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DETERMINANTS OF SUSTAINABLE USE OF IMPROVED YAM PRODUCTION PRACTICES AMONG FARMERS IN EBONYI STATE, NIGERIA

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Abstract
The study examined determinants of sustainable use of improved yam production practices among farmers in Ebonyi State, Nigeria. A total of one hundred and twenty farmers were selected across the state using multi-stage sampling procedure. Data collection was achieved by using a well-structured questionnaire and personal interview. Data analysis made use of frequency counts, percentages, mean scores and multiple regression analysis. Results obtained revealed that out of twenty two (22) improved yam production practices disseminated by Ebonyi State Agricultural Development Programme (ADP), fourteen (14) are currently being used by farmers in the area. These include; storage in barns ($\bar{x}$ = 4.6), harvesting in 7 – 12 months($\bar{x}$ = 4.5), staking ($\bar{x}$ = 4.4), use of NPK 12:12:17 ($\bar{x}$ = 4.2), yam-cassava relay intercrop ($\bar{x}$ = 4.0), weeding ($\bar{x}$ = 4.0), yam-melon intercrop ($\bar{x}$ = 3.5), band placement of fertilizer ($\bar{x}$ = 3.5), among others. Results of the multiple regression analysis revealed that income level, age of respondents, cost of yam production, socio-cultural acceptability, economic viability, farming experience, level of education, extension contact and awareness of farmers were all important and significant variables affecting sustainable use of improved yam production practices in the study area. Given the enormous potentials and importance of yam in the area, it has become imperative that youths be encouraged to participate effectively in yam production, because majority of farmers in the area are aged and retiring from active production practices. This will ensure food security. Also relevant inputs like fertilizers, herbicides and planting materials should be subsidized by government. This will help reduce the cost of production of the crop.

Keywords: Awareness, Extent of Use, Regression, and Yam

Introduction

Yam is the common name for some plant species in the genus Dioscorea (family Dioscoreaceae) that form edible tubers. Yams are perennial herbaceous vines cultivated for the consumption of their starchy tubers in Asia, Africa, Central and South America and Oceannia. The tubers are also called "yams" (Akoroda, 2009; Ironkwe, 2011 and Encyclopedia, 2009). There are many different cultivars of yams, though the popular ones are *D. rotundata*, *D. cayenensis*, *D. Bulbifera, D. esculenta, D. dumentorum* (FAO, 2014), Yams are primary agricultural and culturally important commodity in West Africa, where over 95% of the world's yam corp is harvested. It is the main staple crop of the Igbos in South-East Nigeria, where for centuries it has played and is still playing a dominant role in both their agricultural and cultural life (Asumugha and Ekwe, 2011). Priority is given to the crop over other crops in land allocation. It is celebrated with annual yam festivals. The new yam festival celebrates the main agricultural crop of the Igbos, Idomas and Tivs (Ironkwe *et al*., 2008 and Ironkwe, 2012).

Yam is an attractive crop among poor farmers with limited resources, available all year round, unlike other unreliable crops. These characteristics make yam a preferred food and culturally important food security crop in some sub-saharan African countries, though over the years, yam has undergone series of dramatic changes in terms of production (Izekor and Olumese, 2010). Yams are extremely important to subsistence farmers in Africa, and to the African economy as a whole. Small-scale farmers are responsible for about 90% of Africa's total agricultural production, and agriculture accounts for between 30 – 40% of Arica's gross domestic product (IFFRI, 2009). In 2019, world production of yams was 74.32 million tones, led by Nigeria with 67.34%. Total farm size devoted to yam production in Nigeria was 6.24 million hectares, which is 70.03% of worlds farm size area of 7.43 million hectares (FAO, 2019).

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Sustained agricultural production in most sub-saharan countries is under threat due to declining soil fertility and loss of top soil through erosion, chemical deterioration such as nutrient depletion, physical degradation such as compaction and biological deterioration of natural resources including the reduction of soil biodiversity (Saidou *et al*., 2004; Lal, 2001; Hellin, 2003 and Sanchez, 2002). Yam production within the region is as threatened as other crops due largely to the aforementioned factors. One of the greatest challenges facing Nigeria is the need to sustain the production and supply of major staples like yam, cassava, potato and cocoyam (Akoroda, 2011). Nigeria is a nation with acute hunger (food insecurity) and food security is regarded as an important aspect of any consideration of sustainability of the nation's wealth (Nwaihu *et al*., 2013). It is however expected that sustainable use of improved yam production practices among farmers in production belts will go a long way towards ameliorating the incidence of food insecurity.

Several studies have enumerated different factors that affect yam production in Nigeria and elsewhere. These include but are not limited to Zaknayiba and Tanko (2013), Maikasuwa and Ala (2013) and Donye (2012). However, there appears to be inadequate attention in the area of sustainability of improved yam production practices, hence the need for this study.

Methodology

The study was conducted in Ebonyi State, Nigeria. Ebonyi State is one of the thirty six (36) States in Nigeria and located in the South-East geographical zone with its capital at Abakaliki. Predominantly, agriculture is the source of livelihood of Ebonyians with majority of the population residing in the rural areas. The State is blessed with good arable land for growing food crops like yam cocoyam, cassava, vegetables, maize, groundnut, rice, potatoes, plantain and rearing livestock (such as local cattle, goat, sheep, poultry), while fishing activities are prominent in riverine areas of the state. Yam production is prominent among farmers in the State. A Multi-stage sampling procedure was used for the study. Two out of the three agricultural zones in the State were randomly selected in the first stage. In the second stage, three extension blocks were randomly selected from each of the two agricultural zones giving a total of six extension blocks. In the third stage, two cells or circles were randomly selected from each of the six selected blocks, giving a total of twelve cells. The fourth stage involved random selection of ten farm families (heads of farm households) from each of the twelves cells. This gave a total of one hundred and twenty (120) respondents which constituted the sample size of the study. Data collection was achieved by using a well structured questionnaire which was validated for the purpose. The data were analysed using mean score on a five point rating scale. A mid point was obtained thus:

$$\frac{5+4+3+2+1}{15} = 3.0 \text{ …….. (1)}$$

However for purpose of decision making, an upper limit was established; the upper limit was 3 + 0.05 = 3.05. The implication is that any mean score response > 3.05 (the upper limit) was adjudged to be high in terms of sustainable use of the improved yam production practices in the study area, where as any response below the bench mark of 3.0 was adjudged as low. Multiple regressed analysis was used to determine the relationship between sustainability of improved yam production practices and farmers selected socio-economic characteristics. The regression model is implicitly expressed thus:

$$Y_i = (X_1, X_2, X_3, X_4, X_5 \ldots\ldots X_i) + e_i \text{ ….. (2)}$$

Where

$$Y = \frac{N}{T} x \frac{100}{1} \text{ (Adapted from Nwaiwu } et\ al.\text{, 2013)}$$

Y = Perceived sustainability index of improved yam practices (1-5)

N = Number of improved yam production practices utilized by farmers

T = Total number of improved yam production practices available for farmers

X_1 = Income generated from yam (Naira).

X_2 = Household size (number of people living and eating together)

X_3 = Age (years)

X_4 = Cost by production (Naira)

X_5 = Socio-culturally affordable (mean score)

X_6 = Economically affordable (mean score)

X_7 = Farm size (ha)

X_8 = Farming experience (years)

X_9 = Educational level (years spent in school)

X_{10} = Extention services/contact (dummy variable: yes = 1 or no = 0)

X_{11} = Awareness (dummy variable: yes = 1 or no = 0)

e_i = error term

Results and Discussion

Distribution of Rural Farmers Awareness of Improved Yam Production Practices in the Study Area

Results in Table 1 show that out of twenty two (22) improved yam production practices disseminated by Ebonyi State Agricultural Development Programme (EBADEP) to rural farmers in the study area, majority (99.2%) of the respondents were aware of weeding. Majority 116 (96.7%) of the respondents- were aware of storage in barns, use of NPK 12:12:17 and harvesting in 7 – 12 months (95.0% each), yam - cassava relay inter-cropping (93.3%), staking (90.8%), Yam- Vegetables intercropping (89.2%), and Yam – Maize – Melon intercropping (86.7%).

Table 1: Percentage Distribution of Rural Farmers Awareness of Improved Yam Production Practices in the Study Area (n = 120)

Practices (variables)	Yes	Percentage	No	Percentage
Mechanical clearing and cultivation	87	72.5	33	27.5
Intensive tillage	86	71.7	34	28.3
Treatment of seeds/setts	63	52.5	57	47.5
Lime Application on Acidic soil	64	53.3	56	46.7
Weeding	119	99.2	01	0.8
Use of NPK 12:12:17	114	95.0	06	5.0
Intensive Ridge making and planting	89	74.2	31	25.8
1m x 30cm spacing (minisett)	65	54.2	55	45.5
1m x 1m spacing (ware yam)	69	57.5	51	42.5
Minisett sole cropping	83	69.2	37	30.8
Ware Yam Sole Cropping	71	59.2	49	40.8
Yam-Maize intercropping	95	79.2	25	20.8
Yam-melon intercrop	102	85.0	18	15.0
Yam-Maize-Melon intercrop	104	86.7	16	13.3
Yam-Cassava relay Intercrop	112	93.3	08	6.7
Yam-cowpea-maize intercrop	98	81.7	22	18.3
Yam-Vegetables intercrop	107	89.3	13	10.8
Band placement of fertilizer	98	81.7	22	18.3
Staking	109	90.8	11	9.2
Harvesting in 7-12 months	114	95.0	06	5.0
Storage in barns	116	96.7	04	3.3
Storage in cold or ventilated room	62	51.7	58	48.3

Source: Field survey, 2018

Others were; yam – melon intercrop (85.0%), yam-cowpea-maize intercrop and band placement of fertilizers (81.7% each), yam-maize intercrop (79.2%), intensive ridge making and planting (74.2%), mechanical clearing and cultivation (72.5%) and intensive tillage (71.7%).

Distribution of farmer's extent of use of improved yam production practices in the study area

The extent of use of improved yam production practices among the rural farmers in the study area was very high and satisfactory. Results are in agreement with Akinbile *et al*. (2014) who noted that awareness of innovations give high probability of their extent of use, thereby improving users' standard of living. Results in Table 2 revealed that out of twenty two (22) improved yam production practices disseminated to the farmers, fourteen (14) were used on sustainable basis. These include; storage in barns (x = 4.6), harvesting in 7-12 months (x = 4.5), staking (x = 4.4), use of NPK 12:12:17 (x = 4.2), yam-cassava relay intercropping (x = 4.1), yam-vegetable intercropping (x = 4.0), weeding (x = 4.0), band placement of fertilizer (x = 3.5), yam-cowpea-maize intercropping (x = 3.5),yam-melon intercropping (x = 3.5), yam-maize-melon intercropping (x = 3.4), yam-maize intercropping (x = 3.4), intensive ridge making (x = 3.2), and intensive tillage (x = 3.2). The implication is that sustainable use of these improved yam production practices is hinged on the desirable qualities of the improve technologies. The desirable qualities of the improved technologies include; economic viability, affordability, environmental friendliness, socio-cultural acceptability and managerial/ agronomic adaptability, among others. Therefore, sustainable use of improved yam production practices enhance and promote income generation and food security.

Table 2: Mean score distribution of Extent of use of improved yam production practices

Variables	1	2	3	4	5	¯	Remarks
Mechanized clearing/cultivation	53	24	24	14	5	2.1	Not used
Intensive tillage	31	15	17	18	39	3.2	Used
Treatment of seed/setts	68	05	16	18	13	2.3	Not used
Lime application on acidic soils	49	33	25	10	03	2.0	Not used
Weeding	02	04	19	59	36	4.0	Used
Use of NFK 12:12:17	02	06	06	60	46	4.2	Used
Intensive ridge making/planting	19	16	31	31	23	3.2	Used
1m x 30cm spacing (Minisett)	43	29	22	19	07	2.3	Not used
1m x 1m spacing (ware yam)	39	35	21	17	08	2.3	Not used
Minisett sole cropping	38	26	28	24	04	2.4	Not used
Wave yam sole cropping	39	19	28	28	06	2.5	Not used
Yam maize inter-cropping	07	09	41	55	08	3.4	Used
Yam-Melon inter-cropping	10	07	26	64	13	3.5	Used
Yam-Maize – Melon intercrop	13	10	35	44	18	3.4	Used
Yam-Cowpea-Maize intercrop	01	06	19	45	49	4.1	Used
Yam cassava relay intercrop	09	10	37	46	18	3.5	Used
Yam – vegetable intercrop	02	07	13	60	38	4.0	Used
Band placement of fertilizer	14	12	22	47	25	3.5	Used
Staking	02	02	09	38	69	4.4	Used
Harvesting in 7-12 months	-	-	10	43	67	4.5	Used
Storage in Barns	-	-	06	33	81	4.6	Used
Storage in cold/ventilated room	34	13	31	21	21	2.9	Not used

Source = Field survey, 2018
Note: $x < 3$ represents "Not used"
$x > 3$ represents "Used"
1 = Never used; 2 = rarely used, 3 = sometimes used, 4 = often used and 5 = always used

Determinants of Sustainable use of improved yam production practices in the study area

Results of the multiple regression analysis for sustainable use of improved yam production practices are summarized in Table 3

Table 3: Multiple regression Analysis Showing Determinants of sustainable use of improved Yam Production Practices in Ebonyi State

Variable	Linear +	Exponential	Double log	Semi-log
Constant	58.834	4.079	3.469	15.413
	(9.665)***	(38.245)***	(5.726)***	(4.465)***
Income level	4.03E-04	2.43E-09	-0.341	-2.730
	(4.043)***	(3.015)***	(-2.921)***	(-2.206)***
Household size	-0.094	-0.002	0.127	1.954
	(1.363)	(-0.367)	(1.895)*	(2.161)**
Age of respondents	-1.078	-0.002	-0.034	-2.867
	(-2.472)**	(-0.892)	(0.423)	(-2.193)**
Loss of Yam Production	-8.52E – 05	1.30E – 06	0.140	8.932
	(-2.469)**	(2.141)**	(3.218)**	(3.687)***
Socio-cultural Acceptability	1.272	0.016	-0.136	-1.069
	(3.766)***	(2.547)**	(-0.408)	(-2.214)**
Economic viability	1.460	-0.004	-0.105	-0.655
	(3.546)***	(-3.251)***	(-2.145)**	(-2.325)**
Farm Size	0.257	0.032	0.069	2.408
	(1.447)	(1.038)	(1.970)*	(1.223)
Farming Experience	1.052	1.301	-0.049	-2.446
	(2.403)**	2.275)**	(-1.586)	(-1.424)
Level of Education	1.251	0.004	0.084	5.891
	(2.364)**	(1.791)*	(2.420)**	(3.042)***
Extension contact	3.018	0.002	-0.015	2.344
	(3.503)***	0.055)	(-0.43)	(1.237)
Awareness	22.689	0.334	0.363	24.06
	(12.531)***	(10.523)***	(10.144)***	(12.040)***
R-squared	0.880	0.790	0.799	0.825
Adjusted R-squared	0.847	0.748	0.741	0.793
F – statistic	132.846 ***	94.116 ***	91.240***	122.511***

Source: Field survey, 2018
***** Significant at 1%, ** significant at 5%, * significant at 10%**
Values in parenthesis are t-ratios. + = lead equation

The linear functional form was chosen as the lead equation because its (R^2) value was the highest at 0.880, indicating that 88.0% observed variations in the use of improved yam production practices are explained by the variables included in the model. Nine of the explanatory variables were significant at 1% or 5% level. The regression analysis showed that the coefficient of income level of the farmers had strong positive relationship with sustained used of improved yam production practices in the study area. This implies that as the income level of the farmers increased, their use of improved yam production practices gets sustained or equally increases. Furthermore, the result showed that socio-cultural acceptability economic viability of yam had positive relationship with sustainable use of improved yam production practices at 1% level each. This implies that as the socio-cultural acceptability of yam increased, there is a commensurate increase in sustained use of improved yam production practices. In like manner, as the economic viability of the crop increased, so do use of improved yam production practices or gets sustained. Farming experience was also positively related to sustainable use of improved yam production practices, indicating a strong implication for increase in yam production. As the years of farming experience increases, production also increased. The number of years spent in production gives an indication of the practical knowledge acquired (Nwaru, 1993, Ekwe *et al*., 2010).

Level of education of the farmers had a positive and significant relationship with sustainable use of improved yam production practices at 5% level. This is so because the more educated the farmer becomes, the more ability he gains in understanding and applying improved technological innovations that move his farming enterprise forward. Onwuka *et al*. (2010) and Ekwe *et al*. (2010) are in agreement that educational status informs the type of job and standard of living one has, and this impacted directly on sustained use of improved yam production practices. The result further revealed that extension contact and farmers' awareness of the improved yam production practices had positive and significant relationship with sustainable use of the improved production practices at 1% level each. The implication is that the more contact the farmers had with extension personnel, the more favourably disposed they are towards adopting the improved practices. In like manner, the more the farmers are aware of the improved yam production practices and their potentials, the more they adopt those improved technologies. Age of the farmers and cost of yam production showed strong negative relationships with sustainable use of improved yam production practices at 5% level each. This implies that both age and cost of production greatly influenced the total output of the farmer and must be taken into consideration for yam production in the study area. The implication is that as the farmers age increased, their sustained use of the improved production practices decreased. This makes it imperative for much younger and innovative men and women to take over the farming enterprise from the old and aging farmers. On the other hand, as the cost of yam production increases, sustained use of improved production practices decreases. The need for subsidizing relevant inputs needed for yam production to be subsidized as a means of reducing the cost of production of the crop. The F-ratio was statistically significant showing that the variables used for analyses were good.

Conclusion

Ebonyi State is prominent in yam production. Farmers' level of awareness of the improved yam production practices disseminated to them had very positive and significant relationship with their sustainable use of those improved technologies. In addition to the high level of awareness of the farmers on the improved yam production practices, the important determinants of sustainable use of improved production practices include; farmers' level of income, socio-cultural acceptability of the crop, economic viability of the crop, farming experience, farmers' level of education, and extension contact. Given the enormous potentials of yam production in the study area, it has become imperative that youths be encouraged to participate effectively in yam production because majority of the farmers are becoming aged and retiring from active farming. This will ensure food security. Also relevant farm inputs like fertilizers, herbicides and planting materials should be subsidized by government. This will help reduce the cost of production of the crop. There is also need for policies on free and affordable education to enable farmers access and process information on sustainable use of improved production practices.

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