



ADOPTION OF TOMATO POST – HARVEST VALUE ADDITION TECHNOLOGIES (TPVTS) AND WELL-BEING OF TIV RURAL FARMERS IN BENUE STATE, NIGERIA

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ABSTRACT

The study evaluated the adoption of tomato postharvest value addition technologies and well-being of rural farmers in Benue State. A sample size of 400 farmers was selected from six major tomato-producing Local Government Areas of Tiv rural farmers using cluster, purposive, and random sampling techniques. Data was collected through semi-structured interviews and focus group discussions, and analyzed using descriptive and inferential statistics. The results showed a significant increase in farmers' average annual income after adopting improved TPVTs, from ₦31,465.34 to ₦75,697.92. This increase in income enhanced their purchasing power, access to basic necessities, and overall well-being. The study concluded that the high adoption rate of TPVTs among rural farmers has improved their well-being and the rural economy. Recommendations include scaling up TPVTs to all tomato farmers, infrastructural development, and adequate funding to support effective adoption among rural farmers.

Keywords: Adoption, Postharvest, Value-addition Technologies, Well-being

INTRODUCTION

Nigeria is projected to be one of the largest exporters of tomato in the world considering the large quantities of tomatoes produced in the country. This would have contributed significantly to Gross Domestic Product (GDP), created markets for the producers, reduced unemployment and increase income and standard of living of the farmers. In addition, the dietary importance of tomato to human beings and their contribution to rural economy is very important as most of the cases of malnutrition come from the rural region. Yet, most farmers in Nigeria are skeptical in exploring this area of agricultural production due to high postharvest losses which result to low farm income and socioeconomic wellbeing (Food and Agriculture Organization. 2020) and (International Fund for Agricultural Development, 2018). In an effort to boost tomato industry and reduce postharvest losses by encouraging value addition and more investment along tomato value chain, the Nigerian Stored Products Research Institute (NSPRI) together with Food and Agriculture Organization of the United Nations (FAO) developed and recommended certain tomato post-harvest value addition technologies to farmers to prolong its shelf life and reduce crop losses in an attempt to improve on the income and wellbeing of the local producers (Adekunle and Adebayo 2019).. These technologies include: cold water bath, sun dried into chips, peeled tomato preserves, fresh frozen, pureed and sealed with oil in jars, boiled and sealed, pulping and pickling, grind and frozen, processed into jam, fresh refrigerated and processed into juice. Many farmers who had adopted the NSPRI/FAO's package of practice (POP) had claimed that the practices have helped them to reduce tomato postharvest losses thereby increasing their net revenue. The revenue accrued as a result of the adopted technologies had reportedly increased the access of many beneficiaries to more factors of production, created other more small-scale enterprises, employment and investment opportunities that generated more income, improved their socio-economic status and empowered them to fight poverty since inception of the NSPRI/FAO's POP in the area.

Despite these lofty claims, no sufficient empirical details have been available to validate the extent to which there is a correlation between the adoption of the NSPRI/FAO's package of practice (POP) and increase in the economic well-being of the beneficiaries. Thus, empirical details about the



level of adoption of NSPRI/FAO's package of practice (POP) and its effectiveness in reducing tomato postharvest losses remain largely inadequate. The need for detail analysis of the relationship between adoption of the improved tomato post-harvest value addition technologies and socioeconomic well-being of rural farmers in Benue State has become very pertinent in order to close the existing gap in knowledge. The study is therefore designed to: ascertain the adoption level of tomato post-harvest value addition technologies among Tiv tomato farmers in Benue State and the extent to which it has improved the well-being of the farmers adopting the tomato postharvest value addition technologies in the study area. The literature reviewed for the study covered the available tomato post-harvest value addition technologies in Nigeria and adoption level of the technologies. It also covered socio-economic benefits of adopting new technologies as well as ways of enhancing adoption of tomato post-harvest value addition technologies. The study adopted Rogers diffusion of innovation theory as theoretical framework.

METHODOLOGY

Study Area

The study was carried out among Tiv tomato farmers in Benue State, Nigeria. Agriculturally, Tiv people of Benue State constitute the Northern and Eastern agricultural zones of the state.. The geographical position of the Tiv is between 6° 30' and 8° 10' North latitude and 8° and 10° East longitude. The Tiv people of Benue State shares borders with the Chamba and Jukun of Taraba State in the Northeast; Alago in the North, with the Iyala, Gakem and Obudu of Cross River State in the South; and the Idoma and Iggede of Benue State to the West (Emmy and Shamiga Dominic, 2019). The Tiv people are the fourth-largest ethnic group in Nigeria, having a population of about 6.5 million. They occupy a landmass roughly within the Benue State, and parts of Taraba, Nasarawa, and Plateau States, covering an area of approximately 3,682 square kilometers in the Akwaya sub-division (Emmy and Shamiga Dominic, 2019). The Tiv people are the fourth-largest ethnic group in Nigeria with crop farming as their primary occupation. Tiv Land is predominantly woodland savannah, characterized by a tropical climate with two distinctive seasons. There is a wet season from April to October and a dry season from November to March.

The population for the study consists of all the 398,500 tomato farmers in the six major tomato production Local Government areas in the two agricultural zones of Benue State (Benue State Ministry of Agriculture and Natural Resources, 2021). These LGAs are Tarkaa, Gboko, and Buruku from the Northern agricultural zone while Ushongo, Katsina-Ala and Konshisha were selected from the eastern agricultural zone. Tiv people were selected for the study based on the fact that they produce majority of tomatoes cultivated in Benue State.

Sampling Procedure and Sample Size

This study employs cluster, simple random and purposive sampling procedures to draw its population. Here, the extension blocks and cells from the six local government areas leading in tomato production constituted the clusters for the study. One extension block and four extension cells respectively were purposively chosen from each LGA based on the quantity of tomatoes they produce, giving a total of 6 extension blocks and 24 extension cells for the study. These extension blocks were Tarkaa block from Tarkaa LGA, Gboko block from Gboko LGA, Lessel block from Ushongu LGA, Kornya block from Konshisha LGA, Buruku block from Buruku LGA and Katsina block from Katsina-Ala LGA. Simple random procedure was therefore used to select at least 16 respondents from each extension cell, the remaining ones (16) were similarly randomly selected among the 24 cells totaling to 400 respondents using Taro Yamane's sample size determination formula.

Methods of Data Collection and Analysis

The data for this study was elicited from both primary and secondary sources. The basic instruments designed to gather the primary data include; focus group discussion and semi-structured Interview (SSI), while the secondary data however were collected using official documentations. The data gathered for the study were analyzed both qualitatively and quantitatively. Specifically, data on level of adoption, and the well-being of tomato farmers were analyzed quantitatively using statistics such as



percentages, frequency distribution tables, charts, t-test, regression and correlations. Apart from the above, all other information elicited from the respondents were analyzed qualitatively.

RESULTS AND DISCUSSION

Adoption Level of Tomato Postharvest Value Addition Technologies among Tiv Farmers in Benue State

This section of the study dwells on the level of adoption of improved tomato postharvest value – added technologies (TPVTs) among farmers in Benue State. It is worthy to note here that only 288 out of the 400 sampled targeted farmers successfully adopted the TPVTs.

The results in Table 1 revealed that, most (97.9%) of tomato farmers in Benue State adopted sundried into chips as a post-harvest value addition technology, making it the most widely adopted technology. Additionally, majority (62.2%) of tomato farmers adopted pureed and sealed with oil in jars, with 22.6% at the trial stage and 15.6% at the interest stage. Also the results revealed that 61.1% adopted boiled and sealed, with 8.7% at the trial stage and 8.7% at the interest stage, while 44.8% adopted grind and frozen, with 24.3% at the interest stage. Furthermore, 30.2% of the tomato farmers in the study area adopted fresh refrigerated, with 69.8% at the evaluation stage, smaller proportions of farmers adopted other technologies like peeled tomato preserves (15.5%), pulping and pickling (6.9%), process into juice (13.5%), and process into jam (4.9%), while Cold water bath had the lowest adoption rate of 1.0%, with 52.8% of farmers at the awareness stage. The high adoption rate of sundried into chips may be due to its familiarity, simplicity, and cost-effectiveness, as perceived by the farmers.

Further findings from focus group discussions also indicated that sundried into chips was the most popular and commonly adopted technology as compared to the rest of other improved tomato postharvest value addition technologies available in their area due to its familiarity, simplicity and cost effectiveness.

The foregoing implies therefore that tomato farmers in particular and farmers in general usually prefer to accept innovations that are more user – friendly, culturally related and cost – effective. These findings corroborate those of Masere, and Worth (2022) who asserted that a decision on adoption is generally based on affordability, information support, availability of markets and credit facilities offering loans with lower interest rates and other biophysical conditions.

Table 1: Adoption Level of Tomato Post-Harvest Value Addition Technologies among Tiv Farmers of Benue State

Value Addition Technologies	Aware		Interest		Evaluation		Trail		Adoption		Mean	Rank
	F	%	F	%	F	%	F	%	F	%		
Coldwater bath	152	52.8	54	18.8	23	8.0	56	19.4	3	1.0	1.97	10 th
Sundried into chips	-	-	-	-	-	-	6	2.1	282	97.9	4.98	1 st
Peeled tomato preserves	69	24.0	51	17.7	67	23.3	56	19.4	45	15.6	2.85	6 th
Fresh refrigerated	89	30.9	58	20.1	15	5.2	38	13.2	88	30.2	2.92	5 th
Pureed and sealed with oil in jars	13	4.5	27	9.4	4	1.4	65	22.6	179	62.2	4.28	2 nd
Boiled and sealed	19	6.6	25	8.7	25	8.7	43	43	176	61.1	4.15	3 rd
Pulping and pickling	81	28.1	50	17.4	47	16.3	90	90	20	6.9	2.71	7 th
Grind and frozen	17	5.9	70	24.3	37	12.8	35	35	129	44.8	3.66	4 th
Process into jam	72	25.0	62	21.5	62	21.5	78	78	14	4.9	2.65	9 th
Process in to juice	81	28.1	64	22.2	44	15.3	60	60	39	13.5	2.69	8 th

Source: Field Survey, 2023 (n=288)



Estimated Seasonal Income Obtained from Tomatoes Due to Adoption of TPVTs

The results in Table 2 showed that 23.6% of the tomato farmers who adopted the ITPVTs have acquired a seasonal revenue of between ₦82000 - ₦112000, while 20.8% earned an average revenue of ₦113000 - ₦14300 while 14.9 percent got an average revenue of over ₦143,000 after adopting the TPVTs introduced to them. Furthermore, 10.4% had earned between ₦ 20000-50000 while 9.4 % of the farmers acquired an annual income of less than N20000. These altogether produced a seasonal mean income of 75697.92 indicating that the adoption of TPVTs has not just reduced the postharvest losses of tomato but had also increased significantly, the farmers' revenue or income per tomato season. Further findings from the FGDs also confirmed that adoption of TPVTs among tomato farmers in the study area has significantly increased their revenue per tomato farming season.

Table 2: Estimated Seasonal Income Obtained by Tomato Farmers after Adoption of ITPVTs.

Income	Frequencies	Percentages	Mean
Less than ₦20000	27	9.4	₦75697.92
₦20000-50000	30	10.4	
₦51000-81000	60	20.8	
₦82000-112000	68	23.6	
₦113000-143000	60	20.8	
Above ₦143000	43	14.9	
Total	288	100	

Source: Field Survey, 2023

Estimated Annual Income Obtained from Tomatoes Before Adoption of Improve Tomato Post-harvest Value Addition Technologies ITPVTs by Estimated Annual Income Obtained from Tomatoes after Adoption of ITPVTS

This section also involves cross charting of annual income obtained from tomato famers before adoption of TTPVTs by annual income from tomato farming after adoption of ITPVTs by maneuvering it on a bar chart. This is used to examine the differences in income of tomato farmers before and after adoption of improved tomato post-harvest value addition technologies in the study area.

Figure 2 reveal clearly that tomato farmers receive more annual income from their produce after adoption of ITPVTs than before adoption of ITPVIs. A focus group discussion with respondents also affirmed that tomato farmers obtain more income from their tomatoes after adoption of ITPVTs which leads to increase in farmer's yields and income.

Further findings on the difference between the income of tomato farmers before and after adoption of the TPVTs revealed that the tomato farmers in the study area who were hitherto, low on seasonal income of ₦31465.34(AVR) before the adoption of TPVTs had recorded an increase in their seasonal income amounting to ₦75697.92 (AVR) after adopting the TPVTs.

This result is Consistent with the findings of previous studies of Berihun et al., (2014) who asserted that agricultural technology adoption has a positive and significant effect on farm income by which adopters are better-offs than non-adopters.

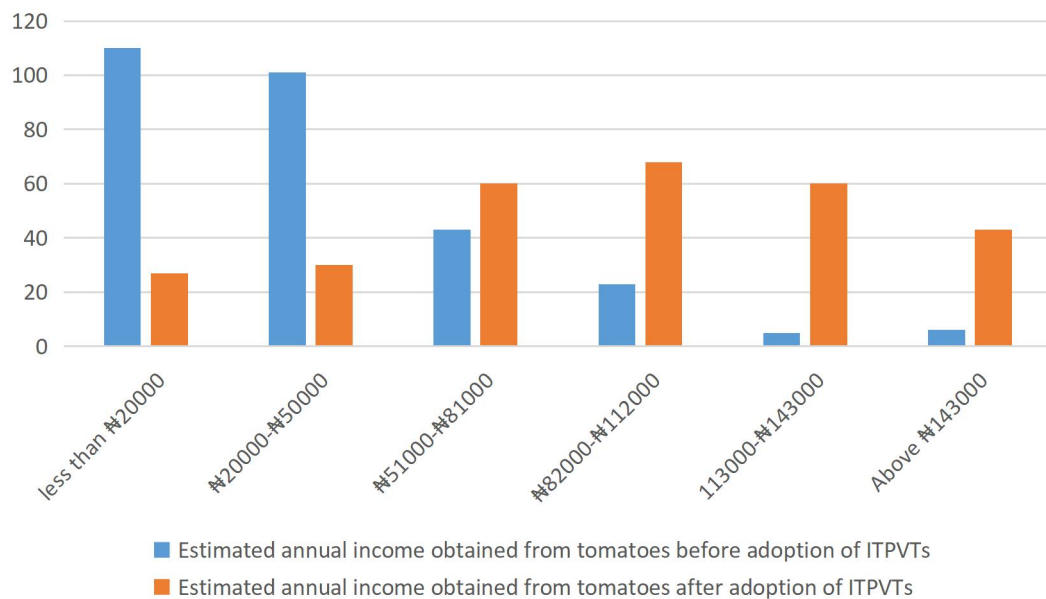


Figure 1: Estimated Annual Income Obtained from Tomatoes Before Adoption of ITPVTs by Estimated Annual Income Obtained from Tomatoes After Adoption of ITPVTs

Analysis of Difference in Income Obtained from Tomatoes Before and After Adoption of Improved Tomato Post-Harvest Value Addition Technologies (TPVTs) Among Farmers

The t – test result in Table 3 gives a significant mean income difference of ₦44232.58 ($P < 0.05$) where $t = 11.828$; $P = 0.00$. This implies that the adopters of TPVTs have higher income after adoption than what they used experienced before the adoption of the value – added technologies. The upward change in their income has consequently increased their access to basic necessities of life such as quality education, health care services, food and nutrition etc. thereby improving their socio economics wellbeing and those of their households.

The foregoing results therefore showed a strong nexus between farmers' adoption of the TPVTs and the accrued revenue or income. Thus, tomato farmers whose levels of technology adoption were high also experienced significant improvement in their seasonal income and vice versa. This implies therefore that tomato farmers who adopted the improved value-added postharvest technologies in the study area had not only succeeded in reducing their levels of postharvest losses but had more quantity of tomatoes to sell and make more revenue leading to high socio-economic well-being than their counterparts who did not adopt the TPVTs. This finding thus, aligned itself with that of Tijani (2022) who reported that the adoption of tomato value addition technologies among farmers in Oyo State had positive effects on their income.

Table 3. Analysis of Difference in Income Obtained from Tomatoes Before and After Adoption of Improved Tomato Post-Harvest Value Addition Technologies (TPVTs) Among Farmers

Variables	No of resp.	Mean (N)	St. deviation	Mean Dff.	D.F	T	Sig
Annual income before Adoption (ITVTs)	288	N31465.34	1.1580276	N44232.586	287	11.828	0.000
Annual income after adoption of (ITVTs)	288	N75697.92	1.49854346				

*= t- Test of Difference Significant at 5% Level of Probability



Utilization of the Income Obtained from the Adoption of Improved Tomato Postharvest Value Addition Technologies and the Socio – Economic Wellbeing of Tomato Farmers

This section of the study discusses the various ways in which the income accruing from adoption of TPVTs were used by beneficiaries that had improved their wellbeing and that of their households. Statistical data derived from the survey indicated that 109 (37.85%) beneficiaries had used the additional income for productive purposes, 97(33.68%) beneficiaries spent the funds on supportive, while 82(24.47%) beneficiaries used the money on direct consumption purposes (see Figure 2 below).

The Productive – based expenditure as depicted in Figure 2 according to the respondents, were those expenditures that could generate additional income for the farmers, supportive purpose expenditure refers to expenditures made by beneficiaries which could complements the production process, while the consumptive expenditure represents part of the accrued income expended that could not yield any actual income. Although there was no sharp demarcating line arbitrary drawn between the productive, supportive and consumptive uses of the funds as supportive and consumption activities are usually inseparably linked with the production sphere and vice-versa in rural households (Akpehe, 2015), the above definitions therefore helped the study to track down the usage of income accruing from adoption of TPVTs among the beneficiaries for further analysis.

As indicated in Figure 2, beneficiaries spent the largest proportions of the income generated from adoption of improved technologies on productive (0.38) and supportive (0.34) ventures respectively. The productive ventures according to findings include: procurement of farm inputs, expanding of farm size, hiring of more labour, setting up and running small – scale business enterprises (SBEs) such as laundry, barbing and hair dressing salons, sports viewing centres, tailoring and fashion designing, food canteens and confectionaries. The supportive venture included: sponsoring the education of their children and wards, building of houses, accessing health care services and other essential facilities (such as construction of water wells and sanitary facilities). These activities in turn, generated a chain of income for them and had further enhanced their access to more factors of production, productive investments, economic security and social capital etc. It also had increased their chances of meeting other basic needs such as shelter, clothing, health, education, skill – acquisition, food and nutrition among others as well as creating more job opportunities, engaging good numbers of people who hitherto had no source of earning their livelihood.

Apart from the proportion of beneficiaries that spent their income on productive and supportive ventures, information in Figure 2 also revealed that a proportion (0.24) of the targeted farmers spent the funds to smoothen other varieties of consumption needs such as feeding, drinking, clothing, socio-cultural festivities such as Christmas and New Year celebrations, marriages, births, promotion and bereavements. Other usages include: acquisition of household items such as television and video sets, furniture, kitchen utensils and mobile telephone,

Corroborating the findings from survey, a 52- year- old discussant at Tarhembe cell in Tarkaa Local Government area affirmed that:

I used the income I made from tomato farming to buy staple food like rice and beans, without which, hunger would have killed me and my eight (8) children if I had not planted tomatoes. So, I solely used the money obtained from adoption of TPVTs for purchase of food for my family" (FGD, 2023) Similarly, a 42-year-old female farmer at Tarkor in Katsina-Ala said that I used the money generated from the use of TPVTs for training my children, even last week I bought two text books at the cost of three thousand seven hundred Naira (N3700) for my son who is in the secondary school, I also used the money to buy drugs for them when they were sick (FGD, 2023).

In the light of the foregoing, it could be deduced that farmers' utilization of TPVTs have increased the per-capital income of the beneficiaries and consequently their socio – economic well-being and those of their family members thereby empowering them to fight and reduce chronic poverty in the area. This is in line with Rajendra and Vilas (2018) who reported that additional return obtained from adoption of improved post- rainy sorghum technology helped the farmers spending significantly higher on purchase of house hold items and other pressing family needs.

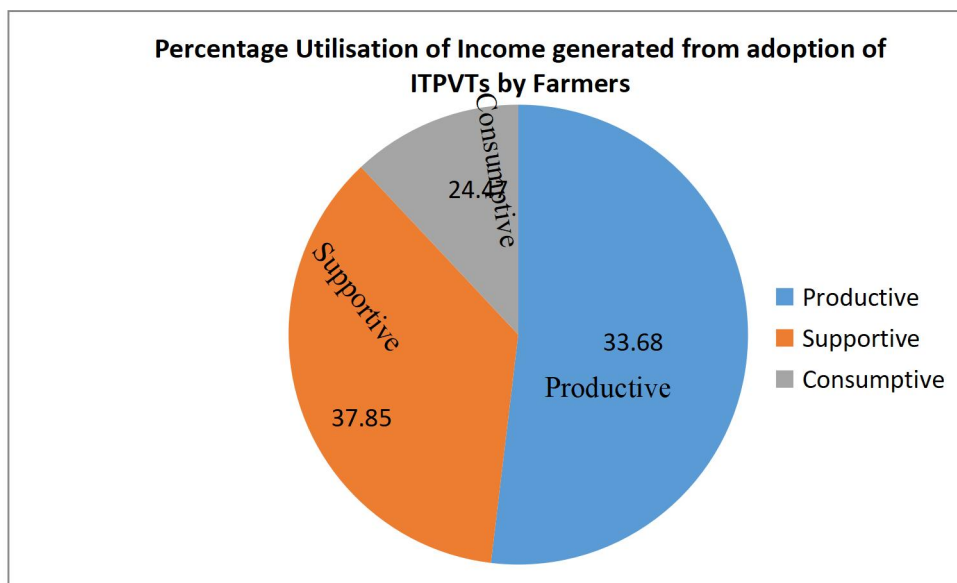


Figure 2: *Utilisation of Income generated from adoption of TPVTs by Farmers*

CONCLUSION AND RECOMMENDATION

The study revealed a high adoption rate of improved tomato postharvest value addition technologies among farmers in the study area, resulting in increased income and improved purchasing power. This, in turn, enhanced their access to basic necessities and significantly impacted their overall well-being and that of their households. Notably, specific technologies like sundried tomato chips, pureed tomatoes sealed in jars with oil, and boiled tomatoes sealed in jars showed higher adoption rates.

Based on these findings, the study recommends effective dissemination of tomato postharvest value addition technologies across all tomato-producing areas in Benue State to minimize losses and boost farmers' revenue. Furthermore, supplementary training should be provided to equip farmers with the necessary skills to adopt low-adoption technologies, ultimately reducing postharvest losses, increasing income, and enhancing overall well-being

REFERENCE

- Adekunle, A. A., and Adebayo, O. S. (2019). Postharvest losses in tomato production in Nigeria. *Journal of Agricultural Science and Practice*, **4**(1): 1-8.
- Akangbe, J. A., Ogundiran T. J., Komolafe S. E., Ifabiyi J. O. and Ajibola B. O. (2014). Tomato farmer's adoption level of post-harvest value addition technology and its constraints in Surulere Area of Oyo State, Nigeria, *Journal of Agriculture and Social Research*, **14** (1): 93-96.
- Akpehe, G. (2015). Supportive and consumptive uses of funds in rural households. *Journal of Rural Development*, **10**(2): 12-20.
- Benue State Ministry of Agriculture and Natural resources (2021). *Report on available agricultural crops and main production areas in Benue State*, farmer desk, department of agricultural services, Ministry of Agriculture, Makurdi.
- Berihun, B., Mengistu, D., & Kebede, T. (2014). Impact of agricultural technology adoption on farm income in Ethiopia. *Journal of Agricultural Economics and Development*, **3**(1): 1-10.
- Emmy and Shamiga Dominic, (2019). *The History of the TIV People* Published by Agula . pp32-30
- Food and Agriculture Organization. (2020). *The state of food and agriculture in Nigeria*. Rome, Italy: FAO.



- International Fund for Agricultural Development. (2018). *Rural development report*. Rome, Italy: IFAD.
- Kolawole, O. and Olufemi, D. B. (2018). Does adoption of innovation impact farm production and household welfare in Sub-Saharan Africa? A meter Analysis. *Agricultural Resource Economic Review*, **48**(1): 1-2, at <https://www.cambridge.org/core/terms>
- Kuranen-Joko, D. N. and Dzahan, H. L. (2018). Determinants of post-harvest losses among tomato farmers in Gboko Local Government Area of Benue State, *International Journal of Agricultural Research and Food Production*, **3**(4): 27-33.
- Masere, T.P. and Worth, S.H. (2022). Factors influencing adoption, innovation of new technology and decision-making by small-scale resources- constrained farmers: the perspective of farmers in Lower-Gweru, Zimbabwe, *Afr. Journal of Food, Agric. Nutr. Dev.*, **22**(3): 57.
- Mignouna, B., Manyong, M., Rusike, J., Mutabazi, S. and Senkondo, M. (2011). Determinants of adopting imazapyr-resistant maize technology and its impact on household income in western Kenya, *Agbioforum*, **14**(3): 158-163.
- Obekpa, H. O. (2019). Reducing post-harvest Losses in tomatoes, feed the future innovation Lab for food security policy; Nigeria Agricultural Policy Project AgEcon Search <http://ageconsearch.umn.edu/aesearch@umn.edu>.
- Ocholi, A., Nyiatagher, Z. T. and Ayila, V. N. (2020). Effect of marketing intermediaries on pricing of agricultural perishable products: A case study of onions and tomatoes in Benue State, *Journal of Agricultural and Crop Research Nigeria*. **8**(7): 132-139.
- Oduro, O. E., Aboagye, A. P. and Acquaye, N. A. (2014). Effects of education on the agricultural productivity of farmers in the Offinso Municipality, *International Journal of Development Research*, **4**(9): 1951-1960.
- Osebeyo, S. O, and Goodness C. A. (2014). Transaction costs and marketing decision: a case study of smallholder tomato farmers in Makurdi, Nigeria. *Urban, Planning and Transport Research*, **2**(1), 333-340, DOI: 10.1080/21650020.2014.939296.
- Rajendra & Vilas. (2018). Impact of improved post-rainy sorghum technology on farmers' income and expenditure, *Journal of Agricultural Economics and Rural Development*, **6**(1): 10-18.
- Tijani, S. A. (2022). Determination of utilization of tomato value addition technologies among beneficiaries in Oyo State, Nigeria. *Agricultural Tropical Et. Subtractica*, **55**(8):169-184.
- Wandji, N., Pouomogne, J. N., Binam, N. and Nouaga, R. Y. (2012). Farmer's perception and adoption of new aquaculture technologies in the western highlands of Cameroon, *Tropicul*, **30**(3): 180-184.