed to modify the multiple cropping systems	24.17
Total	100.00

From the data presented in Table 17 above, it was evident that farmers agreed that the multiple cropping systems should be modified to suit their farming system approach. There was therefore need to modify the systems so that majority of our farmers will be adopting the cropping systems which have inherent advantages over the old systems.

Differences of Levels in Perception of Constraints by Contact Farmers

There was no significant difference in the level of perceived constraints among contact farmers in Aninri and Uzo-Uwani local government Areas of Enugu State.

Earlier, it was suspected that the areas the contact farmers were operating might have influenced their adoption of the multiple cropping systems. T-test was employed to determine the production constraints based on their location. Any probability level less than or equal to 0.05 was recognised as significant.

4.1.18 Table 18 Difference of levels in perception of constraints by contact farmers in Aninri and Uzo-Uwani local government Areas of Enugu State.

Variable	t-value
Unawareness of the multiple cropping systems	-0.56
Low level of education	-0.58
Improved planting materials	-2.30x
Agro-chemicals like apronplus furadan	-1.93
Fund	-1.20
High cost of inputs	-1.96
Time	-1.77
Unavailability of labour	-3.47x
Land tenure problems (small farm size)	-1.42
Motivation like letter of commendations, praises to the farmers	-0.65

** significant at P< 0.05 level.*

Table 18 shows that only improved planting materials (-2.30x) and availability of labour (-3.47x) were the constraints with significant difference at the probability level of 0.05, while the remaining were not significant.

The null hypothesis which stated that there was no significant difference in the levels of perceived constraints among the contact farmers based on their location was accepted. This showed that whether the contact farmers were at Aninri in Awgu agricultural zone or Uzo-Uwani in Nsukka agricultural zone had no effect on the rate of adoption of the multiple cropping systems of yam/cassava/maize/melon alternate row and cassava/rice.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The overall purpose of the research was to ascertain the factors militating against the adoption of yam/cassava/maize/melon and cassava/rice and examined the implication of their non-adoption to rural poverty in Enugu State. The specific objectives of the study were to

(i) Determine the difference in crop yield per hectare between yam/cassava/maize and cassava/rice and traditional intercropping system.

(ii) Examine the income differentials between the adopters and non-adopters

(iii) Determine the level of poverty between the adopters and non-adopters in terms of income and material possession

(iv) Ascertain the constraints to adoption of the multiple cropping systems in Enugu State

(v) Make recommendations that will enhance the adoption of the cropping systems in an effort to alleviate rural poverty.

Contact farmers in Aninri and Uzo-Uwani local government areas of Awgu and Nsukka Agricultural zones of Enugu state made up the population while the sample size was two hundred contact farmers, made up of one hundred adopters and one hundred non-adopters randomly selected from four communities from the two Agricultural zones``````````````````.

The results showed that about 52% of the farmers were of the range of 41-

60 years, while 12.50% had no primary education, majority 50% had primary school education. The main source of farm labour was the family labour from. While the major source of income were from personal savings and friends and neighbours.

Distribution of differential mean crop yield, showed that the combined biological yields of all the component crops in the alternate-row system out performed those of single-row planting system.

Household size, Annual farm income, Annual income from other source, credit availability were found to be positively related to the rate of adoption of the multiple cropping systems. Unawareness of the multiple cropping systems, lack of improved planting materials, low education on the part of the contact farmers, lack of agro-chemicals, lack of fund and high cost of inputs were found to be constraints to the adoption of the multiple cropping system.

Scarcity of improved rice seeds like ITA 315, 257, scarcity of improved cassava cultivars like Tms 30572, 30555, disruption of growth and development of rice at the furrow by erosion, high demand for agro-chemicals to treat cassava/rice pests significantly contributed to the low rate of adoption of cassava/rice cropping pattern.

The following environmental related factors-: evolution of pests, evolution of diseases, and poor soil fertility had significant influence on the adoption of the two multiple cropping systems.

The contact farmers agreed that they had cordial relationship with the agricultural extension agents. However, this established relationship has not been manifested or reflected in the rate of adoption of the multiple cropping systems. Majority of the contact farmers were also of the opinion that some element in the multiple cropping system should be modified.

There was no significant difference in the level of perception of constraints by contact farmers in Awgu and Nsukka agricultural zones.

CONCLUSION

The investigation of the constraints to the adoption of yam/cassava/maize/melon alternate row and cassava/rice cropping systems is timely and of great importance. The study identified the constraints and weaknesses of the cropping systems and proffered solutions to help improve their adoption by contact farmers. It is hoped that when contact farmers adopt the systems massively, their purchasing power will increase. This no doubt will reduce rural poverty to a marginal level.

Finally, when the contact farmers adopt the multiple cropping systems, there will be great quantities of improved varieties of cassava cultivars, and rice seeds yams and in this way the standard of living of the contact farmers who constitute the bulk of the people found in rural areas would be improved.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed.

1. Diagnostic survey in On-Farm Adaptive Research (OFAR) of Agricultural Development Programme should be evaluating the cropping systems periodically. This will help them detect areas of problems and provide immediate solutions. This will go a long way in enhancing the adoption of the technologies.

2. The contact farmers who adopt the technologies should be motivated by organising prize-giving days. It could also be by giving them letters of commendations. These will motivate other farmers so that they too could also adopt the technologies

3. Since rural poverty was very common among the contact farmers, they should be encouraged to form co-operatives to enhance their capital saving strength, and their ability to borrow from formal financial institutions.

4. The farmers should be encouraged to embrace the Adult literacy programmes. This will help them understand some of the technologies transferred to them by the agricultural extension agents.

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APPENDIX

Constraints to Adoption of Recommended multiple cropping system and implications of their non-adoption to Rural poverty in Enugu State

INTERVIEW SCHEDULE

Dear contact farmer,

You are requested to provide answers to the following questions. This interview schedule is purely for academic purpose and all information supplied will be treated in absolute confidence.

Please tick (_/) in the appropriate box and fill in the space provided as accurately as possible.

Thanks

OCHIAKA, JOSEPH SUNDAY
B.Sc (HONS) NIGERIA

BACKGROUND INFORMATION

1 Sex. male ( ) female ( )
2 Age
(a) 21-30 years ( ) (b) 31-40 years ( )
(e) Above 60 years ( )

3 Marital status: (a) married ( ) (b) single ( )

4 Highest level of educational attainment
a No primary school at all ( )
b Incomplete primary school ( )
c Completed Primary school ( )
d Incomplete primary school ( )
e Complete secondary school ( )
f Others (please special.....

5 How many children do you have
i 0-2 (ii) 3-5 (iii) 6-8 (iv) 9 and above

6 How many dependent relatives above 15 years and are capable of performing farmwork are living with you?
i 0-2 (ii) 3-5 (iii) 6-8 (iv) 9 and above

7 What is your major source of farm labour

i Family labour ( )
ii Hired labour ( )
iii Personal labour ( )
iv tractorization ( )
v Others (please specify).....

8 What is your major source of income

i Personal savings ( )
ii Friends and neighbours ( )
iii Co-operative societies ( )
iv Isusu (thrift savings) ( )
v Banks ( )

9 Which of the following cropping systems do you practice

i Single-row cropping system ( )
ii alternate-row cropping system ( )
iii Traditional cropping system ( )

10 What is the population range of your crop in the three cropping systems
Single-row cropping Yam..... cassava.....maize.....melon
Alternate-row cropping Yam..... cassava.....maize.....melon
Traditional intercropping Yam.....cassava.....maize.....melon

What in the average yield of Yam, cassava, maize melon annual

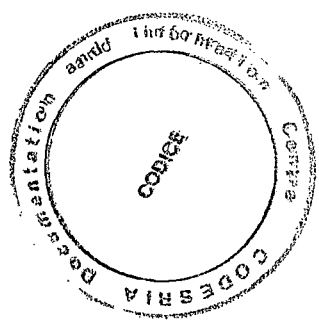
CONTACT FARMERS-RELATED CONSTRAINTS

Tick as applicable using the following ratings -:

Very high degree =VHD
High degree =HD
Little degree =LD
Not a constraint =NC

Degree of contribution to non-adoption of Yam/cassava/maize/melon and cassava/rice

	CONSTRAINTS	VHD	HD	CD	NC	VHD	HD	CD	NC
1	Unawareness of the multiple cropping systems								
2	Low level of education								
3	Lack of improved planting materials like cassava cuttings and rice seeds								
4	Lack of agro-chemicals like apronplus, furadan								
5	lack of fund								
6	High cost of the inputs								
7	Lack of time								
8	Unavailability of labour								
9	Land tenure problems (small farm size)								
10	Lack of motivation, like letters of commendations, praises to the farmers								



AGENCY - RELATED CONSTRAINTS

Tick as applicable Degree of contribution to the non-adoption of yam/cassava/maize/melon and cassava/rice

		Yam/cassava/maize/ melon				Cassava/rice			
	CONSTRAINTS	VHD	HD	CD	NC	VHD	HD	CD	NC
1	Irregular visits of extension agents to farmers								
2	Lack of technical competence on the part of the extension agents								
3	Non-involvement of contact farmers in decision-making and planning of the systems								
4	In appropriate use of communication channels/skills by extension agents								
5	Irregularity of extension agents at subcircle meetings								
6	Non-organisation of field days by extension agents								
7	Lack of periodic training for contact farmers								
8	Does not establish good working relationship with-the farmers.								

INCOME DIFFERENTIAL BETWEEN ADOPTERS AND NON-ADOPTERS OF THE RECOMMENDED MULTIPLE CROPPING SYSTEMS

State the total income you earn in the last year or farming season 1997/98

		Adopters	Non-Adopters
a	Total farm income		
b	Total farm non-cash income		
c	Total non-farm cash income		
d	Total non-farm non cash income		
e	How much of your farm income did you save in the last farming season		
f	Amount of savings with saving institutions		
g	Amount of saving kept in cash in the house		
h	Amount of savings in financial instruments (bonds, shares etc)		
i	Amount of saving in kind-land, seeds, livestock, fertilizer		
j	Bicycle		
k	Vehicles		
l	Motorcycle		

MULTIPLE CROPPING SYSTEM-RELATED CONSTRAINTS-YAM/CASSAVA/MAIZE/MELON ALTERNATE ROW

Please tick as applicable Degree of contribution to the non-adoption of Yam/cassava/maize/melon alternate-row

	CONSTRAINTS	VHD	HD	CD	NC
1	Too close spacings that are involved in the system				
2	Non-uniform sprouting of the yams				
3	Overshadowing of the late sprouting yams by the cassava component especially Tms 30572, Tms 30555				
4	Lack of staking materials for the yams				
5	small size of the planting materials				
6	Wastes of land after harvesting of yams				
7	Lack of agro-chemicals like apronplus to treat the seeds before planting				
8	Lack of organic and inorganic fertilizer				
9	The laborious nature of the system				

CASSAVA/RICE

Please tick as applicable Degree of contribution to the non-adoption of cassava/rice.

	CONSTRAINTS	VHD	HD	CD	NC
1	Lack of improved rice seeds like ITA 315, 1425				
2	Lack of improved cassava cultivars like Tms 30572 30555				
3	Disruption of growth and development of rice at the furrow by erosion				
4	Lack of agro-chemicals to treat cassava/rice pests and diseases				
5	The complex nature of the practices involved				
6	Lack of storage facilities				
7	The system is of low income generation				
8	The system conflict with the people's culture				

ENVIRONMENTAL-RELATED CONSTRAINTS

Please tick as applicable.

Degree of contribution to the non-adoption of Yam/cassava/rice.

		Yam/cassava/maize/ Melon				cassava/rice			
		VHD	HD	CD	NC	VHD	HD	CD	NC
1	Evolution of pests								
2	Evolution of disease								
3	Irregular rainfall								
4	Poor soil								
5	Problem of theft								
6	Lack of motorable feeder roads								
7	Problem of soil erosion								
8	Fire outbreak (especially during dry seasons)								

Describe the relationship that exists between you and the extension agent (a) Good ( ) (b) Fair ( ) (c) Poor ( )

In your opinion, do you think that the multiple cropping systems could be modified to suit your situation, Yes ( ) No ( ) suggest ways of modifying/improving the multiple cropping systems to enhance their adoption by contact farmer as a way of reducing their rural poverty

1 .....
2 .....
3 .....
4 .....
5 .....
6 .....
7 .....
8 .....
9 .....
10 .....