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## Assessment of Effect of Farmers' Use of Improved Sweetpotato Production Technologies on Sweetpotato Vine Yield in South –East, Nigeria

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### ABSTRACT

*This study assessed effect of farmers' use of improved sweetpotato production technologies on vine yield in South–East, Nigeria. Multi-stage sampling and proportionate sampling methods were used to collect data for the study. Three States, namely Abia, Anambra and Ebonyi States were purposively selected, two agricultural zones were randomly selected from each of the States to give a total of six (6) zones, two (2) blocks were randomly selected from each of the zones to give a total of twelve (12) blocks, finally, proportionate sampling technique was used to select farmers from the circles to give a sample size of 364 sweetpotato farmers. List of sweetpotato farmers from sweetpotato farmers' association, Abia State, Extension Services Programme office of NRCRI Igbariam outstation, Anambra State and Sweetpotato farmers' association, Ebonyi State served as the sampling frame. Data for this study were collected using structured questionnaire and analyzed using descriptive statistics such as mean while inferential statistics used were Z-test and Ordinary Least Square regression model. The result shows that mean of age was 37.3 years, mean education was 12 years and mean of farm size was 0.6ha. Grand mean of utilization was 2.61 on a three-point rating scale, indicating high level of utilization of sweetpotato production technologies by the farmers. The value of Z-calculated (82.525\*\*) is greater than the value of Z-tabulated (1.67). Regression result showed significant effect on vine yield at 1% and 5% levels respectively. The study, it was concluded that the improved sweetpotato production technologies disseminated to farmers were highly used and the use of improved sweetpotato production technologies had positive effect on the farmers vine yield. Therefore, it is recommended that sweetpotato farmers should use the production technologies disseminated to them to improve their vine production since it was found to increase the vine yield.*

**Key words:** Farmers, Use, Sweetpotato, Production, Technologies, Vine yield.

### Introduction

In Nigeria, agriculture is still the main stay of the economy as majority of the rural dwellers are into farming (National Bureau of Statistics (NBS), 2018). (Food and Agricultural Organization (FAO), 2014) posited that Nigeria's agriculture has high potentials for employment generation, food security, poverty reduction and industrialization. The need to produce enough food crops to meet the ever-growing population demands have necessitated research for improve varieties of various crops including sweetpotato.

Sweetpotato (*Ipomoea batata* (L) Lam) is an important tropical staple food crop, belonging to the morning-glory family known as *convululaceae*. It originated from Latin America (Low *et al.*, 2017). It is a root crop mostly grown in many parts of the globe, It is native to tropical America and is commonly called a yam in parts of the United States. Sweetpotato is a major crop that suffered serious neglect in the past but now occupies a global position as a source of food and industrial raw material (Jia, 2013). However, it is the only crop among the root and tuber crops that has a positive per capita annual

rate of increase in production in sub-Saharan Africa (Olagunj *et al.*, 2013). Nigeria is the third largest producer of sweetpotato in the world with China leading, followed by Uganda (FAO, 2015). Sweetpotato is regarded as early maturing crop, has relatively little labour requirement and ability to thrive under Sub-Saharan Africa's climate and it offers a particular significant potential for increasing food production and income in Nigeria like other crops (Udemezue, 2019). Its ease of cultivation and ability to thrive even under harsh conditions promote its spread in Africa. Sweetpotato 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 (Low *et al.*, 2017).

There is dearth of information on the effect of farmers' use of improved sweetpotato production technologies on the yield of vine in South East, Nigeria, to see if there is increase or decrease in the yield of sweetpotato vine as a result of using improved sweetpotato production technologies disseminated to the farmers in the Zone. Hence, the study to assess farmers' use of improved sweetpotato production technologies on vine yield in South–East,

Nigeria. Specific objectives of the study are to describe the socioeconomic characteristics of farmers and ascertain the farmers' level of use of improved sweetpotato production technologies.

H0<sub>1</sub>: Use of improved sweetpotato production technologies has no significant effect on vine yield; and

H0<sub>2</sub>: There is no significant difference between vine yield before and after use of improved sweetpotato production technologies disseminated;

## Methodology

The study was conducted in South-East, Nigeria. Multi-stage sampling technique was used to collect data for the study. Three States, namely Abia, Anambra and Ebonyi States were purposively selected, two agricultural zones were randomly selected from each of the States to give a total of six (6) zones, two (2) blocks were randomly selected from each of the zones to give a total of twelve (12) blocks. Finally, proportionate sampling technique was used to select farmers from the circles to give a sample size of 364 sweetpotato farmers. List of sweetpotato farmers from sweetpotato farmers' association, Abia State, Extension Services Programme office of NRCRI Igbariam outstation, Anambra State and Sweetpotato farmers' association, Ebonyi State served as the sampling frame. Data for this study were collected using structured questionnaire. Data were analyzed using descriptive such as mean while inferential statistics used were Z test and Ordinary Least Square regression model. The models specification for Z test is thus;

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

Where Z = calculated value of difference between means

$\bar{x}$  = Mean yield score of sweetpotato vines in bundle before use of the technologies

$\bar{x}$  = Mean yield score of sweetpotato vines in bundle after use of the technologies

$n_1$  = Sample size of respondents before use of the technologies

$n_2$  = Sample size of respondents after use of the technologies

$\sigma_1^2$  = Standard deviation of respondents before use of the technologies

$\sigma_2^2$  = Standard deviation of respondents after use of the technologies.

Ordinary Least Square regression model is implicitly stated as;

$Y = (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12} + u)$

Where:

Y = Vine yield (Bundle)

X = Improved sweetpotato production technologies (mean)

$X_1$  = Improved sweetpotato varieties (mean)

$X_2$  = Sweetpotato intercropping (mean)

$X_3$  = Land preparation methods (mean)

$X_4$  = Vine cutting (3 and 4 nodes) (mean)

$X_5$  = Plant spacing (30cm x 30cm) (mean)

$X_6$  = Planting time (mean)

$X_7$  = Use of herbicide (mean)

$X_8$  = Weeding (1<sup>st</sup> and 2<sup>nd</sup>) (mean)

$X_9$  = Use of fertilizer (mean)

$X_{10}$  = Earthing-up (mean)

$X_{11}$  = Use of insecticide (Pest control management) (mean)

$X_{12}$  = Proper harvesting time (mean)

U = error term

## Results and Discussion

### Socioeconomic characteristics of the farmers

Table 1 result shows that mean of age was 37.3 years. This implies that a good number of the respondents were in their active age. This finding is in agreement with Ifenkwe and Umeh (2014) who opined that active age of farmers is a positive factor to sustainable food production, poverty alleviation among farmers and improve agricultural extension. The mean years of formal education was 12 years, indicating that greater number of them had secondary education and are considered literate farmers. Finding of this study also is consistent with the work of Kainga *et al.* (2016) who observed that majority of the farmers in South East had one form of formal education or the other. The mean of annual income was ₦579,395.6. This implies that the farmers' income was low. Hamadina (2015) reported that income from farming activities is low, and there is generally poverty amongst small holder farmers. The mean of household size was 6 persons. It is expected that large number of persons in a household will increase the level of sweetpotato cultivation and use of sweetpotato production technologies. Onubuogu *et al.* (2014) reported a similar result that most farm families have large household size of 6-10 persons. The mean of farm size was 0.6ha. This result reveals that the sweetpotato farmers were small holder farmers. The result corroborates that of Abugu *et al.* (2013) who reported that majority of farmers in the South-East Nigeria were small scale farmers, on the average cultivate less than 2 hectares of land. The mean years of farming experience was 10.6 years, indicating that the farmers had enough farming experience in sweetpotato farming. Arimi (2014) opined that higher number of years of experience in farming help farmers in the use of technology.

**Table 1: Distribution of farmers Socioeconomic characteristics**

Variable	Mean
Age	37.3 years
Education level	12years
Annual income	₦579,395.6
Household size	6years
Farm size	0.6ha
Farming experience	10.6 years

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

### Farmers' level of utilization of improved sweetpotato production technologies

Result from Table 1 shows that farmers' level of utilization of improved sweetpotato production technologies on a three-point rating scale had the following means: plant spacing 30 x 30 cm was ( $\bar{x}$  =2.91), 1<sup>st</sup> and 2<sup>nd</sup> weeding regimes was ( $\bar{x}$  =2.90), harvesting time was ( $\bar{x}$  =2.90), time of planting had ( $\bar{x}$  =2.87), improved sweetpotato varieties had ( $\bar{x}$  =2.82), land preparation technology had ( $\bar{x}$  =2.79), earthening-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) had ( $\bar{x}$  =2.05). Grand mean of utilization was 2.61 on a three-point rating scale, indicating high level of utilization of sweetpotato 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 sweetpotato 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 sweetpotato varieties	2.75	2.78	2.93	2.82	High utilization
Sweetpotato 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 regimes (1 <sup>st</sup> and 2 <sup>nd</sup> )	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
<b>Grand mean</b>	<b>2.57</b>	<b>2.59</b>	<b>2.68</b>	<b>2.61</b>	<b>High utilization</b>

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

### Z-test analysis of difference between vine yield before and after use of improved sweetpotato production technologies

Table 3 shows the difference between vine yield before and after use of improved sweetpotato production technologies disseminated. The Z-test statistic in Table 4.13 shows significant difference ( $P < 0.05$ ) in vine yield before and after use of improved sweetpotato production technologies in South-East, Nigeria. From the result, vine mean yield before use of improved sweetpotato production technologies was 78.1823 bundles/ha, while vine mean yield after use of improved sweetpotato production technologies was 123.8804 bundles/ha. There was sweetpotato vine yield difference of 45.70 bundles/ha between vine yield before and after use of

improved sweetpotato production technologies. This finding is in agreement with Agbarevo and Mazza (2018), who reported that increase in farmers' yield as a result of application of better technologies can be used to measure the success of agricultural development programme.

The value of Z-calculated (82.525\*\*) is greater than the value of Z-tabulated (1.67). This implies that improved sweetpotato production technologies increased farmers vine yield. Hence, the Z-test rejects null hypothesis which stated that there is no significant difference between vine yield before and after use of improved sweetpotato production technologies. Use of improved sweetpotato production technologies has significantly increased sweetpotato vine yield.

**Table 3: Z-test analysis of difference between vine yield before and after use of improved sweetpotato production technologies**

Source of Variation	N	Mean (bundle/ha)	Standard Deviation	Standard Error	Difference Bundle/ha	Z-cal	Z-tab
Vine yield before	364	78.1823	26.41433	1.3845	45.70	82.525**	1.67
Vine yield after	364	123.8804	65.18784	3.4168			

Source: Field Survey, 2021 Significant at 5% level. Null H0 Rejected.

#### Regression analysis of effect of farmers' use of improved sweetpotato production technologies on vine yield

Table 4 shows the regression analysis of effect of farmers' use of improved sweetpotato production technologies on vine yield. Among the four functional forms, the linear form was selected as the lead equation because of number of significant variables and fair conformity to *a priori* expectation. The R<sup>2</sup> value of 0.8790 implies that about 87.90% of the variation in utilization of improved sweetpotato production technologies by the respondents was explained by independent variables. F-ratio of 68.274\*\*\* was also highly significant at 1%, indicating goodness of fit.

Variables such as improved sweetpotato varieties, land preparation methods, vine cutting of 3 and 4 nodes, weeding (1<sup>st</sup> and 2<sup>nd</sup>), use of fertilizer, use of insecticide, earthing-up and proper harvesting time were found to have significant effect on vine yield. The result on Table 3 reveals that use of improved sweetpotato varieties was significant and positive at 1% level. This result shows that the higher the use of improved sweetpotato varieties in sweetpotato production, the more increase in the vine yield. The result also, reveals that land preparation methods

were significant at 1% and positive to vine yield. This implies that use of land preparation methods disseminated to the farmers in production of sweetpotato increases the vine yield. The result in Table 4 also shows that weeding (1<sup>st</sup> and 2<sup>nd</sup>) was significant and positive at 1% level. This implies that use of 1<sup>st</sup> and 2<sup>nd</sup> weeding technology increases the vine yield. This will enable the plant to stand alone without any competition with weeds in absorption of soil nutrients. Also, it was revealed that vine cutting of 3 and 4 nodes, use of fertilizer, earthening-up and proper harvesting time were significant and positive at 5% level respectively. These results imply that increase use of vine cutting of 3 and 4 nodes, use of fertilizer, earthening-up of the sweetpotato plant and proper harvesting time, increase the vine yield. The result also, shows that use of insecticide for pest control management was significant at 5% but negative. This implies that the more the use of insecticide for insect control on the sweetpotato plant, the lower the vines yield. This may be attributed to the effect of inappropriate administration of chemical on the leaves of growing sweetpotato plant. Therefore, the null hypothesis was rejected.

**Table 4: Regression analysis of effect of farmers' use of improved sweetpotato production technologies on vine yield**

Technologies	Abia Linear	Anambra Exponential	Ebonyi Linear	South-East Pooled +Linear
<b>Constant</b>	0.000 (5.626)***	0.013 (-2.484)**	0.000 (7.794)***	0.002 (-3.053)***
Improved sweetpotato varieties	0.184 (1.332)	0.000 (9.474)***	0.000 (5.480)***	0.000 (14.248)***
Sweetpotato intercropping	0.027 (2.226)**	0.258 (-1.133)	0.689 (0.400)	0.453 (-0.751)
Land preparation methods	0.100 (1.648)	0.001 (3.490)***	0.006 (2.775)**	0.000 (4.714)***
Vine cutting (3 and 4 nodes)	0.960 (-0.050)	0.007 (2.705)**	0.001 (3.209)***	0.005 (2.808)**
Plant spacing (30cmx30cm)	0.863 (0.173)	0.513 (1.958)	0.303 (-1.186)	0.013 (0.407)
Planting time	0.358 (0.921)	0.317 (0.219)	0.611 (0.461)	0.128 (1.013)
Use of herbicide	0.073 (1.798)*	0.153 (1.432)	0.005 (2.805)**	0.142 (1.471)
Weeding (1 <sup>st</sup> and 2 <sup>nd</sup> )	0.399 (-0.844)	0.414 (0.818)	0.265 (-1.117)	0.000 (6.406)***
Use of fertilizer	0.918	0.444	0.099	.070

	(0.103)	(0.766)	(-1.654)*	(2.785)**
Earthing-up	0.086	0.077	0.941	0.017
	(1.721)*	(1.771)*	(0.074)	(2.395)**
Use of insecticide	0.068	0.061	0.214	-0.004
	(1.830)*	(1.877)*	(-1.246)	(-2.851)**
Proper harvesting time	0.934	0.011	0.006	0.011
	(0.082)	(2.569)**	(2.779)**	(2.549)**
R Adjusted	0.3561	0.6747	0.6930	0.8768
R <sup>2</sup>	0.3583	0.6769	0.6952	0.8790
F-Statistics	19.972***	45.682***	47.355***	68.274***

Source: Field survey, 2021

Note: Figures in parenthesis represent t-ratios; \*\*\* = at 1% and \*\* = at 5% significant levels, + = Lead Equation. Null H0 Rejected.

### Conclusion and Recommendation

From the findings of the study, it was concluded that the improved sweetpotato production technologies disseminated to farmers such as improved sweetpotato varieties, sweetpotato intercropping, land preparation methods, vine cutting (3 and 4 nodes), plant spacing (30cm x 30cm), planting time, use of herbicide, weeding (1<sup>st</sup> and 2<sup>nd</sup>), use of fertilizer, earthing up, use of insecticide and proper harvesting time, were used and the use of improved sweetpotato production technologies had positive effect on the farmers vine yield. Therefore, it is recommended that sweetpotato farmers should use the production technologies disseminated to them to improve their vine production since it was found to increase the vine yield.

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