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EFFECT OF FARMERS' UTILIZATION OF IMPROVED SWEET POTATO PRODUCTION TECHNOLOGIES ON ROOT YIELD IN SOUTH-EAST ZONE, NIGERIA

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ABSTRACT

*The study assessed the effect of farmers' utilization of improved sweet potato production technologies on root yield in the South-East Zone, Nigeria. Multi-stage sampling and proportionate sampling methods were used to collect data for the study. Three States, Abia, Anambra, and Ebonyi were purposively selected. Finally, a proportionate sampling technique was used to select farmers from the circles to give a sample size of 364 sweet potato farmers. Data were collected using a structured questionnaire and analyzed using descriptive statistics, while the inferential statistics used were Z-test and Ordinary Least Square regression model. The results showed that the majority (72.25%) of the farmers were females, while few (27.75%) were males, the mean age was 37.3 years, a greater number (53.57%) of the farmers had secondary education, and 69.23% of the farmers had farm size that fell between 0.1-0.9ha. The grand mean of utilization was 2.61 on a three-point rating scale, indicating a high level of utilization of sweet potato production technologies by the farmers. The result of the Z-test showed a significant difference (P< 0.05) with the value of Z-calculated (14.905**). Regression results showed a significant relationship in root yield at 1% and 5% levels. The study concluded that improved sweet potato production technologies disseminated to farmers were highly utilized and the utilization had a positive effect on the farmers' root yield. It was, therefore, recommended that sweet potato farmers should utilize the improved sweet potato production technologies disseminated to them in order to improve production.*

Keywords: *Farmers, Utilization, Improved Sweetpotato, Technologies, and Yield*

INTRODUCTION

Sweet potato (*Ipomoea batata (L) Lam*) is an important tropical staple food crop, belonging to the morning-glory family known as *convolulaceae.* It originated in Latin America (Low *et al*., 2017). It is a root crop mostly grown in many parts of the globe, is native to tropical America, and is commonly called a yam in parts of the United States. It is regarded as an early maturing crop, has relatively little labour requirement, and has the ability to thrive under Sub-Saharan Africa's climate (Uzoigwe *et al*., 2019). Sweet potato is an important food security crop in Nigeria and Africa at large, and it is known as the crop that is there when the maize fails (Jia, 2013). Sweet potato leaves have added nutritional value, with greater amounts of protein and crude fiber. The leaves and tender shoots of sweet potato are also eaten and are very nutritious, unlike potato leaves, which are toxic. The skin is edible and has high nutritional value. One hundred grams of fresh sweet potato leaves contain more iron, vitamin C, folates, vitamin K, and potassium but less sodium than the tuber (USDA, 2011). The tubers have high levels of carbohydrates for daily energy production. Sweet potatoes are appropriate for meeting the nutritional needs of malnourished children and elderly populations who need high-energy foods that are also suitable for small stomachs. The crop is grown for multipurpose; its roots and vines are used both for human food and for animal feed. Sweet potato is used in a variety of ways for food, feed, and processed products such as bread, ready-to-eat breakfast, French fries, syrup, starch, and beverages (Walker *et al.,* 2014).

Sweet potato production technologies have been developed and disseminated in the South-East Zone of Nigeria, but there is still a dearth of information on how the disseminated improved sweet potato production technologies utilized by the farmers affect sweet potato root yield (Udemezue, 2019). Hence the study to assess the effect of farmers' utilization of improved sweet potato production technologies on root yield in the study area. The specific objectives of the study were to; ascertain the farmers' utilization level of improved sweet potato production technologies and estimate farmers' root yield before and after the utilization of improved sweet potato production technologies disseminated.

It was hypothesized that there was no significant difference between root yield before and after the use of improved sweet potato production technologies disseminated; and, Use of improved sweet potato production technologies had no significant effect on root yield

METHODOLOGY

The study was conducted in South-East, Nigeria. Multi-stage and proportionate sampling methods were used to collect data for the study. Three States, Abia, Anambra, and Ebonyi, were purposively selected, and two agricultural zones were randomly selected from each of the States, to give a total of six zones. Two blocks were randomly selected from each of the zones, to give a total of twelve (12) blocks. Finally, a proportionate sampling technique was used to select farmers from the circles to give a sample size of 364 farmers. A list of farmers from the Sweet Potato Farmers' Association, Abia State, Extension Services Programme office of NRCRI Igbariam outstation, Anambra State, and Sweet Potato Farmers' Association, Ebonyi State served as the sampling frame. Data for this study were collected using a structured questionnaire. Data were analyzed using descriptive such as frequency, percentages, and mean, while inferential statistics used were Z-test and Ordinary Least Square regression model.

Z-test was calculated by getting the difference between the mean yield score of roots before and after utilization of the sweet potato production technologies (root yield measured in Kg).

The variables were measured with mean from a three-point rating scale (Always used, sometimes, and Never. 3, 2, and 1 respectively). This was tested using Ordinary Least Square Regression Model (OLS). The variables are improved sweet potato production technologies, improved sweet potato varieties, sweet potato intercropping, land preparation methods, vine cutting (3 and 4nodes), plant spacing (30cm x 30cm), planting time, use of herbicide, weeding regime (1st and 2nd), use of fertilizer, earthing-up (mean), use of insecticide and proper harvesting time.

RESULTS AND DISCUSSION

Farmers' Socioeconomic characteristics

Table 1 result shows that the majority (72.25%) of the farmers were females while a few (27.75%) were males. This implied that female folk were involved in sweet potato farming more than their male counterparts. The finding is in agreement with Anyaegbunam, Nwokocha, and Uwandu, 2019, who reported that sweet potato is viewed as a women's crop. The results showed that 39.84% of the farmers fell between the age brackets of 30-39 years and 30.49% of them fell between the age brackets of 40-49 years. This implied that a good number of the respondents were their active age. The average number (53.57%) of the farmers attended secondary education level, indicating that they are considered literate farmers. This finding is consistent with that of Kainga *et al*., (2016) who observed that the majority of the farmers in the South East had one form of formal education or the other. A good number (69.23%) of the farmers had farm sizes of less than 1 hectare (0.1-0.9 ha), indicating that the sweet potato farmers were smallholder farmers. The result also shows that 43.68% of the respondents had a farming experience of 6 – 10 years, indicating that the farmers had enough farming experience in sweet potato farming. According to Arimi (2014), who opined that a higher number of years of experience in farming help farmers in the use of technology.

Table 1: Distribution of farmers Socioeconomic characteristics

Variables	Abia (n=64)	Anambra (n=99)	Ebonyi (n=201)	South-East n=364(Pooled)
Sex				
Male	18(28.13)	31(31.31)	52(25.87)	101(27.75)
Female	46(71.87)	68(68.68)	149(74.13)	263(72.25)
Age				
20-29	11(17.19)	19(19.19)	36(17.91)	66(18.13)
30-39	31(48.44)	42(42.42)	72(35.82)	145(39.84)
40-49	19(29.69)	31(31.31)	61(30.34)	111(30.49)
50-59	3(4.69)	7(7.07)	32(15.92)	42(11.54)
Educational level				
Non formal education	0(0.00)	1(1.56)	4(4.04)	5(1.37)
Primary	2(3.13)	3(3.03)	4(1.99)	9(2.47)
Secondary	28(43.75)	66(66.67)	101(50.25)	195(53.57)
Tertiary	34(53.13)	30(30.30)	91(45.27)	155(42.58)
Farm size				
0.1-0.9	52(81.25)	69(69.69)	131(65.17)	252(69.23)
1-1.9ha	9(14.06)	24(24.24)	59(29.35)	92(25.27)
2- 2.9ha	3(4.69)	6(6.06)	11(5.47)	20(5.50)
Farming experience				
1-5	19(29.69)	15(15.15)	25(12.44)	59(16.21)
6-10	30(46.88)	45(45.45)	84(41.79)	159(43.68)
11-15	11(17.19)	28(28.28)	76(37.81)	115(31.59)
16-20	3(4.69)	7(7.07)	9(4.45)	19(5.21)
21-25	1(1.56)	2(2.02)	5(2.49)	8(2.20)
26-30	0(0.00)	2(2.02)	2(1.00)	4(1.10)

Total	**364**

Source: Field Survey, 2021 Figures in parenthesis are percentages.

Farmers' level of utilization of improved sweet potato production technologies

The result from Table 2 shows that farmers' level of utilization of improved sweet potato production technologies on a three-point rating scale had the following means: plant spacing 30 x 30 cm was ($\bar{x}$ =2.91), 1st and 2nd weeding was ($\bar{x}$ =2.90), harvesting time was ($\bar{x}$ =2.90), time of planting was ($\bar{x}$ = 2.87), improved sweetpotato varieties was ($\bar{x}$ = 2.82), land preparation technology had ($\bar{x}$ =2.79), earthing-up had ($\bar{x}$ =2.79), vine cutting 3 and 4 nodes was($\bar{x}$ =2.58), sweetpotato intercropping was ($\bar{x}$ =2.32), use of fertilizer was ($\bar{x}$ =2.23), use of herbicide had ($\bar{x}$ =2.20), use of insecticide (pest control management) was ($\bar{x}$ =2.05). Grand mean of utilization was 2.61 on a three-point rating scale, indicating high level of utilization of sweet potato production technologies by the farmers. This finding is in line with Odoemelam *et al.* (2016), who opined that farmers can only utilize technologies when they are aware of such technologies.

Table 2: Farmers' level of utilization of improved sweet potato production technologies

Technologies	**Abia (n=64)** $\bar{X}$	**Anambra (n=99)** $\bar{X}$	**Ebonyi (n=201)** $\bar{X}$	**South-East (n=364) Pool** $\bar{X}$	**Decision**
Improved sweet potato varieties	2.75	2.78	2.93	2.82	High utilization
Sweet potato intercropping	2.25	2.33	2.40	2.32	High utilization
Land preparation methods	2.68	2.82	2.86	2.79	High utilization
Vine cutting (3 and 4 nodes)	2.75	2.56	2.42	2.58	High utilization
Plant spacing (30cmx30cm)	2.84	2.75	3.13	2.91	High utilization
Time of planting	2.74	2.88	2.98	2.87	High utilization
Use of Herbicide	2.09	2.25	2.27	2.20	High utilization
Weeding (1st and 2nd)	2.89	2.78	3.05	2.90	High utilization
Use of Fertilizer	2.27	2.21	2.20	2.23	High utilization
Earthing-up	2.75	2.78	2.86	2.79	High utilization
Use of Insecticide	2.10	2.03	2.01	2.05	Low utilization
Harvesting time	2.78	2.89	3.05	2.90	High utilization
Grand mean	**2.57**	**2.59**	**2.68**	**2.61**	**High utilization**

Source: Field Survey, 2021Note: Benchmark mean score = 2.00.

Results showing the difference between root yield before and after the utilization of improved sweet potato production technologies

Table 3 shows that the Z-test statistic shows a significant difference (P< 0.05) in root yield before and after the utilization of improved sweet potato production technologies in South-East, Nigeria (root yield measured in kg). From the result, the mean root yield before the utilization of improved sweet potato production technologies was 14,795.30 kg/ha, while the mean root yield after the utilization of improved sweet potato production technologies was 28,511.92kg/ha. There was a sweet potato root yield difference of 13,716.62kg/ha. The value

of Z-calculated (14.905**) is greater than the value of Z-tabulated (1.67). This implies that improved sweet potato production technologies increased farmers' root yield. The finding of this study is in line with McEwan (2015), who observed that local cultivars of sweet potato tend to be low yielding and late maturing compared with earlier maturing, high yielding, or exotic varieties.

Table 3: Result showing the difference between root yield before and after utilization of improved sweet potato production technologies disseminated

Source of Variation	N	Mean (kg/ha)	Standard Deviation	Standard Error	Difference kg/ha	Z-cal	Z-tab
Root yield before	364	14,795.30	1178.173	61.749	13,716.62	14.905**	1.67
Root yield after	364	28,511.92	2288.181	119.926			

Source: Field Survey, 2021 Significant at 5% level.

Effect of Farmers' Use of improved sweet potato production technologies on root yield

Table 4 shows the regression analysis of the relationship between farmers' use of improved sweet potato production technologies on root yield. The R^2 value of 0.8435 implied that 84.35% of the variation in the use of improved sweet potato production technologies was explained by independent variables. F ratio of 61.265 *** was also highly significant at 1%, indicating goodness of fit. Variables such as improved sweet potato varieties, sweet potato intercropping, land preparation methods, plant spacing, weeding, use of fertilizer, use of insecticide, earthing-up, and proper harvesting time were found to have a significant effect on root yield.

The result in Table 4 revealed that improved sweet potato varieties were significant and positive at a 1% level. This showed that an increase in the use of improved sweet potato varieties increased the root yield. The result also, revealed that sweet potato intercropping was significant and positive at a 5% level. This implied that sweet potato intercropping with other crops increased its yield. This may be attributed to the fact that some crops such as legumes have the tendency of fixing nitrogen on the soil, which improves soil fertility and increases crop yield. This finding supports Ebe *et al*. (2017) who stated that intercropping provides yield advantages in the form of increases in overall productivity. The result also, revealed that land preparation methods were significant at 1% and positively related to root yield. This implies that the land preparation method used in the production of sweet potatoes increases the root yield. The result in Table 4 also, shows that plant spacing was significant and positive at a 1% level. This implied that plant spacing of 30cm x 30cm in sweet potato farming increased the root yield. The result shows that weeding (1^{st} and 2^{nd}) was significant and positive at a 1% level. This indicates that the use of weeding technology increases the root yield in sweet potato farming. This will enable the plant to stand alone without any competition with weeds in the absorption of soil nutrients. Also, it was revealed that the use of fertilizer was significant and positive at a 5% level. This result implies that increased use of fertilizer technology in sweet potato farming increases sweet potato root yield. The result shows that earthing-up was significant and positive at a 5% level. This implies that the more earthing-up of the soil was done on the sweet potato plant, the increase in the root yield. This finding is in line with *a priori* expectation and agrees with the finding of Chukwu, Madu, and Okoro (2016) who observed that earthing-up was done to heap up soil around the base of the plants to cover exposed emerging tubers by soil erosion and to increase effective feeding and bulking area of the tubers. The result also, shows that the use of insecticide (pest control management) was significant and positive at a 5% level. This implies that increase use of pest control management such as insecticide in controlling pests of sweet potato increases the sweet potato root yield. According to Boukhris *et al.* (2015) observed that the application of insecticide alone resulted

in a reduction in aphid infection in potatoes by 82%. The result reveals that harvesting time was significant and positive at 5%, indicating that increased use of proper harvesting time increases the sweet potato root yield. This will enable the farmer to harvest fresh roots with no infestation of pest attacks.

Table 4: Regression analysis of the effect of farmers' use of improved sweet potato production technologies on root yield

Technologies	Abia Linear	Anambra Semi-log	Ebonyi Semi-log	South-East Pooled +Linear
Constant	0.000 (6.049)***	0.000 (4.422)***	0.000 (12.218)***	0.000 (4.656)***
Improved sweet potato varieties	0.776 (0.285)	0.000 (7.664)***	0.142 (1.473)	0.004 (2.925)***
Sweet potato intercropping	0.000 (3.710)***	0.000 (5.577)***	0.484 (0.700)	0.014 (2.458)**
Land preparation methods	0.537 (0.618)	0.000 (4.814)***	0.000 (8.427)***	0.000 (6.174)***
Vine cutting (3 and 4 nodes)	0.358 (-0.921)	0.098 (-1.565)	0.027 (-2.228)**	0.200 (-1.285)
Plant spacing (30cmx30cm)	0.086 (1.721)*	0.000 (8.696)***	0.365 (0.908)	0.001 (3.485)***
Planting time	0.491 (0.690)	0.739 (0.334)	0.919 (0.101)	0.349 (0.939)
Use of herbicide	0.012 (2.522)**	0.825 (0.22)	0.172 (1.369)	0.200 (-1.283)
Weeding (1^{st} and 2^{nd})	0.083 (1.737)*	0.019 (2.292)**	0.004 (2.920)***	0.001 (3.291)***
Use of fertilizer	0.213 (1.248)	0.001 (3.341)***	0.102 (1.640)	0.000 (3.626)***
Earthing-up	0.064 (1.855)*	0.000 (4.946)***	0.088 (1.709)	0.001 (3.324)***
Use of insecticide	0.159 (1.412)	0.000 (5.661)***	0.564 (-0.578)	0.020 (2.37)**
Proper harvesting time	0.660 (0.441)	0.185 (1.330)	0.995 (-0.007)	0.009 (2.631)**
R Adjusted	0.4422	0.615	0.6440	0.8384
R^2	0.4464	0.628	0.6462	0.8435
F-Statistics	24.923***	49.290***	41.375***	61.265***

Source: Field Survey, 2021

Note: Figures in parenthesis represent t-ratios; *** = at 1% and ** = at 5% significant levels, + = Lead Equation.

CONCLUSION AND RECOMMENDATION

The study concluded that the improved sweet potato production technologies disseminated to farmers were highly utilized by sweet potato farmers and the utilization of the sweet potato production technologies had a positive effect on the farmers' root yield. It is, therefore, recommended that sweet potato farmers should utilize the improved sweet potato production

technologies disseminated to them in order to improve production since it was found to increase the root yield in the study area.

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