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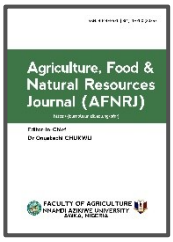

Original Article

Adoption of improved sweet potato (*Ipomoea batatas* (L.) Lam) production technologies among small-scale farmers in Vandeikya, Benue State, Nigeria

OPEN ACCESS

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ABSTRACT

Technology adoption depends on its compatibility with existing values, complexity, observability of benefits, divisibility into adoptable units, and relative advantage over current practices. This study assessed the adoption of improved Ipomoea batatas production technologies by farmers in Vandeikya Local Government Area of Benue State, Nigeria. A multistage sampling procedure (in conjunction with purposive and random sampling techniques) was used in selecting 584 respondents for this study. Data were collected using a structured questionnaire and analyzed using descriptive and inferential statistics. Results revealed that most respondents, 25.9% had access to improved species, 25.0% had access to improved pre-planting facilities, and 52.6% relied on manual labour. 55.0% had no access to fertilizer and manure inputs. The majority of respondents, 74.7% spotted low yield from the local Ipomoea batatas seedlings, while 15.9% indicated using improved sweet potato production technologies. However, factors such as scarcity of inputs, high cost of fertilizer and labour, scarcity of planting materials, among others, militated against the adoption of the technologies. It is recommended that Ipomoea batatas farmers seek help in the phase of difficulties during sweet potato cultivation, where they lack awareness. This involves approaching active resources such as extension agents, credit facilitators, and other technicians who have the requisite knowledge to help resolve challenges in the pre-planting, planting, post-planting, as well as harvest and post-harvesting phases of Ipomoea batatas cultivation.

KEYWORDS: *Carbohydrates, Protein, Proximate, Vetellaria paradoxa, Ziziphus mauritiana*

INTRODUCTION

Sweet potato can be regarded as a poverty alleviation crop as a result of its high yield and economic returns (FAO,2017). It is the only root and tuber crop that can be grown and harvested within four months. Specifically, it can be grown two to three times within a year. However, domestic production of sweet potato is below the demand in Nigeria, and rising per capita income is now complemented with huge imports. (Abed *et al.*, 2024). Disseminating improved varieties and other modern inputs to sweet potato farmers is very important to reduce the rate of sweet potato importation in Nigeria.

In Nigeria, numerous research studies have been conducted regarding the process of the transfer of improved varieties accompanied by other management practices that will produce higher yields in order to boost food security (FAO, 2017). Despite all these efforts, research findings still indicate that rural farmers in most cases find it difficult to access improved sweet potato production technologies that are suitable for their local conditions. Moreso, limited knowledge of these new

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technologies, as well as a lack of skills in crop production among farmers, reduces crop productivity. Most reasonable proportions of farmers are aware of the improved production technologies but do not adopt them due to some factors such as inadequate information on improved production technologies, lack of education, lack of access to credit etc; however, most peasants are uneducated and ageing, the introduction of sustainable credit into agriculture will attract the youth and the educated, but in study area, the population of the youths in the rural area has been greatly lessened by rural urban migration, as most youth want to obtain white collar jobs and are not interested in farming, this corroborated (Nwajiuba, 2012; Saliu et al., 2016). Furthermore, Lawal & Shittu (2006) posited that lack of access to credit causes setbacks to the productivity of farmers as a result of the fact that these farmers do not have resources to procure improved seedlings, chemicals, and hired labor, as well as transport and market their produce, which would have improved their productivity. However, adoption of improved sweet potato production technologies should lead to a significant increase in yield production. (Dibra, 2015). The adoption of any technologies depends on their characteristics: compatibility with the existing values, culture, and norms, complexity of the innovation, observability of the edges the new innovation has over the old practice, the degree to which it can be broken into adoptable units, and its relative advantage over other existing practices. Findings from (Bello *et al*., 2020) indicated that adoption of improved varieties helped raise farmers' area harvested and yield per hectare, respectively, by 0.39 ha and 217.9 kg/ha for NERICA and 0.51 ha and 210.4 kg/ha for other improved varieties, thereby increasing their productivity.

This study assesses the adoption rate of improved *Ipomoea batatas* production technologies and factors influencing the adoption of these technologies among small-scale farmers in Vandeikya Local Government Area of Benue State.

METHODOLOGY

Vandeikya Local Government Area was carved out of Gboko LGC in 1976, in sequence to the National local government reform of 1976. The name Vandeikya derives from a popular rock in the area. Vandeikya is located between longitude 80 301 to 90 001East and latitude 6030-7000North. It has a land mass of 183,939 square meters (0.7 Square miles) with a population of about 361,600 as at 2021 estimates (NPC, 2021) The climate is tropical sub humid with the mean annual rainfall of between 1,200 and 2,000 mm (47 and 79) averaging seven months in the year, while the mean annual temperature is 32.5 °C (90 °F). The wet season is from April to October or November, while the dry season is from November to March. The area is predominantly rural with agriculture (farming) as the major means of livelihood. The crops grown include *Ipomoea batatas*, cassava, Sorghum, and vegetables.

Population of the study

The total population of the Vandeikya local government is projected to be 361, 600, (NPC, 2021); therefore, the study covered the entire population in the area since the people are farmers and the majority are engaged in sweetpotato farming.

Sampling Technique and Sample Size

The sample size for this study was 600. Hence, there was a dearth of a comprehensive list of sweetpotato farmers in the Vandeikya local government area; Cochran's (1963) sample size determinant was deployed. (Cochran, 1963) draws on a 95% level of significance (±5% confidence interval), presence of sweetpotato farmers was estimated at 50% (.5) with a marginal error of .04 (4 percentage points).

Cochran's (1963) formula derives as follows:

$$n = \frac{[Z/_2]^2 (p\ q)}{e^2} \qquad n = \frac{[Z/_2]^2 (p)(1-p)}{e^2}$$

Where: n= sample size, Z^2 =confidence level, p= rate of occurrence or prevalence (the estimated proportion of an attribute that is present in a population), q=complement of p, and e= margin of error. Therefore;

$$n = \frac{[1.96]^2\ 0.5\ (1-0.5)}{0.04^2} \qquad n = \frac{3.8416\ (0.25)}{0.0016} \qquad n = 600.25 = 600$$

Sampling Procedures

A multi-stage sampling technique was employed. In the first stage, the twelve administrative council wards in the study area were clustered into two areas, namely the Tiev and Kyan clusters. Tiev comprises six council wards, including: Mbayongo, Mbakaange, Nyamangbagh, Ningev, Mbatyough, and Vandeikya Township. While Kyan also had six council wards comprising: Mbagbam, Mbadede, Mbagbera, Mbajor, Tsambe, and Mbakyaha. In the second stage, two council wards were randomly selected from each clustered area to make a total of four council wards. These include Mbadede and Mbagbera from the Kyan cluster and Mbatyough and Mbakaange from the Tiev cluster. The third stage involved random selection of *Ipomoea batatas* farmers drawn by 5% proportionate to size in each of the four villages, making a total of 600 respondents**.**

Data Collection Methods and Sources

This study employed a mixed-methods strategy approach, which involved the combination of both quantitative (closed-ended) and qualitative (open-ended) approaches in response to the research objectives (Creswell & Hirose, 2019).

Primary data were collected through questionnaires and In-depth interviews as the survey instruments. Data were analyzed using triangulation, indicating that both qualitative and

quantitative techniques were used. Such as mean score, distribution table, and simple percentage.

RESULTS AND DISCUSSION

The Rate of Adoption of Improved Sweet potato Production Technologies by Farmers in Vandeikya LGA

The rate of adoption of improved *Ipomoea batatas* production technologies was categorized into three phases, including pre-planting, Planting, post-planting, and harvesting/storage. Table 1 presents data on the rate/percentage of adoption of improved facilities for *Ipomoea batatas* (SWP) farming. 12.7% of respondents had access to financial loans for SWP farming. (Onyeneke, 2017) Posited that lack of access to credit causes setbacks to the productivity of farmers as a result of the fact that these farmers do not have resources to procure improved seedlings, chemicals, and hired labour, as well as transport and market their produce, which would have improved their productivity. Also, 19.9% had access to current information and tips on engaging in SWP farming. 13.2% had access to *Ipomoea batatas* pre-planting, planting, as well as post-planting (harvest and storage) training exercises. 5.0% had access to *Ipomoea batatas* cultivation technologies, both foreign and local techniques. Finally, 25.9% had access to improved species of *Ipomoea batatas* seedlings as well as recent initiatives and techniques of controlling losses. This data revealed that the majority of respondents had access to improved facilities for *Ipomoea batatas* production in Vandeikya LGA. It also revealed a clear disparity in access to such facilities that are required for improved *Ipomoea batatas* farming in the local government area.

Table 1: Adoption of pre-planting improved SWP production technologies

Pre-planting improved SWP technical facilities	Frequency=584	Percent %
Access to financial loans and other inputs for SWP farming	74	12.7
Access to current information and innovative tips for engaging in SWP farming	116	19.9
Access to SWP pre-planting/planting, harvest, and storage training exercises	77	13.2
Access to SWP cultivation, both foreign and local technologies and techniques	29	5.0
Access to improved species of SWP seedlings, as well as recent initiatives and techniques for controlling losses	151	25.9

Field Survey, 2023

Table 2 presents data on the rate of adoption of planting and post-planting of improved *Ipomoea batatas* technologies. Considering the nature of mounds, *Ipomoea batatas* farmers preferred; the majority, 50.3% had a preference for heap mounds, which were used to plant *Ipomoea batatas*. Also, the majority of respondents, 52.6% relied on menial labour on their *Ipomoea batatas* farms. Findings also showed that more than half, 52.6% of SWP farmers, relied on manual labour for planting and post-planting exercises. Moreover, 55.0% of *Ipomoea batatas* farmers had no access to fertilizer and manure inputs. However, 59.1% controlled pests with various chemical applications. While 51.5% used chemicals to control weeds. Overall, planting and post-planting activities for most 67.5% SWP farmers were carried out using one form of mechanism or another in Vandeikya LGA. This is in line with (Obulamah *et al*., 2023) that land preparation can be manual or mechanized. This data suggests that the majority of respondents adopted certain improved technological facilities for input application in the post-planting phase of *Ipomoea batatas* production; they largely required menial labour on their sweet potato farms in Vandeikya LGA.

Table 3 presents data on the rate of adoption of harvest and post-harvest improved *Ipomoea batatas* production technologies in Vandeikya LGA. The majority of *Ipomoea batatas* farmers, 43.8% preferred the sequential harvesting technique; however, the majority, 33.4% opted for manual *Ipomoea batatas* harvesting. Most *Ipomoea batatas* farmers 61.1% refuted interests in sorting their harvest produce. The majority, 39.9% transported harvested *Ipomoea batatas* tubers via motorcycles rather than tricycles. Considering the preparation of harvested *sweetpotato* produce for storage, the majority, 47.3% of *Ipomoea batatas* farmers applied it as a growth stopper and a humid catalyzer to prevent decay and sprouting. This solution was utilised over other growth stoppers available. While the silo and heap storage were preferred amongst 50.3% *of Ipomoea batatas* farmers in Vandeikya LGA.

Factors Influencing the Adoption of Improved *Ipomoea batatas* Production Technologies in Vandeikya LGA

Table 4: Majority of respondents 74.7% spotted low yield from the local *Ipomoea batatas* seedlings as one of the major factors that could prompt their adoption of improved *Ipomoea batatas* technologies. Also, 63.3% spotted increased yield and value of improved SWP in the local market as a factor to adopt improved *Ipomoea batatas* technologies. This implies that as improved *Ipomoea batatas* technologies brought higher yields and an increased value for its quality, more and more *Ipomoea batatas* farmers were convinced to adopt improved technologies. Moreover, the majority, 57.1% agreed that the allocation of conducive and easily accessible farmland for cultivation was another motivating factor to adopt improved *Ipomoea batatas* technologies. This implies that as more fertile farm lands were accessible, there was a need to adopt improved *Ipomoea batatas* technologies for optimal production. Furthermore, 51.4% indicated availability of extension services as the precondition to adopting improved *Ipomoea batatas* production technologies. This is in line with (Okeke et al., 2020; Egwonwu

et al., 2020) who stated that Agricultural extension services can assist in transferring important knowledge and information that can assist in increasing farmers' productivity, income, and access to the market. However, 43.8% respondents spotted the ineffectiveness of some home-based traditional *Ipomoea batatas* production techniques, prompting the adoption of improved *Ipomoea batatas* technologies. While 43.6% indicated accessibility to improved fertilizer inputs (inorganic and organic) as a major reason why they adopted improved *Ipomoea batatas* technologies. Their access to both chemical and non-chemical-based fertilizers and preservatives to boost *Ipomoea batatas* farm yields encouraged their adoption of improved *Ipomoea batatas* technologies. Moreover, 23.3% highlighted high demand for improved *Ipomoea batatas* consumption in their locality as a major factor influencing their adoption. Of course, with an increased demand for higher quality *Ipomoea batatas*, farmers would likely adopt technologies that improve their productivity. 15.9% indicated the ease of using improved *Ipomoea batatas* production technologies and techniques as a major factor influencing their adoption. Finally, 9.1% indicated access to loans, which enhance the affordability of improved *Ipomoea batatas* technologies, was a main driving force of adopting improved *Ipomoea batatas* production technologies. Lack of access to credit has been implicated in previous studies as a hindrance to adoption. Access to credit has been reported to stimulate technology adoption. It is believed that access to credit promotes the adoption of risky technologies through relaxation of the liquidity constraint as well as through the boosting of households' risk-bearing ability (Simtowe & Zeller, 2013). When credit is lacking, adoption becomes difficult.

Table 2: Adoption of planting and post-planting improved SWP technologies

Planting & post planting technologies	Measurements	Frequency	Percent %
What mound do you use for planting your SWP?	None	43	7.4
	Ridges	247	42.3
	Heaps	294	50.3
	Total	584	100
What kind of labour do you use on your SWP farm?	Mechanical	255	43.7
	Manual	307	52.6
	Technological	22	3.8
	Total	584	100
What type of farm input do you apply to your SWP farm?	None	316	55.0
	Manure	88	15.3
	Fertilizer	100	17.4
	Mixed	71	12.3
	Total	575	100
How do you control pests?	None	35	6.0
	Chemical applications	345	59.1
	Manual picking	204	34.9
	Total	584	100
How do you control weeds in your SWP farm?	Chemical method	301	51.5
	Manual methods	283	48.5
	Total	584	100
What method do you use for SWP farming exercises?	Mechanized methods	394	67.5
	Non-mechanical methods	190	32.5
	Total	584	100

Field Survey, 2023

Table 3: Adoption of harvest/postharvest improved SWP production technologies

harvest/postharvest improved technologies		Frequency	Percent %
Which style of harvesting technologies do you use on your SWP farm?	Manual Harvesting	195	33.4
	Mechanical Harvesting	133	22.8
	Sequential Harvesting	256	43.8
	Total	584	100
How do you sort harvested SWP tubers?	I don't sort my products	357	61.1
	Manually by sight and hand	169	28.9
	By machine (scales)	58	9.9
	Total	584	100
How do you transport harvested SWP	Wheelbarrows and charts	140	24.0
	Motor and Tricycles	233	39.9
	Conventional Vehicles	211	36.1
	Special harvester trucks	0	0.0
	Total	584	100
Which preservative do you prefer for your SWP product?	Ashes	77	13.5%
	Sand	269	47.3%
	Saw Dust	190	33.4%
	Refine Dust	33	5.8%
	Total	569	100.0%
Which storage type do you have access to for your SWP?	Pit Storage	136	24.0%
	Clamp/Evaporative Storage	52	9.2%
	Silo/Heap storage	285	50.3%
	Indoor storage	94	16.6%
	Total	567	100.0%

Field Survey, 2023

Table 4: Factors influencing the adoption of improved SWP production technologies in Vandeikya LGA

Factors influencing the adoption of improved SWP technologies in Vandeikya LGA	Frequency N = 584	Percent %
Low yield of local SWP seedlings/vines	433	74.7
Ineffectiveness of some home-based traditional SWP production techniques	254	43.8
Allocation of conducive and easily accessible farmland for SWP cultivation	331	57.1
Access to improved fertilizer inputs (inorganic and organic) and other chemical and non-chemical preservatives	253	43.6
Access to loans that enhance the affordability of improved SWP technologies	53	9.1
High demand for improved SWP consumption in my locality	135	23.3
Ease of use of improved SWP technologies/facilities	92	15.9
Increased yield and value of improved SWP in the local market for SWP farmers	367	63.3
Availability of extension services for improved SWP technologies	298	51.4

Field Survey, 2023

CONCLUSIONS AND RECOMMENDATIONS

The inability of the farmers to adopt most of the technologies could be attributed to several factors. In some cases, the characteristics of the technology play a significant role. It could be argued that farmers who perceive the technology as consistent with their needs and compatible with their environment are likely to adopt it since they find it a positive investment. Farmers' perception of the performance of the technologies significantly influences their decision to adopt them. Therefore, for ease of adoption of any new technology to be introduced to farmers, they should be involved in its evaluation to find its suitability to their circumstances.

In light of these study findings, the following conclusions were drawn. The inconsistencies in the adoption of some of the improved *Ipomoea batatas* technologies by farmers in Vandeikya LGA were due to their unaffordability,

inaccessibility, and inadequate information on sweet potato production technologies. Thus, the rate of adoption of improved *Ipomoea batatas* production technologies by Farmers in Vandeikya LGA is low, which was determined by the inconsistency of farmers. Based on the findings of the study, it is recommended that non-governmental organizations, Private sector actors, and relevant agencies should collaborate with the Benue State Agricultural Development Authority (BNARDA) by organizing more specialized training to address the gap in knowledge amongst the farmers in the study area. This would enable the farmers to improve their skills and obtain optimum information regarding the adoption of these technologies. In addition, government and non-governmental organizations should gear efforts to link *Ipomoea batatas* farmers to credible financial institutions that enable them to access loans. With the provision of such loans, local SWP farmers could afford most of the improved SWP technologies that were made available to them.

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