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An Analysis of the Determinants of the Adoption of Improved Plantain Technologies in Anambra State, Nigeria

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Abstract. The study examined farmers' adoption of improved plantain technologies in Anambra State, Nigeria. A structured questionnaire was administered on one hundred and eighty six (186) adopters of the technologies. A multistage random sampling technique was employed in selecting the adopters. Data collected were analyzed using descriptive statistics, multiple regression analysis and Pearson product moment correlation (PPMC). The study showed a high level of awareness among the farmers. The adoption of these technologies was relatively low. The results revealed that farmers' age, farm size, household size, educational status, farmers' income and extension visit are significantly related to the farmers' level of adoption of the technologies. The socio-economic characteristics of plantain farmers were thus found to have significant effect on the adoption of the technologies. Farmers' awareness level was significantly related to the adoption of the technologies. Based on the findings, the study therefore recommends aggressive awareness campaign, farmers adult education programme and farm income expansion policy be put in place.

Key words: awareness**,** adoption, improved plantain technologies, Nigeria

Introduction

Plantain (Musa spp., ABB genome) is a giant herb that is cultivated in humid forest and mid- latitude zone of sub- Sahara Africa. Its origin is believed to be the South East Asia. However, a remarkable diversity of plantain exists in sub- Sahara Africa. The food crop is generally triploid, steril and develops fruits by parthenocapy. Total world production is estimated to be over 76 million metric tons. Twelve (12) million metric tons are produced in Africa annually (INIBAP in Fakayode et al., 2011). Fortaleza, (2012) indicates that plantain is one of the major stable foods in Nigeria. National per capita consumption figures show its importance relative to other starchy staples. Besides being the staple for many people in more humid regions, a growing industry, mainly plantain chips, is believed to be responsible for the high demand being experienced now in Nigeria.

Akubuilo *et al.*, (2007) stated that adoption is a decision made by an individual or group to use an innovation in a continuous manner. He also stated that technology is the systematic application of scientific or other organized body of knowledge to practical purposes. This includes new ideas, inventions, innovations, techniques, methods and materials.

Inspite of the several researches, attempts and break- through made by many research institutions such as International Institute of Tropical Agriculture (IITA), National Horticulture Institute (NIHORT), etc towards technology or biotechnology development in plantain production, Echebiri in Faturoti et al., (2008) noted that little exists in terms of adoption among farmers especially in Anambra State. It is noted that most farmers grow plantain in compound farms where fertility is maintained by regular use of household refuse. Some of these plantain cultivars include the false horn, Agbagba, Red Ogoni, Binikpite and Double Reacher (Akele et al., 2003; Ajayi and Mbah, 2007).

However, plantain production in Anambra State has been hampered by a number of constraints. Notable among these are the dependence on local plantain cultivars, poor farming techniques and problem of pests and diseases. The black sigatoka disease is a serious disease of plantain, capable of reducing the crop yield by 75%, which led to a concluded five year project on improved plant breeding techniques and developed new cultivars to increase yields of Musa crops (IITA, 2009).The study will bring to light the major plantain technologies available in the area and their adoption level. This will help extension workers in Anambra State to develop effective extension strategies to disseminate improved plantain production technologies to the farmers in the area.This research therefore intends to assess the adoption of improved plantain technologies in Anambra State.

Objectives of the study

Specifically, this study was designed to assess plantain farmers' awareness level of improved plantain production technologies, determine the level of adoption of the technologies and analyze the relationship between the levels of adoption and the farmers' socio-economic characteristics.

The following null hypotheses were tested

1. **H_0**: The socio- economic characteristics of plantain farmers do not significantly affect the level of adoption of improved plantain technologies.
2 **H_0**: There is no significant relationship between adoption of the technologies and the farmers' awareness level.

Methodology

Area of the study

The study was conducted in Anambra State, which is located in the south-east geopolitical zone of Nigeria, it consist of twenty one (21) Local Government Areas grouped under four (4) agricultural zones of Anambra State Agricultural Development Programme, these are Ogbaru, Ayamelum, Anambra west, Aguata and Awka North. The study area has an approximated land area of 4,416square kilometers and lies between longitude $6^{0}20^{/}$N and $7^{0}00^{/}$E and latitudes of $7^{0}16^{/}$N and $7^{0}00^{/}$E. Its boundaries are formed by Delta State to the West, Imo State to the South, Enugu State to the East and Kogi State to the North (NBS, 2007).

Method of Data Collection

Data used for the study were sourced mainly from primary and secondary sources. Primary data were collected using structured questionnaire administered to the adopters of improved plantain technologies in the study area. The secondary data were sourced from journals, articles and relevant extension agencies in the state. A multi-stage random sampling technique was used for the study. The first stage involved the random selection of four (4) Local Government Areas. In each selected Local Government Area, five (5) communities/villages were randomly selected. Lastly, ten (10) farmers involved in improved plantain production were randomly selected from each community from a list obtained from the Local Government Area. This gave a total of two hundred (200) respondents. However due to incomplete information in some questionnaires, only one hundred and eighty six (186) of the respondents constituted the sample size for the study.

Method of Data Analysis

Descriptive statistical tools such as frequency counts, percentages and means were used to describe the data collected, while inferential statistical tools were used to test hypotheses, using Pearson Product Moment Correlation (PPMC) and multiple regression model. The adoption index was calculated as the number of technologies adopted by a particular farmer as a percentage of the total number of technologies under study. In developing the adoption score a respondent scores one for each recommended practice adopted (Ajayi et al., 2006). This score is expected to range between 1 and 14.

Multiple Regression Model

The regression equation estimated is stated as equation (1)

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + ei \quad \text{--------} \ (1)$$

Where;

Y = Adoption Index

X_1 = Age of farmers {Years}

X_2 = Farm size {Hectares}

X_3 = Household size {Number}

X_4 = level of education {years}

X_5 = Farm income {Naira}

X_6 = Farming experience {Years}

X_7 = Extension visits {Monthly}

e_i = error term

b_0 = intercept

$b_1 - b_7$ = regression coefficients of the explanatory variables which are to be estimated.

$X_1 - X_7$ = explanatory variables (socio-economic characteristics)

Results and discussion

Farmer's Knowledge of Improved Plantain Production Technologies

Table 1 shows distribution of the farmers by their level of awareness of the technologies. Awareness promotes demand and demand is a force for rapid adoption and spread of agricultural innovations. In order to determine the level of awareness, 14 (fourteen) plantain production technologies were considered. The result revealed that weeding (100%), propping (98.4%), pruning (84.9%), fertilizer / manure application (78%), hybrid varieties (74.2%), and mulching (63.4%), had high level of awareness. It also indicates that most (83.9%) of the farmers were not aware of hot water treatment, 77.4% were not aware of chemical application while Sucker Cleaning, Sucker multiplication, Planting Space, Desukering, Planting Time and Debudding were not known by 74.7%, 68.3%, 52.7%, 51.1%, 50.5% and 50.5% respectively. This result implies that while majority of the farmers were abreast of recommended production practices at field level, they seem to lack relevant information on hot water treatment and chemical application.

Level of Adoption of Improved Plantain Technologies by the Respondents

Table 2 shows that majority of the respondents adopted propping (69.9%), followed by weeding, fertilizer / manure application, mulching and pruning having 68.8%, 59.7%, 55.9% and 54.8% respectively. These were the only technologies that had adoption and use level above 50%. This is an indication that their adoption level of improved technologies is affected by farmers' awareness of technological information pertaining to the crop. This result is in agreement with the view of Ekong (2003) that awareness is the first stage in the adoption process. The average adoption level of improved plantain technologies was 33.67%. Although there was a relatively high awareness of some of the recommended plantain technology in the study area, the level of adoption of these technologies remain low. The low level of adoption in the case of hybrid varieties was mainly attributed to its unavailability while others could be; due to poor delivery system of the extension agents, high cost of adopting the technologies, low level of formal education among farmers, their ages and the management and technicality involved in the technologies. As a result of low improved technologies employed by most small scale farmers, the desirable level of increase in agricultural production has been difficult to achieve.

Table 3 shows the distribution of respondents by their adoption score. The table reveals that majority (24.2%) of the respondents adopted five (5) technologies. Also about 20.4%, 11.8%, 9.1%, 10.2% and 7% of the farmers adopted 6, 4, 3, 2 and 1 plantain technologies respectively. The average number of technologies adopted by the farmers is 4.7138 (approximately 5).

Table 4 shows the distribution of respondents by their adoption index. The table reveals that majority (24.2%) of the respondents had adoption index of 0.36%. Also about 20.4%, 11.8%, 9.1%, 10.2% and 7% of the farmers had adoption index of 0.43%, 0.29%, 0.21%, 0.14% and 0.1% respectively.

Relationship between Level of Adoption and Farmers Socio-Economic Characteristics

Table 5 presents the results of the estimated multiple regression model. This is done in order to analyze the relationship between the levels of adoption of improved plantain technologies by the farmers' and their socio-economic characteristics; a multiple regression analysis was carried out. Four functional forms were tried (linear, semi log, double log and exponential). The linear functional form was chosen because; it has the highest coefficient of multiple determination (R^2) value (0.963). It has the highest F-calculated value (212.211) and had the highest number of significant independent variables (X_1, X_2, X_3, X_4, X_5, and X_7).The multiple regression result of the linear functional form is presented on table 3. The coefficient of multiple determinations, R^2 was 0.96 or 96%, which indicated that the included socio-economic variables (independent variables) explained 96% of the total variations in the adoption level of farmers (dependent variable) while the remaining 4% is due to error term. The variables tend to explain the adoption of improved plantain technologies very well. The estimated model shows that six (6) variables were statistically significant at various levels of significance. These are farmers' age, farm size, household size, educational level, farmers' income and extension visit. Age of farmer (X_1) had a positive effect on the adoption of the technologies. This may be as a result of the mature age of the respondents. This takes the presumption that as farmers get older they acquire more experience which will in turn increase their understanding. This attribute can be tapped to improve the respondents farming prowess thereby increasing their level of adoption of the technologies. Farm size (X_2) follows the *a priori* expectation. It is positive and significant at 5%. This means that the larger the farm size, the higher the level of adoption and by extension the higher productivity of the adopters will be. This means that corresponding increase in adoption of the technologies stimulated by desire for increased production. The household size (X_3) of the farmers is positively signed as expected. Household size has been frequently reported as having a positive impact on farmers' adoption decisions (Adesina and coulibaly, 1999). Again, Feder et al., in Baez (2004) disclosed that household size influenced farming decision about management practices. Educational level (X_4) of the respondent is statistically significant at 1% and has a positive sign. This agrees with the findings of Zegeye and Burton et al., in Faturoti et al., (2006), who emphasized strong positive influence of education on adoption. This reveals that the more the number of years in school, the better the level of adoption of the technologies by the respondents, this is because the more the level of enlightenment, the better the willingness of the farmers to accept farming innovations. The farmers could easily understand the new technologies and are more willing to adopt than their illiterate counterparts. The farmers' income (X_5) was positively signed as expected. These agree with the findings of Ekwe (2004), that income is positively related to farmers' adoption of new technologies. This implies that income encourages the adoption of improved technologies. On the other hand, increase in adoption of improved technologies could result in increase in yield as well as accruable income. Moreover, IITA (2009) indicated that economic viability of a technology determines the extent of the adoption. This is because farmers are always ready to adopt any measure or technology that will increase their income from the farm. Equally, the adoption of a given technology requires some financial commitments. An increase in farm income will enable the farmers to meet these commitments, thereby increasing adoption level. A negative significant relationship was established between extension visits (X_7) and adoption level. This trend is unexpected and negates other studies on adoption. The explanation may be that extension support for the innovation under study was almost non-existent. Some 60.8% of the respondents recorded no visit by extension agents. As such, since adoption could occur at its present level without the expected extension visit, the negative relationship is therefore not unexpected.

The F-ratio which determines the overall significance of a regression model is statistically significant at the 1% level. The F- computed value of 212.211 is greater than the F- critical value of 2.95. This implies that the independent variables jointly exerted great influence on the level of adoption of the technologies. This leads to the rejection of the null hypothesis that, there is no significant relationship between farmers' socio-economic characteristics and the level of adoption of the technologies. The conclusion is that farmers' socio-economic characteristics are significantly related to the adoption level of the technologies.

Relationship between Adoption and Awareness Level of Improved Plantain Technologies

Table 5 reveals that there is a significant though low relationship with r = 0.41 awareness level and the adoption level of the technologies. The P-value is less than 0.05. This results in the rejection of the null hypothesis which states that, there is no significant relationship between adoption of the technologies and the farmers' awareness level. Awareness campaign is needed to enhance the level of adoption so that the weak correlation coefficient can become strong or at least equal to 0.5. The higher the correlation coefficient, the better the degree of co-movement between awareness and adoption of the technologies. Hence, the higher the level of awareness *ceteris paribus*, the higher the adoption level is expected to be.

Conclusion

The findings indicated that the farmers' age, farm size, household size, educational status, farmers' income and extension visit showed a significant relationship with the farmers' level of adoption of the technologies. The result showed that there is a high level of awareness among farmers on the technologies though the adoption of these technologies was relatively low considering their potentials. The study revealed that the farmers' awareness level was significantly related to the adoption of improved plantain technologies in the study area.

Recommendations

The following recommendations are proffered;

- Aggressive awareness campaigns need to enhance the adoption of the technologies since this variable has a positive relationship with the level of adoption.
- Farmers' adult education / enlightenment workshops are needed to provide information on the technologies. This recommendation flows from the significance of the age which rules them out of regular schools, and from the positive effect of education and farming experience on adoption. The workshops should be designed to increase their knowledge about the technologies and hence their experience with them.
- Farm income expansion policy is required. Expansion in farm income will translate into increase adoption. This could have a multiplier effect especially on the output and consequently on farm income. By extension the added income could lead to further adoption of the technologies.

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Table 1: Percentage Distribution of the farmers by the Level of Awareness of Improved plantain Production Technologies in the Study Area

Technologies	Aware		Not Aware	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Planting Space	88	47.3	98	52.7
Planting Time	92	49.5	94	50.5
Sucker Cleaning	47	25.3	139	74.7
Hot Water Treatment	30	16.1	156	83.9
Sucker multiplication	59	31.7	127	68.3
Hybrid Varieties	138	74.2	48	25.8
Pruning	158	84.9	28	15.1
Mulching	118	63.4	68	36.6
Fertilizer application	145	78.0	41	22.0
Propping	183	98.4	3	1.6
Chemical Application	42	22.6	144	77.4
Debudding	92	49.5	94	50.5
Desukering	91	48.9	95	51.1
Weeding	186	100	0	0

Source: Field Survey, 2014

Multiple Responses

Table 2: Distribution of respondents according to level of adoption of the improved plantain technologies

Improved technologies	Adopters	
	Frequency	Percentage (%)
Planting Space	75	40.3
Planting Time	62	33.3
Sucker Cleaning	24	12.9
Hot Water Treatment	1	0.50
Sucker multiplication	37	19.9
Hybrid Varieties	35	18.8
Pruning	102	54.8
Mulching	104	55.9
Fertilizer application	111	59.7
Propping	130	69.9
Chemical Application	22	11.8
Debudding	14	7.5
Desukering	34	17.2
Weeding	128	68.8

Source: Field Survey, 2014

Multiple Responses

Table 3: Distribution of respondents by their adoption score

Adoption Score	Frequency	Percentage (%)
1	13	6.99
2	19	10.22
3	17	9.14
4	22	11.83
5	45	24.19
6	38	20.43
7	23	12.37
8	8	4.30
9	1	0.54
Total	**186**	**100**

Source: Field Survey, 2014

Table 4: Distribution of respondents by their adoption index

Adoption Index	Frequency	Percentage (%)
0.1	13	6.99
0.14	19	10.22
0.21	17	9.14
0.29	22	11.83
0.36	45	24.19
0.43	38	20.43
0.5	23	12.37
0.57	8	4.30
0.64	1	0.54
Total	**186**	**100**

Source: Field Survey, 2014

Table 5: Multiple Regression result of the relationship between the levels of adoption of improved plantain technologies by the farmers' socio-economic characteristics in the study area

Variable	coefficient	Standard error	t- statistics	Sig T
Farmers' Age (X_1)	0.754**	0.287	2.628	0.011
Farm Size (X_2)	0.765*	0.365	2.096	0.041
Household Size (X_3)	1.011**	0.296	3.417	0.001
Educational Status (X_4)	1.869**	0.330	5.664	0.000
Farmers' Income (X_5)	1.093**	0.252	4.343	0.000
Farmers' Experience (X_6)	0.022	0.237	0.093	0.926
Extension visit (X_7)	-1.596**	0.341	-4.684	0.000
(Constant)	-3.115	0.542	-5.747	0.000

Source: Data Analysis, 2014.

** Significant at 1%* Significant at 5%

R^2 = 0.963, Adj R^2 = 0.959, F - Ratio = 212.211

Table 6: Relationship between Adoption and Awareness Level of improved plantain Technologies

Variable	r	P-Value	Decision
Awareness level vs adoption level of improved plantain technologies	0.41	0.001	significant

r = correlation coefficient, p- probability level of significance p<0.05(significant)

Source: Field Survey, 2014