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ADOPTION OF SWEET POTATO PRODUCTION TECHNOLOGIES IN ABIA STATE, NIGERIA

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ABSTRACT

Improved production technologies of sweet potato were jointly developed by International Institute of Tropical Agriculture (IITA) Ibadan and National Root Crops Research Institute (NRCRI) Umudike to eliminate constraints associated with farmers' use of local production technologies. Several years after introduction of the technologies to farmers, sweet potato production in Abia State has remained low and unimpressive despite the relevance of the crop in household food security. This paper therefore seeks to evaluate farmers' adoption of sweet potato production technologies in the state. A three-staged random sampling technique was employed to select 150 respondents from the three agricultural zones in the state. Data were collected from respondents with use of structured questionnaires and analyzed with descriptive statistics as well as multiple regression analysis. Result of analysis revealed an R^2 *value of 0.280 indicating that 28% of variation in the adoption of the improved production technologies was accounted for by the variables considered in this study. Adoption of sweet potato production technologies was relatively at a medium level. Also, the result indicated that accruable farm income, farm size cultivated as well as sweet potato output was positively related to farmers' adoption of the technologies. Thus it was recommended that the mass media should be used to promote and popularize sweet potato and its improved production practices. Soft loans should be provided to farmers for more investment in sweet potato production since expectation of increased income would stimulate adoption of technologies.*

Key words: adoption, sweet potato production technologies

INTRODUCTION

Sweet potato is ranked as the third most important root crops in Sub-Saharan Africa, after cassava and yam as well as the fifth most valuable crops in developing countries of the world (Hahn and Hozyo 1998). Sweet potato *(Ipomoea batatas)* is one of the world's most widely grown and valuable crops. Farmers in more than 100 countries in the tropics, sub-tropical and warm temperate areas rely on it for its ability to produce high yield on marginal lands with little investment (Horton *et al.,* 1989). It is often a subsistence crop in many developing countries like Nigeria, where sweet potato is grown at peasant level as mono crop or intercropped with other crops such as maize, yam, cassava and vegetables (Akoroda and Nwokocha, 1996). It serves as feed for animals and raw material for industries. It is grown over a wide range of environments within latitude 30^o N and 30^o S and at altitudes as high as 2,000m above sea level.

Sweet potato plants can continue to yield over a long period of time; one crop may be harvested for as long as six years. It does well in a relatively low pH, and although it is not as highly tolerant to draught as cassava, it does have good drought tolerance (Hahn, 1984). Sweet potato requires relatively little attention and labour (Asumugha and Chinaka, 1998). In Western Nigeria, it is capable of producing about 30 – 40 tons/ha in four months gestation period, without fertilizers (Hahn *et al.,* 1983). Both leaves and roots of sweet potato play enormous roles in providing carbohydrate, vitamins and minerals in amount comparable to those of fruits for human and livestock consumption (Collins 1987). It possesses high

nutritional value, high energy source and low input requirement (Alvarez 1986). In most parts of northern Nigeria, it is a major source of carbohydrate (Anazonwu-Bello 1976).

Despite the excellent qualities and potential of sweet potato in achieving household food security, levels of production and consumption of sweet potato in Abia State remains very low. This is evidenced by the near absence of the crop in majority of farmers' farms (Onunka *et al.,* 2000), even though Asumugha and Chinaka (1998) reported that the cost of production is very minimal when compared with other root and tuber crops like yam.

According to Hahn (1984), there has been considerable progress in development of improved sweet potato varieties and production practices otherwise known as improved production technologies. The improved sweet potato production technologies have the potential of doubling the yield of farmers if adopted. Through Abia State Agricultural Development Programme (ABIADEP), National Root Crops Research Institute Umudike transferred these improved production technologies of sweet potato to farmers in Abia as were as other States in South east agro-ecological zone of Nigeria over ten years ago. Use of local varieties and indigenous technique was prevalent among sweet potato farmers in some area while the crop was almost absent in many areas. Considering the importance of sweet potato in household food security and survival in one hand and its low production level in the state, the study was thus carried out to ascertain farmers' behaviour towards the technologies and to examine possible variables that influenced farmers' adoption of the improved production technologies of sweet potato in Abia State.

METHODOLOGY

The study was carried out in three agricultural zone of Abia State namely, Aba, Ohafia and Umuahia. A 3-stage random sampling technique was employed in selecting respondents for the study. The first stage involved a random sampling of two local government areas from each zone. The second stage was yet another random sampling of five communities from each of the sampled LGA while in the third stage five farmers were randomly selected in from each of the sampled communities. Thus a sample size of 150 respondents from 30 communities of six (6) Local Government Areas in Abia State was selected for the study. With the use of structured questionnaire, primary data were collected from the respondents while back up secondary data were obtained from relevant literatures at NRCRI Umudike literary. Data collected were analyzed with descriptive statistics as well as multiple regression model. Although the three functional forms of multiple regression analysis were used in the data analysis, the double-log (Cobb Douglas) function was preferably chosen in result interpretation because it showed higher sensitivity in the measure of the variables than the linear and semi log functions. The three functional forms are specified as follows:

1. Linear: $Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 \ldots. b_gX_g + e$
2. Semi log: $Y = \log b_o + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + \ldots b_g + \log x_1 + e$
3. Double log (Cobb Douglas): $\text{Log } Y = \log b_o + b_1 \log x_1 + b_2 \log x_2 \ldots b_g + \log x_1 + e$

Where

Y = adoption index for sweet potato production technologies
X_1 = Gender of respondents (male = 1; female = 0)
X_2 = Age of respondents in years
X_3 = Marital status (married = 1; unmarried = 0)
X_4 = Household size (absolute number of members of farm households)

X_5 = Level of education in number of years spent at school
X_6 = Farming experience (number of years in farming)
X_7 = Farmers cash income (in Naira).
X_8 = Farm size (farmland cultivated in hectares)
X_9 = Output (total sweet potato yield in a year)
E = Error term
Bo = Intercept.

For measurement of adoption level; values were assigned to the various stages of adoption using a five point hedonic scaling pattern as follows; unaware = 0; aware = 1; interest = 2 evaluative = 3; Trial = 4, Hence scores for adoption level of each technology was obtained by multiplying out accrued number of respondent by the point attached to each adoption stage and then divide by the total number of respondents. Furthermore, farmers' adoption of the technologies was categorized into three: high, medium and low. The categories were obtained by dividing the five spaces in the 0-5 point scales into three parts as employed by Onu and Obibuaku (1987). This gave a unit interval of 1.67. This unit interval was then subtracted successively from maximum point downwards to obtain the lower class marks. Thus categories of adoption were classified as follows 5-3.33.00 = High; 3.32 – 1.65 Medium; 1.64 and below = low adoption.

RESULTS AND DISCUSSION:

Results in Table 1 revealed that majority (74.0%) of the farmers in the area were above 40 years of age as against 26.0% who were below. This implies that there were more ageing farmers than the young ones. As a result, farm innovations might not be easily adopted because of the old farmers who are conservative and more resistant to change. Majority (82.0%) of the respondents were male farmers, while only 18.0% were females. Onyenweaku and Mbuba (1991) reported that naturally, male farmers exert authority over females and that they are more likely to adopt innovations faster than their female counterparts who would first seek permission from their husband before taking any serious farm decisions. Table 1 also indicates that most (67.0%) respondents were married, while 33.0% were unmarried. The married respondents obviously have families members that constitute the farm households in the area. Tshunza *et al* (1999) opined that married respondents were more likely to adopt and extend innovation to others through support for their spouses and other household members.

The educational status of farmers in the study area was relatively low as evidenced by majority of respondents (60%) who had only primary education. One-third of respondents (33%) however, attended secondary school while only 3% obtained post secondary education. Uwakah (1983) remarked that high educational status facilitates adoption as it makes one to be more objective in evaluating innovation which positively influences adoption behaviour.

Results in Table 1 further indicated that most respondents (80%) cultivated 0.5-1 hectare of land annually. Several crops such as yam, cassava, vegetables and sweet potato competed for the available lands which were allocated according to priority given to the crops by each farmer. Only 2% of respondents cultivated more than 1hectare each year. Most of the respondents (50%) in the study area had 6 – 10 household members while 36% had over 10 household members. The results corroborated with the report of Ekwe (2004) which indicated that most farmers in Abia State had large households which readily provided labour

for on-farm and off farm activities. Large households also have advantage of disseminating adopted innovations through its members.

Results in Table 1 also showed a relatively low income from sweet potato as evidence by majority (90%) of respondents who earned N2000 or less from sweet potato production annually. Only 2% of respondents above N4,000 from sweet potato. The trend of the result once more indicates the low production level of the crop in the area which was largely attributed to paucity of improved production technologies among farmers in the study area. Furthermore, results in Table 1 indicated that farmers' average output for sweet potato was relatively low. Majority of respondents (45%) produced between 500-700kg of sweet potato annually. Only 5% of respondents produced over 700kg of sweet potato annually. This record may be attributed to small land area cropped as well as low adoption of the improved production technologies.

Results in Table 2 revealed that on the average 47% of respondents were not aware of the improved production recommendations of sweet potato disseminated to farmers in the area while others were at various stages of adoption of the technologies as follows aware(12%), interest (8%), evaluation (9%), trial (10%) and use (16%). Furthermore, results of assessment of the farmers' use of the technologies in the study area revealed medium level of adoption (1.72) for all the component production technologies of sweet potato. Out of the seven component technologies, there was medium level of adoption or such technologies like use improved varieties (1.70), time of planting (1.88) fertilization application (1.80), sweet potato intercrop (1.83) and harvesting technique (2.33). However, planting space (1.51) and planting pattern (0.97) were low in adoption among the farmers. Furthermore, for an important activity like planting pattern to score low in adoption, it further revealed the paucity of technical information on sweet potato production among farmers in the study area. Of course the obvious consequence were low yield as well as low income. Ekwe (2004) has established that income is positively related to farmers' adoption of new technologies.

From results in Table 3, regression analysis indicated an R^2 value of 0.28 for the independent variables ($X_1 - X_9$). This implies that 28% of the variation in adoption of improved production technologies of sweet potato was explained by the aforementioned, independent variables considered in this study. Also the result revealed that only three variables viz farm income (X_7), farm size(X_8) and output (X_9) were positively related to adoption at 5% level of significance.

Farm income from sweet potato (X_7) indicated a very significant positive relationship with adoption of the improved technologies. This suggests that accruable income from sweet potato had positive influence on the farmers' adoption behaviour towards the production technologies. Thus increase in income from sweet potato encouraged farmers to adopt the technologies; on the other hand, increase in adoption of production technologies could results in increase in yield as well as accruable income. Moreover, IITA (1990), indicated that economic viability of a technology determines the extent of the adoption. The results further showed that farm size (X_8) had very significant positive relationship with adoption of sweet potato production technologies at 1% level of significance. This also suggests that increase in farm size encouraged increase in adoption of the production technologies. This could be explained by the fact that farmers who wish to increase their farm size for sweet potato production basically desire increased yield and would naturally adopt improve technologies to achieve this aim. Although results of this study showed that 0.5-1 ha of farmland were cultivated by most farmers in the area which resulted in low sweet potato production in the state, yet increase in farm size would cause a corresponding increase in adoption of improved technologies stimulated by desire for increased production. Similarly, result in Table 3

revealed a very significant positive relationship existing between sweet potato output and adoption of production technologies. It basically implies that increase in output at the trial stage of adoption would encourage many farmers to adopt the production technologies. Asumugha, and Chinaka (1998) had reported that production cost and output were positively related to adoption of agricultural technologies introduced to farmers in south eastern Nigeria.

On the other hand, no significant relationship was observed between adoption of production technologies of sweet potato and such variables like age, sex, marital status, educational status, years of farming experience as well as household size.

CONCLUSIONS AND RECOMMENDATIONS

The low production of sweet potato in Abia State as evidenced by its sporadic presence in farmers farm as well as its small quantities in both local and urban markets (Onunka, *et al* 2000) is largely attributed to several factors one of which was farmers use of local varieties and production practices. Improved production technologies jointly developed by IITA Ibadan and NRCRI Umudike were introduced to farmers in the state over a decade ago. The production technologies have potentials of boost the productivity of sweet potato. The main thrust of this study was to evaluate current adoption status of the technologies as well as the variables influencing the adoption.

From the results of the study it could be concluded that:

- a sizeable proportion of farmers in the state were unaware of the technologies as indicated by 47% of the respondents. This implies that such farmers would only use the local varieties and practices for sweet potato production. This certainly resulted in low production.
- adoption of improved production technologies of sweet potato was still at the medium level. Similarly adoption was 'medium' for five component technologies such as improved varieties, time of planting, fertilizer application, sweet potato intercrop and harvesting technique but low for planting space and planting pattern.
- farm income, farm size and farm output of sweet potato were positively related to adoption of the improved sweet potato production technologies in the state.

It is therefore recommended that the agency for extension service delivery in the state – Abia State Agricultural Development Programme (ABIADEP) should mount promotional campaign on sweet potato production in the mass media as a way of popularizing the improved production technologies as well as sensitizing farmers to increase sweet potato production in the state. Also organization of field days and farmers' training on sweet potato production as well as procurement and distribution of improved varieties to farmers by ABIADEP are effective strategies for stimulating adoption of the technologies. These strategies can quickly boost sweet potato production.

Since farm income and farm size are positively related to adoption of the technologies, granting of soft loans to farmers will enable them invest more for high income. This will also, enhance adoption of the technologies. Sweet potato production in Abia State will grow if efforts are put in place to encourage farmers' adoption of improved production technologies as recommended.

Table 1: Distribution of Respondents according to socioeconomic characteristics and sweet potato output.

Variable	Frequency	%	Variable	Frequency	%
Age			**Educational Status**		
≤ 30yrs	14	9.13	No formal education	5	3.3
31-40	25	16.7	Primary Education	90	60.0
41-50	44	29.3	Secondary Education	50	32.4
>50	67	44.7	Post. Sec. Education	5	3.3
Total	**150**	**100**	**Total**	**150**	**100**
Sex			**Marital status**		
Male	125	82	Married	100	66.7
Female	25	18	Unmarried	50	33.3
Total	**150**	**100**	**Total**	**150**	**100**
Farming experience			**Household size**		
≤ 8	30	20.0	≤ 5	21	14.0
9-14	38	25.3	6-10	75	50.0
>15	82	34.7	11-15	42	28.0
Total	**150**	**100**	>15	12	18.0
			Total	**150**	**100**
Farm size			**Farm income (N)**		
Below 0.5 hectare	27	18	≤ 1000	6	4
0.5-1 hectare	120	80	1100-3000	24	16
Above 1 hectare	3	2	3100-6000	63	42
Total	**150**	**100**	>6000	57	38
			Total	**150**	**100**
Sweet potato output (kg)					
≤ 300	38	25.3			
300-500	37	24.7			
500-700	68	45.3			
>700	7	4.7			
Total	**150**	**100**			

Source: Field Survey, 2003

Table 2: Distribution of Respondents According to Stages in adoption of Improved Production Technologies of Sweet Potato

Improved Production Technologies	Not Aware 0	Aware 1	Interest 2	Evaluation 3	Trial 4	Use 5	Average (5.max)	Remark
a. Improved varieties	0 (360)	4(28.00)	32(10.9)	6(2.0)	8(1.3)	33(22)	1.70	Medium
b. Time of planting	0(53.30)	7(4.7)	20(6.70)	72(160)	48(80)	27(18.0)	1.86	Medium
c. Planting space	0(32.00)	3(20.00)	80(26.7)	45(10.0)	52(8.7)	4(2.6)	1.51	Low
d. Planting pattern	0(65.30)	22(14.70)	6(2.0)	15(3.3)	12(2.0)	19(12.7)	0.97	Low
e. Fertilizer application	0(38.00)	23(15.30)	20(6.70)	54(12.00)	148(24.7)	5(3.3)	1.80	Medium
f. Sweet potato intercrops	0(58.00)	2(1.30)	12(4.0)	6(1.30)	52(8.7)	40(26.7)	1.83	Medium
g. Harvesting technique	0(46.00)	5(3.30)	8(2.7)	81(18.00)	80(13.3)	35(23.3)	2.33	Medium
Mean	0(46.6)	19(12.6)	24(83)	39(8.6)	56(9.52)	24(16.00)	1.72	Medium

Source: Field Survey, 2003. Figures in parenthesis are percentage

Table 3: Multiple Regression Analysis of Relationship between selected variables and Adoption of Production Technologies of Sweet Potato

Functional forms	Constant	X^1	X^2	X^3	X^4	X^5	X^6	X^7	X^8	X^9	R^2	Adjusted R
Linear	1.601**	-0.0064	-08.532 -0.853	0.400	0.2464	-0.431	-0.0051	2.433*	4.620 0.462	3.900*	0.183	0.137
	(2.397)	(-0.942)	(-0.405)	(1.477)	(0.099)	(-0.847	(-.401)	(2.999)	(1.840)	(4.468)		
Semi-log	0.471*	-0.000157	-0.00127	.140	.00353	0.115	-0.02.8	1.0130	1.355*	1.2200*	0.160	0.112
	(1.844)	(-0.444)	(-0.150)	(1.357)	(.373)	(1.351)	(-521)	(3.261)	(1.181)	(5.981)		
Double-log	-0.08781**	-0.01076	0.305	0.187	-0.133	456.4	-.05298	1.211***	1.131***	1.302***	0.280	0.163
	(-0.135)	(-.086)	(0.270)	(1.266)	(-0.22)	(0.558)	(0.765)	(3.691)	(2.502)	(5.586)		

*Significant at 1%, ** Significant at 5%, *** Significant at 10%

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