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ADOPTION OF SOME NRCRI, UMUDIKE, DISSEMINATED TECHNOLOGIES IN EBONYI STATE, NIGERIA

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ABSTRACT
The paper examined adoption status of selected farm technologies developed and disseminated by National Root Crops Research Institute, Umudike to farmers in Ebonyi State, Nigeria. A field survey was conducted in one randomly selected agricultural zone (Ebonyi North) of the State. Two extension blocks, were randomly selected out of the 6 in the zone. In each block, two circles out of 8 in each block were randomly sampled as well. Twenty five farmers were similarly sampled for each circle. Thus a sample size of 100 respondents was selected for the study. Structured questionnaire were used to collect vital data for the study. Data collected were analyzed by descriptive statistics and multiple regressive analyses to determine factors affecting adoption of the technologies. Results of the analysis showed that out of the 35 technologies examined, 8 had high level of adoption, 17 were at moderate level while adoption level was low in 10 technologies. Also results of the study showed an R^2 *of 0.958 indicating that 95.8% of variation in adoption of the technologies was accounted for by the variables considered in the study. Specifically the results indicated that age, extension contact, and income were significant but negatively influenced adoption of the technologies. However farming experience, education, extent of involvement in farming, had significant and positive influence on adoption of the technologies. There is therefore the need to intensify promotion of the technologies to improve awareness for increased adoption.*

Keywords: adoption, disseminated technologies, farmers, constraints, Ebonyi state.
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INTRODUCTION
The purpose of technology development is to enhance living conditions, generate opportunities for people to make livelihoods and improve their standard of living (Ironkwe, 2011). Therefore, technology development and transfer processes are considered to be primary driving forces for growth and welfare in developing countries, (Balakrishnan, 2004). In view of this fact, agricultural sector in Nigeria direct technology development towards improving productivity to ensure availability of food and increased farmers' income in the country. Agricultural technology development and transfer in Nigeria are combined

responsibilities and efforts of research and extension agencies. The research agencies are involved in development of technologies while the extension agencies disseminate the developed technologies to farmers for adoption to increase production. The concept of adoption of innovation is therefore central to understanding the processes of change in human societies, especially in the use of agriculture technologies by the farmers in our rural areas.

Adoption is a decision to apply an innovation and to continue to use it in other to increase productivity and income (Van De bar and Hawkins, 1996). According to Adebayo (2005), adoption of innovation is commonly believed to have taken place when the innovation has been tried and accepted by the majority of the people concerned. The adoption of innovation is therefore described as one of the important process through which systematic social change takes place in a rural area (Jibowo, 1992). Hence, adoption is not a sudden event, but a process a farmer undergoes before he starts to use an innovation.

National Root Crops Research Institute (NRCRI), Umudike is one of the agricultural research institutes in Nigeria. It has the national mandate to research on root and tuber crops of economic importance to improve productivity of such crops in the country. The Institute has developed and released different technologies on root and tuber crops to farmers in Nigeria to increase their productivity and income thereby enhancing their livelihoods. What happened to those technologies generated from the Institute and transferred to the farmers for adoption, and the reactions of the farmers are important facts to be considered. This study was therefore carried out to determine the adoption of some NRCRI, disseminated technologies in Ebonyi State, Nigeria. However, according to Ironkwe (2005), the test for effectiveness of any agricultural research effort is that the technologies developed must have been extended to the ultimate users (the farmers) to increase production. Thus after developing and transferring agricultural technologies, efforts should be made to find out whether or not farmers are really utilizing the transferred technologies and to what extent. Consequently, this would help to evaluate the usefulness and relevance of the technologies as well as elicit farmers' reactions towards the technologies.

OBJECTIVES

The specific objectives of the study are to

i determine levels of adoption of some selected technologies disseminated for over 5 years by the Institute.

ii identify constraints militating against adoption of root and tuber crops technologies in the State.

iii determine the factors influencing adoption of the technologies.

METHODOLOGY

The study was conducted in Ebonyi State, Nigeria. Out of three agricultural zones in the State, Ebonyi North was randomly selected for the study. Multi-stage sampling procedure was used in selecting the respondents for the study. In the first stage, two blocks out of six were randomly selected. Two circles were randomly selected from each of the selected blocks in the second stage. Finally, twenty five farmers were randomly chosen from each of the selected circles. A total number of 100 farmers were chosen for the study and interviewed with the aid of interview schedule. The list of farmers obtained from the zonal office of the Agricultural Development Programme of the state formed the sampling frame. In this study, the adoption process which consist five stage – awareness, interest, evaluation, trial and adoption proposed by Rogers (1995), and Van Den Ben and Hawkins (1996) was used to determine the level of adoption of the technologies. Five point likert scale rating was used to determine the level of adoption of each of the selected technologies. They are stated as follows: 0 = unaware, 1 = aware, 2 = interest, 3 = evaluation, 4 = trial, 5 = adoption.

To get the mean adoption score of the technologies, the assigned response value is multiplied by the number of response recorded and divided by the sample size. Furthermore, to determine the level to be ascribed to each mean adoption score, the five interspaces between 1and 5 is divided into the three prospective levels of high, medium and low. Thus 5/3 = 1.67. This gives a class interval of 1.67. The class interval is then deducted successively from the highest point to give the following class range of 3.35 – 5.00 = high; 1.68 – 3.34 = medium and 0 – 1. 67 = low. Thus mean adoption score that fall into any of the class range are so ascribed as high, medium or low (Ekwe and Nwachukwu, 2006). Frequency and percentages were used to identify the constraints militating against the adoption of the technologies while multiple regression analysis was used to determine factors influencing adoption of the technologies. The four functional forms were fitted into the data and the best functional form was chose based on some econometric reasons.

The regression model was specified implicitly as: $Y=f(X_1, X_2, X_3, X_4 \ldots\ldots X_n + e)$ where Y= the adoption index, X_1= Age of the farmer in years, X_2 = Sex, (male = 1, female = 0), X_3 = Marital status, (married = 1, single = 0) X_4 = Farming experience in years, X_5 = Household size (number of persons in the house), X_6 = Educational status in years, X_7 = Type of farmer (full-time = 1, part-time = 0), X_8 = Farm size in hectare, X_9 = Extension contact (contact = 1, no contact = 0), X_{10}= Membership of cooperative (member = 1, non- member =0), X_{11}= Income in Naira, e= Error term.

RESULTS AND DISCUSSION

Table 1 reveals various adoption levels for the 35 technologies evaluated. Majority of technologies in yam recorded high adoption. Three out of six technologies had high adoption while two technologies recorded medium and one had low adoption. For cocoyam, 9 out of 13 technologies evaluated had medium level of adoption four had low level of adoption. Sweet potato technologies were yet to be adopted fully, 3 out of8 had medium while 5 had low level of adoption level. The 8 technologies on cultural practices recorded better adoption as 5 technologies had high adoption level and 3 had medium adoption level. Generally, out of 35 technologies evaluated, only 8 technologies (22.86%) had high adoption while 17 technologies (48.57%) recorded medium adoption level. This implies that most of these technologies have not been fully adopted by the farmers in the State. However, there is an appreciable improvement in the adoption levels of technologies on yam and cultural practices in the study area.

Results in Table 2 revealed that scarcity of planting materials (93.00%), lack of fund (92.00%), high cost of fertilizer (88.00%), crude farm implement (73.00%), lack of input (60.00%), poor extension contact (53.00%), among others are major constraints militating against adoption of the technologies in the study area. This result agreed with the findings of Maina (1984) in Ironkwe (2011), and Ironkwe *et al*., (2013), who reported that available production technologies and equipment are not being used widely by farmers because of difficulties in obtaining inputs needed for the technology. Furthermore, the result agreed with Ironkwe *et al.*, (2012) who identified similar constraints as being factors militating against adoption of these technologies in Anambra State Nigeria.

Table 3 shows the result of the multiple regression analysis. The multiple regression analysis was done and four functional forms (linear, exponential, semi-log and double log) were tried. Linear model proved to be the lead equation based on some econometric reasons that it has the highest coefficient of multiple determinations (R^2) which is (0.958). This means that 95.8% of variation in adoption of the selected technologies was explained by the variables included in the model while the remaining 4.2% was accounted for by the error term (e) as well as variables which might have been left out. In addition the F statistic (33.953***) was positive at 1% alpha level and was therefore used for the analysis. Age of the respondents, extension contact and income had negative, but significant effects on the adoption of the technologies. However, farming experience, education, type of farmer had positive and significant effects on the adoption of the technologies evaluated. This implies that as age, extension contact and income of the respondent increased; there was corresponding decrease in the adoption of the selected technologies.

Age is an important factor that influences adoption. The results showed that age had negative and significant effect an adoption at 1% alpha level. Since ability of a farmer to take risk and be innovative decreases with age, this result is in consonance with *a priori* expectation and agreed with the report of Nwaru, (2004), Ironkwe (2011) and Ironkwe*et al.*, (2013). Hence effort should be geared towards motivating the younger farmers and youths, who are more energetic and innovative, to adopt the technologies for increased food production in the State.

Extension agents help to transfer improved technologies to farmers through regular visit. Such visits create room for useful interaction which enhances adoption of innovation. (Ekwe, 2004), hence Okonkwo *et al*., (2009) stated that adoption of improved technologies increases with an increase in the number of extension contact. This is because the farmers are likely to receive more valuable information about technologies from the extension agents during such visits. Such information would help to improve their skills and reduce uncertainty in the technology adoption. That extension contact was negative and significant is contrary to *apriori expectation* and means that either the extension agents are not effective in their job in reaching out to the farmers with the technologies or that their number is not enough to *cover* the farmers in the study area. This could result to majority of the farmer not having adequate knowledge about the technologies to enhance their adoption.

Income is another factor that determines adoption of any given technology. It is a known fact that adoption increases as income increases (Ghadin and Pannell, 1999), as farmers would want to adopt the technologies that would enhance their productivity at reduced cost, and increase income. But the result revealed that income of the farmer had negative but significant relationship with adoption which is contrary to *a priori* expectation. The result implies that the adoption of the technologies without the available market channels and good prices might not have positive impact on the income of those who adopt them. This could negatively affect the adoption of these technologies as the farmers would not want to continue to use technologies that would not increase their income. However, this result disagreed with the finding of Ironkwe (2005) who reported positive and significant relationship between income and adoption of yam minisett technology among women farmers in Abia State Nigeria.

On the contrary, increase in farming experience, education, type of farmer all contributed to a corresponding increase in the adoption of the selected technologies. The years of farming experience of the farmers was positive and significant at 1% level implying that experienced farmers are adopting the technologies more than the less experience ones. This is according to *a priori* expectation that experience increase adoption. This is because with more experience in farming, the farmer could be more skilful and less averse to risk involved in

adopting new innovations. Experience is knowledge and skill gained by contact with facts and events (Nwaru, 2004). According to Ghadin and Pannell (1999), farmer's previous experience with other innovations either positive or negative would likely influence his perception of importance or relevance of the technology. Therefore, the number of years a farmer has been in the farming business may give an indication of the practical knowledge he or she has acquired on how to cope with the inherent farm production activities. This knowledge if properly channelled, will lead to increased adoption.

Educational status of the farmer also had positive and significant effect on adoption of the technologies. This means that the more educated ones were adopting the technologies more than less or non-educated ones. This is in consonance with *a priori* expectation that education enhances adoption. Education and training help to unlock the natural talents and inherent enterprising qualities of the farmers. It also enhances his ability to understand and evaluate new production techniques leading to increase adoption and productivity (Ironkwe *et al.*,2009, and Nwaru, 2007).

Type of farmer had positive and significant effect on adoption showing that the full-time farmers adopted the technologies more than the part-time. This result is in agreement with *a prior* expectation. The full-time farmers are expected to be more committed to the farming business than the part-time since it is his only source of income. He would go all out to adopt any technology that would help him improve production potential, enhance productivity and increase income at reduced cost.

CONCLUSION

Out of 35 technologies evaluated, only 8 technologies had high adoption level, 17 were at medium adoption level while others were still at low level adoption in the study area. Scarcity of planting materials, lack of fund, high cost of fertilizer, crude farm implements, lack of input among others, were the problems militating against the adoption of the technologies in the State. Age, farming experience, educational status, and type of farmer, extension contacts and income are the socio-economic factors influencing adoption of the technologies in the study area. In view of the outcome of this study, it is thus recommended that promotion and popularization efforts should be intensified in creating more awareness of the technologies among farmers in the State. Public and private partnership arrangement could facilitate the supply of improved planting materials and other inputs to farmers. Again, agricultural training programs that target the youth in the rural areas could be a way of generating interest of the youth in agriculture to increase productivity. More so, the economic benefits of these technologies should be included in the adoption package to create a clearer picture of advantages of the technologies as a way of enhancing adoption in the State.

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Journal of Agriculture and Food Sciences **A.G. Ironkwe, K.C Ekwe, F.N. Nwako, and N.C Ezebuiro**
Volume 11 Number 2, October 2013 p. 15-25 .

APPENDIX

Table 1:Levels of adoption of selected root and tuber crops technologies in Ebony State

Yam	Nn O	A 1	I 2	E 3	T 4	A 5	Total	Mean	Level of Adoption
White yam	5	21	6	4	1	63	364	3.64	High
Yellow yam	5	29	2	0	2	62	351	3.51	High
Water yam	36	25	4	0	3	28	185	1.85	Medium
Chinese yam	44	26	6	2	3	15	119	1.19	Low
Yam minisett	10	19	7	1	0	62	346	3.46	High
Yam value addition	9	26	10	3	2	50	313	3.13	Medium
Cocoyam									
Coco India	36	41	2	0	4	17	136	1.36	Low
Ede Ofe green	25	17	5	1	0	43	245	2.45	Medium
Ede Ofe Pup	30	17	17	2	4	40	273	2.73	Medium
Giant Edeofe	16	22	4	0	13	40	282	2.82	Medium
Ede Ukpong	50	17	0	2	1	30	177	1.77	Medium
Ede Ghana	70	5	4	0	2	20	152	1.52	Low
Ede Ocha	44	15	4	2	5	26	179	1.79	Medium
Ede Uhie	63	5	2	2	3	25	152	1.52	Low
Ede okokoro	68	10	2	2	0	18	110	1.10	Low
Cocoyam minisett	42	6	2	0	4	41	231	2.31	Medium
Cocoyam flour	30	21	5	0	6	36	235	2.35	Medium
Cocoyam crisp	53	11	5	1	5	25	169	1.69	Medium
Cocoyam soup thickener	40	11	2	0	7	38	233	2.33	Medium
Sweet potato									
TIS 8441	35	23	2	1	2	36	218	2.18	Medium
TIS 8164	39	15	1	2	5	38	233	2.33	Medium
TIS 8710087	52	15	4	1	3	25	163	1.63	Low
CIP Wagebolye	70	10	1	1	1	16	99	0.99	Low
Ex. Igbariam	67	11	2	2	2	15	104	1.04	Low
Sweet potato flour	54	24	1	0	3	18	128	1.28	Low

Journal of Agriculture and Food Sciences **A.G. Ironkwe, K.C Ekwe, F.N. Nwako, and N.C Ezebuiro**
Volume 11 Number 2, October 2013 p. 15-25 .

Sweet potato	Nn O	A 1	I 2	E 3	T 4	A 5	Total	Mean	
Sweet potato Chips	49	20	2	0	5	28	184	1.84	Medium
Ginger drink	63	21	0	0	0	16	101	1.01	Low
Cultural Practices									
Land clearing	13	23	3	0	0	61	334	3.34	Medium
Weeding 2-3 times	6	24	0	0	0	70	374	3.74	High
Use of herbicides	8	19	3	1	0	68	368	3.68	High
Disease control measures	19	8	2	2	0	69	363	3.63	High
Recommended spacing	12	15	1	1	1	67	359	3.59	High
Use of fertilizer	6	22	1	0	0	70	374	3.74	High
Methods of staking	4	29	1	0	1	44	255	2.55	Medium
Mulching	33	19	0	1	1	43	241	2.41	Medium

Source: Field Survey data, 2013.

Note: Mean from 3 and above is full adoption level. Nn = None, A = Awareness, I = Interest, E = Evaluation, T = Trial, A = Adoption.

Tables 2 :Distribution of respondents according to the constraints militating against adoption of the technologies.

Constraints	**Frequency**	**Percentage**
Scarcity of planting materials	93	93.00
Lack of fund	92	92.00
High cost of fertilizer	88	88.00
Crude implement	73	73.00
Lack of input	60	60.00
Poor extension contact	53	53.00
Poor weather condition	46	46.00
Problem of land	43	43.00
High cost of labour	42	42.00
Poverty	8	8.00

Source: Field Survey data, 2013

Table 3: **Estimated multiple regression results of the factors influencing adoption of the technologies in Ebonyi State**.

Variables	Linear	Semi- log	Double- log	Exponential
Constant	0.205	-0.113	0.306	0.976
	(0.421)	(-0.448)	(0.795)	(0.941)
Age	-2.221***	-0.068	0.003	-0.024
	(-2.728)	(0.0616)	(0.012)	(-0.035)
Sex	0.145	0.061	0.204	0.084
	(1.080)	(0.873)	(0.106)	(0.397)
Marital Status	0.164	0.115	-0.998**	-2.356**
	(1.025)	(1.384)	(-2.917)	(-2.554)
Farming	0.958***	0.401***	0.887***	2.610***
Experience	(14.822)	(11.957)	(5.240)	(5.720)
Household size	0.043	-0.012	-0.024	0.074
	(0.764	(-0.395)	(-0.234)	(0.268)
Education	0.176*	-0.082	0.018	0.215
	(1.755)	(1.572)	(-0.132)	(-0.573)
Type of farmer	0.236*	0.069	-0.143	-0.304
	(1.792)	(1.007)	(-0.502)	(-0.394)
Farm size	0.110	0.070	0.175	0.425
	(1.172)	(1.438)	(1.000)	(0.899)
Extension contact	-0.634***	-0.306**	0.150	0.317
	(-2.709)	(-2.516)	(0.598)	(0.469)
Membership to	0.056	0.065	-0.093	-0.066
cooperative	(0.554)	(1.240)	(-0.333)	(-0.088)
Income	-0.136**	-0.083**	-0.140	-0.405
	(-2.168)	(-2.552)	(-1.012)	(-1.084)
Access to	0.164	0.082	0.714*	2.625**
Credit	(1.151)	(1.112)	(1.840)	(2.509)
Access to land	0.028	0.062	-0.679	-2.461*
	(0.167)	(0.705)	(-1.469)	(-1.974)
Access to market	0.271	0.101	0.242	0.671
	(1.77)	(0.845)	(1.064)	(1.092)
R^2	0.958	0.788	0.848	0.932
R adjusted	0.923	0.753	0.823	0.877
F statistics	33.953***	22.599***	27.743***	16.914***

Source: Field Survey data, 2013.