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Journal of Agricultural Extension
Vol. 20 (1) June, 2016
ISSN(e): 24086851; ISSN(Print); 1119944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae
Email: editorinchief@aesonnigeria.org

Utilization of Cocoyam Production Technologies among Women Farmers in Abia State, Nigeria

Http://dx.doi.org/10.4314/jae.v20i1.2

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Abstract

The study analysed utilization of improved cocoyam production technologies among women in Abia State, Nigeria. A multistage random sampling technique was used to select sixty (60) women. Data for the study were collected using a structured questionnaire and analysed with descriptive statistics and inferential statistics (Logit regression model). The study revealed that the respondents had a mean age of 45.50 years, a mean farm size of 1.3 hectares, a bi-monthly contact with extension, while 73.33% sourced information on cocoyam production technologies from research institutes. The levels of utilization of cocoyam production technologies shows that the women utilized weed control ($\bar{x}$= 4.11), manure application ($\bar{x}$= 3.96), harvesting technologies ($\bar{x}$= 3.70), crop mixture ($\bar{x}$= 3.65) and time of planting ($\bar{x}$= 3.10), with a utilization index of 60.4%. The result of Logit regression analysis showed that coefficient of education, farming experience, farm income, adaptability and accessibility of technology influenced women in utilizing cocoyam production technologies. Disease infestation, high cost of labour and infrequent visits by extension officers were identified as constraints to cocoyam production technologies utilization. The study recommends accessibility of technology through extension and development of hybrid cocoyam varieties that are adaptable to farmers' environment for increased cocoyam utilization.

Keywords: *Utilization of cocoyam, production of cocoyam, cocoyam technologies, women in cocoyam*

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Introduction

Nigeria is the world's largest producer of cocoyam. The average production figure for Nigeria is 5.400 metric tonnes which accounts for about 37% of total world's output of cocoyam (FAO, 2012). Cocoyam is one of the major roots produced in large quantity in Nigeria. There are two main edible types of cocoyam in Nigeria; they are *Colocasia esculentum* and *Xanthosoma saggittifolium*. In Nigeria, cocoyam is regarded as a major crop especially in female headed households (Onwubuja and Ajani, 2012). Cocoyam is Nigerian's giant crop grown mainly for its corm and cormels. The crop has assumed nutritional and industrial significance in flour industries (Onwubuya and Ajani, 2012). It is nutritionally superior to yam and cassava in terms of its digestibility, contents of crude protein and essential minerals, such as Ca, Mg, and P (Chukwu, 2012). All parts of the cocoyam (corm, cornel, leave and flower) are edible and it is used in the treatment of diabetes, prevention of cancer and as food for the aged people, individuals and children (Kundu *et al.,* 2012).

Women farmers are the principal labour force on small holder farms and perform the largest share in land preparation, weeding, transporting, processing and marketing of agricultural products (Ugboaja, 2013; Odebode, 2012). This is found to be true in the case of cocoyam where women play an active role in cocoyam production, processing and marketing (Onyenobi *et al.,* 2010). These women have contributed to over 60% of the labour force to food production and processing (Mgbada, 2000; Ogbonna and Nwaobiala, 2014). In Nigeria, cocoyam production is on the increase due to massive awareness created by the National Root Crops Research Institute (NRCRI, 2005). The institute developed cultivars of cocoyam that are resistance to disease and have high yield capacity, notably among these were; Nce011, Nce012, Nce003, Nce004, Nce005, Nce006, Nce007, Nce008, Nce009, Nce010, Nce011, Nce012, Nxs001, Nxs002, Nxs002, Nxs003, Nxs004 (FAO, 2012; Mbanaso *et al.,* 2008). Upon these cultivars, resources allocation to cocoyam is significantly low when compared to other roots crops (Eke-Okoro, 2005). Rural women, need to be acquainted with new technologies, such they utilize them for increased cocoyam production.

In order to increase the yield of cocoyam cultivars, National Root Crops Research Institute, Umudike Abia State, Nigeria developed improved field production packages that involve early planting, application of appropriate levels of inorganic and organic soil amendment materials, mulching open field, suitable for inter-crops and time of operations and control of cocoyam root rot blight. Other agronomic practices disseminated to farmers include; using 25g sett of cocoyam, time of planting (May-June), spacing (60cm x 60cm), 50cm x 50cm for mixed cropping, use of mulching materials, NPK 20:10:10 fertilizers, planting depth (10-50cm), pest control, weed control, crop mixture (arable crops), use of manure (side dressing application), harvesting (8-12months) (NRCRI, 2005).

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Combination of factors like farmers socio-economic and socio-cultural characteristics were observed to exact influence on different ways of technology utilization (Unamma, 2004). Batx (1999) observed that risks involved in technologies were considered to determine farmer's opinion to use them or not. It is therefore, of opinion that those technologies which have risk characteristics when compared to their traditional alternative or practices will be utilized faster than technology with a low relative risk reduction (Nwaobiala, 2014). Information and innovation which are intended to improve agricultural production should be disseminated to farmers (male and female) and ultimately meet their need. However, variations exist on relevant production technologies needed by women farmers; lack of adequate access to extension service, low knowledge and skills in performing various farm operations has been an impediment to increase agricultural production (Ajala, *et al*., 2013). Women farmers has been by and large rejected by excising extension system, receiving about 5-7% of extension service due to their limited control over assets and decision making that are evident in agricultural institutions (RMRDC, 2004).

Production of cocoyam has not been given priority attention probably because of cocoyam's inability to earn foreign exchange and its unacceptability to high income groups for both consumption and other purposes (Edet and Nsikak, 2004). However, despite women roles in food crop production, there is dearth of empirical data on the state of utilization of cocoyam production technologies in the study area. As a result of these problems, this study provided answers to the following research questions:

i. What are the socio-economic characteristic of the women involved in cocoyam production in the study area?
ii. What are the source(s) of information by women cocoyam farmers in the study area?
iii. What are the levels of utilization of cocoyam production technologies by women farmers in the study area?
iv. What are the problems faced by women in using these production technologies?

The following specific objectives were stated. To:

i. describe the socio-economic characteristics of the respondents in the study area;
ii. identify source(s) of information on cocoyam production technologies by women farmers;
iii. assess the level of utilization of cocoyam production technologies by farmers in the study area; and
iv. identify the problems faced by women in using cocoyam production technologies in the study area.

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Hypothesis

H_o: There is no relationship between farmers' characteristics and utilization of cocoyam production technologies among women farmers in Abia State, Nigeria

Methodology

This study was conducted in Abia State, Nigeria. Abia State lies between longitudes 7^o 23^1 and 8^o 2^1 East of the equator and latitudes 4^o 47^1 and 6^o 12^1 North of the Greenwich Meridian. The State is located East of Imo State and shares common boundaries with Anambra to the North, Enugu and Ebonyi states to the West and East respectively. On the East and South East, it is bounded by Cross River and Akwa Ibom States and by Rivers State on the South. Abia State is made up of 17 Local Government Areas (LGAs) and most of the people especially, the rural dwellers are engaged mainly in subsistence farming. They engage in arable crop production such as cassava, yam, cocoyam, rice, maize and sweet potatoes. Abia State has three agricultural zones namely Aba, Ohafia and Umuahia. The research was conducted in the two agricultural zones out of the three agricultural zones of Abia State namely Umuahia and Aba. A list of cocoyam women farmers that participated in cocoyam rebirth training organized by National Root Crops Research Institute Umudike which formed the sampling frame was collected from Abia State Agricultural Development Project (ADP). A multistage sampling technique was used in the selection respondents. First two (2) blocks each were randomly selected from the two agricultural zones (Umuahia zone – Ikwuano block, Umuahia North; Aba zone – Osiisoma block and Isiala Ngwa South) to give a total of 4 blocks. From the selected blocks three circles were randomly selected to give a total of 12 circles. Finally, five cassava farmers each were randomly selected from each of the selected circles to give a sample size of 60 cocoyam farmers. A structured questionnaire was used to elicit information from the farmers. Objectives i, ii, iii and iv were achieved with descriptive statistics such as frequency counts, percentages and mean scores, while the hypothesis tested was achieved with Logit regression analysis. The levels of utilization of cocoyam production technologies by women farmers was achieved using a 5-point Likert type scale of; always = 5, often = 4, sometimes =3, rarely =2, and never =1. Based on the mid score decision rule, any mean score of 3.0 and above imply that they utilized the technology, while respondents with mean score of less than 3.0 do not utilize the technologies.
The utilization indices of the respondents were calculated According to Nwalieji *et al*., (2014):
a) Computation of the total mean utilization score per technology. This was computed by dividing the total utilization score by the number of respondents involved.
b) Computation of the grand mean adoption score. This was calculated by adding all the mean utilization scores and dividing by the number of innovations considered.

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c) Computation of the utilization index. This was carried out by dividing the total mean adoption score by 5 - point Likert type scale.

Model Specification

The Logit Regression Model

The factors that influence the utilization of cocoyam production technologies by women farmers were determined using Logit regression analysis.

The model in this study is based on the assumption that utilization of cocoyam technologies by farmers is likely to be impacted by many factors. These factors are related to technology attributes such as; education, farming experience, farm income, farm size, cost of input, quantity of input, quality of input, extension contact, availability of input and distance.

The model parameters are estimated by maximizing this log likelihood function with respect to parameters that is, the parameters reported in the paper are those of which the likelihood function is at maximum.

The estimate Logiit model has the following specifications;

$$y = \beta_o + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 + \beta_{10} + e_1$$

Where,

y= technology utilization (utilized = 1, not utilized = 0)
β_o= A vector of estimated parameter
β_1 = education level (years)
β_2 = farming Experience (years)
β_3 = farm income (₦)
β_4 = farm size (hectares)
β_5 = cost of input (₦)
β_6 = quantity of input (kg)
β_7 = quality of input (yes = 1, otherwise = 0)
β_8 = extension contact (number visit by extension agent)
β_9 = availability of input (yes = 1, otherwise = 0)
β_{10} = distance (km)
$\beta_1 - \beta_{10}$= *parameters to be studied*
e_1 = *error term*

Distribution of Socio-economic Characteristics of Respondents

The socio-economic characteristics of respondents are shown in Table 1. The result reveals that 51.67% of the women were married, 30.00% of them widowed, 11.67% were single, while 6.67% were divorced. This implies that

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married people dominate in agricultural activities in Nigeria (Onwubuya *et al.,* 2009). The mean age of the respondents was 45.4 years. The implication of this finding shows that the women were strong being in their productive age (Olaniyi and Adewale, 2014). The mean household size of the women was 9.5 persons. The result implies that large household size may be an advantage to farmers in terms of farm labour supply. Bauchi *et al.,* (2008), asserted that household size is the most important input for unpaid labour. This result further indicates that 35.0% of the women acquired secondary education. 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 (Yahaya, 2002). The table also reveals that the respondents had a mean farming experience of 20.5 years. With more experience, a farmer can become less averse to the risk implied by adopting a new technology (Nwaobiala, 2014). The result indicates that the mean farm size of the respondents was 1.3 hectares. The result indicates that cocoyam production in the study is dominated by small-holder scale producers. Farm size affects adoption costs, risk perceptions, human capital, credit constraint, labour requirements, tenure arrangements and more. With small farms, it has been argued that large fixed costs become a constraint to technology adoption (Abana and Singh, 1993) especially if the technology is costly (Okoye *et al.,* 2009). The mean annual farm income of the women was ₦20, 900.00, while 66.67% of the respondents had bi-monthly contact in the study area. It is hypothesized that contact with extension workers and adequate information on production techniques will increase farmer's likelihood of adoption of improved agricultural practices (Salau *et al*., 2014).

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Table 1: Distribution of selected socio-economic characteristics of cocoyam women farmers in Abia State, Nigeria

Variables	Percentage (n= 60)	Mean
Marital Status		
Married	51.67	
Single	11.67	
Divorced	6.67	
Widowed	30.00	
Age (years)		
20 – 30	22.22	
31 – 40	34.44	
41 – 50	18.89	
51 – 60	17.78	**45.4 years**
61 – 70	3.33	
Household Size (numbers)		
1 – 4	23.33	
5 – 7	16.67	
8 – 11	50.00	**9.5 persons**
12 - 15	10.00	
Education		
No Formal Education	13.33	
Primary School Education	31.67	
Secondary School Education	35.00	
Tertiary School Education	20.00	
Farming Experience ()years)		
1– 10	13.33	
11 – 20	21.67	
21 – 30	23.33	**20.5 years**
31 – 40	24.44	
Farm Size (hectares)		
0.1 – 0.5	38.33	
0.6 – 1.0	11.67	
1.1 – 1.5	25.00	**1.3 hectares**
1.6 – 2.0	16.67	
2.1 – 2.5	8.33	
Annual Farm income (₦)		
5,000 – 10,000	15.00	
11,000 – 15,000	11.67	
16,000 – 20,000	1.67	**₦20.900.00**
21,000 – 30,000	50.00	
31,000 – 50,000	21.67	
Extension Contact		
None	13.33	
Weekly	1.67	
Forth nightly	8.33	
Monthly	10.00	
Bi- monthly	6.67	

Source*: Field Survey Data, 2014*

Sources of Information on Cocoyam Production Technologies by Women Farmers

Table 2 shows the frequency distribution of respondents according to sources of information in cocoyam production technologies by farmers in the study area. The results show that the most important source of agricultural

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information in the area was Research Institutes (73.33%), followed by extension agent visits (46.6%) and ADP/Ministry of Agriculture (26.67%). Agricultural information needs are as important as other resources for agricultural production. Aphunu and Agwu (2013) affirmed that farmers whether small, medium or large scale, need information on production recommended technologies for farm management, acquisition, allocation and utilization of farm resources.

Table 2: Frequency distribution of respondents according to sources of information on cocoyam production technologies in the study area

Sources of information	Percentage
Research Institutes	73.33
ADP/Ministry of Agriculture	26.67
Attending field-days	6.67
Extension Agent Visits	46.67
Radio programme	6.67
Television programme	16.67
Fellow cocoyam farmers	6.67
Extension training programmes	3.33
Personal observation	20.00

Source: *Field Survey, 2014.*
Multiple responses recorded

Levels of Utilization of Cocoyam Production Technologies by Women Farmers

The results in Table 3 show the level of utilization of cocoyam production technologies by women farmers in the study area. The result show that the production technologies utilized by the women include; weed control ($\bar{x}$= 4.11), use of manure ($\bar{x}$= 3.96), harvesting ($\bar{x}$3.70), crop mixture ($\bar{x}$= 3.65) and time of planting, ($\bar{x}$= 3.10). The implication of the result shows that the total mean of cocoyam production technologies by women was 3.02 with a utilization index of 60.4%, indicating they adopted these technologies since the mean score is above 3.0. The result is in conformity with Okoye *et al.,* (2009) where they found that cocoyam women farmers in Enugu North Local Government Area of Enugu State adopted most of these technologies.

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Table 3: Levels of utilization of cocoyam production technologies by women farmers in the study area

Production Technologies	Mean
25g sett of cocoyam	2.38
Time of planting (May -June)	3.10
Spacing (100cm × 50cm)	2.62
Fertilizer (NPK 20:10:10)	2.65
Planting depth (10 cm)	2.35
Pest control	1.65
Weed control	4.11
Crop mixture (Tree Cropping)	3.65
Use of manure	3.96
Harvesting	3.70
Grand mean	**30.17**
Total mean	**3.02**
Utilization index	**0.604**

Source: *Field Survey, 2014*
Decision Rule: 3.0 and above = utilization, less than 3.0 = non utilization

Relationship between Farmers' Characteristics and Utilization of Cocoyam production Technologies among Women Farmers in Abia State, Nigeria

Table 4 shows the Logit regression estimates of the determinants of utilization of cocoyam production technologies in Abia State. The Chi^2 (χ^2) value of 34.97 was highly significant at 1% level of probability indicating a Logit regression of best fit. The Pseudo R^2 value of 0.7076 indicates 70.76% variability in cocoyam technology utilization was explained by the independent variables. The coefficient for education was positive and significant at 10% level of probability. This implies that any increase in education will lead to increase in probability and intensity of technology utilization among the farmers in the study area. Education is thought to create a favourable mental attitude for the acceptance of new practices especially on information-intensive and management-intensive practices (Caswell *et al*., 2001). The coefficient of farming experience was also positive and significant at 1% level of probability. This implies that an increase in farming experience will lead to increase in probability and intensity of technology utilization in the study area. Increased utilization is thought to stem from accumulated knowledge and experience of farming systems obtained from years of observation and experimenting with various technologies (Bonabana-Wabbi, 2002). The coefficient for farm income was positive and significant at 5 level of probability. This implies that any increase in income will lead to increase in technology utilization among the farmers in the study area. Kehinde (2013) noted that the decision to adopt is often an investment decision. Technologies that are capital-intensive are only affordable by wealthier farmers (EL Oster and Morchert, 1999) hence the adoption of such technologies is limited to larger

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Email: editorinchief@aesonnigeria.org

farmers who have wealth (Khanna, 2001). The coefficient for adaptability and accessibility of technologies were all positive and highly significant at 1% level of probability. This implies that any increase in these variables will increase the probability and intensity of technology utilization in the study area. Acquisition of information about a new technology demystifies it and makes it more available to farmers (Oladeja *et al*., 2006).

Table 4: Determinants of technology utilization among cocoyam women farmers in the Abia State, Nigeria

Variables	Coefficient	Standard error	t-value
Constant	15.2085	3.9807	3.81***
Age (X_1)	0.0179	0.0597	0.30
Marital status (X_2)	-0.2347	0.8022	-0.29
Education (X_3)	1.3805	0.7150	1.93*
Farming experience (X_4)	0.0470	0.0130	3.61***
Household size (X_5)	-0.2474	0.2124	-1.16
Farm Income (X_6)	0.00047	0.00017	2.76**
Extension Contact (X_7)	-0.15447	0.3705	0.42
Adaptability (X_8)	3.2080	0.7695	4.12***
Accessibility (X_9)	0.7178	0.7604	4.22***
Farm size (X_{10})	-0.2981	0.2590	-1.15
Chi^2 (χ^2)	34.97***		
Pseudo R^2	0.7076		
Log likelihood	-144.9756		

P≤ 10, ** P≤ 0.5 and ***P P≤ 0.1
Source: Field survey, 2014.

Constraints Militating Against the Utilization of Cocoyam Production Technologies

Table 5 show frequency distribution of respondents militating against the utilization of cocoyam production technologies by women in the study area. The most important constraint was disease infestation (91.67%) followed by high cost of labour (85.00%), infrequent visit by extension officers (70.00%) and complexity of technology (33.33%).

Table 5: Distribution of respondents according to constraints militating against utilization of cocoyam production technologies in the study area

Constraints	Percentage
Complexity of technologies	33.33
High cost of planting materials	18.33
Accessibility to information	15.00
Disease infestation	91.67
Unavailability of land	21.67
Socio-cultural factors	15.00
High cost of labour	85.00
Infrequent visit by extension officers	70.00

Multiple responses
Source: *Field Survey, 2014.*

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Conclusion and Recommendations

The study showed that most of the women farmers sourced cocoyam production technologies from research institutes and extension agents and utilized selected cocoyam production technologies such as weed control, use of manure, harvesting, crop mixture and time of planting. The study also proved that socio-economic characteristics and technology attributes influenced women utilization of cocoyam production technologies in the study area.

There is need to encourage experienced farmers to increase the utilization of improved cocoyam technologies for increased income and productivity. This will be achieved by organizing seminars and workshops for the women. There is need to increase the accessibility of the technologies by creating awareness through the extension services.

Researchers should develop hybrid cocoyam varieties that are adaptable to farmers' environment. This will help increase the output of cocoyam

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Vol. 20 (1) June, 2016
ISSN(e): 24086851; ISSN(Print); 1119944X
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