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Factors Influencing Farmers' Participation in Sweet Potato Farming Practices in Owerri North Local Government Area, Imo State, Nigeria

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Abstract

The study analyzed farmers' participation in sweet potato farming practices in Imo State, Nigeria. Multi-stage random sampling technique was used to select sixty (80) farmers. Data were collected through a structured questionnaire and analyzed with descriptive statistics and inferential statistics (probit and multiple regression analyses). Result showed half (50.0%) of the farmers were males and females respectively, with mean ages of 45.5 years, 56.7% were married, mean farm size of 0.5 hectares and intercropped cassava/maize/sweet potato (63.3%). The result indicates that farmers' sourced information on sweet potato farming practices from personal observations (90.0%), fellow farmers (86.7%) and television programmes (78.67%), while 63.3% intercropped sweet potato vines with cassava and maize. The farmers had favourable perception ($\bar{X}$=2.9) and had high participation ($\bar{X}$=2.3) in sweet potato cultivar characteristics. Probit regression result showed that coefficient for tuber yield, vine yield, early maturity, disease and pest tolerant and good culinary test influenced farmers' participation of sweet potato farming practices. Multiple regression result showed that coefficients of gender, age, marital status, occupation and farm size influenced farmers' participation of sweet potato production activities in the study area. Breeding of early maturing, high yielding and disease resistant varieties by researchers and access to land for sweet potato farming activities were advocated.

Keywords: *Factors, Participation, Sweet Potato, Farming, Practices*

Introduction

Sweet Potato is an important food and feed crop in Sub-Sahara Africa and ranks fourth after maize, bananas and cassava. Sweet potato is one of the most staple carbohydrate foods in Sub-Africa (FAOSTAT, 2018). It is highly adaptable to relatively marginal sorts and erratic rainfall, has high productivity per unit land and labour, guarantees some yield even under the most adverse conditions. Specifically, sweet potato can be grown two to three times in a year with supplementary irrigation. It does not have the problem of anti-nutritional factors such as cyanides and oxalates that exist in cassava and

cocoyam respectively (Food and Agriculture organization (FAO), 2013). Agricultural technologies developed through participatory research have a greater chance of adoption and diffusion by farmers because they are developed in response to local constraints and meet end-users needs and preferences. It also demands a systematic understanding of different types of participatory research approaches to select the most appropriate tools such as participatory rural appraisal, focus group discussions, participatory selection in segregating populations and participatory cultivar testing and selection (Plaude et al., 2015). The technologies developed for sweet potato production include seedbed preparation, plant population (30cm on ridges and 25cm on mounds). Planting material, soil requirement, time of planting, weed control methods, earthening up, pest and disease control methods and time of harvest among others National Root Crops Research Institute (NRCRI), 2008).

In order to disseminate these technologies to the farmers for uptake and subsequent use through the National Root Crops Research Institute (NRCRI) Umudike the technology review meetings with Agricultural Development Programmes (ADPs) in the South-East zone and the Research-Extension-Farmer-Input Linkage System (REFILS) embarked upon regular and intensive campaigns aimed at educating the farmers on the benefits of sweet potato production to ensure its widespread adoption and participation by contact farmers (Udemezue et al., 2018). Although, sweet potato as a crop is consumed in all parts of the county, there seem to a death of information on factors influencing its participation by farmers in the study area.

Objectives of the study

The broad objective is to analyze factors influencing farmers' participation in sweet potato farming practices in Owerri North Local Government Area of Imo State, Nigeria.

Specific objectives of the study were to;

i. describe the socio-economic characteristics of the sweet potato farmers
ii. identify farmer's sources of information on sweet potato farming practices in the study area
iii. assess farmer's perceptions about sweet potato cultivar characteristics cultivated in their area
iv. ascertain the level of participation of farmers in sweet potato farming practices
v. examine constraints associated to sweet potato farming in the study area.
vi. estimate socio-economic factors influencing farmers

vii. participation in sweet potato farming activities; and
viii. estimate cultivar characteristics influencing farmers participation in sweet potato farming activities in the study area

Hypotheses of the Study

The following hypotheses were tested.

Ho_1: Cultivar characteristics such as; High yield, high vine yield, early maturity, drought resistance, disease and pest tolerance, good culinary test, high dry matter content, sweetness and skin colour, do not significantly influence participation of farmers in sweet potato farming practices.

Ho_2: Household size, farm income, marital status, farm size, farming experience, education, membership of social organisations and extension contact do not influence farmer' participation in sweet potato farming practices.

Methodology

The study was conducted in Owerri North Local Government Area of Imo state, Nigeria. Owerri North was created in 1996 by the administration of General Sanni Abacha with Headquarters at Orie Uratta. Owerri North fall within the Eastern Senatorial Zone of Imo State Owerri North lies between the Latitude: 5^0 27` 24.3" 5.4567$^0$ North of the equator and longitude: $7^0$'9.8` 7.1027^0 East of the Greenwich Meriden, with an elevation of 115meters. The Local Government Area is bounded to the north by Mbaitolu and Ikeduru Local Government Areas, to the east by Aboh Mbaise Local Government Area, to the south-east by Ngor Okpala Local Government Area, to the south-west by Owerri West Local Government Area, and to the west by Owerri Municipal and Owerri West Local Government Area respectively (Imo State Planning Commission (IMSPC), 2010). Multistage random sampling technique was used in the study. First four (4) circles from Owerri North Local Government Area (Agricultural Blocks) were selected namely; Uratta, Emekuku/Emii, Alaenyi and A.O.O.U. (Agbala, Obibiezena, Obube and Ulakwo). From the selected circles five (5) sub circles each were randomly selected to give a total of twenty (20) sub circles. Finally, simple random sampling technique were adopted to select four (4) sweet potato farmers from the sub circles each that give a total of eighty (80) farmers. Specifically, objectives i, ii, iii, iv, v and vi were realized using descriptive statistics while the stated hypothesis were tested with probit and multiple regression analyses.

Measurement of Variables

a. Farmers perception on sweet potato cultivars characteristics was measured using perception item statement rated on a 4-point likert type scale of Strongly Agree = 4, Agree = 3, Disagree = 2 and Strongly disagree = 1. A mid-point was obtained thus 4+3+2+1 = 10 divided by 4 = 2.5. The means score of 2.5 implied favourable and less than 2.5 is unfavourable perception.

b. The level of participation of farmers in sweet potato farming activities was measured on a 3-point likert type rating scale of: always = 3, occasionally = 2 and never = 1. The bench mark was obtained thus 3+2+1 = 6 divided by 3 to give 2.0.The following decision rule were used: 1.00 – 1.50 (low), 1.51 – 1.99 (moderate), 2.0 and above (high).

c. Constraints associated with sweet potato farming was measured using a 3 – point likert type rating scale namely; Severe = 3, Mild = 2 and Never = 1. The bench mark was obtained thus 3+2+1 = 6 divided by 3 to give 2.0. Any constraint item of 2.0 and above was regarded as serious and otherwise not serious.

Model Specifications

The probit model were based on the assumption that participation of farmers in sweet potato farming practices is likely to be influenced by many factors. These factors are related to cultivar characteristics such as; high tuber yield, high vine yield, early maturity, drought resistance, disease and pest tolerance, good culinary taste, high dry matter content, sweetness and skin colour. The model parameters were estimated by maximizing log likelihood function.

The Probit model to be estimated is explicitly stated as;

$$Y = \beta_o + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 + e_1$$

Where,

Y= probability of farmers participating in sweet potato farming activities ranges from 0 – 1.

β_0= constant

β_1 = high tuber yield (yes = 1, otherwise = 0)

β_2 = high vine yield (yes = 1, otherwise = 0)

β_3 = early maturity (yes = 1, otherwise = 0)

β_4 = drought resistance (yes = 1, otherwise = 0)
β_5 = disease and pest tolerance (yes = 1, otherwise = 0)
β_6 = good culinary taste (yes = 1, otherwise = 0)
β_7 = high dry matter content (yes = 1, otherwise = 0)
β_8 = sweetness (yes = 1, otherwise = 0)
β_9 = colour of tuber (yes = 1, otherwise = 0)
$\beta_1 - \beta_9$= parameters to be studied
e_1= error term

b. Multiple regression analysis fitted by means of the Ordinary Least Squares were estimated. The four functional forms of multiple regression model viz: Linear, Semi-Log, Exponential and Cobb-Douglas were tried. The best fit was chosen as the lead equation based on its conformity with econometric and statistical criteria such as the magnitude of R^2, F – ratio, a priori expectation and number of significant variables.

The four functional forms are expressed as follows:

i. **Linear Function**

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + ei$$

ii. **Semi – log function**

$$Y = L_n\beta_0 + \beta_1 L_n X_1 + \beta_2 L_n X_2 + \beta_3 L_n X_3 + \beta_4 L_n X_4 + \beta_5 L_n X_5 \beta_6 L_n X_6 + \beta_7 L_n X_{7+} \beta_8 L_n X_8 + \beta_9 L_n X_9 + ei$$

iii. **Exponential function**

$$LnY = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + ei$$

iv. **Cobb Douglas Function**

$$LnY = L_n\beta_0 + \beta_1 L_n X_1 + \beta_2 L_n X_2 + \beta_3 L_n X_3 + \beta_4 L_n X_4 + \beta_5 L_n X_5 + \beta_6 L_n X_6 + \beta_7 L_n X_7 + \beta_8 L_n X_8 + \beta_9 L_n X_9 + ei$$

Where,

Y = level of participation of farmers in sweet potato farming *practices* measured by mean scores.
X_1 = age (years)
X_2 = household size (numbers)
X_3= farm income (naira)
X_4= marital status (married = 1, otherwise = 0)
X_5 = farm size (hectares)
X_6 = farming experience (years)
X_7 = education (years)
X_8 = membership of social organisation (numbers)

X_9 = extension contact (numbers)
ei = error term

Results and Discussion

Selected Socio-economic Characteristics of Farmers

Table 1: Distribution of Respondents' According to Socio-economic Characteristics (n=80)

Variables	Indices
Gender	
Male	50%
Female	50%
Marital Status	
Married	56.7%
Age	
Mean ($\bar{X}$)	45.5 years
Household Size	
Mean ($\bar{X}$)	5 persons
Educational Status	
Secondary	36.7%
Extension Contact	
None	36.7%
Farm Size	
Mean ($\bar{X}$)	0.5 hectares
Farming Experience	
Mean ($\bar{X}$)	6.3 years
Occupational Status	
Farming	51.7%
Annual Farm Income (₦)	
Mean ($\bar{X}$)	₦66, 702.40
Intercrop Practices	
Cassava/Maize/Sweet potato	63.3%

Source: *Field Survey, 2019*

Results

in Table 1 showed that half (50%) of the respondents were males and females respectively while 56.7% were married. The result is in contrast with the findings of Olagunju *et al.*, (2013) that sweet potato farming is mostly cultivated by women in Nigeria. Mbanaso *et al.*, (2015) noted that married farmers with their household are usually better off to adopt labour intensive farming activities, thereby leading to increased output. The mean ages of the respondents was 43.3 years implying that that they had ability to take risk and make decisions whether to participate in sweet potato farming practices based on the utility derived (Abdullahi *et al.*, 2018). The mean household size is 5 persons. This is advantageous to farming since it will enable the farmer to use family labour and thereby reduce the cost of hiring labour for sweet potato farming. Also, 36.67%acquired secondary education which suggests that educated farmers will influence awareness, perception, reception, and participation in agricultural practices (Kanu *et al.*, (2019). The result revealed that36.67% of the farmers had no contact and monthly contacts with extension. This implies that extension delivery and contact with extension agents by sweet potato farmers was not effective and may be attributed to problems of poor extension farmer ration and funding from relevant agencies (Yusuf, 2018). The mean farm size of farmers was 0.5 hectares which imply that sweet potato farming is practiced predominantly at subsistent level as they cultivate less than 5 hectares of land and categorized as small scale farmers in Nigeria (Lagat and Maina, 2017). The mean farming experience of the farmers was 6.3 years, more than half (51.67%) were full time farmers with mean annual farm income of famers was ₦66, 720.00. Arifin and Nirawal, (2018) posited that income levels of the farmers depend largely on the enterprise combination and farm size. The result indicates that most (63.33%) of the farmers intercropped sweet potato with cassava and maize. The result suggests that farmers intercropping sweet potato with other arable crops may be attributed to profit maximization and efficient utilization of available land which is a scarce resource in the study area (Nwaobiala and Anyanwu, 2016).

Sources of Agricultural Information

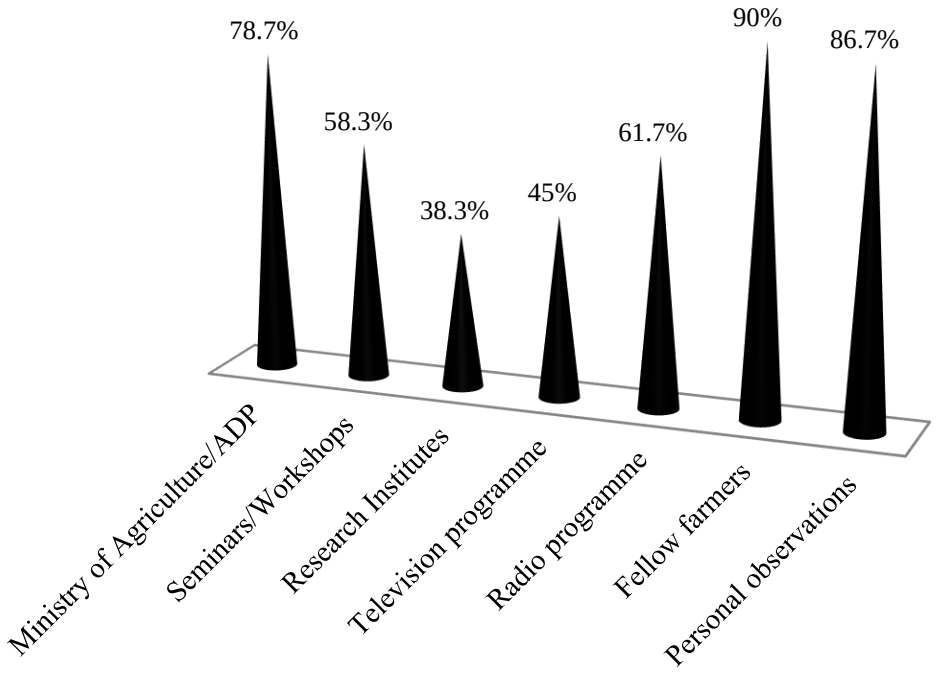

Figure 1: Sources of nformation on Sweet Potato Farming Practices

Data on sources of information on sweet potato farming practices is shown in figure 1. The result indicates that majority (90.0%) sourced information from fellow farmers, personal observations (86.67%) and most (78.67%) from Ministry of Agriculture/ADP. The result is in agreement with the finding of Ajala, Ogunjimi and Farinde (2013) as they obtained similar result among arable crop farmers in Nigeria.

Perception of Farmers on Sweet Potato Cultivar Characteristics

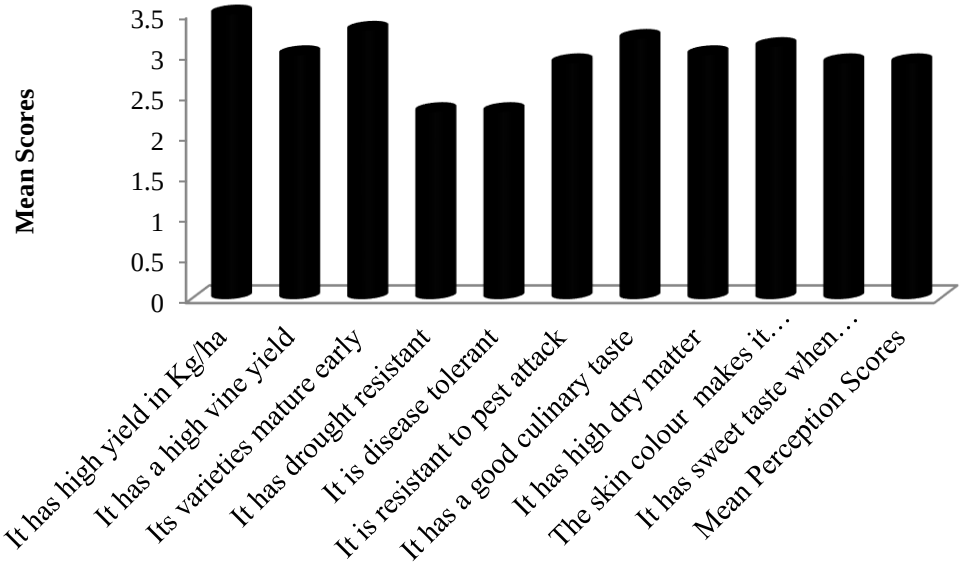

Figure 2: Mean Perception Scores of Sweet Potato Cultivar Characteristics

The perception of sweet potato cultivar characteristics among farmers is shown in figure 2. Result indicates that the respondents perceived that sweet potato has high yield in Kg/ha ($\overline{X} = 3.5$), it natures early ($\overline{X} = 3.3$) and has good culinary taste ($\overline{X} = 3.2$). Furthermore, they agreed that sweet potato the skin colour makes it nutritious ($\overline{X} = 3.1$), it produces high vine yield ($\overline{X} = 3.0$), it is resistant to pest attack and has sweet taste when consumed with mean scores of 2.9 respectively. The mean perception score of the farmers was 2.9, indicating that the farmers has favourable perception of the sweet potato cultivar characteristics. Ayodeji *et al*., (2019), Nwaobiala and Issac, (2017) observed that technology attributes of a crop influences farmers' decision to participate and adopt its farming practices.

Level of Participation of Farmers in Sweet Potato Farming Practices

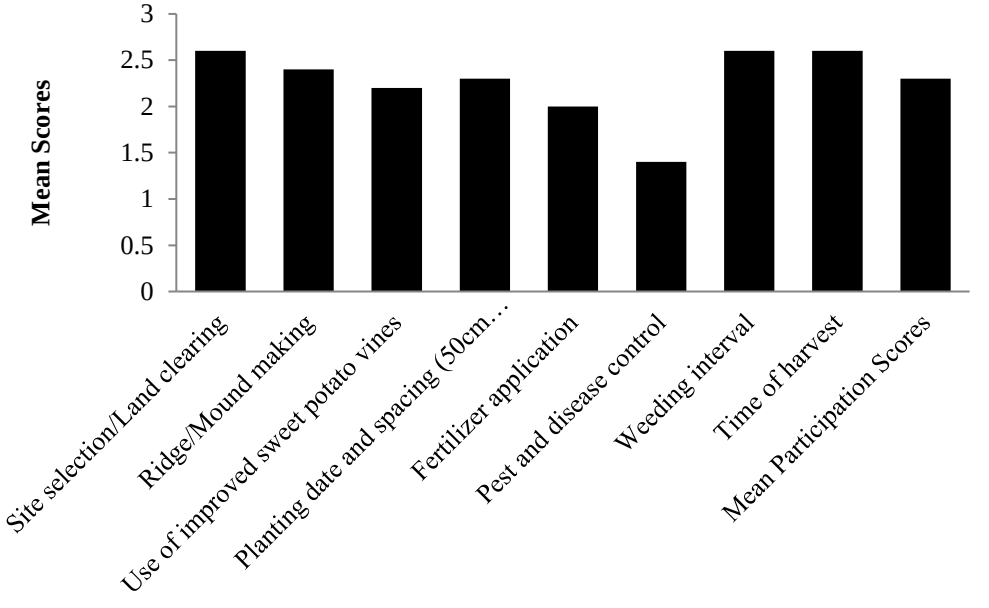

Figure 3: Levels of Participation in Sweet Potato Farming Practices

Participation of farmers in sweet potato farming practices is shown in figure 3. Result showed that the farmers had high participation in site selection/land clearing, weeding intervals and time of harvest with mean scores of 2.6 respectively. However, they participated highly in making ridge/mound ($\overline{X} = 2.4$), planting date and spacing ($\overline{X} = 2.3$), use of improved sweet potato varieties ($\overline{X} = 2.2$) and fertilizer application ($\overline{X} = 2.0$). The mean participation scores for the farmers in sweet potato farming practices was 2.3, which indicates that they had high participation in these practices. Agbarevo and Okringbo (2019) asserted that sweet potato is a major arable crop that is being promoted by National Root Crops Research Institute Umudike that encourages adoption and participation of farmers due to its economic and nutritious value.

Constraints to Sweet Potato Farming

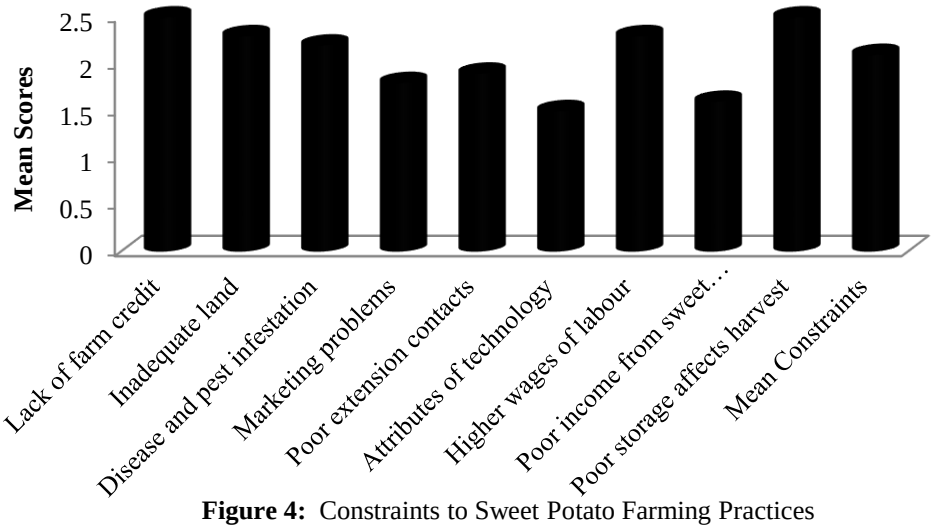

Figure 4: Constraints to Sweet Potato Farming Practices

The result in Figure 4 showed that the respondents affirmed that lack of farm credit and poor storage as it affects harvest with mean scores of 2.5 were serious constraints to sweet potato farming in the study area. Also, they inferred that inadequate land and high labour wages having mean scores 2.3 were serious problems as against disease and pest infestation ($\overline{X} = 2.2$). The mean constraint scores for the farmers in sweet potato farming practices was 2.1, indicating that they were serious. Tewe *et al*., (2012) posited that majority of these constraint factors outlined affected sweet potato farming in Africa.

Sweet Potato Cultivar Characteristics Influencing Farmers' Participation in Sweet Potato Farming Practices

Table 2: Probit Regression Estimates of Influence of Sweet potato Attributes on the Participation of Farmers' Farming Practices in the Study Area

Variables	Parameters	Coefficients	Standard Error	t- value
Constant	βo	3.5803	1.3397	2.67**
High tuber yield	β_1	1.2378	0.2167	5.71***
High vine yield	β_2	-1.3136	0.5121	2.57**
Early maturity	β_3	0.7357	0.3356	2.49**
Drought resistant	β_4	-0.5510	0.4881	-1.13
Disease and pest tolerant	β_5	0.8489	0.4634	1.83*
Good culinary test	β_6	-1.1264	0.5676	-2.98**
High dry matter	β_7	-0.8523	0.52600	-1.62
Sweetness	β_8	0.6020	0.4833	1.25
Colour of tuber	β_9	0.1567	0.4763	0.33
Log likelihood		-126.4288		
Chi^2 (χ^2)		18.67		
Pseudo R^2		0.6610		

Source: STATA 4A Result

*P≤ 0.10, ** P≤ 0.05 and ***P ≤ 0.01

The empirical results of probit regression estimates of the influence of cultivar characteristics on the farmers' participation in sweet potato farming practices in the study area are shown in Table 2. The Chi^2 (χ^2) was highly significant at 1.0% level of probability indicating regression of best fit. The likelihood ratio tests indicate that the slope coefficient was significantly different from zero for farmer's participation. The coefficient for tuber yield was positive and highly significant at 1.0% level of probability. This indicates that increase in yield will increase the probability of participation of farmers in sweet potato farming practices. This is expected because high tuber yield will attract farmers to remain in the business and thus increase participation. Rios *et al.*, (2008) in a study on linkages between participation and yield reported that households with higher productivity tend to participate more of the activities. The coefficient for vine yield was positive and significant at 5.0% level of probability. This implies that increase in vine yield will lead to a corresponding increase in probability of participation in sweet potato farming practices. Sweet potato seed as a business had recently received attention by international donor to ensure continuous supply of quantity seed all the year round following the study of Issah *et al.*, (2017). The coefficient of early maturity had a positive sign and significant at 5.0% level of probability. This implies that increase in early maturing variety of sweet potato will lead to increase in probability of participation in sweet potato farming

practices among the farmers. This is expected as farmers tend to participate more in crops that have high rate of return on investment within a short period of time. Markos and Loha, (2016) found that sweet potato has gained prominence due to its short growth cycle and ability to survive in diverse agro-ecologies and water stress soils. The coefficient for disease and pest tolerant was positive and significant at 10% level of probability each. This implies that increase in disease and pest tolerant will increase probability of participation in sweet potato farming practices among the farmers. This is also expected as farmers pay more attention to the sweet potato cultivars with resistance to diseases. Issah *et al.*, (2017) observed that farmers have recorded great successes and participation particularly at introduction of sweet potato cultivars with resistance to the sweet potato virus disease (SPVD). The coefficient of good culinary test was significant at 5.0% and inversely related with the probability of participation of sweet potato farming practices among the farmers in the study area. This is an indication that any increase in variety with good culinary test will lead to a corresponding decrease in probability of participation of sweet potato farming practices by the farmers. Heuze *et al.*, (2017) who noted that the vegetative parts of sweet potato are of very valuable feed for livestock.

Selected Socio-economic Factors Influencing Farmers' Participation in Sweet Potato Farming Practices

Table 3: Multiple Regression Estimates of Influence of Selected Socioeconomic Characteristics on Farmers' Participation in Sweet Potato Farming Practices

Variables	Linear	Exponential	Cobb Douglas	Semi-log+
Constant	1.1843(0.75)	-0.3133 (1.68)*	-1.5414 (1.96)	20.1984 (8.48)***
Gender	-0.6219 (2.13)*	0.2681(1.86)*	0.1631(1.78)*	-0.6216 (-2.28)**
Age	0.0202(0.88)	0.00429 (0.64)	0.2284 (0.78)	0.1514(2.42)**
Marital Status	0.0852 (2.84)**	0.1422 (3.098)**	0.0631(3.42)***	0.6178(4.32)***
Education	-0.0375 (-1.01)	-0.00573 (-0.53)	-0.0106 (-0.16)	-0.1318 (-0.58)
Occupation	-0.5020(-2.73)*	-0.1341 (-0.95)	-0.1335 (1.49)	-0.5798(-2.34)**
Farming Experience	-0.0170(-0.33)	-0.0082 (-0.54)	-0.0462 (-0.43)	-0.1267 (-0.34)
Household Size	0.01926 (0.15)	0.0226 (0.59)	0.0845 (0.54)	0.0958(0.18)
Farm Size	-1.6978(-1.78)*	-0.5252 (-1.89)*	-0.3091(4.29)***	-0.7685(-4.66)***
Extension Contact	0.0182 (0.08)	0.009133 (0.16)	0.0411 (0.25)	0.0689 (0.12)
Income	0.4759 (0.62)	-0.0131 .(0.24)	0.0068 (0.07)	0.0662 (0.18)
Cooperative Membership	0.2841 (0.82)	0.79984 (1.10)	0.0814 (0.25)	0.0203 (0.59)
R^2	0.4610	0.4076	4706	0.5997
R – Adjusted	0.3930	0.3420	0.4013	0.3992
F – Ratio	21.5060	27.6245	24.4601	39.92

Source: STATA 4A Result

*P≤ 0.10, ** P≤ 0.05 and ***P ≤ 0.01

Figures in parentheses are t-values

+ lead equation

The results in Table 3 show the regression estimates of influence of selected socioeconomic characteristics on farmers' participation in sweet potato farming practices. Among the four functional forms estimated, the Semi-Log form was chosen as the lead equation based on a high R^2 value, number of significant factors and agreement with a priori expectations. The F-value was highly significant at 1.0% level indicating a regression of best fit. The R^2 value of 0.5997 showed that 59.97% of the variability in participation was explained by the independent variables. The result showed that coefficient of gender was negatively signed and significant at 5.0% level of probability. This implies that increase in female farmers will lead to increase in participation of sweet potato production activities by farmers in the study area. This is also an indication that female headed households are more likely to participate in sweet potato farming practices than their male-headed household's counterparts. The finding is consistent with Okoye. (2017) who found that sweet potato was traditionally grown and produced by women in South East Nigeria. Coefficient of age was significant at 5.0% level and positively related with level of participation in sweet potato farming practices in the study area. This implies that increase in age will lead to a corresponding increase in participation of farmers in sweet potato production activities. Although this finding is in contrast with Ukpabi, (2012) who noted that younger farmers are more risk takers, thus they are capable of searching markets in the distant and competitive places like local markets than the aged farmers. The coefficient of marital status was positively signed and highly significant at 1.0% level of probability. This implies that farmers who are married will increase participation in sweet potato farming practices in the study area. The married have advantage over others since the spouse and children will serve as major sources of labour hands in farms and play major roles in sweet potato production as observed by Onubuogu and Onyeneke, (2012). The coefficient for occupation was significant at 5.0% and had an indirect relationship with participation by farmers in sweet potato farming practices. This implies that increase in number of full time farmers will lead to a corresponding decrease in participation of sweet potato activities in the study area. This is against *a priori* expectation probably because sweet potato production is not the primary crop grown in the area, those that are more likely to participate in sweet potato farming practices are non-full farmers. The coefficient for farm size also had an indirect relationship with the level of participation of farmers in sweet potato farming practices in the study

area and highly significant at 1.0% level. This implied that increase in farm size will decrease the participation of farmers in sweet potato farming practices. The result is also against *a priori* expectation probably because crop versus land allocation in the study area may be a function of priority. In contrast, Adeoti *et al*., (2014) found that with relatively large land size, farmers are likely to participate actively in agricultural technologies.

Conclusion and Recommendations

The study has shown that personal observations, fellow farmers and television programmes were sources of sweet potato farming practices, had favourable perception of sweet potato cultivar characteristics and high participation in the sweet potato farming practices. Probit regression result showed that tuber yield, vine yield, early maturity, disease and pest tolerant and good culinary test and multiple regression result such as gender, age, marital status, occupation and farm size influenced farmers' participation in sweet potato farming practices in the study area.

Based on the finding of the study, the following recommendations were made;

(i) Improvement and breeding for early maturing, high yielding varieties, disease and pest resistant varieties of sweet potato since high yield will influence effective participation.

(ii) Polices on inclusion of female farmers in decision making, law formulation and implementation especially on sweet potato production will go a long way to increase participation.

(iii) The result of the study call for effective implementation of existing land use policy was intended to enable farmer's access to land for effective participation in sweet potato farming practices.

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