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ANALYSES OF ADOPTION OF WATER YAM VALUE ADDED TECHNOLOGIES AMONG RURAL WOMEN IN OKIGWE LGA, IMO STATE

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ABSTRACT
The study assessed the adoption of new Water Yam value added technologies among rural women in Okigwe Local Government Area (LGA) of Imo State, Nigeria following participation in a training organized by the National Root Crops Research Institute (NRCRI), Umudike on Root and Tuber Crops. The study described the socio-economic status of trainees/respondents, and identified the problems the trainees (rural women) encountered before and after the intervention by NRCRI; ascertained the level of adoption of the Water Yam Technology packages; and estimated the determinants of adoption of the Water Yam Value Addition Technologies (WYVAT). Data for the study were elicited from 120 respondents. The major findings revealed that the level of adoption of the Technologies of processing into doughnuts (WYVAT IV) had the highest mean score of 3.89, followed by flour (WYVAT III =2.18). Important factors influencing the level of Adoption of Water Yam Value Addition Technologies include: education, income, household size, frequency of extension contacts, membership of cooperatives, and experience. Important constraints also militating adoption include: lack of electricity supply, inadequate funding, lack of transport facilities and lack of value-added products processing materials. The study therefore call for policies aimed at provision of free and affordable education for the girl-child, access to more extension contacts, encouraging the women to form/join cooperatives for increased adoption of these technologies. There is also need for provision of stable power supply, rehabilitation of rural roads and provision of simple processing tools to enhance adoption.

Keywords: Water Yam, Value addition and Adoption

Introduction

Water yam, among other varieties of yam, is an important tuber crop which constitutes the major staple food items of more than 58% of Nigerians (Nwachukwu, 2010). The crop plays a crucial role in the sociological, nutritional and economic development of the country (Ikeorgu, 2011). Water Yam has been in existence in Nigeria for many decades, and farmers have not been enjoying better price for the crop. This is due to post-harvest losses, and there was little or no processing of this crop to make it valuable. Hence, farmer's earnings were not commensurate with the efforts they put in water yam production. In an effort to guide against poor earnings and encourage people to eat water yam (Aniedu, 2014), the Federal Government of Nigeria released funds for a Training Programme of the Rural Women on the Root and Tuber Crops Value Addition Technologies by NRCRI, Umudike. The purpose was to promote the new and improved forms of processing, utilization and packaging of the agricultural crops (water yam inclusive) for sustainable food production, income generation, increased source of nutrition for diabetic patients and possible foreign exchange earnings in the country (Oti and Aniedu, 2011).

Water yam (*D. alata*) is consumed in different forms. Water yam can be consumed fresh as tuber after cooking; used as soup thickener, processed into "*Achicha*", roasted in fire, and can also be fried into chips (Asumugha, 2014). Yam has different varieties developed by NRCRI, Umudike (*D. alata* – water yam, *Dioscorea rotundata, D. cayenensis, D. bulbifera* – white yam). Yam varieties are rich in vitamins and may be used also as cash crop, snacks, feed for livestock or as industrial crop for production of alcohol and medicines (Amamgbo, 2010). They are good source of carbohydrates for diabetic patients and convalescents, and fortified food for infants (Oluyemi *et al*., 2005).

Water Yam as part of the mandate crop of NRCRI, Umudike and Nigeria has become the largest world producer of yam, including water yam, which accounted for an annual production of about 47.53 metric tonnes (FAO, 2018). NRCRI, Umudike developed several Water Yam value-added technologies aimed at addressing the high perishability of Water Yam tubers, and diversifying the use of Water Yam and other varieties of Yam. These technologies make it possible for an array of secondary products like Bread, Biscuits, Cake, Chin-Chin, Doughnut, Chips, Salad cream etc. to be derived from the various varieties of Yam flour. Through the various processing, utilization and packages techniques, alternative uses of Water Yam have resulted in the emergence of wide array of food recipes through value addition. All the practices involved in diversifying the processing and utilization of Water Yam tubers are termed value-added technologies. The challenges of meeting the rapidly growing food needs of the masses cannot be successfully overcome without harnessing the abundant knowledge and capacity in extension services (Nwachukwu and Kanu, 2011). Hence the need to make the tuber crop products available in more widely and readily usable forms (Chinaka, 2017).

Methodology

The study was conducted in five Communities, namely; Umulolo, Ezinachi, Amuro, Ogii and Ihube in Okigwe Local Government Area, Imo State of Nigeria. The main food crops grown are yam, cassava, water yam, rice, cocoyam and maize while the cash crops include: oil-palm, banana, various types of fruits, cocoa and rubber. Okigwe LGA was purposively selected because, it is one of the major water yam producing areas in Imo State, and it is where the technologies had been transferred to the rural women. From the ADP Extension Agent supervising the survey in Okigwe LGA, the list of women trained were obtained. The five Communities were purposively selected as a result of their involvement in water yam production. Twenty-four water yam value addition trainees were purposively selected from each of the five Communities making a total of one hundred and twenty respondents as sample size for the study. The analytical techniques used to test and analyze the data include: descriptive statistics, adoption index and multiple regression analysis. For effectiveness, knowledgeable Agricultural Development Project (ADP) Agents were engaged to facilitate accuracy of data collection. Both primary and secondary data were used for the study.

Analytical Techniques

Level of adoption was analysed by the use of a five-point Likert rating scale thus; adoption (5), trial (4), evaluation (3), interest (2), awareness (1), and aware (1). Respondents with mean score of 3.60 and above imply increased probability of adoption while respondents with mean score less than 3.60 imply probability of not adopting. To determine the mean likert level = Xs = ΣX. Xs of each item were computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the sum with the number of respondents to the items. This can be summarized with the equation below.

$$Xs = \Sigma fn/N \quad (1)$$

Where,
Xs =mean score
Σ = summation
f= frequency
n = likert nominal value
N= number of the respondents
Xs=1+2+3+4+5= 18/6 =3.60

The ordinary least square multiple regression models was used to estimate the influence of some socio-economic factors on level of adoption of the value added technologies in the study area. The model is specified thus;

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8) + e \quad (2)$$

Where,
Y= Level of Adoption among beneficiaries of Water Yam Value Added technologies (%)
X_1 = Age (years)
X_2 = Years of formal education (years)
X_3 = Family size (Number of persons in a household)
X_4 = Income of beneficiaries (₦)
X_5 = Experience (years)
X_6 = Marital status (dummy variable; 1=married, 0=otherwise)
X_7 = Membership of Cooperative Society (dummy variable; 1=member, 0=non-member)
X_8 = Frequency of extensión contacts (Regular = 1, Not Regular = 0)
e = Error term

Constraints militating against the adoption of water yam value added technologies was analysed with the use of a four-point Likert rating scale thus; high (4), moderate (3), Low (2), and none (1). Respondents with mean score of 2.50 and above imply the constraint was an important one while respondents with mean score less than 2.50 imply constraint not important. To determine the mean likert level = Xs = ΣX. Xs of each item were computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the sum with the number of respondents to the items. This can be summarized with the equation below.

$$Xs = \Sigma fn/N \quad (3)$$

Where,
Xs = mean score
Σ = summation

f= frequency
n = likert nominal value
N= number of the respondents
Xs=1+2+3+4= 10/4 = 2.50

Results and Discussion

The results in Table 1 show the socio-economic characteristics of the respondents. Many (50.00%) of the respondents were between the age range of 45-54yrs while 16.67% and 5.00% were between the ages of 35-44 and 55-64yrs respectively. Only 8.33% were between the age range of 5-34yrs. This implies that the rural women who are engaged in water yam value addition were still strong and active. Age is another factor thought to affect adoption. Age is said to be a primary latent characteristic in adoption decisions. However, there is contention on the direction of the effect of age on adoption. The effect is thought to stem from accumulated knowledge and experience of farming systems obtained from years of observation and experimenting with various technologies (Bobabana-Wabbi, 2002). The results show that many (45.83%) of the respondents attained secondary level of education and 35.83% attained primary level of education, while 18.33% did not attain any form of formal education. The ability to read and understand sophisticated information that may be contained in a technological package is an important aspect of adoption. According to Ibe (2013), educated farmers are expected to be more receptive to improved techniques while farmers with little or no education are less receptive to improved technologies. About 62.50% of the respondents were full time farmers. This follows Asumugha (2003) who observed that full-time farmers tend to be less amenable to income diversification than their part-time counterparts. Many (50.83%) of the respondents had large household size of 9-12 persons, while 12.50% and 36.67% had household sizes of 1-4 and 5-8 persons respectively. This is in line with the findings of Ikeorgu, (2011) who noted that large family size necessitates respondents to adopt new technologies for increased returns to sustain their families. Many (50%) of the respondents had income ranging from N700,000.00 - N899,999.00. Programs that produce significant gains can motivate people to participate more fully in them. In fact, people do not participate unless they believe it is in their best interest to do so. Farmers must see an advantage or expect to obtain greater utility in adopting a technology (Bonabana-Wabbi, 2002). Majority (58.33%) of the respondents had farming experience ranging from 21 – 30 years indicating that they have long years of experience in processing. Okoye, (2009) indicated that experience is a major factor in the adoption of technologies and should serve as an advantage for increased investment and technology utilization. Majority (75%) of the respondents were married. This must be, and not only to boost food production but also to augment their family income, as mothers and home makers. Results also show that majority (84.00%) belong to cooperatives while 16.00% do not. Acquisition of information about a new technology through cooperatives demystifies it and makes it more available to farmers. Information reduces the uncertainty about a technology's performance hence may change individual's assessment from purely subjective to objective over time (Caswell *et al*., 2001). Exposure to information about new technologies as such significantly affects farmers' choices about it. Feder and Slade (1984) indicate how, provided a technology is profitable, increased information induces its adoption.

Table 2 shows the distribution of Trainees by level of Adoption. It was observed that processing water yam into doughnuts had the highest level of adoption (3.89), followed by water yam flour (3.66) among the five Water Yam technologies.

The results in Table 3 show the regression estimates of the determinants of level of adoption of water yam value added technologies among beneficiaries who participated at the NRCRI training organized for rural women in Okigwe LGA of Imo State. The results show that education, family size and frequency of extension contacts were all positive and significant at varying levels for all the technologies disseminated. This implies that any increase in education, family size and frequency of extension contacts will lead to a corresponding increase in the level of adoption of the value-added technologies in the study area. Educated farmers are expected to be more receptive to improved farming techniques, while farmers with low level of education or without education would be less receptive to improved farming techniques (Okoye *et al*., 2004). A larger household size would be expected to increase the probability of adoption of innovations. Effiong (2005) reported that a relatively large household size enhance the availability of labour. The coefficients of income were positive and significant at varying levels for the technologies except for cakes. This implies that any increase in income will lead to a corresponding increase in the levels of adoption of value-added water yam chin-chin, flour, bread and doughnuts each. This also followed same scenario for membership of cooperatives except for chin-chin which was not significant. The coefficients for experience were also positive and significant for flour, bread and doughnuts at varying levels indicating a direct relationship with level of adoption. The F-values were all significant at 1% level indicating that all the variables used for analyses were adequate.

The results in Table 4 show the constraints militating against the adoption of water yam technologies disseminated in the study area before and after intervention by NRCRI in the form of training. The results revealed that important constraints include: lack of electricity supply, inadequate funding, lack of

transport facilities and lack of value-added products processing materials. The results show that these constraints were visible before and even after the intervention with the levels increasing after the intervention. This might have affected the adoption of the technologies except for flour and doughnuts which had been with the people even before the intervention.

Conclusion

The research showed that the level of adoption of WYVATs were low except for flour and doughnuts that has been with the people even before the intervention. The respondents were constrained by factors such as lack of electricity supply, inadequate funding, lack of transport facilities and lack of value-added products processing materials which were more important for value added water yam chin-chin, bread and cakes. Important factors influencing adoption include: education, household size, frequency of extension contacts, income, membership of cooperatives and experience. The results therefore call for policies aimed at provision of free and affordable education to enable the rural women access and process innovations that will enhance adoption. The women should be encouraged to form groups and cooperatives for ease of access o information and enhance economics of scale where they can procure inputs and facilities for use as a group. Extension agents should increase their visits to the rural women farmers to enhance their access to information on WYVATs. There is also need for stable electricity supply and rehabilitation of rural roads network where the bulk of food items comes from. More agricultural engineers should be trained and employed in Agricultural Sectors of the economy to manufacture food processing machines in Nigeria. This will not only boost food production in Nigeria, but it will also create more employment opportunities and increase foreign exchange earnings in the country.

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Table 1: Distribution of Respondents according to Socio-Economic Characteristics

Variable	Frequency	Percentage
Age (years)		
25-34	10	8.33
35-44	20	16.67
45-54	60	50.00
55-64	30	25.00
Total	120	100.00
Educational attainment		
No. Formal Education	22	18.33
Primary Education	43	35.83
Secondary Education	55	45.83
Occupation		
Full time farming	75	62.50
Part time farming	45	37.50
Family Size		
1 – 4	15	12.50
5 – 8	44	36.67
9 – 12	61	50.83
Income (Naira)		
100,000 – 299,999	10	8.33
300,000 – 499,999	20	16.67
500,000 – 699,999	30	25.00
700,00 - 899,-999	60	50.00
Experience (years)		
1 – 10	10	8.33
11 – 20	5	4.16
21 – 30	70	58.33
31 – 40	35	29.17
Marital Status		
Married	90	75.00
Single	30	25.00
Membership of Cooperatives		
Non-member	20	16.00
Member	100	84.00

Source: Field Survey, (2018)

Table 2: Distribution of trainees by level of adoption (AIETA)

Adoption Level of Technology	Aware	Interest	Evaluation	Trial	Adoption	Total	Mean	Decision
WYVAT I(Chin-chin)	10(10)	34(68)	30(120)	32(128)	14(70)	326	2.72	Reject
WYVAT II (Cakes)	12(12)	46(92)	29(87)	18(72)	15(75)	338	2.82	Reject
WYVAT III (Flour)	-	26(52)	21(63)	41(164)	32(160)	439	3.66	Accept
WYVAT IV (Bread)	32(32)	44(88)	34(102)	10(40)	-	262	2.18	Reject
WVAT V (Doughnuts)	-	16(32)	21(63)	43(172)	40(200)	467	3.89	Accept

Source: Field Survey, (2018)

Table 3: Regression Estimates of Determinants of adoption of water yam value addition technologies among the beneficiaries in the study area

Variables	Chin-chin	Cakes	Flour	Bread	Doughnuts
Constant	11.828***	4.367***	44.626***	8.121***	65.266*
	(8.622)	(7.615)	(3.529)	(3.279)	(1.946)
Age	0 .611	0.016	1.007	0.441	3.392
	(1.568)	(1.444)	(0.348)	(1.604)	(1.583)
Education	0.181**	0.074**	3.012***	0.801**	4.847***
	(2.367)	(3.364)	(3.527)	(2.989)	(3.925)
Family size	0.040**	0.032**	2.045***	1.000**	5.712***
	(1.120)	(2.737)	(3.593)	(2.712)	(3.484)
Income	0.853**	4.356	6.128***	0.077	7.547***
	(2.354)	(1.310)	(4.133)	(0.468)	(4.163)
Experience	0.227	0.005	2.001**	0.034**	2.615**
	(0.636)	(1.352)	(3.025)	(2.214)	(2.691)
Marital Status	0.357	0.106	1.764	0.036	2.929
	(0.673)	(0.404)	(0.680)	(0.137)	(1.342)
Membership of Cooperative society	0.861	0.910**	3.015***	0.958**	4.178***
	(1.174)	(2.396)	(4.043)	(4.715)	(3.518)
Frequency of Contact	0.441**	0.008**	4.718***	0.880**	6.771***
	(2.345)	(1.185)	(3.436)	(2.506)	(3.897)
R^2	0.651	0.701	0.755	0.646	0.784
F-ratio	14.336***	15.077***	20.986***	19.233***	25.077***

Source: Field Survey, (2018)
*** = denote significant at 1%, ** = denote significant at 5% levels, * = denote significant at 10%
Figures in parentheses are t-values

Table 3: Problems encountered by trainees before and after NRCRI Intervention (n = 120)

Constraint	Mean Score of Trainees (After)	Mean Score of Trainees (Before)
Lack of Electricity Supply	3.91*	3.86*
Fuel Scarcity	2.32	1.13
Marketing of Products	2.17	2.23
Crop rot	1.36	1.34
Lack of transport facilities	2.91*	2.72*
Inadequate value addition facilities	3.51*	2.76*
Inadequate funds/funding	5.21*	4.12*

Source: Field Survey, (2018)