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Socio-economic factors influencing adoption of yam Minisett Technology in Niger State of Nigeria

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ABSTRACT.

Nigeria produces about 70% of the world's yam accounting for about 39.9 million tonnes. The major constraint has being that of planting seeds amounting to about one third of the total production cost. In order to reduce this perennial production problem, yam minisett technology developed by National Root Crop Research Institute, Umudike, was thought to be an alternative to solving the planting seed menace. This study attempts to investigate the socio-economic factor influencing the adoption of this new technology. It was conducted in all the 25 local Government areas of Niger State. Data were collected by multi – stage random sampling technique using structured questionnaire. Descriptive statistics and multiple regression analysis were used to analyse the information collected. Results showed that majority of the farmers interviewed had no access to credit, very low extension contact, low levels education, lack of awareness about the minisett technology and therefore were yet to adopt the minisett technology. Farm size (0.796), labour input (-0.585), cooperativeness (1.026), extension contact (0.959), income (0.473) and credit (0.533) were found to significantly influence the adoption of the yam minisett technology. The study recommends increased farm advisory services. Farmers should belong to Cooperative societies.

Key words: adoption, minisett technology, socio-economic factor

INTRODUCTION

Yam is one of the root crops produced in Nigeria. It is the second most important tropical root crop in West Africa after Cassava (Osunde, 2008). The distribution of yam cuts across the world with the total global production put at about 39.9 million tons in 2005, the bulk of which came from the yam belt of West Africa (stretching from Nigeria to C'ote d'Ivoire) from which about 91% of the world's production obtains (FAOSTAT, 2005) in Tsado, (2012). Osunde, (2008) further observed that, West Africa accounts for about 90 - 95% of the world's production with Nigeria producing about 70% of that quantity.

Yam production is constrained by several factors with planting material rated to about one third ($^{1}/_{3}$) of the total cost of production (Bolarinwa and Oladeji, 2009). Nweke *et al.*, (1991) lending credence to this observed that planting material accounted for about 50% of the total cost of production. Lawrence, (2006) found that scarcity and the expensive nature of clean planting material was the major constraint to increasing yam production and productivity in West Africa.

Seed yams are the planting materials used in the field of production of ware or table yam and these are scarce and expensive. Yam farmers in Nigeria obtain planting materials from previous harvest through milking or cutting good ware yam into sections for planting. Hence, the minisett technique was developed by National Root Crop Research Institute, Umudike in collaboration with International Institute of Tropical Agriculture (IITA), Ibadan Nigeria in 1970s as a rapid means of multiplying yam germplasm to address the frequent problems of high cost and non availability of seed yam (Oguntade *et. al.*, 2010).

Minisett are cuts of yam tubers having skin attached to them from carefully selected tubers used as alternative means to the production of seed yam through milking of ware yam. For the traditional method, 100 – 200g setts can be used while minisett technique could be achieved using 25, 20, 15 and 10g cut from tubers and is the only on – farm practicable alternative to the use of ware yams as seed yam (Oguntade *et. al.*, 2010).

Considerable research work has been conducted over years to ascertain the adoption behaviour of farmers in Nigeria in adopting improved technologies (Ajaji and Akinwumi, 1989 in Augustine *et al.*, 2008). Okoro, (2008) conducted a study on the adoption behaviour of farmers on minisett technology across 18 states in Nigeria. The results indicated that only 46.6% of the respondents were aware of minisett technique while 22.4% used the technique.

The adoption behaviour of yam farmers in Niger State has not been fully investigated in recent time. The objectives of this study were to evaluate the awareness of farmers with the minisett seed technology in Niger State and examine the farmers specific characteristics and institutional factors affecting the extent of adoption of the minisett technology.

METHODOLOGY

Study area.

The study was conducted in Niger State, Nigeria. Niger state is located on latitude 3.20^{o}East and longitude 11.30˚North in the North Central Zone of Nigeria with land mass of 92,800 km^{2}and having a population of 3,950,249 whose majority tribes are Nupe, Gwari, Hausa and Kambari with about 85% of this population practicing agriculture specifically, growing yam, rice, sorghum, cowpea and maize in large quantity (Niger State Government Diary, 2008 and Nigerian Census Figure, 2006). The State experiences distinct dry and wet seasons with annual rainfall varying 1,100mm-1,600mm with temperature ranging 29.4^{o}C - 39.2^{o}C (Niger State Government Diary, 2008).

Data Collection.

Data were collected from the three Agriculture zones in the state (a classification module of the Niger State Agricultural Development Project) as follows: Zone I (8 Local Government Area), Zone II (9 L.G.A) and Zone III (8 L.G.A). The study was carried out during the growing season of 2012. The respondents from whom primary data were elicited were selected using a multi – stage random sampling technique. Relevant information was elicited from the respondents using a set of structured questionnaire. Two villages were randomly selected from each Local Government area of the State from which 10 respondents from each village were selected and interviewed. Data collected included, age of the respondent; marital status; house hold size; educational status; farming experience; awareness of the minisett, technology and its acceptance and size of farmland committed to the practice of minisett technique. Information was also gathered on respondents' access to credit whether or not they work under cooperatives and their access to extension education.

Analytical technique

The data collected were analysed using descriptive statistics such as means, percentages, frequencies distribution as well as multiple regression analysis.

Model specification

A farmer adopts a technology only to the extent the new technology is perceived to be superior to his current practice in terms of overall welfare. It was hypothesized that certain socioeconomic and institutional factors are believed to affect the adoption decision of the farmer.

The model is specified in implicit form as:

EAD = f (GEN, AGE, EXP, HHS, EDU, FAS, LAB, MEM, EXT, INC, CRE, μ) ---------- (1)

Where,

EAD = Extent of adoption defined as the number of the components of the technology adopted by the farmer. The components are: 1. Land preparation; 2. Use of seed beds; 3. Recommended sett size (25g-50g); 4. Use of seed dressing chemical (minisett dust); 5. Time of planting (when the rains are steady); 6. Spacing (25cmx100cm) and 7. Fertilizer application.

GEN = Gender of the respondent (Binary variable: male =1, female =2)

AGE = Age of respondent (Number of years)

EXP = Farming experience (Number of years)

HHS = Household size (Number of persons)

EDU = Educational status (Number of years spent in school)

FAS = Farm size (Hectarage devoted to the technology)

LAB = Labour input (in Man-days)

MEM = Membership of cooperative society or farmer association (Dummy variable:

member =1, 0 otherwise)

EXT = Extension contact (Number of times a farmer was visited by extension agent)

INC = Level of personal income of respondent (in Naira),

CRE = Access to credit (Amount received as credit in Naira), and

μ = Error term or disturbance term with stochastic properties

Data were fitted to several functional forms and the equation adjudged to be of "best fit" was used for further discussion. The criteria for the choice of the lead equation are: the relative magnitude of the coefficient of multiple determination (R^2) which gives the explanatory power of the model, number of significant estimated regression coefficients, conformity of signs of estimated regression coefficients with *a priori* expectation, relative magnitude of estimated coefficients and the Overall significance of the R^2 value given by the F-ratio.

The explicit forms of the regression equations are presented as follows:

1) Linear:

$$EAD = \beta o + \beta_1 GEN + \beta_2 AGE + \beta_3 EXP + \beta_4 HHS + \beta_5 EDU + \beta_6 FAS + \beta_7 LAB + \beta_8 MEM + \beta_9 EXT + \beta_{10} INC + \beta_{11} CRE + \mu \quad \text{----------(2)}$$

2) Semi-logarithmic (Linear-Log)

$$EAD = \ln\beta o + \beta_1 \ln GEN + \beta_2 \ln AGE + \beta_3 \ln EXP + \beta_4 \ln HHS + \beta_5 \ln EDU + \beta_6 \ln FAS + \beta_7 \ln LAB + \beta_8 \ln MEM + \beta_9 \ln EXT + \beta_{10} \ln INC + \beta_{11} \ln CRE + \mu \quad \text{----------(3)}$$

3) Exponential (Log-Linear)

$$\ln EAD = \beta o + \beta_1 GEN + \beta_2 AGE + \beta_3 EXP + \beta_4 HHS + \beta_5 EDU + \beta_6 FAS + \beta_7 LAB + \beta_8 MEM + \beta_9 EXT + \beta_{10} INC + \beta_{11} CRE + \mu \quad \text{----------(4)}$$

Double-logarithmic (Cobb-Douglas)

$$\ln EAD = \ln\beta o + \beta_1 \ln GEN + \beta_2 \ln AGE + \beta_3 \ln EXP + \beta_4 \ln HHS + \beta_5 \ln EDU + \beta_6 \ln FAS + \beta_7 \ln LAB + \beta_8 \ln MEM + \beta_9 \ln EXT + \beta_{10} \ln INC + \beta_{11} \ln CRE + \mu \quad \text{----------(5)}$$

RESULTS AND DISCUSSION

Results of the frequency distribution of the socio – Economic characteristics of the respondents such as age, marital status, household size, educational level, farming experience, access to credit, membership cooperative and extension contact are presented in Table 1 and the results are discussed as follows.

Age. A large proportion of the respondents (34.4%) were within the ages of 41-50 years while only 5.6% of them were above the age of 50 years. Similarly the same percentage (5.6%), were below 25 years of age. This is an indication that the majority of the yam farmers in the study area are in their agriculturally active years. They are likely to use their energy to solve the problem of high labour demand for yam production as observed by Bolarinwa and Oladeji, (2009) who observed that yam is considered to be man's crop in Africa because it is labour intensive.

Marital Status. Overwhelming majority (86.8% of the respondents) were married with only 13.2% still single. The large involvement of married farmers implies that, yam is an important source of food and an income to the prospective families. This is in agreement with the findings of Augustine *et. al.*, (2008) who found that over 70% of the married couples were involved in yam production in South Eastern Nigeria.

Household size. A large proportion (58.4%) of the respondents had less than 5 family members while those with greater than 20 members were only 2.0% of the sample. This result suggests that, the farmers may require hired labour in order to increase their productivity/income since yam production is labour intensive.

Educational Status. Result of this study showed that a large proportion (44.8% of the respondents) were not educated while only about 13.6% and 8.8% had or are still attending secondary or postsecondary schools respectively. This suggests that most farmers are likely to exhibit negative attitudes to the adoption of new technologies since education influences adoption rates.

Experience in Farming. About 46.0% had farming experiences above 20 years while those with less than 15 and between 16 to 20 years were 14.4% and 39.6% of sampled respondents respectively. This result reveals that those who had spent more years in farming were more likely to adopt new technologies because farmers' previous experience with other innovations will likely influence their understanding of the gross margin of innovation. Experience also enables the farmer set realistic targets. This finding corroborates the earlier work of Ironkwe, *et. al.,* (2007). They found that experience improves farmers' production skills such as good planting methods and the use of improved seed. This may enhance the profitability of the innovation which is an advantage to the adoption of innovation by the farmers.

Access to Credit. The largest proportion (99.2%) of the respondents had no access to credit. Only 0.8% had access to credit. Access to credit can enhance adoption and profit efficiency. Non availability of credit to the farmers could limit adoption of yam minisett in the study area, because the adoption of improved technology has cost implications. This lends credence to the work of Ironkwe *et. al.,* 2007; who found that farmers' lack of access to credit was a serious limiting factor in the adoption of new technologies.

Membership of Cooperatives. The result of this study shows that majority (95.2%) of the respondents did not belong to any cooperative society. Only about (4.8%) of the respondents were members of a cooperative society, implying that most farmers in the study area had limited access to productive resources by pooling the resources and information about farm practices since cooperative societies serve as medium through which farmers could share ideas, resulting into receiving new information about new farm practices, as well as having access to funds since with the help of other cooperative members' new observations could be discussed (Odurukwe *et. al.,* 2003). These authors also suggested that, if a farmer belonged to a cooperative body, he will be more likely to be exposed to the adoption of new technologies.

Contact with Extension workers. Majority of the respondents (98.2%) did not have access to extension services. Only about 7.2% had access to extension workers. This is an indication that majority of the farmers did not have access to current agricultural practices. This may impede their effective production and hence profit realizable from the adoption of improved technology. A similar assertion was reported by Nnadi and Akwinu, (2006) who claimed that low level of extension contact remained largely responsible for the low level adoption of new technologies.

Results in Table 2, are descriptive statistics of the respondents' level of awareness, adoption of minisett technology, number of years of adoption of minisett technology and farm size devoted to minisett technology.

Awareness of minisett technology. About 58.4% of the respondents were not aware of yam minisett technology in the study area while the rest 41.6% were aware. This portrays that the awareness of minisett technology is still low after several years of its existence. The low level of awareness about the technology may be suggested to be due principally to low level of education along with poor extension services in the study area. This agrees with the work of Okoro, (2008) who found awareness level of minisett technique to be low (47%) in his study area resulting to low adoption rate.

Adoption of minisett technology The result revealed that majority (77.6%) were yet to adopt the technology. This may be due to lack of awareness as a result of low number of extension agents and low risk bearing. This equally indicates that farmers in the study area may still be relying on traditional method of acquiring seed yam through milking of ware yam or seeds obtained from the previous harvest.

Number of years in the adoption of minisett technology. The large proportion of the respondents (79.6%) had never practiced the technology while about 8.0% of the respondents had practiced the technology for the period of 11-20 years. Although the result suggests that the technology had been in existence for long in the study area, yet the adoption level has been low. This it may be suggested to be due largely to the low level rate of education; low level of awareness and probably because respondents are risk-averse farmers.

Table 1: Distribution of Respondent According socio-economic characteristics.

Variables	Frequency	Percentage
Age		
20 years	14	5.6
20 – 30 years	62	24.8
31 – 40 years	74	29.6
41 – 50 years	86	34.4
> 50 years	14	5.6
Total	250	100.0
Marital Status		
Single	33	13.3
Married	217	86.8
Total	250	100.0
Household size		
< 5 members	146	58.4
5 – 10 members	69	27.6
11 -15 members	21	8.4
16 – 20 members	8	3.2
>20 members	5	2.0
Total	250	100.0
Educational Level		
Primary	18	7.2
Secondary	34	13.6
Post - Secondary	22	8.8
Adult Education	3	1.2
Qur'anic Education	60	24.0
None	112	44.8
Total	250	100.0
Farming Experience		
1 – 15 years	36	14.4
16 – 20 years	99	39.6
>20 years	115	46.0
Total	250	100.0
Access to Credit		
No	248	99.2
Yes	2	0.8
Total	250	100.0
Membership cooperative		
Yes	238	95.2
No	12	4.8
Total	250	100.0
Extension Contact		
No	232	92.8
Yes	18	7.2
Total	250	100.0

Source**:** Computed from field survey data, 2012.

Farm size devoted to minisett technology. The result indicated that the majority (88.0%) of the respondents do not practice the technology while those that practiced it did so on farm sizes ranging from 0.01 - 0.25ha and constituted only 6.0% of sampled respondents. Low adoption levels were observed on farms greater than 1ha (2.4%). This means that the hectarage devoted to minisett technology is still low in the study area indicating that many farmers will still depend largely on seed yam obtained from previous harvest.

Table 2: Distribution according to levels of awareness, adoption, number of years of adoption of minisett and farm size devoted to minisett.

Variables	Frequencies	Percentage
Awareness of minisett technology		
No	146	58.4
Yes	104	41.6
Total	250	100.0
Adoption of minisett technology		
Yes	56	22.4
No	194	77.6
Total	250	100.0
Number of years minisett technology adoption		
Never	201	79.6
< 10 years	5	2.0
11 – 20 year	20	8.0
21 – 30 years	8	3.2
31 – 40 year	7	2.8
> 40 years	9	3.6
Total	250	100.0
Farm size of minisett		
Do not practice the technology	220	88.0
0.01 – 0.25 hectare	15	6.0
0.26 – 1 hectare	9	3.6
>1 hectare	6	2.4
Total	250	100.0

Sources: Computed from field survey data, 2012

Regression analysis

Results of regression analysis to determine the socio-economic factors influencing adoption of yam minisett technology are presented in Table 3.

The results in Table 3 indicated that the semi-logarithmic functional form was the equation of best-fit based on the normal economic, econometric and statistical criteria. It had an R^2 value of 0.689 which implies that about 68.9% of the variation in the adoption of minisett technology was explained by the explanatory variables included in the model and was significant at the 0.001 probability level depicted by the F-ratio.

Six explanatory variables out of the eleven modelled were significant at explaining the adoption of yam minisett technology in the study area. The variables with their respective estimated regression coefficients are farm size (0.796), labour input (-0.585), cooperativeness (1.026), extension contact (0.959), income (0.473) and credit (0.533). The positive and statistically significant sign for farm size indicated that farmers with larger farm sizes tended to have more propensity to adopt as compared to farmers with limited farm lands. In other words, as the size of farm holdings increased, the adoption of yam minisett also tended to increase. These results agreed with the findings of Anyaegbunam, *et. al.*, (2009) who found that increased in farm size increased adoptions of yam minisett technology significantly.

The coefficient for cooperartiveness and extension contact were also positive and significant. The findings suggest that, farmers who belonged to a cooperative society and those with access to extension education tended to adopted improved yam minisett technology. These results conform with the finding of Josephine, (2012) that, farmers with access to extension education adopted agricultural technologies as compared to their counterparts who were not privileged. However, the result on cooperativeness negated her finding whereby she found that membership of farmers' to organizations was negative and significant at 5% in her study conducted in the Middle Belt Region of Nigeria.

Income of the farmer and credit access were also found to positively and significantly affect the adoption of the innovation. The adoption of most agricultural innovations is not without cost implications. Credit enables the farmer purchase production inputs and hire more labour in the accomplishment of farm operations during critical periods of labour requirement.

Table: 3 Regression results of socio- economic factors influencing adoption of yam minisett technology.

Variable	Linear	Cobb-Douglas	Semi-logarithmic	Exponential
Constant	-0.181	-2.293***	-3.205	0.405
	(-0.547)	(-3.079)	(-1.608)	(2.469)
Gender	-0.071	0.013	0.034	0.131
	(-0.280)	(0.126)	(0.128)	(1.051)
Age	0.015	0.274	0.099	-0.008
	(1.313)	(1.534)	(0.210)	(-1.396)
Experience	0.012	-0.012	0.049	0.006
	(1.155)	(-0.230)	(0.363	(1.103)
Household size	0.009	-0.082	0.004	0.010
	(0.432)	(-1.501)	(0.024)	(0.921)
Education	-0.026	0.020	-0.122	0.025
	(-0.638)	(0.463)	(-1.061)	(1.230)
Farm size	0.036	-0.085	0.796***	-0.018
	(0.912)	(-1.533)	(5.461)	(-0.931)
Labour	-0.005	-0.061	-0.585***	-0.002
	(-0.932)	(-1.433)	(-5.255)	(-0.884)
Cooperativeness	-1.057**	0.095	1.026***	-0.132
	(-2.289)	(0.710)	(2.928)	(-0.585)
Extension contact	0.696***	0.742***	0.959***	-0.157***
	(10.427)	(15.134)	(5.210)	(4.817)
Income	1.46E-007	0.071*	0.473***	3.92E-008
	(1.730)*	(1.911)	(4.808)	(0.880)
Credit	-0.567	0.784***	0.533**	-0.349
	(-0.681)	(10.088)	(2.159)	(-0.859)
R^2	0.469	0.611	0.689	0.180
R^2adjusted	0.445	0.591	0.666	0.141
F-ratio	19.139***	30.947***	35.769***	4.591***

Source: Computed from field survey data, 2012

Note: ***, ** and * implies statistical significance at 1%, 5% and 10% levels respectively

Figures in parentheses are the representative t– ratios

Conclusion and Recommendations

The result of this study showed that farm size (0.796), labour input (-0.585), cooperativeness (1.026), extension contact (0.959), income (0.473) and credit (0.533) are the major factors that are influencing the adoption of yam minisett technology in the study area.

Because of the importance of these factors in resolving the problem of adoption of yam minsett technology and consequently increasing ware yam production, this study recommends the need for individual farmers to be educated about the prospects of the technology to boost seed yam production. The government, through the State Ministry of Agriculture and its organ, the ADP should intensify her involvement in the provision of high quality extension education activities. Government, cooperate organizations or individuals may be involved in the offering of loans or credit to farmers. The quest to acquire western education through adult education programmes and their readiness to form cooperative societies for the purpose of ease of access to credit, information on best ways to get clean yam seed are also recommended.

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