NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 54 Number 2, December 2023 Pg. 14-20
Available online at: http://www.ajol.info/index.php/naj
https://www.naj.asn.org.ng

Seed Source and Productivity of Sweetpotato Farmers in South East, Nigeria

[1]Okoye, A.C., [1]Daniel-Ogbonna, C., [1]Anedo, E., [2]Okoye, F. U., [1]Eluagu, C. and [2]Onunka, B.N[2]

[1]National Root Crops Research Institute Umudike P.M.B. 7006 Umuahia Abia state, Nigeria
[2]Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria
Corresponding author's email: okoyeamalac@yahoo.com, okoyeamalacgmail.com

Abstract
This study provides empirical evidence on the effect of seed source and productivity of sweetpotato farmers in South East Nigeria. The study identified sweetpotato seed sources used by farmers and the level of productivity; estimated the effect of seed source on the productivity of the farmers; and determinants of the choice of sweetpotato seed source. The result showed that the farmers in the study area sourced sweetpotato seeds from their farms (46%), fellow farmers (24%), Research Institutes RI/ Agricultural Development Programme ADP (16%) and markets (14%). The regression analysis showed that the coefficients of membership in the cooperative society, the area cultivated with sweetpotato and productivity had a direct relationship with seeds sourced from the fellow farmer, other than from the market, while the price of the seed was negative. Coefficients for gender, extension contact, price of seed and farm income had a negative relationship with seeds sourced from RI/ADP and positive for membership of cooperatives, variety type and productivity. Extension contact and farming experience were directly related to the probability of seeds sourced from their farm and negative for membership of cooperatives, price of seed and variety type. There was a significant difference in the productivity of the different seed sources in the study area. The results call for policies aimed at formalizing the sweetpotato seed system and increasing farmers' orientation in the use of quality seed through informal education.
Keywords: Decision, Farmers' seed, Multinomial Logit, Quality and Seed use

Introduction

A seed is any propagative part of a plant, including tubers, bulbs, vines stems etc., especially preserved for growing a new crop. Sweetpotato is propagated through the use of a vegetative part called sweetpotato seed, vine or propagule. The source of the seed determines its quality which may have a positive or negative effect on productivity. The system where farmers have access to quality seed throughout the season is referred to as a seed system. The sweet potato seed system is the economic and social mechanism by which farmers demand seed and preference for desirable traits, with demands met by various possible sources of supply (Lipper *et al*., 2010). The formal seed system is characterized by a clear chain of activities, usually starting with plant breeding and promotion of materials for formal variety release and maintenance. Regulations exist in this system to maintain variety identity and purity and guarantee physical, physiological and sanitary quality. Seed marketing takes place through officially recognized seed outlets, and by way of national agricultural research systems (Louwaars, 1994; Subedi &Borman, 2013). The informal seed system includes other ways farmers access seed ranging from farmer to farmer exchange, use of own old materials or volunteer sprouts etc. The selection, multiplication, dissemination and storage of this system take place as integral parts of crop production rather than as discrete activities (Sperling*et al*., 2013). In Nigeria, the sweet potato seed system is still informal where farmers source seed from neighbour's farms and out-growth from previous farms. More so, there is a growing recognition of a third type of seed system; the intermediate seed system (Subedi*et al*., 2013) which is characterized by entrepreneurial farmers and farmer groups that produce and market crops that are not covered by the formal seed system. In Nigeria, these groups are called Decentralized Vine Multipliers (DVMs) that produce Quality Declared Seed (QDS), which is to be inspected by the NASC and sold within their communities. Irrespective of the seed system being observed, the source of seed has a relationship with the seed quality and productivity. Nigeria ranks as the 3rd largest sweetpotato producer in the world after China and Tanzania and 1st in West Africa with about 4.03mmt (FAO, 2018) and yield of 2.35t/ha, indicating low productivity compared to 20t/ha researcher managed. The decrease in productivity has been attributed to the

quality of seed use, poor management inadequate technical know-how etc. To harness the current potential for sweetpotato production and export, its productivity must be improved and the seed system formalized. Various government-supported research and development activities have undertaken efforts to raise the productivity of small-holder farmers. Despite the efforts directed at improving sweetpotato production over the years, low productivity remains a major challenge in the sector (Olayinka, 2016). However, this has been linked with the use of disease-infected seeds. Inadequate availability of good quality seed at the beginning of planting time often implies that farmers will have no other option than to plant whatever is available. Farmers usually continue the traditional practice of retaining some proportion of their yield for use as seed and attempt to purchase seed when the seed they retained from the previous harvest is not enough and profitable. However, seed use and source also depend on other factors which this study unveiled. The study therefore analyzed factors responsible for the choice of seed source and its effect on productivity of sweetpotato farmers in South East, Nigeria.

Materials and Methods

Study Area

The study was carried out in South Eastern Zones of Nigeria. The Zone lies within *Latitude: 9° 4′ 55.1964″, Longitude: 8° 40′ 30.9972*" with a total land mass of 10,952,400ha. The zone has approximately 40 million resident populations (NPC, 2015) and is made up of five states: Abia, Anambra, Ebonyi, Enugu and Imo States.

Sampling Procedure

A multi-stage sampling design that involves random and purposive procedures was used for the study. Three (Anambra, Ebonyi and Enugu State) out of the 5 States in the Southeast geo-political zone were randomly selected for the study. In the second stage, two agricultural zones per state were randomly selected. In the third stage, two Local Government Areas (LGAs) were randomly selected from each zone. Three communities were purposively selected from each LGA due to the intensity of production giving a total of 36 communities in the fourth stage. In the last stage, 10 sweetpotato producers were randomly selected from each community, giving a total of 360 respondents for a detailed study.

Analytical Procedure

Descriptive statistics, ANOVA and multinomial Logit regression model were used for the study. The level of productivity was estimated using the ratio of quantity harvested to the total area of land harvested.

$$\text{Productivity (Tonnes/hectare)} = \frac{\text{Total Quantity of Sweetpotato Harvested (kg)}}{\text{Total Area Cultivated with Sweetpotato (hectare)}} \quad \ldots (1)$$

Determinants of choice of farmers' seed source in the study area were analysed by the use of a multinomial logit regression procedure. The dependent variable (seed source) was defined as farmers' source of seed from – market, fellow farmers, own farm, RI/ADP. This was coded as binary variables 1 to 4. Given that the dependent variable has more than two alternatives among which the decision maker has to choose from, the study employed the multinomial logit model because of its documented superiority and ease of computation (Greene, 2003).

The probability of a farmer's choice of source j was estimated using is expressed thus:

$$P_{ij} = \frac{eX\beta_j}{\sum_j^j eX_i\beta_j} \quad \text{for } j = 1 \text{ to } 4 \quad \ldots\ldots (2)$$

$$\text{Prob } (Y_i = J/X_i) = P_{ij} = eX_i\beta_i \Big/ \sum_j^j=4\ eX_i\beta_j, \quad \text{for } j > 1 \quad \ldots\ldots (3)$$

$$\text{Prob } Y_i = 1/X_i = P_{ij} = \frac{1}{1+\sum_j^j=4\ eX_i\beta_j} \quad \text{for } j > 1 \quad \ldots\ldots (4)$$

Where,

P_{ij} is the probability representing the farmer's chance of using seed type j,

X_i represents a set of explanatory variables,

e is the natural base of logarithms, and

β_j are parameters to be estimated by MLE.

The estimated equations provide a set of probabilities for the j + 1 choice for a decision maker with X_i characteristics. For identification of the model, there is a need to normalize by assuming $\beta_0 = 0$. Thus the probabilities are given by equations (3), (4).

The marginal effects of explanatory variables on probabilities are specified as:

$$\Delta_{ij} = dP_{ij}/X_i = P_{ij}\ [\beta_{ij} - \sum_j^j = 0P_{ij}\beta_j] = P_{ij}\ [\beta_j - \beta\text{-}] \quad \ldots.(5)$$

In these models, the log odds type of variety used was modeled as a linear combination of the explanatory variables.

The model is explicitly modeled as:

$$Y = \beta_0 + \beta_1X_{1+}\beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + u_i \ldots\ldots (6)$$

Where,

Y= Sweetpotato Seed Source (market =1, fellow farmers=2, own farm=3, RI/ADP=4), X_1= sex (dummy variable; male=1, female=0), X_2= educational background (years), X_3= number of times of extension contacts, X_4= membership of cooperatives (dummy variable; yes =1, no=0), X_5= farming experience (years), X_6= area cultivated with sweetpotato (hectare), X_7= estimated price of seed (Naira), X_8= farm income (Naira), X_9= variety type (dummy variable; white variety=1, orange variety = 0), X_{10}= productivity (t/ha), ui= error term. The data were analysed with the use of STATA. 14.2. (2016).

Results and Discussion

Average Statistics of Sweetpotato Farmers

The results in Table 1 showed the average statistics of the respondents in the study area. The result showed the

average farmer's age as 45 years, household size of 6 persons with 7 years of education. The respondents had an average extension contact of about 7 times in a year, 16 years of farming experience and 0.87 hectare cultivated with sweetpotato. This implied that the farmers were still young, active, agile and within the productive age and with large household sizes. Olagunju *et al.* (2013) noted that sweetpotato production in Nigeria is dominated by younger farmers and Adesina and Zinnah *(*2015) observed that younger farmers tend to be more productive than their aged counterparts. The results also imply that the majority of the farmers are literate and had contact with an extension which indicates access to information on new and modern agricultural innovations (Olagoke, 1991). The respondents had many years of farming experience with small farm holdings. The majority of the respondents were female farmers, married, belonged to cooperatives and owned land, implying availability of labour, and access to production input like land. Harun (2014) noted that farmers who are not married hurt agricultural production and economic growth of farm households.

Farmer's Seed sources

The result in Figure 1 presented the distribution of sweetpotato farmers according to the seed source used in the study area. The result showed that many (46.10%) of the respondents sourced their planting materials from their farm followed by exchange from the neighbouring farmers (23.90%), RI/ADP (16.40%) and market (13.60%). In line with the findings, Rajendran *et al*. (2017) noted that the use of volunteer sprouts and farmer-to-farmer sweetpotato vine exchange have been the main sources of seed among farmers in Africa, due to limited quantities available at the start of the rainy season. Thus, this has led to the re-cycling of vines and accumulation of sweetpotato virus diseases causing up to 98% reduction in root yields. Kaguongo *et al*. (2008) observed that 90% and 70% of farmers in Uganda and Kenya respectively, selected seeds for planting using their own from their farms. FAO (2015) stated that 70% of sweetpotato farms in Uganda have bacterial wilt due to farmer-to-farmer exchange of seeds.

Productivity

The variations in productivity among the seed sources used by the farmers are shown in Table 2. The result showed that the average productivity (t/ha) of the farmers were 5.33, 4.88, 8.83 and 5.09 for seeds sourced from the market, fellow farmers, RI/ADP and own far with an average area of land cultivated of 1.48ha, 0.81ha, 0.68ha and 0.79ha respectively. This indicated that farmers from seeds sourced from RI/ADP gave the highest yield, followed by seeds sourced from the market, or own farm and the lowest yield recorded from seeds sourced from fellow farmers. This result follows the findings of FAO (2020) with an average yield of sweetpotato as 4.8t/ha. The average area of land cultivated by farmers also indicated small land holdings; even farmers who sourced seed from the market that had the largest area of land cultivated with sweetpotato still have less than two hectares. From the survey, we found that those who sourced seed from the market were those who got seed from the cooperative markets, exhibitions, and open markets, especially in Ebonyi State where sweetpotato seeds were traded in the open market. They further multiplied these seeds to get some reasonable quantity before production.

Determinants of seed source among sweetpotato farmers

The result in Table 3 shows the multinomial Logit regression estimates on the determinants of seed source among sweetpotato farmers in South East, Nigeria. The result shows that the coefficient for gender was negative and significant at a 5% level of probability for seed source from RI/ADP. The coefficient for education was also negative and highly significant at 1% level for own farm seed source and extension contact for seed sourced from RI/ADP level significant at 10% and positive for own farm at 5%. The coefficients for membership of cooperatives had a direct relationship with seed sourced from fellow farmers and RI/ADP and were significant at a 1% level each. Farming experience had a direct relationship with seed sourced from own farm and significant at 1% level. The coefficient for the area of land cultivated was negatively signed and significant at a 5% level of probability for seed sourced from a fellow farmer. The result also shows that the coefficients for the price of seed had a negative relationship with seed sourced from the fellow, farmer, RI/ADP and own farm and significant at 10%, 5% and 1% levels respectively. Farm size was significant at a 10% level and negatively related to seed sourced from RI/ADP. The coefficient for variety type was negative and significant at 1% level for seed sourced from RI/ADP and positive for seed sourced from own farm and significant at 10% level. The coefficient for productivity had an indirect relationship with seed sourced from RI/ADP and was significant at a 1% level. A farming community's food security relies profoundly on its seed safety. However, the negative sign for gender was an indication that the probability of a female's source of sweetpotato seed from RI/ADP was high other than from the market. In corroboration with the results, Behailu, *et al*. (2018) noted that there are gender differences in seed security and source though both men and women farmers consider seed as a key resource for food and livelihood security. The aforementioned study also found that females tend to be proactive in the selection of seeds and argued that women need to ensure good supplies of their preferred varieties of seed as they are often the main producers of food to feed the family. Farmers with little or no education tend to source seeds from their farms other than from the market. This may be because of a lack of orientation in the use of quality seeds and seed sources. Education increases human capital and skills and enhances the likelihood of the uptake of new technologies (Wafula *et al*., 2015). Also, Onyeneke (2012) noted that education enables farmers to access and process information on innovations that tend to enhance productivity. The importance of extension contact in disseminating information and the use of input is very crucial in agriculture. Unexpectedly, the

decrease and increase in the number of extension contacts increase farmers' source of seed from RI/ADP and own farms respectively other than the market source. Those who had contact may feel they have all the information it takes to proceed with production and not necessarily the quality of seed whereas those without extension contact purchase seed from RI/ADP on the course of search for information. The number of extension contacts with the farmers determines the desired behavioural change (Aneato *et al*., 2012). The study also observed that farmers usually search for improved seeds and information from agricultural research institutes and programs especially when not satisfied with the available information from extension agents. The findings indicated that farmers who belong to cooperatives tend to source sweetpotato seed from fellow farmers and RI/ADP other than from the market. The role of cooperative societies in input (seed) distribution/market and the wide range of coverage to the final users is important. AFD (2018) noted that seed cooperatives source foundation seeds from national authorities or programs which are used for further multiplication by its members. Seeds are distributed among members and sold to neighboring farmers in cooperate markets. Ajah (2015) also observed that cooperative farmers had access to farm inputs including seeds as they traded (production of seed) seed among themselves (cooperative market). The finding observed that farmers who had many years of experience in sweetpotato production tended to source seed from their farms other than from the market. This is against *a priori* expectation probably because farmers with little or no experience may not differentiate between diseased seeds from quality seeds and this might be because of no difference in sweetpotato growing experience between purchasers and non-purchasers of certified seed following Okello *et al*. (2016). The result also shows that an increase in the area of land will increase the probability of seed sourcing from fellow farmers rather than from the market. This is expected as farmers' source for alternative seed input if the area of cultivation increases. Interestingly, an increase in the price of seed in a farmer's locality would lead to a corresponding decrease in the probability of seed source from either fellow farmer, ADP/Research or own farm other than from the market. This also implied that the price of seed is one of the major factors that determined the seed source type and use. As sweetpotato seed price increases at a point, farmers may switch to other substitute seeds, such as farm-saved seed or voluntary sprouts or a different crop entirely. An increase in farm income will decrease the probability of seed sources from RI/ADP other than the market. Farmers usually search for quality seeds when they realize poor yield and thus low income from the previous harvests. Wondimagegn *et al*. (2011) noted that farmers use improved seeds when they are sure of an increase in output, thus, an increase in farm income. The result on variety type implies that any increase in demand for orange-fleshed variety (OFSP) will increase the probability of seed source from RI/ADP, while the increase in white-fleshed variety (WFSP) increased the probability of seed source from own farm. Any increase in productivity implied a corresponding increase in the probability of seed source from the RI/ADP other than from the market.

Marginal effects of the determinants of seed source

The marginal effects of the determinants of seed source use were also estimated as shown in Table 4. The results indicated that there was an increased probability of source of sweetpotato seed from the market by 6.62%, 10.68%, 1.00% and 9.7% following an increase by one person in farmer's cooperatives, an increase in area cultivated with sweetpotato by one hectare, decrease in seed price by one Naira and increase in productivity by 1t/ha respectively. The result also showed that the probability of increasing female farmers by one person, decrease in extension contact by one, increase in membership of cooperatives by one person, decrease in the price of seed and farm income by one Naira each, increase in OFSP variety by one bundle, and productivity by 1t/ha will lead to 71.19%, 8.61%, 22.56%, 0.63%, 3.1 x 10^{-5} %, 30.3% and 3.3% increase in source of seed from RI/ADP respectively. A decrease in education by one year, an increase in the number of extensions contact by one, an increase in farming experience by one year, an increase in seed price by one naira and an increase in WFSP variety by one bundle will increase the probability of seed source from own farm by 0.50%, 9 x 10^{-4}%, 2.7 x 10^{-4} %, 2.62 x 10^{-5}% and 39.80% respectively.

Test of significant differences in level of productivity among different sweetpotato seed sources

The result in Table 5 presented the test of significant differences in the level of productivity among different sweetpotato seed sources used in the study area. The result shows a significant difference at a 1% level of probability. The result implied that there was a significant difference in productivity among seed source types found in the study area.

Conclusion

This study provided empirical evidence on the effect of seed sources on the productivity of sweetpotato farmers in South East, Nigeria. The result showed that seed sourced from the ADP/RI had the highest productivity than, market; own farm and fellow farmers. The price of seed in the farmer's locality was found to be a common factor of seed source among the four levels of seed source sampled in the study area. The result raises policies if attended to might unlock and release benefits associated with sweetpotato production with regards to seed source use. Emphasis on policies that will formalize the sweetpotato seed system in Nigeria should be implemented, where farmers' orientation in the use of quality seed should be advocated for through the use of cooperative societies, extension education and relevant institutions. Formal or informal institutional arrangements like farmer cooperatives/groups should be enlightened on the need to use quality seeds.

References

Adesina, A. A. & Zinnah, M.M. (2015). Technology

Characteristics, Farmer Perceptions and Adoption Decisions: A Tobit Model Application in Sierra Leone. *Agric. Econ Journal* 9, 297-311.

Anaeto F.C., Asiabaka C.C., Nnadi F.N, Ajaero J.O, Aja O.O, Ugwoke F.O, Ukpongson M.U, & Onweagba A.E. (2012). The role of extension officers and extension services in the development of agriculture in Nigeria. *Journal of Agricultural Research* 1(6), 180 – 185.

Ajah, J. (2015). Comparative Analysis of Cooperative and Non-cooperative Farmers' Access to Farm Inputs in Abuja, Nigeria. *European Journal of Sustainable Development* 4(1), 39-50.

Behailu, M., Bimer, E. & Mohd, J.D. (2018). The Role of Women-Headed Households in the Local Seed Business in Ethiopia: The Case of JabiTehnan, Bure and YilmanaDensa Districts. *Global Journal of Human-Social Science* 18(3), 152-163

FAO (2015). Food and Agriculture Organization of United Nations. Farm Management Extension Guide, pp 52.

FAO (Food and Agricultural Organization) (2018) Production statistics. Available at: http://www.fao.org/faostat/en/#data/QC/. Last accessed at 06.04.2020.

Greene, W.H. (2003). Econometric Analysis. Prentice Hall, Upper Saddle River.

Harun, M.E. (2014). Women's workload and their role in agricultural production in Ambo district, Ethiopia.*Journal of Development and Agricultural Economics*6,356-362.

Iloka, A.W. & Anuebunwa, F.O (1995). Appraisal Study of Agricultural Extension System of Southeast-Agro-Ecological zone, Nigeria. Working paper; Federal College of Agriculture, Ishiagu, Nigeria.

Kaguongo, W., Gildemacher, P., Demo, P., Wagoire, W., Kinyae, P., Andrade, J., Forbes, G., Fuglie, K. & Thiele, G. (2008). Farmer practices and adoption of improved potato varieties in Kenya and Uganda.Working Paper; International Potato Center (CIP), Lima, Peru.

Lipper, L., Anderson, C.L. & Dalton, T. (2010). Seed Trade in Rural Market: Implication for Crop Diversity and Agricultural Development, Earthscan Press London.

Louwaars, N. (1994). Seed Supply System in the Tropics: International Course on Seed Production and Seed Technology. International Agric. Centre, Wageningen, the Netherlands.

NPC (2015) (National Population Commission) Estimated Population Figures. National Population Commission, Nigeria.

Okello, J.J., Zhou, Y., Kwikiriza, N., Ogutu, S.O., Barker, I., Schulte-Geldermann, E., Atieno, E. & Ahmed, J.T. (2016). Determinants of the Use of certified seed potato among smallholder farmers: The case of potato growers in Central and Eastern Kenya. *MDPI Agriculture Journal* 6(5), 12-27.

Olagoke, M. A. (1991). Efficiency of Resource Use in Rice Production Systems in Anambra State, Nigeria. African Development, Winrock International, Arlington, USA.

Olagunju, F.I., Fakayode, S.B., Babatunde, R.O. & Ogunwole-Olapade, F. (2013). Gender Analysis of Sweet Potato Production in Osun State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology 2(1), 1-13.*

Olayinka I. B (2016). Performance Analysis of Small Scale Sweet Potato Farms in Oyo State, Nigeria. *Agricultura Tropica Et Subtropica Journal* 49(1-4), 38-44.

Onyeneke, R.U. (2012). Socioeconomic Analysis of the Effect of Microfinance on Small-Scale Poultry Production in Imo State. *International Science Research Journal* 3, 34 -40

Rajendran, S., Kimenye, L.N. & McEwan, M. (2017). Strategies for the development of the sweetpotato early generation seed sector in Eastern and Southern Africa. *Open Agriculture Journal* 2, 236 – 243

Sperling, L., Boettiger, S., Rubyogo, J.C. & Buruchara, R. (2013). Getting new Varieties out to millions. PABRA and the power of partnership. Agpartner-change press, Ethiopia.

Subedi, A. & Borman, G. (2013). Critical success factors for local seed business: Report on the 2012 assessment. Centre for Development Innovation, Wageningen, the Netherlands

Wafula, L., Oduol, J., Oluoch-Kosura, W., Muriuki, J., Okello, J. & Mowo, J. (2015). Does building the technical capacity of smallholder farmers enhance the adoption of conservation practices?: A case of conservation agriculture with trees in Kenya. World Agroforestry Centre Press Nairobi, Kenya.

Wondimagegn, M., Bekabil, F. & Jema, H. (2011). Pattern, trend and determinants of Crop Diversification: Empirical Evidence from Smallholders in Eastern Ethiopia. *Journal of Economics and Sustainable Development* 2(8), 273-284

Table1: Average Statistics of Sweetpotato Farmers in South East, Nigeria (n=360)

Variable Description	Means	Std. dev	Min.	Max.
Age	45.1110	11.0477	26.00	87.0000
Household size	5.8605	2.2576	0.0000	15.0000
Educational level (years)	7.2777	5.1882	0.0000	16.0000
Number of extension contacts	6.8229	6.9304	0.0000	30.0000
Farming experience (yrs)	15.9719	8.1658	2.0000	45.0000
Area cultivated with sweetpotato	0.8769	0.4279	0.025	3.0000
Dummy (%)				
Gender (female)	82.76			
Married	87.22			
Member of cooperative society	79.45			
Ownership of land	73.88			

Source: Field survey, 2021

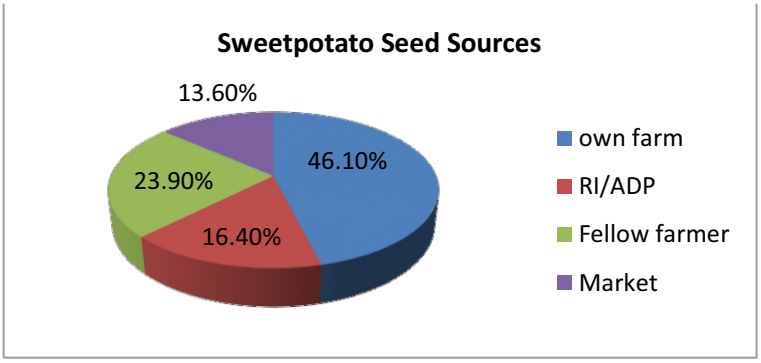

Fig. 1: Distribution of Sweetpotato Farmers According to Seed Source
Source: Field survey, 2021

Table 2: Productivity of Sweetpotato by Seed Source Type

Variables	Market	Fellow Farmer	RI/ADP	Own farm
Quantity Harvested (kg)	7881.6	3951.5	6007.8	4017.8
Area of land (ha)	1.48	0.81	0.68	0.79
Productivity (kg/ha)	5325.4	4878.4	8834.9	5085.9

Field survey, 2021

Table 3: Multinomial Logit Regression Estimates of the Determinants of Seed Source among Sweetpotato Farmers in South East, Nigeria

Variable	Fellow farmer	RI/ADP	Own Farm
Gender	0.1153 (0.20)	-1.3798 (-2.58)**	-0.4811(-0.77)
Educational level	-0.0615 (-0.96)	0.0137 (0.21)	-0.03303 (-4.31)***
Extension contact	0.0530 (0.79)	-0.1744(-1.75)*	0 .074296 (2.75)**
Membership of cooperative	0.8659 (3.43)***	21.4698 (6.27)***	-1.0789 (-0.67)
Farming experience	-0.0269 (-0.67)	0.0328 (0.89)	0.0159 (3.56)***
Area cultivated sweetpotato	0.6074 (2.52)**	0.8109 (1.23)	-0.3319 (-0.47)
Estimated Price of seed	-0.0027 (-1.9)*	-0.0069 (-2.64)**	-0.0016 (-3.46)***
Farm income(sweetpotato)	6.99e-07 (0.22)	-6.53e-06 (-1.93)*	-0.0003 (-0.00)
Variety type	0.0021 (0.23)	-2.8922 (-4.32***)	0.0237 (1.82*)
Productivity	0.0485 (1.99)	-0.0007 (-2.54**)	0.0492 (1.53)
Constant	7.0651 (2.11)**	27.0518 (3.99)***	1.8494 (0.70)
LR Chi2	81.95		
Prob> chi2	0.0000		
Log-likelihood	-131.4421		

The log-likelihood **survey, 2021**
Figures in Parentheses are the t-values
***, ** and *** are significant at 10%, 5% and 1% level of probability respectively.**

Table 4: Determinants of Marginal Effects

Variable	Market	RI/ADP	Own Farm
Gender		-0.7194	
Educational level			-0.0050
Extension contact		-0.0861	9.8 x 10-6
Membership of cooperative	0.0662	0.2256	
Farming Experience			2.7 x 10-6
Area cultivated sweet potato	0.1068		
Price of seed	-0.001	-0.0063	-2.62 x 10-7
Farm income		-3.1 x 10-7	
Variety type		-0.3027	0.3980
Productivity	0.0970	0.0338	

Source: Field survey, 2021

Table 5: Test of Significant Differences in productivity among Sweetpotato Seed Sources used in the Study Area

Source	Df	SS	MS	F
Model	3	27274439.29	9091479.26	242.61***
Error	4	0.00	0.0000	
Total Corrected	7			

***** is significant at 1%**

Source: Field survey, 2021