

Post-Harvest Losses of Sweet Potatoes and Socio-Economic Well-Being of the Farmers in Vandeikya Local Government Area of Benue State, Nigeria

Christopher Azaager Abari PhD

abarichris@gmail.com

Department of Sociology,

Moses Orshio Adasu University, Makurdi – Nigeria

Peter Terna Tyover

Department of Sociology,

Moses Orshio Adasu University, Makurdi – Nigeria

Plangnandaniel17@gmail.com

Aondohemba Godwin Iornenge

ayugodwin@gmail.com

Department of Sociology and Anthropology,

University of Nigeria, Nsukka-Nigeria

Abstract

Post-harvest losses of sweet potatoes have a profound negative effect on socioeconomic wellbeing of farmers. This study investigated the effect of post-harvest losses of sweet potato on the socio-economic wellbeing of the farmers in Vandeikya Local Government Area. Specifically, the study investigated the causes of post-harvest losses of sweet potatoes, the effect of post-harvest losses of sweet potatoes on the income of farmers and effect of post-harvest losses on food availability. Modernization theory was adopted. Using a cross-sectional survey design. A sample size of 378 respondents was drawn from sweet potato farmers in the area using a multi-stage sampling technique. The instruments of data collection were a structured questionnaire and analyzed using descriptive statistics of frequency, percentage, mean and standard deviation to address the research objectives. Chi-square statistics and Pearson correlation analysis were used in testing the hypotheses at 0.05 level of significance. Findings revealed that, lack of adequate modern processing facilities, lack of storage facilities, poor marketing system/lack of buyers, poor handling practices, poor access roads, absence of agro allied industries, among others. Findings also revealed that post-harvest losses of sweet potato have a significant effect on the socio-economic wellbeing of farmers in the study area. The study concluded that investing in modern storage facilities, providing training on best practices for post-harvest handling, and enhancing market access through improved infrastructure and cooperative systems are crucial. The study recommended the establishment of agro-allied industries in the state, provision of loans and grants to farmers, provision of more access roads and rehabilitation of damaged ones, provision of sweet potato improved varieties to farmers, improved extension services, among others as the strategies to reduce post-harvest losses of sweet potatoes in order to boost the socio-economic wellbeing of the farmers in the area.

Key Words: Post-harvest losses, sweet potatoes, Socio-economic, Well-being, Farmers, Vandeikya.

Introduction

Sweet potato is grown and consumed worldwide. However, the share of the production that is

traded in the world market is relatively small (International Potato Centre: CIP, 2013). Sweet potato (*Ipomoea batatas* L.) is an important food, feed, and vegetable crop in most developing countries, which account for about 97 percent of the world production. They produce 131 million tonnes per year on approximately 9 million ha and obtain mean estimated yields of 13.7 tonnes (Food and Agriculture Organization [FAOSTAT], 2015). Sweet potato is widely grown in Africa, Asia, and Latin America, with China accounting for 52 percent of the crop, grown on approximately 4.7 million ha (FAOSTAT, 2015).

As one of world's valued root crops; Asia, accounts for 86.5 percent of the world's production followed by Africa, which is the second largest producer of sweet potatoes, accounting for 10.6 percent of total production. 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 (Laurie et al. 2012). 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). However, it is known to be among the world's most important, versatile, and under-exploited food crops (International Potato Centre (CIP, 2013). 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).

Sweet potato is grown and consumed worldwide. However, the share of the production that is traded in the world market is relatively small (International Potato Centre: CIP, 2013). Sweet potato (*Ipomoea batatas* L.) is an important food, feed, and vegetable crop in most developing countries, which account for about 97 percent of the world production. They produce 131 million tonnes per year on approximately 9 million ha and obtain mean estimated yields of 13.7 tonnes (Food and Agriculture Organization [FAOSTAT], 2015). Sweet potato is widely grown in Africa, Asia, and Latin America, with China accounting for 52 percent of the crop, grown on approximately 4.7 million ha (FAOSTAT, 2015).

As one of world's valued root crops; Asia, accounts for 86.5 percent of the world's production followed by Africa which is the second largest producer of sweet potatoes, accounting for 10.6 percent of total production. 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 (Laurie et al. 2012). 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). However, it is known to be among the world's most important, versatile, and under-exploited food crops (International Potato Centre (CIP, 2013). 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).

In sweet potatoes, post-harvest losses occur at various stages from production, post-harvest handling, storage, marketing, distribution and processing. These include losses in quantity and tuber quality, arising from physical damage, rodent attack, fungal and bacterial diseases, and physiological processes such as dehydration and respiration. An estimated loss of 10-60% of total crop has been reported (NAS, 2019). Weight loss during storage in traditional or improved barns, or clamp storage can reach 10-12% in the first 3 days and 30-60% after 5 days. Weight losses of 33-67% after 5 days storage has been reported (Coursey, 2017). In West Africa alone, this amounted to an annual loss of one million tons of sweet potatoes (Okposen, Meyen & Ufur, 2016).

The magnitude of weight loss in stored sweet potatoes increases rapidly after the first few days. Transit losses of about 15- 40% occur in Nigeria due mainly to inefficient storage and transport facilities. Losses of sweet potatoes varied from 7-23% during 4 days of storage, and in Puerto Rico, postharvest losses of sweet potatoes due to decay exceeded 50% (Selvakumaran, Shukri, Ramli, Pak Dek, Wan Ibadullah, 2019). Processing losses during culinary preparation of peeled sweet potatoes can amount to 10-15%. Rembold, 2011; Save Food, 2013) reported that sweet potato harvest and post-harvest losses in Nigeria are also affected by socio-economic factors such as inadequate marketing system, inadequate transportation facilities, government regulations and legislation, poor maintenance, lack of information and unavailability of needed tools and equipment.

The socioeconomic well-being of farmers relates to their standard of living, farmers ability to afford the basic needs of life such as quality health care, housing, clothing, education and nutritious food. Over 70 percent of people living in rural areas depend on agriculture to meet these basic needs. In Vandeikya, Sweet potatoes serves not only as a staple food but a major source of income to the rural farmers as such harvest and postharvest losses of the produce do not only cause food shortages but also diminish their standard of living.

Post-harvest losses account for a reduction of about 20-50% in world sweet potato production (Tarawali & Asiedu 2012). A study conducted by Ojore, Richard, Bwala, & Amaka, (2012) in Rivers State Nigeria, found postharvest losses of sweet potato to be as high as 27.7%. A more recent study conducted by Okeke, Mbah, Madukwe, and Nwalieji (2020) in Nigeria reported an annual postharvest loss of sweet potatoes at 50% while Chukwuma (2014) estimated an annual loss of sweet potatoes in the Agwu local government of Enugu State to be about 30%. The above statistics show the varying degrees of sweet potatoes losses which affect the socioeconomic well-being of the rural farmers. Benue state being the major producer of sweet potatoes in the North-Central region of Nigeria has had its fair share in post-harvest losses. Though high postharvest losses are incurred one cannot state with certainty and quantify the level of these losses that are incurred among sweet potatoes farmers in the state. The socio-economic well-being of farmers is greatly hampered by these losses as agricultural production constitutes the major means of their livelihood. As a result of the losses in sweet-potato and other agricultural produce, the farmers incomes are lowered and as a result of very low income, rural farmers find it difficult to meet their requirements for a balanced diet, better shelter, and acquisition of good clothing materials.

The following specific objectives were formulated for the study

- i. Investigate the causes of post-harvest losses of sweet potatoes among the farmers in Vandeikya LGA.
- ii. Examine the effect of post-harvest losses of sweet potatoes on the income of the farmers in Vandeikya LGA.
- iii. Examine the effect of post-harvest losses of sweet potatoes on food availability among the farmers in Vandeikya LGA.

Research Hypotheses

The study is anchored on the following hypotheses

- H₀₁** There is no significant relationship between the level of postharvest losses of sweet potatoes and the income of farmers in Vandeikya LGA.
- H₀₂** Post-harvest losses of sweet potatoes have no significant effect on food availability among farmers in Vandeikya LGA

Conceptual framework

Sweet potato (*Ipomoea batatas* (L) Lam)

Sweet potato (*Ipomoea batatas* (L) Lam) is one of the major staple crops and the most important food security promoting root crop in the world, especially in sub-Saharan Africa (Low, et al. 2009). Nigeria is second largest producer of sweet potato in Africa after Uganda with 2,600,000 metric tons annually (National Root Crops Research Institute, 2020).

Sweet potato is highly adaptable to relatively marginal soils and erratic rainfall and has high productivity per unit land and labour and guarantees some yield even under the most adverse conditions. Sweet potato varieties exist in many colours of skin and flesh, ranging from white to purple, although white and yellow-orange flesh is the most common. Sweet potatoes are usually consumed without special processing. According to Steffey (2015) the fresh root is boiled, roasted, baked or fried as chips, which may be sold as snacks or salted and eaten as sweet potato crisp in most part of Nigeria, sweet potatoes are also fed to livestock or processed industrially into alcohol, starch, noodles, dessert and flour. Sweet potato is grossly under-exploited as food in Nigeria. Nwosu (2015) observed that the minimal utilization of sweet

potato in Nigeria is obviously due to non-availability of adequate sweet potato based recipes that satisfy the food habit of Nigeria.

Post-Harvest Losses

According to Bourne (2017), post-harvest means after separation from the medium and site of immediate growth or production of the crop. Post-harvest begins when the process of collecting or separating food of edible quality from its site of immediate production has been completed. Actually, post-harvest begins at the moment of separation of the edible commodity from the plant that produced it by a deliberate human act with the intention of starting it on its way to consumption. The post-harvest period ends when the food comes into the possession of the final consumer. The sequence of activities carried out during post-harvest is referred to as post-harvest system. Post-harvest system, according to Grolleaud (2004), encompasses a sequence of activities and operations that can be divided into two groups. The first group contains technical activities which include harvesting, field drying, threshing, cleaning, additional drying, storage, processing; while the second group, economic activities include transporting, marketing, quality control, nutrition, extension, information and communication, administration and management. Within the food system there is a stage of preparation for production (preproduction); a period of production; a time for harvest; occasions for transportation; stages where assembly, packaging or selection occur; several periods of short or long term storage; and stage where food is distributed to the consumers (Aparecida, Pedrosa, Schmiele, Gioia, Nojima, Steel, & Nabeshima, 2019).

Socio-Economic Wellbeing

The individual's well-being is identified as a measure of the quality of human life. The living standard which includes human well-being is methodically related to quality of life and generally indicates how an individual behaves in society (Narayan et al., 2017). However, there is no exact method to measure the well-being of humans in literature. Kesebir & Diener (2018) defined well-being as a measure of human lifestyle which makes a positive assessment of their lives and their confidence, emotions, satisfaction and engagement in day-to-day activities. It is often tied to identifying the financial status of individuals as well. However, well-being is a wider concept than economic or material well-being (Courtland and Clay, 2010). Thus, it is currently recognized as a multidimensional concept by policymakers and researchers. However, social-economic wellbeing is conceptualized for this study to mean individual level or access to income and their abilities to meet the basic needs of life including clothing, shelter, education, quality health care and other basic needs of life.

Theory

The theory adopted in study

Modernization Theory

Modernization theory is an economic theory rooted in capitalism which evolved in the 1950s and 1960s. According to Huntington (1968), three main historical conditions were favorable to the inception of the modernization theory of development after the Second World War. First, there was the rise of the United States as a superpower. While other Western nations, such as Great Britain, France, and Germany, were weakened by World War II, the United States emerged from the war strengthened and became a world leader with the implementation of the Marshall Plan to reconstruct war-torn Western Europe. Second, there was the spread of a united world communist movement. The Former Soviet Union extended its influence not only to Eastern Europe, but also to China and Korea. Third, there was the disintegration of European colonial empires in Asia, Africa and Latin America, giving birth to many new nation-states in the Third World. These nascent nation states were in search of a model of development to promote their economy and to enhance their political independence. Modernization is a comprehensive theory which deals with the whole process a nation encounters in its attempts of transforming from primitive to a modernized society. Modernization consists of a gradual process of specialization and separation of social structures, with the aim of promoting efficiency in the developmental

process of any society. According to Roxborough (1979), modernization theory operates on economic oriented principles which posit that capital formation and investment are the major determinants of economic growth and development.

The most prominent scholar of the stage model is W.W. Rostow. For Rostow (1962), development is divided into five stages which are; the traditional society, the pre-condition for take-off stage, the take-off stage, the maturity stage, and the stage of high-mass consumption. The traditional stage is an agrarian society that is not aware of its capability to transform its society to a modern community. They are therefore not willing to take advantage of the potential of modern science and technology (Okereke & Ekpe, 2002). At the stage of precondition for take-off, the society becomes aware of its transformation potential and in turn gets involved in the application of modern science and technology to agricultural and industrial practices. The opportunity for investment and commerce therefore increases at this stage. The takeoff stage places emphasis on the eradication of traditional obstacles which hinders economic growth and development. At this stage, the commercialization of agriculture is introduced, and investment rises to a maximum level. The drive to maturity stage is a period when the economy shows the capacity to extend beyond the original industries that served as its pivot for take-off. The final stage of development is that of high mass consumption, it focuses on the production of durable consumer goods and services which is marked by a rise in real income (Okere & Ekpe, 2002). Implicit in the stage model is the assumption that some countries are developed because of their strict adherence to this evolutionary developmental process. Psychological/ Idiosyncratic theory is also another strand in modernization theory which attributes development to certain attitudinal personality variables. It is assumed that it is the innovative personality of a nation that stimulates economic growth and development (Okereke & Ekpe, 2002).

Applying modernization theory to this work suggests replacing traditional methods with modern post-harvest technologies such as improved storage facilities (e.g., temperature- and humidity-controlled storage), packaging, and transportation systems will reduce losses, preserve crop value, and enhance profitability. According to modernization theory, training and extension services, along with access to credit and agricultural innovations, are essential to transition farmers from subsistence to commercial agriculture. Improved post-harvest handling would result in better quality sweet potatoes, higher market prices, and increased incomes, directly enhancing farmers' socioeconomic well-being. Modernization theorists argue that education is central to development educating farmers can lead to behavioral change, better decision-making, and faster adoption of loss-reducing innovations.

Methodology

The study adopted a cross-sectional research design. This design was best suited for this study due to its suitability in determining the prevalence of a phenomenon, situation, problem, attitude, or issue, by studying a cross-section of the population. Cross-sectional design is useful in obtaining an overall 'picture' as it stands at the time of the study. It is designed to study some phenomenon by taking a cross-section of it at one time (Babbie, 2013). It involves only one contact with the study population.

The total population of Vandeikya local government is projected to be 361, 600, (NPC, 2022) therefore the study covered all the estimated population in the area since the people are farmers and almost everybody is engaged in the sweet potatoes farming. However, the actual population of sweet potato farmers is unknown. So, the study employed Salant & Dillman (1994) sample size determination for unknown population. Salant & Dillman (1994) have presented various population sizes and their characteristics at three levels of plus or minus ± 5 , ± 3 and ± 10 percent reliability levels. They have therefore submitted that a population of between 2000 and 2500, population value with a 50/50 split and 5% sampling error will require 333 sample values of responses for a flawless generalization. This number they said would provide accurate estimates of the unknown values and parameters which the research seeks to address. They have also explained that a "50/50 split" means the population to be studied is relatively varied while a "80/20 split" means the population is less varied; where most people have certain characteristics and a few do not have. They have therefore recommended that it is best to be conservative and use the 50/50 split.

Thus, is determined by;
$$\frac{\text{the population per council ward}}{\text{Total population of council wards}} \times \text{Sample size}$$

Table 1: Sample Size per Four Selected Council wards

Council Wards	Population of Sweet Potato Farmers	Number of Respondents
Mbadede	617	93
Mbagbera	567	85
Mbatyough	502	76
Mbakaange	528	79
Total	2214	333

Source: Field survey 2024.

Therefore, the sample size for this study is 333 sweet potato farmers. The study was estimated to make statistical sample error of 0.05, that is 5% errors, thus bringing its confidence interval to 95%. Because of the large area and population of the farmers in the area, the researchers added additional 67 respondents to make up a total of 400 respondents for the study. This was to take care of some questionnaires that may be wasted and those that may not be returned.

Multi-stage sampling was adopted in this study including cluster, and simple random sampling techniques respectively. Multi-stage sampling was preferred due to its ability to attain a good sample from a homogeneous and spatially large population, especially where there is no clearly defined sampling frame. It was also preferred due to its ability to cover a wide geographic area. While simple random sampling was preferred for its flexibility and practical fairness in allowing equal opportunities to all known elements in the study. Purposive sampling was also employed due to the notion of selecting suitable discussants via researchers' judgmental initiative.

At the first stage, the twelve administrative council wards in the study area (Vandeikya LGA) were clustered into two broad cluster areas namely *Tiev* and *Kyan* clusters. *Tiev* comprised of six council wards including: Mbayongo, Mbakaange, Nyamangbagh, Ningeve, Mbatyough and Vandeikya Township, that make the *Tiev* State Constituency in Benue State House of Assembly. *Kyan* also has six council wards comprising: Mbagbam, Mbadede, Mbagbera, Mbajor, Tsambe and Mbakyaha, which make up *Kyan* State Constituency.

At the second stage, two council wards were randomly selected from each clustered area. The researcher wrote the names of all the council wards on small pieces of paper, squeezed properly and dropped in two separate containers labeled *Kyan* and *Tiev* respectively. Then the research assistant was asked to pick two different squeezed pieces of paper from each of the two containers. Four council wards picked through this process including: Mbadede and Mbagbera from *Kyan* cluster. and Mbatyough and Mbakaange from *Tiev* cluster.

At the third stage, simple random sampling was again used to select respondents from each of the four council wards sampled. In each council ward two communities were randomly selected and each community sweet potatoes farmers were randomly selected until the required number of respondents was reached.

The primary source of data collection was used in this study; this was done through questionnaire instrument. Questionnaires were administered to the sample sweet potatoes farmers to get data, so that the objectives of the study would be achieved. The questionnaire was self-administered and other-administered. The questionnaire was designed in a structured format to collect data from sample respondents.

This study adopted quantitative technique of data analysis. Data gotten through questionnaire will be analyzed quantitatively using Statistical tools such as tables, frequencies and simple percentages. Valuations were based on the highest (modal) or most significant percentage of responses demonstrating the magnitude of acceptance or rejection of views regarding the question in-view. Similarly, hypotheses test analyses were conducted using statistical techniques

such as Chi (X^2), Spearman's correlation statistics and ordinal logistic regression analysis so as to aide statistical decision making and conclusion concerning hypothesis statements.

Results

Analysis was based on 378 questionnaire that were retrieved from the field.

Table 2: Socio-demographic Attributes of Respondents

Variables	Freq. (n=378)	Percentage (100)
Sex	269	71.2
Male	109	28.8
Female	70	18.5
Age		
18-30		
31-45	127	33.6
46-55	114	30.2
56-65	38	10.1
65 Above	29	7.7
Marital Status		
Single	115	30.4
Married	213	56.3
Divorced	-	-
Widowed	50	13.2
Level of Education		
None	42	11.1
Primary	113	29.9
Secondary	159	42.1
Tertiary	64	16.9
Primary Occupation		
Civil Service	43	11.4
Farming	228	60.3
Trading	79	20.9
Crafts making	28	7.4
Farming Experience		
1-10 years	86	22.8
11-20 years	200	52.9
21-30 years	64	16.9
31 years above	28	7.4
Farm Size	36	9.5
<1 hectare		
1-2 hectares	128	33.9
3-4 hectares	136	36.0
4 hectares Above	78	20.7
Estimated Annual Income		
Less than ₦100,000	92	24.3
₦100,000- ₦200,000	186	49.2
₦201,000- ₦300,000	65	17.2
₦301,000- ₦400,000	35	9.3

Source: Field Survey 2024

According to data in the table above, 71.2% (269) of the respondents were male while 28.8% (109) were female. On the age distribution of respondents, study findings revealed that 18.5% (70) respondents fell within the age range of 18-30 years, 33.6% (127) were of the age bracket of 31-45 years while 30.2% (114) respondents were in the age category of 46-55 years, 10.1% (38) fell in the age range of 56-65 years and 7.7% (29) were of the ages of 66 years and above. Concerning the marital status of respondents study findings showed that 56.3% (213) respondents were married, 30.4% (115) were single and 13.2% (50) were widowed. Educational status of respondents indicated that 11.1% (42) respondents had no formal education, 29.9% (113) had primary qualifications while 42.1% (159) had secondary qualification and 16.9% (64) had tertiary qualifications. On occupational distribution of respondents, study findings

revealed that 11.4% (43) were civil servants, 60.3% (228) were farmers while 20.9% (79) were petty traders and 7.4% (28) were craft men. The farming experience of respondents showed that 22.8% (86) respondents had farming experience of between 1-10 years, 52.9% (200) had experience of 11-20 years while 16.9% (64) respondents had farming experience of between 21-30 years and 7.4% (28) had experience of 31 years above. On respondents farm size, study findings indicated that 9.5% (36) respondents had a farm size of less than 1 hectare, 33.9% (128) had between 1-2 hectares while 36% (136) had a farm size of between 3-4 hectares and 20.6% (78) had farm size of between 4-6 hectares. Farmers estimated annual income indicated that 24.3% (92) respondents had an estimated annual income of less than | 100,000, 49.2% (186) earn up to | 100,000-| 200,000 per annum while 17.2% (65) of the respondents had an estimated annual income of | 201,000-| 300,000 and 9.3% (35) earned up to | 301,000-| 400,000 per annum. This indicated that majority of the respondents were living on less than one dollar per day as such they were living below poverty line.

Table 3: Causes of Post-Harvest Losses of Sweet Potato among Farmers in Vandeikya LGA

Causes	Freq. (n=378)	Percentage (100)
Lack of adequate Processing Facilities	108	28.5
Lack of adequate Modern storage facilities	68	17.9
Poor Marketing system/lack of buyers	98	26.0
Poor handling practices	28	7.4
Poor access roads	23	6.1
Absence of Agro-allied industries	38	10.1
Pest and rodents attacks	15	4.0

Mean=2.89, Standard Deviation 1.761

Source: Field Survey 2024

Data in Table 3 above revealed that 28.5% (108) respondents pointed to lack of adequate processing facilities as the major cause of PHL of sweet potato. 17.9% (68) respondents maintained that lack of adequate modern storage facilities is a major cause of PHL of sweet potato while 26.0% (98) respondents noted that poor marketing system, low prices and lack of buyers is the major factor responsible for post-harvest losses of sweet potato. Similarly, 7.4% (28) of the respondents stressed that poor handling practices is one among the factors causing PHL of sweet potato, 6.1% (23) respondents pointed to poor access roads while 10.1% (38) agreed that absence of agro-allied industries is the major cause, 4.0% (15) respondents pointed to pest and rodent attacks with a mean of 2.89 and standard deviation of 1.753. The finding implies that they are varied factors influencing PHL of sweet potato among farmers in Vandeikya LGA.

Table 4: Annual Income from Sales of Sweet potatoes when there are Minimal Losses

Cost (in Naira)	Freq. (n=378)	Percentage (100)
Less than 10,000	8	2.1
10,000-40,000	21	5.6
41,000-70,000	103	27.2
71,000-90,000	190	50.3
91,000-100,000	28	7.4
100,000 Above	28	7.4

Mean=5.03, Standard Deviation=1.310

Source: Field Survey 2024

Findings on the income generated from sweet potato when farmers incur minimal sweet potato post-harvest losses as presented in Table 8 above revealed that 2.1% (8) of the respondents generated an income of less than ₦ 10,000 from the sale of sweet potato when they suffer minimal sweet potato post-harvest losses, 5.6% (21) of the respondents earned from ₦ 10,000- ₦ 40,000. Concerning those who generated an income of ₦ 41,000 – ₦ 70,000 when losses were minimal constituted 27.2% (103) of the respondents. Meanwhile, 53.3% (190) respondents earned ₦ 71,000- ₦ 90,000 and 7.4% (28) of the respondents derived an income of ₦ 90,000- ₦ 100,000 and ₦ 100,000 above respectively. This also indicates that majority (50.3%) sale sweet potato between 91,000-100,000 when they do not incur post-harvest losses with a mean of 5.03 and standard deviation of 1.310. From the data above, majority of the farmers (50.3%) earned between 71,000-90,000 naira when they incur minimal post-harvest losses of sweet potato. This indicates that majority of the farmers generated more revenue from sweet potato when they incur minimal losses. When farmers incur minimal losses, there is more quantity of sweet potato to take care of consumption by the household and for sales. More income is therefore generated from sales which is used to satisfy other basic needs.

Table 5: Annual Income from Sales of Sweet potatoes when farmers incur High Losses

Cost (in Naira)	Freq. (n=378)	Percentage (100)
Less than 10,000	77	20.4
10,000-40,000	203	53.7
41,000-70,000	28	7.4
71,000-90,000	28	7.4
91,000-100,000	21	5.6
100,000 Above	21	5.6

Mean=2.41, Standard Deviation 1.342

Source: Field Survey 2024

On the income generated from sweet potato when farmers incur high post-harvest losses of sweet potato, findings indicated that 20.4% (77) of the respondents generated an income of less than ₦ 10,000 from sales of sweet potato when they suffer high post-harvest losses, 53.7% (203) respondents earned from ₦ 10,000- ₦ 40,000. Those who generated an income of ₦ 41,000 – ₦ 70,000 when high losses were incurred constituted 7.4% (28) respondents. Meanwhile, 7.4% (28) earned ₦ 71,000- ₦ 90,000 and 5.6% (21) of the respondents derived an income of ₦ 90,000- ₦ 100,000 and ₦ 100,000 above respectively. This revealed that majority (53.7%) respondents generated an annual income of between 10,000-40,000 when they incur high sweet potato post-harvest losses with mean of 2.41 and standard deviation of 1.342. The above findings revealed that majority of the respondents (53.7%) generated an annual income of 10,000-40,000 from sweet potato when they incur high losses. This revealed that farmers generated less income when they incur high losses as the quantity and quality of the produce is lost thereby leaving the farmers with little to sell.

Table 6: Effects of Income on farmers' Wellbeing

Effects	Freq. (n=378)	Percentage (100)
Inability to access quality health care	96	25.4
Poor housing	95	25.1
Inability to afford quality education	134	35.4
Poor clothing	47	12.4
Others	6	1.6

Mean=2.46, Standard Deviation 1.046

Source: Field work, 2024.

After ascertaining the effect of post-harvest losses of sweet potato on the income of farmers, the study further examined the effects of income on farmers' wellbeing. Findings of the study indicated that 25.4% (96) respondents pointed to inability to access quality health care as the major effect of income on farmers' wellbeing, 25.1% (95) said poor housing is the major effect of income on the wellbeing of farmers while 35.4% (134) maintained that farmers' inability to afford quality education is the major effect of income on their wellbeing and 12.4% (47) respondents said poor clothing is the major effect of income on farmers' wellbeing, 1.6% (6) respondents pointed to other effects of income on wellbeing of farmers.

The data in table 6 above revealed that reduction in farmers' income has enormous implications on their wellbeing. Farmers' income which is used to satisfy their basic needs is acquired through sales of agricultural produce including sweet potato which they pointed out as one of their major produced crops. As such when they incur losses which leads to a reduction in the quality and quantity of the product, it affects its marketability and leads to low prices thereby affecting the amount of money generated from its sales. The reduction in farmers' income is inversely related to their wellbeing as farmers lack the funds to meet their basic needs of life such as housing, clothing, health care services and education there by reducing their standard of living and that of their households. It has also made a good number of them unable to meet the health, educational and other developmental needs of their families thereby leading to generations of poverty or poverty cycle.

Most farmers in the study area were unable to acquire education for themselves and that of their children. Majority of them did not have any educational qualifications as they had no resources to do so. The highest level of education which most of them attained was between primary and secondary education, only few of them had tertiary education. This was basically because there were government primary and secondary schools in those communities with little charges on school fees which they could afford. They, however, could not afford tertiary education as it required them leaving their communities and their farms and could also not bear the high cost of tuition.

On the part of their children, majority of them could not send their children to school, especially tertiary institutions. For those who went out of their way to ensure that their children acquired education, only the male children were selected for tertiary education as they could not afford to send all of them to school. The girls were meant to marry after secondary or primary education.

Table 7: Post-harvest losses of Sweet Potatoes on Food availability among farmers in Vandeikya LGA

Effect of Post-Harvest Losses	Freq. (n=378)	Percentage (100)
Reduced household food availability	120	31.7
Increased food prices	85	22.5
Loss of income affecting food purchase	95	25.1
Increased dependence on alternative crops	45	11.9
Increase hunger	33	8.7

Mean=2.39, Standard Deviation 1.341

Source: Field Survey 2024

Table 7 above indicated a significant proportion of respondents (31.7%) reported that post-harvest losses of sweet potatoes lead to a reduction in household food availability. This suggests that a substantial amount of produce is lost before it can be consumed, affecting food security at the household level. About 22.5% of the respondents identified increased food prices as an

effect of post-harvest losses. When supply is reduced due to spoilage or wastage, market prices tend to rise, making sweet potatoes less affordable for both farmers and consumers. A quarter of respondents (25.1%) highlighted that post-harvest losses result in income losses, making it difficult for farmers to purchase other food items. Since many smallholder farmers in Vandeikya LGA rely on agricultural sales as their primary source of income, losses from spoilage reduce their purchasing power, thereby limiting food accessibility. Approximately 11.9% of respondents reported that due to sweet potato losses, farmers resort to alternative crops as a substitute for food and income. This coping strategy, while useful, may not always be sustainable if alternative crops are not as readily available or profitable and finally a smaller but still notable proportion (8.7%) of respondents indicated that post-harvest losses directly contribute to increased hunger. This highlights the role of food availability in nutritional well-being, as reduced supply can lead to food shortages, especially in farming households that rely on sweet potatoes as a staple food. Also, Mean = 2.39 suggests that the average impact of post-harvest losses on food availability leans toward moderate to high effects. A Standard Deviation = 1.341 shows variability in responses and indicates that farmers experience post-harvest losses differently, with some facing more severe effects than others.

Test of Hypotheses

The first hypothesis for this study proposed that:

H₀: There is no significant relationship between the level of post-harvest losses of sweet potatoes and farmers income among farmers in Vandeikya LGA.

H₁: There is a significant relationship between the level of post-harvest losses of sweet potatoes and farmers income among farmers in Vandeikya LGA.

This assumption seeks to ascertain the impact post-harvest losses of sweet potatoes has on the income of farmers in the study area. A t-test for the significant impact of sweet potatoes post-harvest losses on the income of farmers is used to achieve this purpose as shown in table 8 below

Table 8: Correlation Statistics for Linear Relationship between Post-harvest Losses of Sweet potatoes and Farmers Income

Variable	N	χ	SD	df	R	Sig.
Post-harvest losses of Sweet potatoes	378	4.42	1.134	376	0.732	0.001
Farmers Income	378	3.46	1.486			

Source: Field survey 2024

The result on Table 13 above showed that post-harvest losses of sweet potatoes is statistically related to farmers' income. This is because the significance level (0.001) is less than 0.05. The value of 0.732 implied that there is a positive correlation between post-harvest losses of sweet potatoes and farmers income. The reduction in farmers' income was found by the study as the major impact of post-harvest losses of sweet potatoes on farmers' wellbeing. As a result of the shortfall in farmers income due to the reduction in quality and quantity of sweet potatoes as a result of post-harvest losses, most farmers find it difficult to afford basic health care, housing, education, clothing and nutritious food. Most of them are unable to send their children to school, find it difficult to invest and expand the sizes of their farms. All these negative impacts on their standard of living thereby affecting their socio-economic wellbeing. Therefore, the hypothesis states that there is no significant impact of the level of sweet potatoes post-harvest losses and the income of farmers is refuted. The study concludes that post-harvest losses of sweet potatoes have significant impact on income among farmers in Vandeikya Local Government Area.

Hypothesis 2:

H₀: There is no relationship between post-harvest losses of sweet potatoes and food availability among farmers in Vandeikya LGA.

H₁: There is a relationship between post-harvest losses of sweet potatoes and food availability among farmers in Vandeikya LGA.

This hypothesis is concerned with establishing the relationship between Sweet potatoes post-harvest losses and food availability among Tiv farmers in Benue state. Chi-Square based statistics is used to ascertain this relationship (see table 15 below)

Table 15: Chi-Square Test of the Relationship between Sweet potatoes Post-Harvest Losses and Food Availability

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	559.489a	45	.000
Likelihood Ratio	458.256	45	.000
Linear-by-Linear Association	.266	1	.606
N of Valid Cases	378		

a. 38 cells (63.3%) have expected count less than 5. The minimum expected count is .06

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Nominal by Nominal	Phi	1.217			.000
	Cramer's V	.544			.000
	Contingency Coefficient	.773			.000
Interval by Interval	Pearson's R	.027	.054	.515	.607c
Ordinal by Ordinal	Spearman Correlation	.006	.057	.122	.903c
N of Valid Cases		378			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

The above statistical test found that the value of Chi-Square (χ^2) in the association is 559.489 at degree of freedom (df) of =45 and P value of 0.000, since P value is less than 0.5, it means that the variables are significantly related. Furthermore, the measured strength of the association between post-harvest losses of sweet potatoes and food availability found the value of Cramer's V to be = 0.544 and contingency coefficient value of = 0.773 indicating a Strong positive association. This implies that sweet potatoes post-harvest losses have significant impact on food availability in the study area.

Sweet potatoes, which was found to be a staple food and a major source of income to farmers in the study area have grave impact on food and nutritional needs of farmers when the quality and quantity of the produce is lost to post-harvest handling. Apart from consuming sweet potatoes in form of fufu, sweet potatoes floor, chips, among several others, farmers also use the income generated from sales of Sweet potatoes to purchase other food items to balance their nutritional needs as such when they experience high losses that reduces the income they generate from Sweet potatoes they have less of Sweet potatoes to consume and money to purchase other food items that nourishes their bodies for healthy living. The hypothesis which states that sweet potatoes post-harvest losses have no significant impact on food availability is also rejected. It can be deduced from the findings that sweet potatoes post-harvest losses have significantly impact on food availability in the study area.

Discussion of Findings

This section outlines the major findings from the data acquired from various respondents in the study. These findings are discussed in accordance with the study objectives. Therefore, this objective was to investigate the major causes of post-harvest losses of sweet potatoes among the farmers in Vandeikya LGA. Finding revealed that, the major cause of postharvest losses in were lack of adequate processing facilities, lack of adequate modern storage facilities, poor marketing system/lack of buyers, absence of agro-allied industries among others. This finding agrees with Gautam et al. (1993); Watson et al., (1992). that, sprouting in sweet potato roots occurs very quickly especially when soil moisture is high and the harvest is delayed. It also occurs during prolonged storage in conditions of high temperature and humidity.

This objective focuses on the effect of post-harvest losses on the socio-economic well-being of farmers. Findings revealed postharvest losses has effect on the wellbeing of farmers. Farmers' income which is used to satisfy their basic needs is acquired through sales of agricultural produce including sweet potato which they pointed out as one of their major produced crops. As such when they incur losses which leads to a reduction in the quality and quantity of the product, it affects its marketability and leads to low prices thereby affecting the amount of money generated from its sales. The reduction in farmers' income is inversely related to their wellbeing as farmers lack the funds to meet their basic needs of life such as housing, clothing, health care services, and education there by reducing their standard of living and that of their households. This agrees with Essiet (2014), that postharvest losses led to reduction in farmers' income. Post-harvest losses have been a huge drain on local production, as colossal quantities of food are lost year after year. A study conducted by Nda (2018) on the effects of harvest and post-harvest losses of cassava on income of farmers in Vandeikya Local Government Area, Benue State also found that post-harvest losses have grave implications on the income of farmers and could consequently result into a rapid decline in their welfare.

Conclusion

Post-harvest losses has a detrimental effect on farmers' well-being. The study concluded that investing in modern storage facilities, providing training on best practices for post-harvest handling, and enhancing market access through improved infrastructure and cooperative systems are crucial. Addressing these issues will not only reduce post-harvest losses but also improve the socio-economic well-being of farmers, thereby contributing to sustainable agricultural development in the area.

Recommendations

Based on the findings of the study, the following recommendations were made;

- i. Government should establish agro-allied industries that will help Benue state as a one of the top sweet potato producers in the nation minimize post-harvest losses.
- ii. Government through Bank of industry and Bank of agriculture make deliberate efforts toward assisting farmers with finance that will help them acquire modern processing and storage facilities that will enable them process sweet potatoes into other food forms which extend their shelf life
- iii. Improved extension Services, there should be improved extension services by agricultural extension workers to sensitize farmers on post-harvest losses of sweet potato because most of them are not aware of best farming practices.
- iv. Government should create more access roads and rehabilitate the damaged ones for easy conveying of the product through the production chain to the consumers.

References

- Adewoyin, B O. (2023). Pre-harvest and postharvest factors affecting quality and shelf life of harvested produce. *Intech Open*. doi: 10.5772/intechopen.111649
- Aparecida, P.A.P., Pedrosa, M.T., Schmieles, M., Gioia, L.C., Nojima, M.A., Steel, C.J., & Nabeshima, E.H. (2019). Orange-fleshed sweet potato flour as a precursor of aroma and color of sourdough panettones. *LWT Food Sci. Technol*: 101,145-51.

- Carballo P.I., Mu, T.H., Zhang, M., & Ji, L.L. (2018). Effect of high hydrostatic pressure to sweet potato flour on dough properties and characteristics of sweet potato-wheat bread. *Int. J. Food Sci. Technol*; 53(4): 1087-94. <https://doi.org/10.1111/ijfs.13687>
- Chukwunta, P. C. (2014). An analysis of post-harvest losses management strategies by farmers in Awgu Local Government Area of Enugu State, Nigeria. *Institute for Development Studies, University of Nigeria, Nsukka, Enugu Campus*.
- CIP (2013): Project baseline and impact studies conducted in Ethiopia, Kenya, Rwanda and Uganda, unpublished
- Courtland L.S. & Clay, P.M. (2010), *Measuring Subjective and Objective Well-being: Analyses from Five Marine Commercial Fisheries*, Human Organization, 69(2), 158-168.
- Food and Agricultural Organization (FAO) (2015). Food and Agricultural Organization of the United Nations, Statistical Databases (FAOSTAT).[http://faostat3.fao.org/browse/Q/QCE/ E](http://faostat3.fao.org/browse/Q/QCE/E). (Retrieved on 20/05/2016)
- Grolleaud, M. (2004). Post-harvest Losses: Discovering the Full Story. Overview of the Phenomena of Losses during the Post-harvest System. Retrieved from http://www.foa.org/docrep/004/ac_301e/AC301e.htm.
- Kesebir, P., & Diener, E., (2018), *In pursuit of happiness: Empirical answers to philosophical questions*. *Perspectives on Psychological Science*, 3, 117-125.
- Laurie, S.M., Van Jaarsveld P.J., Faber, M., Philpott, M.F. and Labuschagne, M.T. (2012). Trans-β-carotene, selected mineral content and potential nutritional contribution of 12 sweet potato varieties. *J. Food Compos. Anal.*, 27, 151-159
- Low, J. Lynam, J., Lemaga, B., Crissman, C., Barker, I., Thiele, G., Namanda, S., Wheatley, C. and Andrade, M. (2009). Sweetpotato in Sub-Saharan Africa. In: Loebenstein, G. and Thottappilly, G. (eds.). *The Sweetpotato*. Dordrecht: Springer Science + Business Media B.V
- Narayan, D., R. Chambers, M. K. Shah, and P. Petesch, (2017), *Voices of the Poor: Crying Out for Change*, Oxford University Press for the World Bank, New York.
- National Root Crops Research Institute (2020). National Root Crops Research Institute, Umudike-Root Crops Division. <http://74.6.239.67/search/cache?ei=UTF8&p=www.nrcri.org%2fpages%2fspotato.htm&I>
- Nwosu, K. I. (2015). Welcome address presented by the Director, National Root Crops Research Institute, Umudike, at the opening ceremony of the 2015 annual research review and planning workshop of the Institute, 5th - 7th April
- Ojore, M., Richard, I., Bwala, I., & Amaka, C. (2012). Productivity of Sweet potato-Sweet Potato Intercropping System as Influenced by Varying Lengths of Sweet potato Cutting at Makurdi, Nigeria. *Journal of Biology, Agriculture, and Healthcare*, 2(5), 87-93
- Okeke, M. N., Mbah, E.N., Madukwe, M.C and Nwalieji, H.U (2020). Adoption of improved sweet potato production Technologies among Small - scale Farmers in South East, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology* 37(4): 1-13,
- Okposen O. E. B., Meyen I. W. and Ufur, O. J. (2016). Comparative Evaluation of the nutritional potentials of feeding rabbits with sweet potato leaves and centrosema (each supplemented with 50g mash). *Proc. of the 10th Ann. Farming System Workshop in Southeastern Nigeria*. pp. 119 - 121
- Selvakumaran, L., Shukri, R., Ramli, N.S., Pak Dek, M.S., & Wan Ibadullah, W.Z. (2019). Orange sweet potato (*Ipomoea batatas*) puree improved physicochemical properties and sensory acceptance of brownies. *J. Saudi Soc. Agric. Sci.* 18(3), 332-6