Awareness of Value-added Innovations and Post-harvest Losses of Sweet Potatoes In Vandeikya Local Government Area of Benue State-nigeria

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Abstract
Sweet potato is a vital crop for food security and economic development but high post-harvest losses hinder its potential. This study, conducted in Vandeikya Local Government Area, Benue State, Nigeria, investigated how farmers' awareness of value-added innovations could reduce these losses. Data for the study was sourced from 384 respondents using interview and focused group methods and were analyzed both quantitatively and qualitatively. The diffusion of Innovation theory formed the theoretical base of the study. Major findings of the study revealed that majority of the farmers (68.1%) were not aware of the post – harvest value-added innovations available in the sweet potatoes value chain. Furthermore, farmers' awareness level of the post – harvest value-added innovations available in the sweet potatoes value chain was found in the study to be at 31.9 percent. The chi – square test of significance indicated a significant relationship ($x^2 = 154.04$, $p < .05$) between farmers' awareness of value-added innovations of sweet potatoes and reduction in post-harvest losses of sweet potatoes. The Phi coefficient of 0.633, further suggests a strong association between farmers' awareness of value-added innovations and reduction in post-harvest losses of sweet potatoes in the study area. The study concludes that farmers' lack of awareness of the value – added innovations of sweet potatoes is the primary cause of post-harvest losses of the crop in the study area. The study recommends implementing targeted awareness campaigns and effective training programs to enhance farmers' knowledge and adoption of these innovations. Such initiatives are key to boosting their revenues and improving the sweet potato value chain in the region.

Keywords: **Farmers, Awareness, Value-added Innovations, Post-harvest Losses, Sweet-potatoes.**

Introduction

Sweet potato (*Ipomoea batatas*) is a root and tuber vegetable starchy, sweet-tasting crop that is grown and consumed globally. Shahbandeh (2023), observes that in 2021, the global production of sweet potatoes amounted to approximately 88.9 million metric tons, an increase of about 130 thousand metric tons from the previous year. Its production has increased substantially due to its ecological adaptation with minimal external inputs. Laurie et al. (2012) disclosed that it is one of the world's valued root crops; Asia, accounts for 86.5 percent of the world's production followed by Africa accounting for 10.6 percent of total production. Attah, (2023) stated that in Nigeria, North-Central States of Benue, Kogi and Plateau take the lead in sweet

potato production. Among the 23 local government areas of Benue State, Vandeikya Local Government Area tops the chart in sweet potato production. (Nyor *et al.*, 2019).

The importance of sweet potatoes is increasing in Nigeria's farming and food systems because its production has recorded good profit margin and it is suitable for income generation (Ejechi *et al.,* 2020). It has the potential for food security and serves as a cash crop especially for rural farming households. It is one of the major staple crops and the most important food security promoting root crop in the world, especially in sub-Saharan Africa (Carballo Pérez, Mu, Zhang & Ji, 2018). It has high energy fixing efficiency, produces much dry matter at a short period and contains high levels of vitamins A and C (Adewoyin, 2023). It is a versatile, drought resistant, high yielding crop with a short maturity period of three to five months adapting well to wide ecological conditions.

Despite the significant value of sweet potatoes, it still suffers post-harvest losses. Abebe (2020) held that estimates of the production losses in developing countries such as Nigeria are hard to judge, but some estimate the losses of sweet potatoes to be very high. About 30-50% of the total produce (1.3 million tons) is lost after harvest. These postharvest losses are attributed largely to handling factors, mechanical injuries, sprouting, weight loss, pest and disease infestations, storage conditions, level of awareness and adoption of value-added innovations of sweet potatoes by farmers.

According to Reitz cited in Bonephace *et al.* (2022) rural areas have limited access to agricultural information services. Bowker et al. (2010) found that the information infrastructure is composed of information services, communication systems that process, and transport data inside and outside national boundaries to create awareness of farmers. According to Odini (2014), insufficient information, poor infrastructure, poor agricultural systems and illiteracy have contributed to lack of awareness in rural areas.

According to Bonephace *et al.* (2022), farmers earn their living in rural areas with agriculture as the mainstay of their living and have knowledge gap of agricultural information services. Shetto (2008) indicated that agriculture information awareness is a challenge related to knowledge flow and agricultural information service to farmers. Shortage of agricultural information services increase a gap to farmers awareness as result of poor information. Thus, access to agricultural information is a factor for change and progress in creating awareness in agricultural sector. Hence this paper on awareness of value-added innovations and post-harvest losses of sweet potatoes aiming to assess the awareness of value-added innovations and post-harvest losses of sweet potatoes in Vandeikya Local Government Area of Benue State, Nigeria. The study is therefore anchored on the hypothesis that "there is no significant relationship between farmers' awareness of value-added innovations of sweet potatoes and reduction in post-harvest losses of the crop".

Awareness of value-added Innovations of sweet potatoes

Awareness of value addition of sweet potato has received comparatively little attention in Nigeria, despite its potential to reduce perishability and enhanced utilization of the crop in diverse product forms. Bonephace *et al.* (2022) assessed awareness of farmers on agricultural information services in Mara Region, Tanzania. Quantitative approach was adopted and data collection used single structured questionnaire. Awareness scales measured three factors; awareness knowledge; agricultural information needs and lastly use of ICTs in accessing agricultural information services. The results indicated that majority 280 (93.2%) of respondents had little knowledge of awareness, 22 (91.3%) of the response, needed improved seed varieties and the average, 180 (60%) of respondents have low use of ICT in accessing agricultural information services. It was concluded that the agricultural stakeholder needs more improvement and strategies on agricultural information services, access and knowledge. In its' significance the real situation of farmers on knowledge awareness, their needs and use of ICT was revealed in Tanzania. The reviewed empirical study is relevant and related to the objective under review since it assesses awareness of farmers on agricultural information. while the present study focused on awareness of value-added innovations of sweet potatoes. The reviewed study is

also carried out in Tanzania, while the present study was is in Vandeikya Local Government Area of Benue State, Nigeria.

Omoare *et al.* (2014) assessed the awareness of value addition of sweet potato in Osun State, Nigeria. Multi-stage random sampling technique was used to select 120 respondents for the study. Data obtained were analyzed using descriptive statistics and multiple regression analysis. Findings showed that awareness of value addition of sweet potato was very low among the respondents. Sweet potato farmers in Osun State, were aware of sweet potato sparri (79.20%), chips (76.70%), kunu (62.50%), flour (51.70%), animal feed (51.70%) and vegetable (50.80%). The reason adduced for this is that the product forms of sweet potato can be easily prepared and processed using traditional processing techniques. In contrast, the result further showed that above (80.00%) of the respondents were not aware of sweet potato cake, sweet potato puff-puff, industrial alcohol, sweet potato noodles, and sweet potato doughnut among others. This goes a long way to indicate that, much value is not placed on sweet potato production and processing. Thus, post-harvest losses of the crop increases. The above empirical study relates to the topic under review but differs in the geographical scope which will be filled by this present study.

Ekumankama and Nwankwo (2002) investigated the awareness and adoption of improved agricultural technologies disseminated through the radio, the relationship between personal factors and adoption as well as the problems limiting effective utilization of radio farm messages by farmers in Umuahia zone of Abia State, Nigeria. Eighty completed interview schedules from farmers were analysed using percentages, ranking and multiple regression analysis. It was found that 50 per cent or more of the respondents are aware of eight out of 11 improved agricultural technologies transmitted through the radio farm broadcast. The reviewed study is in divergence with the objective under review especially as it touches on awareness of improved agricultural technologies or innovation, which also differs with the specific crop type and geographical coverage.

Akpe *et al.* (2019), carried out an assessment on the extent of farmers' awareness and adoption of improved agricultural innovations in Ebonyi State. Survey research design was adopted. Two research questions and two null hypotheses guided the study. The population for the study was 367 which comprised 258 registered farmers and 109 extension agents in the three agricultural zones in the State. There was no sampling due to the manageable size of the population. Structured questionnaire was used for data collection. The reliability of the instrument was determined using Cronbach Alpha reliability coefficient method. A correlation of 0.74 was obtained. It was discovered that farmers were not aware of the improved seed used in farming activities. The above reviewed study is relevant to the present study because it hinges on awareness of innovation by farmers, but it differs on the type of agriculture crop to adopt an innovation and is also carried out in Ebonyi State.

Mashi *et al.* (2022), evaluated the factors that influence levels of awareness of climate smart agricultural (CSA) technologies among urban farmers in Kuje town, Abuja, Nigeria using data collected from 491 farming households. The results showed that the farmers that are more educated, older, having larger family sizes, income sources and economic assets, with greater climate change experience and local knowledge, and having farmlands with better physical conditions have more awareness of CSA adaptation strategies. Eleven other factors (namely marital status, tribal inclination, gender, religion, extension service, capacity building, security of tenure, institutional support, farmer organizational affiliation, distance to farmlands, and availability of loans and incentives) have no significant influence on the farmers' awareness levels of CSA adaptation strategies in the study area. The above reviewed study is relevant to this study because it also emphasised on level of awareness of agricultural technologies. It however differs because it concerns with climate smart agricultural technologies, while the present study focuses on awareness of value-added innovations of sweet potatoes. The previous study was also carried out in Kuje, Abuja, Nigeria, while the present study will be carried out in Vandeikya Local Government Area of Benue State, Nigeria. However, the general review revealed low level of awareness of value added innovations and technologies.

Theorical framework

Diffusion of Innovation Theory (DIT)

The concept of diffusion was first studied by the French sociologist Gabriel Tarde in late 19th century and by German and Austrian anthropologists such as Friedrich Ratzel and Leo Frobenius (Kinnunen, 1996). The study of diffusion of innovations took off in the subfield of rural sociology in the midwestern United States in the 1920s and 1930s at this period agriculture technology was advancing rapidly, and researchers started examining how independent farmers were adopting hybrid seeds, equipment, and techniques (Valente & Rogers, 1995).

The proponents of the diffusion of innovation theory include a French sociologist Gabriel Tarde, German and Austrian anthropologists such as Friedrich Ratzel and Leo Frobenius also a Professor of Rural sociology Everett Rogers they felt that the innovation must spread from one society to the other, for the development they focus on dual society modern and traditional societies, there must be a spread of innovation from the develop to the underdeveloped societies.

The major *assumptions/arguments* of diffusion of innovation theory is captured below which is based on two major assertions:

(i) That development is largely the result of the spread of certain cultural patterns and material benefits from the developed to the underdeveloped nations;

(ii) That within each underdeveloped nation a similar process of diffusion takes place from the modern to the traditional sectors.

(iii) Diffusion centers on the conditions which increase or decrease the likelihood that a new idea, product, or practice will be adopted by members of a given culture. Diffusion of innovation theory predicts that media as well as interpersonal contacts provide information and influence opinion and judgment.

(iv) Diffusion is the "process by which an innovation is communicated through certain channels over a period of time among the members of a social system". An innovation is "an idea, practice, or object that is perceived to be new by an individual or other unit of adoption". (Rogers, 1995).

The underlying assumption of diffusionist approach is the traditional/modern dichotomy. The approach is based on the notion of a "dual society".

Diffusionism emerged as a theory of explaining social change when evolutionary theory was discredited as being conjectural. According to diffusionists, cultural change and progress were merely as a result of cultural borrowing. They were of the view, however, that different cultures had diffused from a common source. For example, Smith and Perry claimed that all civilizations everywhere had diffused from an original source in ancient Egypt. He further stated that diffusionists argued that: …few societies, if any, have developed in total isolation, they must have some contacts with other human cultures… no society has ever developed anywhere quite free from outside influence. The diffusionists focus on the role of different factors in enhancing or modifying other cultures. Such factors include diffusion of cultural values, knowledge, skills and technology from already developed social groups. It is the receptiveness to diffusion that leads to social change. According to these theorists, it is the social groups that lack diffusion that do not make any significant change. Some functionalists employ the diffusionist theory in explaining social change (Idyorough, 2015).

According to Rogers (2003), adoption of new technology via a dispersal of innovation with a social system takes place through its adoption by individual or groups. Adoption is a decision to make full use of an innovation as the best course of action available. The decision to adopt an innovation involves a process composed of learning, deciding, and acting over a period of time. The way in which an individual adopts an innovation involves the following five steps namely Awareness stage, Interest stage, Evaluation stage, Trial stage and Adoption stage respectively (AIETA).

Awareness Stage: This is the starting stage wherein the farmer comes to know the existence of the new idea however the farmer lacks detailed information about it. Example when sweet potatoes farmers started hearing about sweet potato candy, most of them lack the full information about what it is, however they kept thinking about it on a daily basis.

Interest Stage: At this stage, the farmer develops interest in the innovation and seeks additional information about it either from extension officer or from fellow farmers or from any source, which he feels credible. That means the farmer acquires more information about an innovation or idea by willing to know what the innovation/idea is, how it works and what its potentialities are. For example, at this stage the farmer now developed interest on the idea received therefore enquire to know more and how sweet potatoes candy is prepared so that if the explanation is satisfactory he/she can key into the new technology.

Evaluation Stage: At the evaluation stage, the farmer makes mental application of the new idea in the present and anticipated future situations and decides whether or not to try it. He judges the utility of the innovation/new technology, makes an assessment whether the idea is applicable to his/her own situation and if applied what would be the result. Example the farmer within himself thinks on the effects of the new technology, either the effects will be positive or negative, because at this stage he or she has an intention of venturing into the innovation that is either to bake sweet potato candy or not.

Trial Stage: Under the trial stage, the farmer may not take up any new idea or innovation right away on a large scale because he/she doesn't want to take risk even though the potential of the idea has been proved. The new idea is applied on a small scale in order to determine its utility or feasibility and applicability in his/her own situation. That is the farmer at this point will give the new technology a trial but he/she will start small as to experiment the innovation in order to avoid risk, for example the farmer will try to produced sweet potato candy on a small scale to see how valuable it may be.

Adoption Stages: Being satisfied with the performance of the new idea tested on small scale in his own situation, the farmer uses the new idea continuously on a full scale. Trial may be considered as the practical evaluation of the new technology / innovation. The innovation becomes a part of his normal value addition. It provides the advantage of the innovation and hence the farmer takes final decision and applies the innovation in a scale appropriate to own situation on a continued basis. Example can be seen now how most people now adopt innovations like sweet potato candy, high improved varieties seeds, organic fertilizers, germination test, cropping calendar and use of drones etc. many farmers now have adopted the new technologies/innovations.

The diffusion approach has been criticised on the ground that because of oceans, mountains and hostile intergroup relations, communication between various social groups, ethnic groups and races was almost impossible as such cultural borrowing could not take place yet these groups were developing on their own. Even where such communication existed in the past, it was often between subjected territories and their conquerors. Although, in spite of this criticism, the theory still remains a central part of the discussion to enhance awareness of value-added innovations and curtail post-harvest losses of sweet potatoes in Vandeikya local government area of Benue State, Nigeria if the theory is adopted and applicable.

Methodology

This section presents the methodology. The study adopted a mixed methods design, this is because mixed methods design combines elements of both quantitative and qualitative data. The research setting is Vandeikya Local Government Area of Benue State Nigeria. Population of the study comprised of sweet potato farmers who cultivate sweet potatoes yearly on a large scale and staff of department of Agriculture Vandeikya local government secretariat. Data on the actual number of sweet potato farmers in the area cannot be ascertained, thus the study used Cochran's formula for unknown population to draw and determine the sample size. Therefore, a sample of 384 comprising sweet potato farmers was determined and drawn. The formula is stated as:

$$n = \frac{Z^2 \,.\, p\,.(1-p)}{e2}$$

Whereas n = sample size

Z = Z-value corresponding to the desired confidence level (1.96 for a 95% confidence level)

p = the estimated proportion of an attribute that is present in the population (0.5)
q =1-p (if p = 0.5, q = 0.5)
e = Margin of error (desired level of precision) (0.05)

The study utilised a multistage sampling procedure namely cluster, purposive and simple random sampling techniques in order to select its respondents. Three methods of data collection were employed namely, structured interview, focus group discussion (FGD) and key informant interview (KII). The study utilised both quantitative and qualitative techniques for data analysis and triangulated. Also, the formulated hypothesis was tested using inferential statistics Chi-Square (x^2). The findings of this study were corroborated and any weakness in the data was compensated for by the strengths of the other data. Constraints were inevitable, although the challenges were however controlled logically and systematically.

Results and Analysis

Table 1: Socio-demographic characteristics of the respondents

S/N	Variable	Category	Frequency = 384	Percent (% = 100)
1.	**Sex**:	Male	163	42.4
		Female	221	57.6
2.	**Age**:	18-30yrs	154	40.1
		31-64yrs	209	54.4
		65yrs above	21	5.5
3.	**Marital status**:	Single	70	18.2
		Married	218	56.8
		Divorced/separated	31	8.1
		Widow/widower	65	16.9
4.	**Educational level**:	None	11	2.9
		Primary	103	26.8
		Secondary	202	52.6
		Tertiary	68	17.7
5.	**Primary occupation**:	Civil service	46	12.0
		Farming	252	65.6
		Trading	19	5.0
		Artisanship	53	13.8
		Others	14	3.6
6.	**Years of farming**:	1-10yrs	67	17.5
		11-20yrs	172	44.8
		21-30yrs	113	29.4
		31yrs & above	32	8.3

Source: **Field Survey, 2024.**

Table 1 is the result showing the socio-demographic characteristics of respondents in the study. The result indicated that regarding respondents' sex, males comprised of 163 (42.4%), while females were 221 (57.6%). In terms of respondents' age, those who fell within the age category of 18-30 years old were 154 (40.1%), those within 31-64 years old were 209 (54.4%), and those whose ages ranged 65 years old and above were made up of 21 (5.5%). In regards to respondents' marital status, single respondents were made up of 70 (18.2%), the married respondents were 218 (56.8%), those divorced or separated were 31 (8.1%), and the respondents who were widowed were 65 (16.9%). The respondents' educational level showed that those with no formal education were 11 (2.9%), while those who had primary education were 103 (26.8%), those who obtained secondary education were 202 (52.6%), and those who attained tertiary education were 68 (17.7%). Regarding respondents' primary occupation, 46 (12.0%) were civil servants, 252 (65.6%) were farmers, 19 (5.0%) were traders, 53 (13.8%) were artisans, while others who neither of the aforementioned occupations were made up 14 3.6%). The respondents' years of farming indicated that those who had farmed within the range of 1-10 years were 67 (17.5%), those within the range of 11-20 years were 172 (44.8%), those within 21-30 years were 113 (29.4%), and those who had been farming for 31 years and above were 32 (8.3%) respectively.

Table 2: Farmers' awareness of value-added innovations of sweet potatoes

Awareness of value - added innovation of sweet potatoes	Aware n= 384	(%) 100	Not-Aware n= 384	(%) 100
Sweet potato noodles	124	32.3	260	67.7
Sweet potato meat pie	185	48.2	199	51.8
Sweet potato candy	58	15.1	326	84.9
Sweet potato bread	191	49.7	193	50.3
Sweet potato buns	73	19.0	311	81.0
Sweet potato cake	91	23.7	293	76.3
Sweet potato doughnut	157	40.9	227	59.1
Sweet potato biscuit	81	21.1	303	78.9
Sweet potato camote chips	199	51.8	185	48.2
Sweet potato puff-puff	61	15.9	323	84.1
Sweet potato juice	193	50.3	191	49.7
Sweet potato chin-chin	117	30.5	267	69.5
Sweet potato ethanol	60	15.6	324	84.4
Total Average Score	**122**	**31.9**	**262**	**68.1**

Source: **Field Survey, 2024.**

Table 2 shows the result of farmers' awareness of value-added innovations of sweet potatoes. The table reveals the frequency of respondents' awareness of the difference value-added innovations identified for this research. The result compares the frequency of respondents' who are aware, and those who are not aware of the understudied value-added innovations. It also provides the average frequency, as well as the average percentage scores between respondents' who are aware and those who are not aware, therefore giving scores that round up to give the original total of the 384 and thus, (100%) respondents of the study.

The result from Table 2 indicates that for sweet potato noodles, 124 (32.3%) of respondents were aware of the value-added innovation, while 260 (67.7%) respondents were not aware. Corroborating the findings on the awareness of value-added innovations of sweet potatoes noodles, a 28 - year female discussant from Mbadede maintained thus:

> We are not very aware of sweet potatoes noodles here in Mbadede. I will say the people who have knowledge of the sweet potatoes noodles are fewer than those who are not aware. In fact, the percentage is insignificant (FGD, 2024).

Similarly, another 33 – year old female discussant from Nyumagbagh has this to say:

> The people who are aware of sweet potatoes noodles in our community are few, comparing to the many who are not aware. Majority of the people here have never even heard about any food like that, while some of us are aware of it, although it is not common in our area (FGD, 2024).

Regarding sweet potato meat pie, result from Table 2 showed that 185 (48.2%) respondents were aware, while 199 (51.8%) respondents were not aware. In line with this finding, a 45 – year old female and 52 year – old male key - informants from Adeiyongo, Tsambe and Ningev maintained thus:

> There is an average level of awareness of sweet potatoes meat pie in our community. About three of our women here who made pastry, even produced sweet potatoes meat pie to sell at Adeiyongo market. However, most people are not aware of it. They do not even patronize the meat pie in the very few places they are sold, for them to know there is a food like that (KII, 2024).

> Here in Ningev, some of us are aware of sweet potatoes meat pie, while most are not aware. My younger brother's wife produces it to sell in small quantity sometimes, although it is not a common food in our place (KII, 2024).

In terms of sweet potato candy, 58 (15.1%) respondents were aware, as compared to 326 (84.9%) respondents who were not aware. Agreeing with this finding on the awareness of value-added innovations of sweet potato candy, a male and a female discussant from Mbayongo and Mbakyaha respectively reported thus:

> For me, I am hearing about this sweet potato candy for the first time. When you mentioned it, one of our brother said he heard of it once, when he travelled. However, majority of us are not aware of the sweet potato candy" (FGD, 2024).

> We are not aware of sweet potato candy here in Mbakyaha. I cannot categorically say no one is aware of it, but to the best of my knowledge, I don't think many people are aware of this sweet potato candy in our community" (FGD, 2024).

Regarding sweet potato bread, result on Table 2 indicated that 191 (49.7%) respondents were aware, while 193 (50.3%) respondents were not aware. Corroborating with the finding on the awareness of value-added innovations of sweet potatoes bread, A male FGD discussant at Nyumagbagh Council Ward, confirmed thus:

> Some of our people are aware of the use of sweet potatoes for bread, while some are not. Most of our people just stick to normal use of sweet potatoes like pounding it for swallow, boiling it to eat, making boiled and dried chips, that they don't care about knowing other new things that can be made from sweet potatoes" (FGD, 2024).

Findings in Table 2 further showed that for sweet potato buns, 73 (19.0%) respondents were aware, as against 311 (81.0%) respondents who were not aware. This result is line with the findings drawn from the FGD discussants in Tsambe. A 38 year – old male discussant from Gbem, Tsambe council ward asserted thus:

> Very few people are aware of the use of sweet potatoes for buns. Majority of the people in our community boil or roast sweet potatoes to eat. Some use it for swallow and they mostly make boiled chips. I don't think we are even aware that it is used for making buns (FGD, 2024).

In terms of sweet potato cake, doughnut, biscuit and camote chips, findings revealed that the farmers awareness levels these post – harvest value – added innovations were 23.7, 40.9, 21.1 and 48.2 percents respectively. This indicates that majority of the respondents were not aware, signifying that the awareness levels of the innovations were poor. Further findings from the FGD corroborated the quantitative results on these variables. For instance, a 43-year-old female discussant at Gbagir, Tsambe council ward revealed thus:

> We are not very aware of most of these value – added innovations you are talking about especially the one of using sweet potatoes to produce biscuit, doughnut and cake. However, these products are produced using different kinds of flour, so, it is possible sweet potato can be used. Two of our members here said they have heard of sweet potato biscuit and cake, but most of us are not aware" (FGD, 2024).

With regards to sweet potato juice, puff-puff, chin – chin and sweet potato ethanol, 193 (50.3%), 117(30.5%), 61(15.9%) and 60 (15.6%) respondents respectively confirmed their awareness of these value – added innovations against 191 (49.7%), 267 (69.5%), 61 (84.1%) and 324 (84.4%) respondents respectively who were not aware. Further finding from FGDs

affirmed that the level of awareness of the respondents on some of the above-mentioned value – added innovations on sweet potatoes were low. According a 40 year – old discussant from Mbadede council ward:

> I have never heard of sweet potatoes puff-puff and I am not aware of it. As we are discussing here, I don't think any of us is aware of the use of sweet potatoes in that manner (FGD, 2024).

Furthermore, a 32 year – old female discussant from Nyumagbagh Council Ward maintained thus:

> Sweet potatoes can be used for puff-puff, but only few of us are aware of it, I got to know about it when I traveled to Lagos some years ago, I will therefore say the awareness of sweet potato puff-puff is very low. I only remembered about it because of this discussion we are having about it now" (FGD, 2024).

Collaborating the finding on the awareness of value-added innovations of sweet potatoes juice, discussants from Mbayongo Council Ward maintained that:

> Most of us are aware of sweet potato juice, but I think not everyone in our community is aware of the juice. It is one of the value-added innovations of sweet potatoes that I think about half of us in this meeting have agreed that we are aware. Of course, we can relate sweet potato juice to the local kunu juice we produce here in our community. With that knowledge, I think most of us agree that sweet potatoes can be used for juice. Therefore, the awareness of sweet potato juice can be said to be up to average in our community (KII, 2024).

In the light of the foregoing, it could be inferred that only 31.9 percent of the respondents in the study area were aware of the understudied value-added innovations of sweet potatoes, while the greater percentage of the respondents (68.1%), constituting over two-third of the sampled population, were not aware of the value-added innovations of sweet potatoes. The above findings imply that majority of the sweet potato's farmers (68.1%) in Vandeikya Local Government area of Benue State, were not aware of modern value-added innovation of sweet potatoes. Some of the sweet potatoes farmers, although aware of these improved value-added innovations of sweet potatoes, did not understand the processes involved in their production. Most of the sweet potato's farmers were completely unaware of such value-added innovations of sweet potatoes, however, were happy hearing of it for the first time. This finding was in contrast with that of Omoare et al. (2014) who found out that majority of sweet potato farmers in Osun State, were aware of sparri (79.20%), sweet potato chips (76.70%), sweet potato kunu (62.50%), sweet potato flour (51.70%), sweet potato animal feed (51.70%) and sweet potato vegetable (50.80%).

Table 3: Chi-square result showing the relationship between farmers' awareness of value-added innovations of sweet potatoes and reduction in post-harvest losses of the crop

Variables Awareness of VAI	Reduction in PHL	Observed Freq. (O)	Expected Freq. (E)	df	x^2	p-value	Decision
Aware	Reduced loss	204	147.3	1	154.035	.000	Sig.
Aware	Increased loss	52	108.7				
Not aware	Reduced loss	17	73.7				
Not aware	Increased loss	111	54.3				
Total		**384**	**384.0**				

Source: **Field Survey, 2024.**

Table 3 is a chi-square result showing the relationship between farmers' awareness of value-added innovations of sweet potatoes and reduction in post-harvest losses of the crop. The result indicates that there is a significant relationship between awareness of value-added innovations of sweet potatoes and reduction in post-harvest losses of sweet potatoes, $x^2(1) = 154.04$, $p < .05$. Therefore, the null hypothesis which stated that, there is no significant relationship between farmers' awareness of value-added innovations of sweet potatoes and reduction in post-harvest losses of the crop in Vandeikya Local Government Area of Benue State is rejected, thus, accepting the alternative hypothesis.

Table 4: Crosstabulation of Awareness of Value-added Innovations (VAI) and Reduction in Post-harvest Losses (PHL) of Sweet Potatoes

Awareness of VAI	Reduction in PHL	Count	% Within Awareness	% Within Reduction	% of Total	Phi Coe.
Aware	Reduced	204	79.7%	92.3%	53.1%	0.633
Aware	Increased	52	20.3%	31.9%	13.5%	
Not aware	Reduced	17	13.3%	7.7%	4.4%	
Not aware	Increased	111	86.7%	68.1%	28.9%	
Total		**384**			**100%**	

Source: **Field Survey, 2024.**

Table 4 is a crosstabulation result from the chi-square (x^2) analysis indicating the awareness of value-added innovations and reduction in post-harvest losses of sweet potatoes. The result shows that among respondents who were aware, 79.7 per cent respondents experienced reduced post-harvest losses (PHL), while among those who were not aware, only 13.3 per cent respondents experienced reduced losses with majority; 86.7 per cent reporting increased losses. The Phi coefficient of 0.633, further suggest a strong association between awareness of value-added innovations and reduction in post-harvest losses of sweet potatoes in Vandeikya local government area of Benue state, Nigeria.

Conclusion / Recommendations

The study presented some major findings. Firstly, it was confirmed that 68.1 per cent of the respondents were not aware of the existence of value-added innovations of sweet potatoes as against 31.9 per cent who were aware. Gathering from the findings of the study, only few farmers are aware of the modern value-added innovations of sweet potatoes in the study area. The value-added innovations of sweet potatoes adopted are mostly traditional once like boiled dry chips. Whereas the modern value-added innovation has low adoption rate. It was suggested that awareness creation, training and supporting farmers with credit facilities among others can enhance awareness of value-added innovations of sweet potatoes, to control post-harvest losses of the crop in Vandeikya Local Government Area of Benue State, Nigeria.

Based on the findings of this research, recommendations are outline as solutions on awareness of value-added innovations and post-harvest losses of sweet potatoes, to enhance adoption of value-added innovations to curtail post-harvest losses of sweet potatoes in Vandeikya Local Government Area of Benue State, Nigeria.

i. The study recommends that, the government through Ministry of Agriculture and Rural Development should create more awareness on value-added innovations of sweet potatoes to enhance adoption and control of post-harvest losses of sweet potatoes among farmers in Vandeikya Local Government Area of Benue State, Nigeria.

ii. Philanthropist, Non-Governmental Organisations and the government should support farmers with the needed logistics to access information on new technologies, to adoption of value-added innovations of the crop such as; sweet-potato noodles, meat pies, candy, bread, buns, cakes, doughnuts, biscuits, camote chips, puff-puff, juice, chin-chin and industrial alcohol, instead of traditional once, which typically have relatively low economic value, to help reduce post-harvest losses in the study area.

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