



EFFECTS OF ADOPTION OF ORANGE-FLESHED SWEET POTATO VARIETIES ON FARM INCOME AND OUTPUT AMONG GROWING HOUSEHOLDS IN EBONYI AND ABIA STATES, NIGERIA

^{1&2}Ben-Chukwu, M.A., ¹Amadi, P.E., ²Mgbebu, E.S., ¹Nwankwo, I.I. and ¹Afuape, S.O.

¹National Root Crops Research Institute, Umudike, Abia State

²Federal College of Agriculture, Ishiagu, Ebonyi State

Corresponding Authors' email: easylink247@gmail.com

Abstract

The study comparatively analyzed the effect of the adoption of orange-fleshed sweet potato (OFSP) varieties on farm income and output of growing households in Ebonyi and Abia States, Nigeria using a well-structured questionnaire on 256 OFSP farmers from four agricultural zones. The data obtained were analyzed using descriptive and inferential statistics such as means, percentages, tables and frequency, adoption score index (of 7 point likert-type scale) and Z-test. The result on socio-economic characteristic showed that the average age of the sweet potato farmers in Ebonyi and Abia States was 47.11 and 49.86 years, respectively, with females dominating in Ebonyi, while males dominated in Abia. Farmers' average farm size was 2.10ha and 1.71ha respectively, and years of farming experience of 8.52 and 9.65 years. The level of adoption of OFSP varieties showed that in Ebonyi, farmers were at the evaluation stage for UMUSPO/3 ($X=2.78$) and trial stage for UMUSPO/1 ($X=3.04$), while in Abia the farmers were at the trial stage for UMUSPO/1 ($X=3.63$) and UMUSPO/3 ($X=3.78$). The Z-test result showed that there were significant differences in farm income and output of OFSP farm households at 1.0% probability levels in both States. Sweet potato farmers in both Ebonyi and Abia States were seriously constrained by low extension visit, inadequate credit facilities and poor government support. The study therefore recommended that OFSP farmers should be strategically given more support to generally boost OFSP adoption, income, output and productivity across the country.

Keywords: Sweet potato, Adoption, UMUSPO/1, UMUSPO/3, OFSP

Introduction

Globally, sweet potato (*Ipomoea batatas*) is a very important food crop and ranked fourth in terms of consumption as the world's most important food crop (Afuape, 2014). Orange-fleshed sweet potato (OFSP) is an improved type of sweet potato that is cultivated in tropical and semi-tropical regions of the world for food and source of income especially among the rural dwellers (Padmaja, 2009). Orange-fleshed sweet potato varieties are rich in beta carotene (a precursor of vitamin A) with proven high content of the nutrient. It is considered a key crop to combat vitamin A deficiency (VAD) problem in sub-Saharan Africa (Low *et al.*, 2007); and also a means to increase sweet potato output at farm level, enhance food security status of farming households, boost nutritional status and improve farmers' livelihoods (Udensi *et al.*, 2011). In spite of the role of orange fleshed sweet potato as one of the world's most important food and vegetable crops in combating vitamins and other nutritional deficiencies, it is still regarded as a minor crop and food for the poor. Despite

growing recognition of livelihood-improving and poverty-reducing potentials of OFSP, precise ways and extent to which OFSP contributes to sustainable livelihoods and poverty reduction in Ebonyi and Abia States have not been verified. Previous studies in South-East Nigeria showed that OFSP was developed and disseminated by National Root Crops Research Institute (NRCRI) Umudike, and further studies indicated that it has been adopted by farmers in various locations including Ebonyi and Abia States where it was disseminated. The study, therefore, aims at determining the effects of orange-fleshed sweet potato adoption on the farm income and output of growing households in Ebonyi and Abia States, Nigeria.

Methodology

The study was conducted in Ebonyi and Abia States, Nigeria. Purposive and multistage sampling techniques were adopted for the study. Two out of the three agricultural zones were purposively selected per State. These Zones were Ebonyi North and Ebonyi South. In

Abia; Umuahia and Ohafia agricultural zones were selected. These zones were purposively chosen because of farmers' involvement in OFSP production. The second stage involved random selection of two extension blocks from the agricultural zones making a total of eight (8) extension blocks sampled. The third stage involved random selection of two circles from each of the chosen blocks to give a total of sixteen (16) circles. Data were collected with questionnaire and scheduled interviews and were analyzed using descriptive and inferential statistics such as frequency, percentages, mean and 7-point rating type scale. The level of adoption of OFSP was determined using adoption score index. It was achieved with the aid of a 7 point ratingscale graded thus: unaware = 0, Aware = 1, interest = 2, evaluation =3, trial =4, accept = 5 and satisfaction = 6. In accordance with Okoye *et al.* (2009), the mean adoption level was determined as follows:

$$X = \frac{\sum x}{n} \dots\dots (1)$$

Mean score was computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the same with the number of respondents to the terms. This is summarized with the equation thus;

$$X = \frac{\sum fn}{nr} \dots\dots (2)$$

Where:

X = Mean score

\sum = Summation

f = Frequency

n = Likert nominal value

n_r = Number of respondents

$$X = 1 + \frac{0+1+2+3+4+5+6}{7} = \frac{21}{7} = 3.0 \dots\dots (3)$$

Decision Rule

Less than 1.0 = unaware, 1.0-1.49 = Awareness, 1.5-1.99 = Interest, 2.0-2.49 = Evaluation, 2.50-2.99 = Trial stage, 3.0-3.49 = Adoption, 3.5 and above = Satisfaction
Also, Z Test statistics to investigate for differences in income between farmers in Abia and Ebonyi States, expressed thus;

$$Z = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \dots\dots (4)$$

Where,

Z = Z statistic

X₁ = Mean of household monthly expenditure of OFSP farmer adopters in Abia State

X₂ = Mean of household monthly expenditure of OFSP farmers adopters in Ebonyi State

S₁² = Standard error of farm household monthly expenditure of OFSP farmer adopters in Abia State

S₂² = Standard error of farm household monthly expenditure of OFSP farmer adopters in Ebonyi State

n₁ = Sample size of OFSP farmers, adopters in Abia State

n₂ = Sample size of OFSP farmers adopters in Ebonyi State

Results and Discussion

Socio-economic Characteristics of Farmers

Table 1 show that 30.47% of OFSP farmers in Ebonyi were between the ages of 41 and 50 years, and 27.34% between 51 and 60 years. On the other hand, 35.16% of OFSP farmers in Abia were between the ages of 41 and 50 years, while 32.03% were between the ages of 31 and 40 years. The mean ages of the OFSP farmers in Ebonyi and Abia were 49.86 years and 47.11 years, respectively. This shows that sweet potato farmers in Ebonyi and Abia states fell within the economically productive proportion of the population that is likely to favour adoption of the orange fleshed sweet potato production as reported by Mbanaso *et al.* (2012). Gender distribution of the respondents showed that 58.59% of OFSP farmers were females in Ebonyi and 45.31% in Abia, while 41.41% were males in Ebonyi and 54.69% in Abia. This suggests that females dominated OFSP production in Ebonyi, while males dominated in Abia. This is in line with the findings of Okwusi *et al.* (2005) that females predominated in the production, processing and utilization of sweet potato in South-East Nigeria. The farm size result shows that majority (59.38%) of the OFSP farmers in Ebonyi and many (47.65%) in Abia had farm size between 1 - 3 hectares. This finding is in agreement with the findings of Emodi (2009) who found small-scale farmers predominating in the South-East agro-ecological zone of Nigeria. Majority (70.40%) and (68.75%) of OFSP farmers in Ebonyi and Abia States had sweet potato farming experience of between 1 and 9 years, respectively. Findings also show that only 42.97% of OFSP farmers in Ebonyi and 50.00% in Abia had access to extension.

Table 1: Socio-economic characteristics of OFSP farmers in Ebonyi and Abia States

	Ebonyi State		Abia State	
	Frequency	Percentage	Frequency	Percentage
Age				
21-30	13	10.16	2	1.56
31-40	19	14.84	41	32.03
41-50	39	30.47	45	35.16
51-60	35	27.34	30	23.44
61 and above	22	17.19	10	7.81
Sex				
Male	53	41.41	70	54.69
Female	75	58.59	58	45.31
Farm size				
<1.0	34	26.56	22	17.19
1.0-3.0	76	59.38	61	47.65
3.1-5.0	15	11.72	27	21.09
5.1 and above	3	2.34	18	14.06
Farming experience				
1-9	90	70.31	88	68.75
10-19	31	24.22	38	24.22
20 and above	7	5.47	2	1.56
Access to Extension agents				
Yes	55	42.97	64	50.00
No	73	57.03	64	50.00
Total	128	100	128	100

Source: Field survey, 2018

Level of adoption of OFSP varieties by farmers in Ebonyi and Abia States

The distribution of sweet potato farmers according to their level of adoption of OFSP varieties in Ebonyi and Abia is presented in Table 2. The Table shows that in Ebonyi, sweet potato farmers were at the evaluation and trial stages for UMUSP0/3 ($X=2.78$) and UMUSP0/1 ($X= 3.04$) respectively, while, sweet potato farmers in Abia State were both at the trial stages for UMUSP0/3 ($X=3.63$), and UMUSP0/1 ($X=3.78$). The grand mean

adoption score for orange fleshed sweet potato technology in Ebonyi and Abia were 2.91 and 3.71 respectively. This shows that OFSP is at trial level in Ebonyi State, while farmers in Abia State were at their trial stage. This implies that farmers in Abia State performed better in terms of adoption than their counterparts in Ebonyi State, probably due to the proximity of the Research Institute (NRCRI) that developed the varieties.

Table 2: Distribution of OFSP according to their levels of adoption

OFSP	Ebonyi										Abia								
	U	AW	I	E	T	AD	S	Total	X	U	AW	I	E	T	AD	S	Total	X	
Rating scale	0	1	2	3	4	5	6												
UMUSPO/3	7 (0)	19 (9)	21 (42)	67 (201)	10 (40)	8 (48)	01 (06)	35 (6)	2.78	4 (0)	9 (9)	20 (40)	16 (48)	39 (156)	29 (145)	11 (66)	46 (6)	3.63	
UMUSPO/1	1 (0)	9 (9)	12 (24)	70 (210)	34 (136)	02 (10)	0 (0)	38 (9)	3.04	1 (0)	5 (5)	19 (38)	15 (45)	49 (196)	34 (170)	5 (30)	48 (4)	3.78	
Total									2.91									3.71	

Source: Field survey, 2018

Figures in parenthesis = rating nominal scores

Decision Rule; Less than 1.0=Unaware, 1.0-1.49 =Aware, 1.50-2.49=Interest, 2.50-3.49=Evaluation, 3.50-4.49=Trial, 4.50-5.49=Adoption, greater than 5.49=Satisfaction

U=Unaware, AW=Aware, I=Interest, AD=Adoption, T=Trial, AC=Accept, S=Satisfied, X-Mean adoption score

Annual farm income before and after adoption of OFSP by farmers in Ebonyi and Abia States

Table 3 shows that 43.75% of Ebonyi State sweet potato farmers had annual farm income less than N100,000 before adoption of OFSP, while 35.94% had annual farm income of between N100,000 and N199,000 with mean annual farm income of N133,085.94. The mean annual farm income of sweet potato farmers in Ebonyi State after adopting OFSP was N369,218.75. On the other hand, 46.87% of Abia State sweet potato farmers had annual farm income less than N100,000 before adoption of OFSP while 38.28% of them had farm income of between N100,000 and N199,000 with mean annual

farm income of N128,164.06. The mean annual farm income of sweet potato farmers in Abia state after adopting OFSP was N343,046.88. This implied adoption of OFSP by OFSP farmers in Ebonyi and Abia States greatly increased the farm income levels of the sweet potato farmers. Income is a major indicator of the farmer's livelihood. This corroborated with the findings of Mendola (2007) and Asfaw *et al.* (2012) that adoption of improved crop varieties (OFSP) increased farmers' income which in turn improves the capacity to adopt other agricultural innovations as they have the necessary capital to start the innovation.

Table 3: Distribution of respondents according to their farm income before and after OFSP adoption in Ebonyi and Abia States

Farm income ('000₦)	Ebonyi State				Abia State			
	Before		After		Before		After	
	Freq	(%)	Freq	(%)	Freq	(%)	Freq	(%)
<100	56	43.75	13	10.16	60	46.87	14	10.94
100-199	46	35.94	16	12.50	49	38.28	23	17.97
200-299	11	8.59	34	26.56	2	1.56	34	26.56
300-399	4	3.13	17	13.28	4	3.13	4	10.94
400-499	1	0.78	8	6.25	4	3.13	7	5.47
>500	10	7.81	40	31.25	9	7.03	36	28.12
Total	128	100.00	128	100.00	128	100.00	128	100.00
Mean (₦)	133,085.94		369,218.75		128,164.06		343,046.88	

Effect of OFSP on income and output of sweet potato farmers in Ebonyi and Abia States

Table 4 shows the paired Z-test for differences in income and farm output of OFSP farmers before and after adoption of OFSP in Ebonyi and Abia States. Our findings show that the mean farm income of sweet potato farmers in Ebonyi State before adoption of OFSP was N133, 085.94, while the mean farm income after adoption was N369,218.75. The mean difference in their farm income after adoption was N236,132.81 with a standard error of 32,483.4459 and Z value of 7.269 which was significant at 1% level. On the other hand, the mean farm income of sweet potato farmers in Abia State before adoption of OFSP was N128,164.06, while after

adoption was N343,046.88. The mean difference in their farm income after adoption was N214,882.81, with a standard error of 30,792.62462 and Z value of 6.978, which was significant at 1% level. This implies that adoption of OFSP in Ebonyi and Abia States has greatly increased the farm income levels of the sweet potato farmers. Income is a major indicator of the farmer's livelihood. This result corroborated the findings of Owuor *et al.* (2004) that adoption of improved crop varieties(OFSP) increased farmers' income which in turn improved the capacity of farmers to adopt other agricultural innovations as they had the necessary capital to start new innovation.

Table 4: Paired Z-test for Differences in Farm Income and Output among Sweet potato Farmers before and after Adoption of OFSP in Ebonyi and Abia States, Nigeria

Variable	Individual mean	Mean difference	Standard error	Z- Value	Sig (2-tailed)
Ebonyi State					
Income before adopting OFSP	133,085.94				
Income after adopting OFSP	369,218.75	236,132.81	32483.4459	7.269***	0.000
Abia State					
Income before adopting OFSP	128,164.06				
Income after adopting OFSP	343,046.88	214,882.81	30792.6246	6.978***	0.000
Ebonyi State					
Output before adopting OFSP	2.1484				
Output after adopting OFSP	2.9469	0.7984	0.1239	6.441***	0.000
Abia State					
Output before adopting OFSP	2.2500				
Output after adopting OFSP	3.0734	0.8234	0.1424	5.785***	0.000

Source: Field Survey data, 2018. *** = significant at 1%

Constraints militating the Adoption of Orange Fleshed Sweet Potato in Ebonyi and Abia States

Table 5 shows the constraints militating against production in the two States. Farmers in Ebonyi State were constrained by inadequate credit facilities (68.75%), poor government support (54.69%), low extension coverage (75.78%), limited available farm size (53.13%) and limited capital to purchase seeds of the new varieties (54.69%). On the other hand, Abia State sweet potato farmers were constrained by inadequate credit facilities (74.21%), poor government support (68.75%), low extension coverage (66.41%), limited farm size (57.81%), limited capital to purchase

seeds of the new varieties (60.94%) and inadequate labour availability (62.50%). These results were in accordance to the findings of Ani (2002) who reported that the availability of credit is essential to the adoption of innovation, and credit makes it easy for farmers to use new machines, improved seeds, fertilizer and even extension services. Also, the observation of Mbansor (2012) that pointed out the weak link between extension and research in Nigeria further supports the findings of this study. The observed weak link between extension agents and farmers will always have a direct negative effect on the adoption of new agricultural technologies.

Table 5: Challenges associated with adoption of OFSP by sweet potato farmers in Ebonyi and Abia States, Nigeria

Constraints	Ebonyi State		Abia State	
	*Frequency	%	*Frequency	%
Inadequate credit facility-	88	68.75	95	74.21
Poor government support	70	54.69	88	68.75
Low extension coverage	97	75.78	85	66.41
High technical involvement	43	33.59	43	33.59
High risks/uncertainties	60	46.88	60	46.88
Limited Farm size	68	53.13	74	57.81
Low labour availability	60	46.88	80	62.50
Difficulty in Method of Planting	33	25.78	40	31.25
Short weeding interval	43	33.59	55	42.97
Low capital to purchase variety	70	54.69	78	60.94
Difficulty in Fertilizer application	55	42.97	57	44.53
Poor farming knowledge	43	33.59	40	31.25
High pest and disease	40	31.25	55	42.97

Source: Field survey, 201. * = Multiple responses recorded

Conclusion

According to the findings of this study, both Ebonyi and Abia states are at various stages of adoption of OFSP, with Ebonyi at the *Evaluation* stage and Abia state at the *Trial* stage. The study further showed that tremendous increases in income and output that can significantly enhance family livelihood are achievable if farmers adopt OFSP production. The study also revealed the major factors that constrain sweet potato farmers in

Ebonyi and Abia States to be low extension coverage, inadequate credit facilities and poor government support. The study therefore recommends that OFSP farmers should be strategically given more support in the form of access to soft capital and enhancement in the technology delivery activities of the extension agents by increasing the frequency of extension agent – farmer contacts.

References

- Afuape, S.O. (2014). Information Book on Sweetpotato Quality Requirements for Enterprise Utilization. Naphthali Publishers. Pp 45.
- Ani, A.O. (2002). Factors Inhibiting Agricultural Production among Rural Women in Southern Ebonyi State, Nigeria. Unpublished Ph.D. Thesis, University of Maiduguri, Nigeria.
- Asfaw, S., Shiferaw, B. and Simtowe, F. (2010). Welfare effect of modern agricultural technologies: A micro-perspective from Ethiopia and Tanzania. CPRC International Conference 2010 Manchester, UK 08-10 September, 2010.
- Emodi, A. I. (2009). Analysis of Rice Innovation System in South-East Nigeria. Unpublished Ph.D Research Findings Seminar. Department of Agricultural Extension, University of Nigeria, Nsukka.
- Low, J.W., Arimond, M., Osman, N., Cunguard, B., Zano, F. and Tschirley, D. (2007). A food based Approach introducing Orange-Fleshed Sweet Potatoes increased Vitamin A intake and serum retinol concentrations in Young Children in Rural Mozambique. *Journal of Nutrition*, 137:1320-1327.
- Mbanasor, J.A. (2012). Pushing Back Poverty in Nigeria: Agribusiness Development. 16th Inaugural Lecture of Michael Okpara University of Agriculture, Umudike delivered on 21st November 2012 at ETF Hall, MOUAU.
- Mendola, M. (2007). Agricultural Technology Adoption and Poverty Reduction: A Propensity-Score Matching Analysis for Rural Bangladesh. *Food Pol.*, 32: 372-393.
- Okoye, B.C., Okoye, A.C., Dimelu, M.U., Agbaeze, C.C., Okoroafor, O.N. and Amaefula, A.B. (2009). Adoption Scale Analysis of Improved Cocoyam Production, Processing and Storage Technologies Across Gender in Enugu North Agricultural Zone of Enugu State, Nigeria. Munich Personal RePEc Archive, MPRA Paper No. 17432, Online at <http://mpa.ub.uni-muenchen.de/17432/>.
- Okwusi, M.C., Amamgbo, L.E.F. and Asumugha, G.N. (2005). Gender Roles in the Production, Processing and Utilization of Sweet Potato in four Major Sweet Potato Producing Areas in Southeast Geo-political Zone. Annual Report of the National Root Crops Research Institute, Umudike.
- Owuor, G., Wangia, S.M., Onyuma, S., Mshenga, P. and Gamba, P. (2004). Self-Help Groups, A Social Capital for Agricultural Productivity: The Case of Smallholder Maize Farmers in Ukwala Division, Siaya District, Kenya. *Egerton Journal of Humanities*, 6 (3): 159 - 176.
- Padmaja, G. (2009). Uses and Nutritional Data of Sweet Potato. In: The Sweet Potato, Loebenstein, G. and Thottappilly, G. (Eds), Springer Science + Business Media B.V. 2009. Pp. 189-234.
- Udensi, U.E., Tarawali, G., Favour, E.U., Asumugha, G., Ezedinma, C., Okoye, B.C., Okarter, C., Ilona, P., Okechukwu, R. and Dixon, A. (2011). Adoption of selected improved cassava varieties among smallholder farmers in South-eastern Nigeria. *Journal of Food, Agriculture and Environment*, 9 (1): 329-335.