Utilization of Good Agricultural Practices and Technologies among Tomato Farmers in Oriire Local Government Area of Oyo State, Nigeria

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ABSTRACT

The focus of this research is on the use of Good Agricultural Practices (GAPs) among tomato growers in the Oriire community of Oyo, Nigeria. Data were collected from 80 registered tomato growers in the study area through interview guides. The collected data undergoes descriptive statistics and Pearson product-moment correlation. The results showed that the average age of the respondents was 40.2 years old, and 63.7% of the respondents were men. The average annual income is ₦242,620. The awareness of GAPs is high (88.8%), but the usage is very low. About 87.5% of respondents received GAP information from relatives and friends. Tomato growers believe that high technical costs and access to credit are the main obstacles to GAP technology. The results show that there is a significant relationship between the selected information sources and the degree of use of GAP technology in tomato production. The study concludes that information channels, high technology costs, and credit availability are impacting GAPs adoption. Agricultural advisors should be ready to distribute GAPs to tomato growers and continuously train tomato growers to adopt and use GAPs.

Keywords: *Awareness, Credit, Constraints, Tomato farmers, Good agricultural practices, Utilization, Information, Technologies.*

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Highlights of this paper

- This paper highlights the benefits of good agricultural practices, including high yield and safe farm products.
- The emphasis is, however, on the extent of awareness and utilization of GAPs by the tomato growers in Oyo State, because it is one thing to have a robust technology but another thing is the communication channel to reach the the target group(s) and acceptance of the technology.

1. INTRODUCTION

Tomato is one of the major vegetable crops cultivated throughout Nigeria. It is the largest vegetable in the world and is at the top of the list of canned vegetables. In Nigeria, tomatoes are considered the most important vegetable after onions and peppers [1]. This is due to its nutritional value, which can be eaten fresh and used as a raw material in the food industry [2-4]. Smallholders in developing countries grow vegetables (tomatoes) to generate income and improve their livelihoods [4-6]. However, due to poor management and lack of technology, they often face poor harvests and low incomes [4, 7, 8]. The average yield of tomatoes is well below the crop's potential [2]. As of 2015, tomato production in Uganda and Tanzania exceeds that in Nigeria [9]. Established Good Agricultural Practices (GAPs) help increase net income and improve product quality through modest prevention and management of some pests and diseases [8, 10-12]. The GAPs, defined by the Food and Agriculture Organization of the United Nations (FAO), are a collection of principles that apply to agricultural and post-production processes that result in safe and healthy produce and non-food products. It is economic, social and ecological sustainability.

The GAPs are based on four principles: Produce sufficient (food security), safe (food safety) nutritious (food quality) produce food economically and efficiently, protect and improve natural resources, and contribute to a sustainable life [10, 11, 13].

The GAP guidelines cover all aspects of agricultural production, agricultural production, including fields, greenhouses, and barns. This includes seed selection, irrigation, pest and disease management, fertilizer application, harvest and post-harvest, food processing, and retail handling. Based on rapid assessment studies, farmers using GAP technology in different locations can improve the yield and quality of their products, increasing their bargaining power when selling their products [14]. The GAPs improve the efficiency of agricultural practices and improves the livelihoods of vegetable farmers, especially small vegetable farmers.

Unfortunately, in Nigeria, tomato yields continue to decline due to inadequate cultivation practices such as over-fertilization (fertilizer can accumulate in the soil and cause problems) and improper watering. This can cause some problems with tomatoes, such as rotting flower edges. Bringing the tomatoes too close will hinder the growth of the tomatoes and reduce fruit production. It also makes it difficult for the sun to penetrate the plant, but inadequate pruning causes the plant to become crowded and promotes the spread of the disease [1, 15]. As the country's health consciousness grows and the demand for safe and healthy tomatoes increases dramatically, Nigerian farmers have used as much resources as they can to increase their production. However, there are still limits in states such as Oyo, tomato production and sale. According to Oladele and Adekoya [16] many of these local farmers are unaware of Good Agricultural Practices (GAPs). Against this background, this survey aims to provide answers to the following survey questions:

i. How well-known are tomato producers about tomato GAPs? ii. What sources of information are available to farmers about GAPs? iii. Which GAPs do tomato growers know? iv. What restrictions do farmers face when producing tomatoes?

1.1. Purpose of Research

The main objective of the study was to assess the utilization level of GAPs among tomato farmers in the Oriire Local Government Area of Oyo State, Nigeria.

1.2. Specifically, This Research

i. Determined the level of awareness of tomato growers through the GAPs of tomato production.
ii. Investigated the level of use of GAP technology by tomato growers.
iii. Identified sources of information available to farmers regarding good agricultural practices in tomato farming.
iv. Identified the limitations that farmers face when using GAP Technology in tomato production.

1.3. The Hypothesis of the Study

H_o: There is no significant relationship between sources of information available to respondents and the level of use of GAP technologies.

2. METHODOLOGY

2.1. The Study Area

The study area is Oriire Local Government Area, Oyo State, Nigeria. The area covers Longitude $8^{0}44'5^{0}$ and Latitude $4^{0}22^{1}3^{0}$N. Oriire LGA has its administrative headquarters at Ikoyi-Ile and it extends from Ipeba River, along Oyo-Ogbomoso road at Dogo junction near Igbeti. Oriire is within the tropical rainforest where agriculture is the main livelihood of the people in this area. Oriire LGA was founded on May 10, 1989. The total population of the 2006 census was 150,628, but today it is estimated to be about 250,000 [17]. Oriire LGA shares boundaries with Olorunsogo East, Atiba South, Ogo-Oluwa South East, Ogbomoso South, Ogbomoso North, Surulere South-West, and Kwara South-North. The local government has 10 political districts, the main ethnic groups are Ikoyi, Ogbomoso, Oyo and Ilorin, with more than 80 towns and villages [18]. It also benefits from light mining activities at the Alaguntan Igbori Maribel site. The local government has 112 elementary schools and 12 junior high schools, and the main market (Ilju market) is visited regularly.

2.2. Sampling Procedure and Sample Size

The study population included all tomato growers from Oriire LGA in Oyo. This study used three-stage sampling method. Ojo, et al. [18] selected cassava processors for their study in same survey area. Oriire LGA block under the Ogbomoso zone was purposively selected because of the predominant cultivation of tomatoes in the area. Ten villages were randomly selected from the LGA which include Boosa, Ikoyi, Bosunla, Ateere, Aponran, Awerankale, Iluju, Temidire, Ahoro bata, and Ayetoto. Eight tomato farmers from each of the ten villages were randomly selected for research. The total sample size was 80. The interview guide served as a means of collecting data.

2.3. Measurement of Variables

The utilization of good agricultural practices was scored on a 4-point rating scale as follows: Always utilized – 3, Occasionally utilized – 2, Utilized before but discontinued -1, Not utilized – 0. The independent variables were the socio-economic characteristics of the respondents such as age, gender, marital status, religion, education level, household size, main occupation, annual income, social group, available sources of information, and restrictions on the use of technology in good agricultural practices.

Age, household size, and annual income were measured at ratio level and converted to interval levels; Tomato growers were asked to indicate their actual age in years. The gender, primary occupation, social group, and sources of information were measured at the nominal level. Marital status was nominally measured as single – 1, divorced – 2, widow – 3, separated – 4, married – 5. A three-point scale of Severe -2, Mild -1, Not a limit-0 was used to measure the limits of good agricultural practices.

2.4. Data Analysis

The data collected were analyzed and presented in frequency distributions, percentages, and averages. Pearson Product Moment Correlation was used to determine the relationship between the use of good agricultural practices and the information sources available to the respondents. Ojo, et al. [18] employed similar statistics to determine the relationship between several selected variables between the Oriire LGA cassava processors.

3. RESULTS AND DISCUSSION

3.1. Socio-Economic Characteristics of Respondents

The results in Table 1 show that the mean age was 40.2 years. The age distributions of 20.2% of respondents were under 30 years, 37.8% were 31 to 40 years, and 31.6% were 41 to 50 years. In a study by Oyediran, et al. [6] in Ogun State, it was found that tomato growers belong to this age group and are economically active.

Table 1. Distribution of respondents according to their socio-economic characteristic (n = 80).

Socio-Economic Characteristics	Frequency	Percentage (%)	Mean
Age (years)			
≤ 30	16	20.2	40.2
31 – 40	30	37.8	
41 – 50	25	31.6	
51 and above	09	11.4	
Gender			
Male	51	63.7	
Female	29	36.3	
Marital status			
Single	12	15.0	
Widow	05	6.3	
Married	63	78.7	
Education (years spent in school)			
≤ 6	33	41.3	9.6
7 – 12	27	33.7	
13 and above	20	25.0	
Household size (persons)			
≤ 5	65	81.3	4.0
6 and above	15	18.7	
Primary occupation			
Farming	53	66.3	
Civil servant	5	6.3	
Trading	15	18.8	
Artisan	07	8.6	
Annual Income (₦'000)			
≤ 200	50	62.5	242.62
201-600	27	33.6	
601-1000	03	3.9	
Social organization			
Yes	76	95.0	
No	04	5.0	

Source: Field survey, 2021.

It was shown that 63.7% of the respondents were male and remaining (36.3%) were female. Oyediran, et al. [6] reported on the superiority of males to females of tomatoes grown in Nigeria whereas Ojimi, et al. [19] found that tomato marketing is dominated by women. The proportion of widowed was 6.3%, single was 15.0% while 78.7% were married. This means that the majority of the people surveyed were married. This is consistent with previous studies by Omoare, et al. [20]; Oyediran, et al. [6] and Ojimi, et al. [19]. The results also show that 41.3% received formal education for less than 6 years, 33.7% received formal education for 7-12 years, and 25% received formal education for 13 years or more. The average length of training was 9.6 years. This means that the majority of respondents have received some form of formal education to help them understand the need to examine and apply GAPs in agricultural activities. This supports the results of Ibitoye, et al. [21]; Adeoye [2] and Oyediran, et al. [6] that trained farmers use improved practices to increase raw material production. High levels of education are very positive for high tomato yields [21]. It was found that 81.3% of the respondents were households with less than 5 people and 18.7% were households with 6 or more people. Ojimi, et al. [19] reported a similar family size range for tomato marketers in Ibadan Metropolis. Large family households can serve as a source of readily available workforce [2]. More so, 66.3% of the respondents were farmers, 6.3% civil servants, 18.8% merchants and 8.6% craftsmen. Also, 62.5% of the respondents earned less than ₦200,000 per annum, 33.6% realized ₦201,000 – 600,000 while 3.9% generated ₦601,000 – 1,000,000. Ninety-five percent of respondents belonged to social organizations and 5% did not belong to any expert group. This means that the majority of respondents belong to social and business groups. Ojimi, et al. [19] found that tomato marketers are active in co-operative groups.

3.2. Awareness of GAP Technology among Respondents

Table 2 shows that 88.8% of respondents are familiar with indigenous soil surveys and 85.0% reported awareness of modern soil testing. Seventy percent of the respondents were aware of avoiding the use of the refuse dumping site for cropping, 96.3% were aware of purchasing seed from a trusted seller, and 92.5% were aware of looking for varieties that are pests and disease resistant. Also, 98.8% were aware of the selection of healthy seedlings for transplanting, 76.3% knew the benefits of organic fertilizers over inorganic fertilizers, and 78.8% knew that there were no toxic elements in their place. Sennuga., et al. [8] reported a high level of awareness of GAPs in northern Nigeria. Furthermore, 92.5% were aware of avoiding contaminated water sources for farming, 90.0% were aware of the appropriate use of agro-chemicals, 96.3% were aware of using a very cleaning container for harvested tomato, and 98.8% were aware of storing tomato in a clean environment.

Table 2. Distribution according to awareness level on GAP technologies by the respondents (n = 80).

Awareness of GAP technologies	Frequency	Percentages
Soil testing (indigenous)	71	88.8
Soil testing (modern)	68	85.0
Avoid use of refuse dumping site for cropping	56	70.0
Purchase seed from trusted seller	77	96.3
Look for varieties which are pest and disease resistance	74	92.5
Healthy seedlings are selected for transplanting	79	98.8
Preference for organic fertilizer against inorganic	61	76.3
Ensure site free from toxic element	63	78.8
Ensure water source is not contaminated	74	92.5
Ensure appropriate use of agro-chemicals	72	90.0
Ensure containers for harvesting tomato are clean	77	96.3
Ensure storage area is kept clean	79	98.8
Ensure storage area is protected from insect and rodents	80	100
Ensure worker equipped with suitable protective clothes	75	93.8
Ensure accident and emergency procedure exist	73	91.2

Source: Field survey, 2021.

Additionally, all (100%) respondents were aware that storage facilities should be protected from insects and rodents, 93.8% were that workers should be equipped with suitable protective clothing, and 91.2% were aware of the accident and emergency exits in the warehouses. This means that respondents in the survey area are familiar with GAPs. This is in contrast to the findings of Oladele and Adekoya [16] who found that GAPs awareness was very low in rural Nigeria.

3.3. Use of GAP Technology

Ninety-five percent of the respondents always ensured the storage area is protected from an insect with a weight mean score (WMS) of 2.95 was ranked first Table 3. Also, 95% also always guaranteed that their storage space was kept clean, with a WMS of 2.95 was ranked first. Healthy seedlings are selected for transplanting by 93.8% of the respondents with a WMS 2.94 was ranked second. Falodun and Ogedegbe [1] opined that the use of improved varieties of seeds and pruning would increase tomato yield.

With a WMS of 2.84, 88.8% kept their tomato harvesting containers clean and ranked third. Moreover, 78.8% always ensured water source is not contaminated with a WMS of 2.67 and it was ranked fourth. With a WMS of 2.58, 77.5% confirmed that pesticides were always used properly and ranked 5th; as the application of pesticides and organic fertilizers increases, so does the production of tomatoes [9, 22]. Proper use of pesticides also increases tomato production [23].

Table 3. Distribution according to utilization of GAP technologies (n = 80).

GAP technologies	Always Utilized	Occasional Utilized	Utilized before but Discontinued	Not Utilized	WMS	Rank
Soil testing (indigenous)	28(35.0)	20(25.0)	10(12.5)	22(27.5)	1.69	9th
Soil testing (modern)	0	18(22.5)	23(28.7)	39(48.8)	0.74	13th
Avo Avoid use of refuse dumping area	16(20.0)	46(57.5)	2(2.5)	16(20.0)	1.78	6th
Purchase seed from trusted seller	12(15.0)	49(61.3)	0	19(23.8)	1.68	8th
Look for varieties which are pest and disease resistance	16(20.0)	46(57.5)	0	18(22.5)	1.75	7th
Healthy seedlings are selected for transplanting	75(93.8)	5(6.30)	0	0	2.94	2nd
Preference for organic fertilizer against inorganic	6(7.5)	50(62.5)	1(1.3)	23(28.7)	1.49	11th
Ensure site free from toxic element	26(32.5)	21(26.3)	1(1.3)	26(32.5)	1.51	10th
Ensure water source is not contaminated	63(78.8)	4(5.0)	1(1.30)	12(15.0)	2.67	4th
Ensure appropriate use of agro-chemicals	62(77.5)	4(5.0)	0	8(10.0)	2.58	5th
Ensure containers for harvesting tomato are clean	71(88.8)	7(8.8)	0	2(2.5)	2.84	3rd
Ensure storage area kept clean	76(95.0)	4(5.0)	0	0	2.95	1st
Ensure storage area protected from insect and rodents	76(95.0)	4(5.0)	0	0	2.95	1st
Ensure worker equipped with suitable protective clothes	4(5.0)	48(60.0)	2(2.5)	26(32.5)	1.38	12th
Ensure accident and emergency procedure exist	4(5.0)	21(26.3)	0	55(68.8)	0.67	14th

Source: Field survey, 2021.

It was also shown that 57.5% of the respondents occasionally avoided the use of agricultural landfills and were ranked 6th with a WMS of 1.78. Similarly, 57.5% of the respondents occasionally utilized varieties which are pest

and disease resistance with a WMS of 1.75 and ranked seventh. In addition, 61.3% always purchased seed from trusted sellers with a WMS of 1.68 and ranked eightieth.

On the other hand, 32.5% do not guarantee that the site is free of toxic elements, 28.7% do not prefer organic fertilizers to inorganic fertilizers, 48.8% do not perform the latest soil tests, and 68.8% do not follow accident / emergency procedures. This means that the subjects of soil testing, fertilization and safe work are not prioritized by the respondents and therefore ranked tenth, eleventh, thirteenth, and fourteenth respectively. Hence, the lowest level of acceptance of GAP technology has been recorded. Findings of Oyewole and Sennuga [24] and Sennuga and Fadiji [25] indicated low adoption of improved technologies. Improper application of improved cultural practices is one of the main factors affecting tomato production, with low yields compared to world yields [1].

3.4. Sources of Information on Good Agricultural Practices Available to Tomato Growers

Table 4 shows that 87.5% of respondents get information from friends and relatives, followed by extension agents (80%), co-farmers (78.8%), television programs (73.8%), and radio programs (72.5%). This means that respondents have received information about GAPs from both formal and informal sources. Sources of information are critical to the adoption of technology [26].

Table 4. Distribution according to sources of information available to tomato farmers about GAP technologies (n = 80).

Sources of information	Frequency	Percentage (%)
Radio programmes	58	72.5
Television programmes	59	73.8
Contact extension agent	64	80.0
Contact co-farmers	63	78.8
Friends/relatives	70	87.5

Source: Field survey, 2021.

3.5. Constraints Faced by the Tomato Farmers in the use of GAP

Results in Table 5 reveal that the high cost of technology with WMS of 1.61 as first constraint, and then lack of banks' credits has WMS of 1.55 and ranked second, and inadequate knowledge about technology with WMS 1.31 was ranked third. Katanga, et al. [27] reported that most rural farmers do not have access to bank loans and therefore rely solely on savings. The fourth problem with WMS 1.30 was the non-availability of farm input followed by the lack of awareness about technology with WMS 1.29 while lack of training needed with WMS 1.25 was the least. This means that high technology costs and cumbersome access to bank loans were the main obstacles for respondents.

Table 5. Distribution according to the constraints faced by the tomato farmers in the use of GAP technologies (n = 80).

Constraints	Serious (%)	Mild (%)	Not a constraint (%)	WMS	Rank
Inadequate knowledge of GAP	34(42.5)	37(46.3)	9(11.3)	1.31	3rd
Farm input availability	30(37.5)	44(55.0)	6(7.5)	1.30	4th
Lack of credit facility	46(57.5)	32(40.0)	2(2.5)	1.55	2nd
Lack of awareness about technology	35(43.8)	33(41.3)	12(15.0)	1.29	5th
Training needed	36(45.0)	28(35.0)	16(20.0)	1.25	6th
High cost of technology	54(67.5)	21(26.3)	5(6.3)	1.61	1st

Source: Field survey, 2021.

3.6. Hypothesis Test

The results of PPMC analysis in Table 6 reveal that there are significant relationships between selected sources of information such as television programs (r = 0.221, p=0.049), extension agent contact (r = 0.404, p =

0.000), contact with co-farmers (r = 0.421, p = 0.000), family and friends (r = 0.409, p = 0.000), and use of GAP technologies on tomato production but the relationships are weak. On this ground, the null hypothesis is hereby rejected.

Table 6. Correlation results.

Information Channels	R(Correlation Coefficient)	P-Value	Remark
Radio	0.180	0.111	Not-significant
Television	0.221*	0.049	Significant
Extension Agent	0.404**	0.000	Significant
Farmers	0.421**	0.000	Significant
Friends	0.409**	0.000	Significant

Note: *Significant at 5%; **Significant at 1%
Source: Calculation from the data collected.

4. CONCLUSION

Based on the results, we found that farmers gathered their information mostly from relatives and extension agents. Challenges for farmers in using GAP technology in the study area were high technology costs, no access to bank credits, and lack of knowledge about GAPs. The study further found that modern soil survey methods, the use of appropriate fertilizers, site toxicity and safety measures were the least of the GAP techniques used by tomato growers in the area studied. A significant relationship was found between some sources of information available to the respondents and good agricultural practices technologies.

5. RECOMMENDATIONS

The study, therefore, recommends that government, non-governmental organizations, and stakeholders in agriculture and rural development;

i. Should take advantage of television programs and extension agents as an existing structure in diffusing innovation to tomato farmers.
ii. Should organize training for tomato farmers to have adequate knowledge of GAP technologies.
iii. Should encourage financial institutions to provide soft loans and credit facilities to the tomato farmers in Oriire Local Government Area, Oyo State.

REFERENCES

[1] E. Falodun and S. Ogedegbe, "Effects of pruning location on growth and fruiting of three tomato (Lycopersicon esculentum Mill) varieties in rainforest zone of Nigeria," *Agro-Science*, vol. 18, pp. 1-4, 2019. Available at: https://doi.org/10.4314/as.v18i3.1.

[2] I. B. Adeoye, "Factors affecting efficiency of vegetable production in Nigeria: A review," *Agricultural Economics*, vol. 1, pp. 1-14, 2020.

[3] L. Ahmed, A. Martin-Diana, D. Rico, and C. Barry-Ryan, "Extending the shelf life of fresh-cut tomato using by-product from cheese industry," *Journal of Food Processing and Preservation*, vol. 36, pp. 141-151, 2012. Available at: https://doi.org/10.1111/j.1745-4549.2011.00562.x.

[4] I. K. Arah, E. Kumah, E. Anku, and H. Amaglo, "An overview of post-harvest losses in tomato production in Africa: Causes and possible prevention strategies," *Journal of Biology, Agriculture and Healthcare*, vol. 5, pp. 78-88, 2015.

[5] V. Afari-Sefa, S. Dagnoko, T. Endres, A. Tenkouano, S. Kumar, and P. A. Gniffke, "Tools and approaches for vegetable cultivar and technology transfer in West Africa: A case study of new hot pepper variety dissemination in Mali," *Journal of Agricultural Extension and Rural Development*, vol. 4, pp. 410-416, 2012. Available at: https://doi.org/10.5897/jaerd12.006.

[6] W. O. Oyediran, A. M. Omoare, A. A. Shobowale, and A. O. Onabajo, "Effect of socio-economic characteristics of greenhouse farmers on vegetable production in Ogun state, Nigeria," *Sustainability, Agriculture, Food and Environmental Research*, vol. 8, pp. 76-86, 2020. Available at: https://doi.org/10.7770/safer-v0n0-art1593.

[7] S. Rajendran, V. Afari-Sefa, O. K. Karanja, R. Musebed, D. Romneye, M. A. Makaranga, S. Samali, and K. R.F., "Farmer-led seed enterprise initiatives to access certified seed for traditional African vegetables and its effect on incomes in Tanzania," *International Food and Agribusiness Management Review* vol. 19, pp. 1-24, 2016.

[8] S. Sennuga., R. Baines, J. Conway, and C. Angba, "Awareness and adoption of good agricultural practices among smallholder farmers in relation to the adopted villages programme: The case study of northern Nigeria," *Journal of Biology, Agriculture and Healthcare*, vol. 10, pp. 34-49, 2020. Available at: https://doi.org/10.7176/jbah/10-6-06.

[9] A. Umar and M. Abdulkadir, "Analysis of resource-use efficiency and productivity of residual soil moisture tomato production in Kaduna State, Nigeria," *International Letters of Social and Humanistic Sciences*, vol. 51, pp. 152-157, 2015. Available at: https://doi.org/10.18052/www.scipress.com/ilshs.51.152.

[10] FAO, *Towards the future we want, end hunger and make the transition to sustainable agricultural and food systems*. Rome: Food and Agriculture Organization, 2012.

[11] J. Ali, "Adoption of innovative agricultural practices across the vegetable supply chain," *International Journal of Vegetable Science*, vol. 22, pp. 14-23, 2016. Available at: https://doi.org/10.1080/19315260.2014.916773.

[12] S. O. Sennuga, "Use of information and communication technologies (ICTs) among smallholder farmers and extension workers and its relevance to sustainable agricultural practices in," A Thesis Submitted for the Degree of Doctor of Philosophy (PhD), Coventry University,United Kingdom, 2019.

[13] M. Lefebvre, M. Espinosa, S. Gomez y Paloma, M. L. Paracchini, A. Piorr, and I. Zasada, "Agricultural landscapes as multi-scale public good and the role of the common agricultural policy," *Journal of Environmental Planning and Management*, vol. 58, pp. 2088-2112, 2015. Available at: https://doi.org/10.1080/09640568.2014.891975.

[14] V. Lazaro, S. Rajendran, V. Afari-Sefa, and B. Kazuzuru, "Analysis of good agricultural practices in an integrated maize-based farming system," *International Journal of Vegetable Science*, vol. 23, pp. 598-604, 2017. Available at: https://doi.org/10.1080/19315260.2017.1341445.

[15] S. Amundson, D. E. Deyton, D. A. Kopsell, W. Hitch, A. Moore, and C. E. Sams, "Optimizing plant density and production systems to maximize yield of greenhouse-grown 'trust' tomatoes," *Hort Technology*, vol. 22, pp. 44-48, 2012. Available at: https://doi.org/10.21273/horttech.22.1.44.

[16] O. Oladele and A. Adekoya, "Implications of farmers' propensity to discontinue adoption of downy-mildew resistant maize and improved cowpea varieties for extension education in Southwestern Nigeria," *Journal of Agricultural Education and Extension*, vol. 12, pp. 195-200, 2006. Available at: https://doi.org/10.1080/13892240600915512.

[17] NPC, *Legal notice of publication of 2006 census final result*. Federal Capital Territory Abuja: Federal Republic of Nigeria Official gazette, 2006.

[18] O. M. Ojo, I. O. Oladosu, W. O. Oyediran, and A. A. Adeniran, "Effectiveness of training cassava processors in oriire local government area of Oyo State, Nigeria," *Discovery Agriculture*, vol. 7, pp. 80-85, 2021.

[19] K. O. Ojimi, W. O. Oyediran, M. B. Salawu, Y. Abiodun, F. A. Alaka, G. A. Otufale, and O. M. Ojo, "Postharvest losses of tomato (Solanum Lycopersicum) in the open markets in Ibadan metropolis," *Agriculture and Food Sciences Research*, vol. 8, pp. 15-19, 2021. Available at: https://doi.org/10.20448/journal.512.2021.82.15.19.

[20] A. M. Omoare, E. O. Fakoya, and W. O. Oyediran, "Value addition of sweet potato (Ipomoea batatas L. Lam): Impending Factors on household food security and vitamin a deficiency (VAD) in Southwest and Northcentral Nigeria," *IOSR Journal of Agriculture and Veterinary Science*, vol. 8, pp. 06-14, 2015.

[21] S. Ibitoye, U. Shaibu, and B. Omole, "Analysis of resource use efficiency in tomato (Solanum lycopersicum) production in Kogi State, Nigeria," *Asian Journal of Agricultural Extension, Economics & Sociology*, vol. 6, pp. 220-229, 2015. Available at: https://doi.org/10.9734/ajaees/2015/18112.

[22] M. S. Tijjani, M. Goni, and A. U. Bukar, "Analysis of resource-use efficiency in tomato production in Jere, Borno State, Nigeria," *Journal of Biology, Agriculture and Healthcare*, vol. 8, pp. 1-4, 2018.

[23] C. C. Abur, "An assessment of irrigated tomato farming on resource productivity of farmers in Vandeikya local government area of Benue state: Application of technical efficiency model," *Global Journal of Human-Social Science*, vol. 14, pp. 43-50, 2014.

[24] S. O. Oyewole and S. O. Sennuga, "Factors influencing sustainable agricultural practices among smallholder farmers in Ogun State of Nigeria," *Asian Journal of Advances in Agricultural Research*, vol. 14, pp. 17-24, 2020. Available at: https://doi.org/10.9734/ajaar/2020/v14i130120.

[25] S. O. Sennuga and T. O. Fadiji, "Effectiveness of traditional extension models among rural dwellers in Sub-Saharan African communities," *International Journal of Advanced Research*, vol. 8, pp. 401-415, 2020. Available at: https://doi.org/10.21474/ijar01/10791.

[26] O. Oladele and S. Tekena, "Factors influencing agricultural extension officers' knowledge on practice and marketing of organic agriculture in North West Province, South Africa," *Life Science Journal*, vol. 7, pp. 91-98, 2010.

[27] Y. Katanga, S. Danwawu, and B. Musa, "Economic analysis of tomato production in Fagge local government, Kano state, Nigeria," *Journal of Economics and Development Studies*, vol. 6, pp. 98-104, 2018.