
POST HARVEST SKILLS REQUIRED BY GRADUATES OF AGRICULTURAL EDUCATION IN TOMATO (*lycopersicum esculentum*) FARMING FOR IMPROVED FOOD SECURITY IN MAKURDI LOCAL GOVERNMENT AREA OF BENUE STATE

***Akaa I.I¹; Amuche. E², Ngbongha.I. O³**

Department of Agricultural Education, Joseph Sarwuan Tarka University, Makurdi

Abstract: *The study was on post-harvest skills required by graduates of agricultural education in tomato (*lycopersicum esculentum*) farming for improved food security in Makurdi Local Government area of Benue State. The study has three objectives and three research questions were raised for the study. The population of the study was 120 comprising 30 extension agents and 90 graduates of agricultural education who are engaged in tomato farming and the entire population was used for the study, hence no sampling. The study used a structured questionnaire for data collection titled Post-Harvest Skills Required by graduates of agricultural education in Handling, Storage and Marketing of Tomatoes (PHSRGHSMT). The questionnaire was validated by three experts, one Department of Agricultural and Technology Education and Two from College of Agronomy Cronbach-alpha reliability method was used and reliability coefficient of 0.93 was obtained, thus indicating that the instrument was reliable and can be used for the study. 120 copies of the questionnaire were administered to 30 extension agents and 90 graduates of agricultural education in Makurdi Local Government and were retrieved on the spot. The data collected was analysed using mean and standard deviation to answer research questions. Any item with the mean value of 2.50 and above was regarded as required while any item with a mean less than 2.50 was regarded as not required. Based on the finding of the study it was concluded that 7 post harvest handling skills are required by graduates of agricultural education to curb post harvest losses thus ensuring food security in Makurdi Local Government, 13 post harvest skills in storing of tomatoes, were all required by graduates of agricultural education and the study went further to conclude that 7 post harvest marketing skills are required among graduates of agricultural education. The study recommended that 7 post harvest skills in handling, 13 post harvest skills in storage and 7 post harvest skills in marketing summing a total number of 27 post harvest skills are required by graduates of agricultural education in Makurdi Local Government. These identified post harvest skills should be used to retrain tomato farmers to ensure continual supply of tomato in the market for ensured food security.*

Keywords: *Post Harvest, Skills, Food Security*

1.0

INTRODUCTION

1.1 Background to the Study

Fresh vegetables and fruits are essential sources of vitamins and minerals for humans' growth across the globe. Tomato (*lycopersicum esculentum*) is one of the popular vegetables amongst these fresh vegetables grown in the world, including Nigeria. Tomato is widely consumed in

Nigerian dishes. Tan et al. (2010), noted that by production, tomato is ranked second only to potatoes in global production of all horticultural produce. In 2017, the production of tomato was estimated at 182 million tons worldwide, including 21 million tons in Africa as reported by food and Agriculture Organization, (FOA) (2018). Tomato is widely grown within the Benue valley due to its rich alluvial soil, good temperature and water source for irrigation during nursery preparation. Charles, (2009), observed that Nigeria is one of the world leading producers of tomatoes, pepper, onions, okra and other vegetables that are grown in its various Agro-ecological zones that range from humid, in the south to sub-humid in the middle belt and semi-arid/arid in the north. The large production of these crop is due to its economic value and nutritional content.

Yusufe et al. (2017), noted that Tomato is a rich source of vitamins and minerals, particularly as a rich source of lycopene (60–90 mg/kg), which constitute an important component of human diets. Tomato also contributes to a healthy well-balanced diet of its consumers across Nigeria and Benue state in particular where it is consumed in all households because it has no cultural and religious restriction. Arab and Steck (2000), observed that the lycopene in tomato is a type of carotenoid with antioxidant properties which is beneficial in reducing the incidence of some chronic diseases like cancer and many other. Its nutritional content ranges from essential amino acids, minerals, vitamins, and dietary fibres. It contains much of vitamin B and C, iron and phosphorus. Tomato fruits are blended fresh or grinded when dried into stew, soup and sauce. Bombelli and Wright (2006), pointed out that despite its nutritional, economics and health importance, production of tomato is constrained by post-harvest losses, which limits the volumes of good quality produce reaching consumers. The perishable nature of produce, inferior technology, and lack of awareness among farmers as well as market factors has resulted in poor handling of the tomato. This has led to the inability of producers to manage supply in the assembling markets leading to post-harvest loss (PHL)

Post-harvest loss (PHL) is the reduction in the quantity and quality of crops produced after harvest. Postharvest food loss is the measurable qualitative and quantitative food loss along the supply chain, starting at the time of harvest till its consumption or other uses (Hodges, 2014). Most tomatoes produced are Benue State are mostly consumed fresh and the excess which cannot be properly stored or processed are left to waste out. This is in line with (Kader, 2002), who observed that these losses are generally more common in developing countries. Arah et al. (2015), noted that Postharvest loss is a major challenge hampering tomatoes production in most developing countries. This can lead to serious consequences for household food security in Nigeria. PHL is One of the main factors contributing to food insecurity in Nigeria. In developing countries like Nigeria and Benue state in particular, storage, packaging, transport and handling techniques are practically non-existent with perishable crops like tomato and so, this allows for considerable losses of the product at the expense of farmers. This is in consonance with the views of Gauraha and Thakur, (2008); Singh, Kushwaha and Verma, (2008), who pointed out that Poor transportation facilities, lack of know-how, poor management and improper market facilities or careless handling of the produce by farmers, market intermediaries and consumers are responsible for the postharvest losses of vegetables. Verma and Singh (2004) in their work reviewed that the overall losses in vegetables can be up

to 25 per cent of total production. Thus, as more tomatoes are needed to be supplied to the growing population, skills in post-harvest loss prevention measures of tomatoes by farmers become paramount.

Skills are acquired habit of performing a task in order to obtain a desired a result; especially skill gained through training and experience (Oketoobo and Onipede 2011). Similarly, Nebechukwu (2007), explained skill to be the ability to perform an activity expertly. The author further added that skills is a well-established habit of doing things and involve the acquisition of performance capability through repetitive performance of an operation. Tomato farmers need to acquire relevant skills in post-harvest management of tomatoes. The skills for performing any operation can be categorized into technical and human skills; and both are required for the success of any enterprise. This is supported by Okoro and Asogwa (2011) who viewed skills as a present observable competence to perform a learned behaviour regarding the relationship between mental activities and bodily movements. It is in view of this that tomato farmers require basic skills in handling, storing and marketing of tomato to avoid post harvest losses.

1.2 Statement of the problem

One of the most well-liked, widely produced, and consumed vegetables worldwide is the tomato (*Lycopersicum esculentum*) and tomatoes have a short shelf life and are extremely perishable. Food security can be achieved either by increase in food production or reduction in loss. Post-harvest management procedures of tomatoes by farmers are therefore necessary to ensure food security and satisfy the rising population's need for food while minimizing losses and maximising profit. Farmers inability to handle, store and market tomatoes has brought a lot of challenges towards food security, as tomatoes are not available all year round in the right quantity and quality. Mitcham, (2014). Observed that in developing countries, an estimated 32% of farm produce is lost due to post harvest losses. These shows that very little is being done to reduce post-harvest loses and there is no way food security can be achieved if wastage is not curbed; not even by increase in production of food crops. Therefore, it becomes necessary to identify the operations and channels where significant losses occur in handling, storage and marketing of tomato for A better understanding .to ensure its supply in the right quantity and quality.

1.3 Objectives of the Study

The main objective is on post-harvest skills required by farmers in tomato (*lycopersicum esculentum*) farming for improved food security in makurdi local government area of Benue state. The specific objectives are:

- 5 To identify post-harvest skills required by graduates of agricultural education in handling of tomatoes for food security in makurdi local Government Area of Benue State.
- 6 To outline post-harvest skills required by graduates of agricultural education in storing of tomatoes in makurdi local Government Area of Benue State.
- 7 To determine post harvest skills required by graduates of agricultural education in marketing tomatoes in makurdi local Government Area of Benue State.

1.4 Research Questions

- 1 What are the post harvest skills required by graduates of agricultural education in handling of tomatoes for food security in makurdi local Government Area of Benue State.
- 2 What are the post harvest skills required by graduates of agricultural education in storing of tomatoes in makurdi local Government Area of Benue State.
- 3 What are post harvest skills required by graduates of agricultural education in marketing tomatoes in makurdi local Government Area of Benue State.

1.5 Significance of the Study

A study on the *post-harvest skills required by graduates of agricultural education in tomato farming for improved food security* in Makurdi Local Government Area of Benue State will be relevant to a range of stakeholders including:

Graduates and Students of Agricultural Education: They would benefit directly from insights into the specific skills needed to manage post-harvest processes, which are essential for reducing losses, enhancing quality, and increasing productivity in tomato farming.

Agricultural Educators and Institutions: This study could guide curriculum development, ensuring that agricultural programs include essential post-harvest handling, storage, preservation, and marketing skills to meet the needs of the local agricultural industry.

Farmers and Agribusiness Practitioners: Tomato farmers and agribusiness stakeholders, particularly those interested in improving food security, would find value in understanding best practices and skills that graduates can bring to enhance tomato post-harvest management.

Government Agencies and Policymakers: Local and regional policymakers responsible for agricultural development and food security could use the findings to shape policies and support programs that encourage skill development in post-harvest management.

Extension Services and NGOs: Organizations working to support agricultural development and reduce post-harvest losses in rural areas could leverage this study to train farmers and graduates in effective post-harvest techniques.

Researchers and Scholars: Those conducting further studies on food security, agricultural education, and post-harvest technology would find this research useful for literature reviews, comparative studies, and policy recommendations.

The paper is organized into six major components, the first component is the introduction, the second part is the methodology and the third part deals with results of major findings. Discussion of major findings and conclusion is recorded in components four and five accordingly, while recommendations take care of component six respectively.

2.0

METHODOLOGY

The study was conducted in Makurdi Local Government Area of Benue State. Makurdi is the capital city of Benue State with a population of about 344,144 (NPC, 2006). The study adopted a survey design, the design is suitable for the study because it is aimed at collecting data from tomato farmers on post-harvest skills required by farmers in handling, storage and marketing of tomatoes for food security in Makurdi Local Government Area of Benue State. The population of the study is 120 respondents comprising of 90 graduates of agricultural education and 30 extension agents. There was no sampling because the researcher made use of the entire population. The instrument for data collection was a structured questionnaire developed titled Post Harvest Skills Required by graduates of agricultural education in Handling, Storage and Marketing of Tomatoes (PHSRGHSMT).

The questionnaire was self-structured by the researcher using the literature in the study. The questionnaire was divided into 3 parts. Part, one had 7 items on post harvest handling of tomato, part two had 13 items on post-harvest storage of tomatoes while part three had 7 items on marketing of tomatoes with a total sum of 27 items. Each item had a response option of Highly Required (HR), Required (R), Slightly Required (SR), and Not Required (NR) with corresponding values of 4,3,2 and 1 respectively. The questionnaire was face and content validated by three experts, one Department of Agricultural and Technology Education and Two from College of Agronomy. The instrument was trial tested on 8 extension agents and 12 tomato graduates of agricultural education in Guma Local Government Area of Benue State, retrieved copies of the questionnaire. To determine the reliability of the instrument, Cronbach-alpha reliability method was used and reliability coefficient of 0.93 was obtained, thus indicating that the instrument was reliable and can be used for the study. 120 copies of the questionnaire were administered to 30 extension agents and 90 tomato graduates of agricultural education in Makurdi Local Government and were retrieved on the spot. The data collected was analysed using mean and standard deviation to answer research questions. Any item with the mean value of 2.50 and above was regarded as required while any item with a mean less than 2.50 was regarded as not required.

3.0

RESULTS OF FINDINGS

Question 1. What are the post-harvest skills required by graduates of agricultural education in handling of tomatoes for food security in Makurdi local Government Area of Benue State

Table 1: Mean Ratings and standard Deviation of the responses of graduates of agricultural education on post harvest skills required by graduates of agricultural education in handling of tomatoes for food security (*n= 120: 90 Tomato graduates of agricultural education and 30 Extension Agents*)

SN	Item statement	Mean	SD	Remark
1	Clean harvested fruits	3.96	0.92	Required
2	Sort fruits based on maturity	3.45	0.90	Required
3	Grade tomato fruits on sizes	3.74	0.96	Required
4	Separate injured tomato fruits	3.06	0.97	Required
5	Remove decayed tomato fruits	3.23	0.95	Required
6	Separate diseased fruits to prevent spray of pathogens	3.87	0.98	Required
7	Arrange fruits in single layer boxers to avoid bruises	4.21	0.93	Required
Grand mean		3.57	0.98	Required

The result in table 1 revealed that all the mean of 7 items on post harvest skills required by graduates of agricultural education in handling of tomatoes ranged from 3.06 to 4.21 and a grand mean of 3.57. This indicates that each of the item had a mean above 2.50 which is the cut-off point. This shows that graduates of agricultural education required all the seven (7) in handling tomatoes. The table also revealed that the standard Deviation of each of the items ranged from 0.92 to 0.98 with a grand standard Deviation of 0.98. This shows that the responses of the respondents were not far from each other and their respective mean

Question 2. What are the post harvest skills required by graduates of agricultural education in storing of tomatoes in makurdi local Government Area of Benue State

Table 2: Mean Ratings and standard Deviation of the responses of graduates of agricultural education on post harvest skills required in storing of tomatoes for food security (*n*= 120: 90 Tomato graduates of agricultural education and 30 Extension Agents

SN	Item statement	Mean	SD	Remark
1	Keep fruits in a well-ventilated container on a paper towel	3.83	0.98	Required
2	Ensure fruits are stored at an optimum temperature	4.07	0.96	Required
3	Ensure fruits are kept under right relative humidity	4.36	0.97	Required
4	Fermenting	3.88	0.94	Required
5	Slice and sundry fruits	3.02	0.99	Required
6	Smash into pasta sauce	3.93	0.96	Required
7	Making salsa	4.27	1.04	Required
8	Produce into ketchup	4.75	0.99	Required
9	Making relish	4.06	0.98	Required
10	Freezing tomato fruits	3.06	0.94	Required
11	Canning	3.95	0.97	Required
12	Blanching	4.01	0.93	Required
13	Make a brine	4.17	0.99	Required
Grand Mean		3.95	0.98	Required

The result in table 2 revealed that all the mean of 13 items on post harvest skills required by graduates of agricultural education in storing of tomatoes were above the cut-off point of 2.50. The mean ranged from 3.02 to 4.17 with a grand mean of 3.95. All the 13-post harvest skill are required by the graduates of agricultural education. The table also revealed the standard Deviation of each of the items ranged from 0.93 to 0.99 with a grand standard Deviation of 0.98. This shows that the responses of the respondents were not far from each other and their respective mean.

Question 3. What are skills required by graduates of agricultural education in marketing tomatoes in makurdi local Government Area of Benue State.

Table 3: Mean Ratings and standard Deviation of the responses of graduates of agricultural education on skills required by graduates of agricultural education in marketing of tomatoes for food security (n= 120: 90 Tomato farmers and 30 Extension Agents)

The result in table 3 revealed that 7 items on skills required by graduates of agricultural

SN	Item statement	Mean	SD	Remark
1	Create an advert for the product	4.29	0.97	Required
2	Identify your target markets	3.72	0.93	Required
3	Understand consumers preference	4.62	0.99	Required
4	Develop a pricing plan	3.21	0.94	Required
5	Identify distribution channels	3.52	0.89	Required
6	Sell at farm gate	3.25	0.91	Required
7	Create online site for marketing	4.31	0.99	Required
Grand Mean		3.84	0.95	Required

education in marketing of tomatoes are required as there are above the cut-off point of 2.50. The mean ranged from 3.21 to 4.31 with a grand mean of 3.84. The table further revealed the standard Deviation of each of the items ranged from 0.91 to 0.99 with a grand standard Deviation of 0.95. This shows that the responses of the respondents were not far from each other on skills required by graduates of agricultural education in marketing of tomatoes.

4.0 DISCUSSION OF FINDINGS

The findings in Table 1 revealed that graduates of agricultural education required 7 skills in handling of tomatoes to avoid post harvest losses. This conforms to the views of Arah et al (2015) who noted that to reduce post-harvest losses and maintain the quality of fruits and vegetables, especially tomatoes, both during and after harvest, it is crucial to be aware of the proper post-harvest handling procedures. He outlined those practices to include precooling after harvest, cleaning, disinfecting, sorting and grading. Furthermore, Arah et al. (2015) added that physical handling can have a drastic effect on the postharvest quality and shelf life of most harvested fruits and vegetables. For instance, rough handling during harvesting and after harvesting can cause mechanical injuries which can affect the postharvest quality and shelf life

of harvested fruit like tomatoes. It is therefore important to know suitable postharvest handling practices needed by farmers in makurdi local Government to maintain the quality and extend the shelf life of harvested tomatoes for food security

Findings in table 2 revealed that tomato graduates of agricultural education require all the 13 skills in post-harvest storage of tomatoes. This is because tomato has very high moisture content and therefore is very difficult to store at ambient temperatures for a long time. Food and Agricultural Organisation [FAO] (2018) reported that the larger the area cultivated, the higher the quantity harvested and the higher the risk of losses due to poor handling lack of adequate storage. The increase in the amount of fruit to be harvested due to the larger farm size leads to an increase in post-harvest losses due to lack of storage facilities

The findings of the study in table 3 revealed that graduates of agricultural education requires skills in marketing of tomatoes through adverts, identifying target markets, understanding consumers preference, developing a price plan identifying channels of and farm gate sales among others This finding in consonance with Kimbongium et al. (2009), who identified marketing skills in sesame seeds to include advertisement sale through electronic media, social media and print media, fix price plan and record sales. The findings also conform to Akintoye et al. (2013), who also noted among others that identification of marketing channel is important in any marketing process.

5.0 CONCLUSION

Farmers suffer a lot of losses during post-harvest in tomato production; to reduce post-harvest losses, certain post-harvest handling, storage and marketing procedures must be followed in order to maintain the post-harvest quality and shelf life of tomato fruits. The study identified 7 post harvest handling skills required by tomato graduates of agricultural education to curb post harvest losses thus ensuring food security in makurdi local government. The study further outlined 13 post harvest skills in storing of tomatoes, these skills were all required by tomato farmers and the study went further to conclude that 7 post harvest marketing skills are required among tomato farmers. This skill facilitates the flow of market information, improved market access, and increased access to higher-value markets. Developing pricing plan and online marketing platforms also help tomato farmers market their products to avoid post harvest losses.

6.0 RECOMMENDATIONS

Base on the findings of the study, it was recommended that, 7 post harvest skills in handling, 13 post harvest skills in storage and 7 post harvest skills in marketing summing a total number of 27 post harvest skills are required by tomato graduates of agricultural education in Makurdi Local Government. These identified post harvest skills should be used to retrain tomato graduates of agricultural education to ensure continual supply of tomato in the market for ensured food security.

REFERENCES

Akintoye,H.A, Idowu,O.O, Adebayo,A.G,. Olatunji,,M.T, Aina,O.O and Shokalu,A.O (2013)Prospects and Challenges of Holticulture business in Nigeria. *European Journal of Social Sciences*-Volume19, Number3, Pp204-216

- Arab,L and Steck,S(2000) "Lycopene and cardiovascular disease,"*The American Journal of Clinical Nutrition*, vol. 71, no. 6, pp. 1691S– 1695S, 2000.
- Arah, I.K, Amaglo, H. Kumah, E. K. and Ofori, H. (2015) "Preharvest and postharvest factors affecting the quality and shelf life of harvested tomatoes: a mini review," *International Journal of Agronomy*, vol. 2015, Article ID 478041
- Arah, I.K., Ahorbo, G.K., Anku, E.K., Kumah, E.K., and Amaglo, H., (2016). Postharvest Handling Practices and Treatment Methods for Tomato Handlers in Developing Countries: A Mini Review. *Advances in Agriculture*, Pp. 1–8. <https://doi.org/10.1155/2016/6436945>
- Basu, A and Imrhan,V (2007) "Tomatoes versus lycopene in oxidative stress and carcinogenesis: conclusions from clinical trials," *European Journal of Clinical Nutrition*, vol. 61, no. 3, pp. 295– 303, 2007.
- Bombelli, E.C., Wright, E.R., 2006. Tomato fruit quality conservation during post-harvest by application of potassium bicarbonate and its effect on Botrytis cinerea: research paper. Facultad de Agronomía, Universidad de Buenos Aires, Av. San Martín 4453 (C1417DSE), Buenos Aires, Argentina. *Cien. Inv. Agr.* 33 (3), 167–172.
- Charles, A. (2009), Reducing Postharvest Losses of Horticultural Commodities in Nigeria through Improved Packaging cited from the world of Food Science article Page Citrus Industry., *W. Ruther et al. (eds)* Vol. 5: Pp. 179-260. Univ. Calif. DANR Pub. No. 3326. cooling. *Int. J. Refrig.* Vol. 9: Pp 352-355.
- FAO, 2018. Basic Harvest and Post-harvest Handling Considerations for Fresh Fruits and Vegetables. Postharvest Training on Food Processing/FAO manual food handling and preservation/CHAPTER 2. FAO, Rome.
- Gauraha, A.K., & Thakur, B.S. (2008), Comparative economic analysis of post-harvest losses in vegetables and foodgrains crops in Chhattisgarh. *Indian Journal of Agricultural Economics*, 63(3): 376.
- Tan, J. M. Thomas-Ahner, E. M. Grainger (2010)., "Tomatobased food products for prostate cancer prevention: what have we learned?" *Cancer and Metastasis Reviews*, vol. 29, no. 3, pp. 553–568, 2010
- Hodges, J. (2014): Postharvest cereal losses in sub-saharan Africa, their estimation, assessment and reduction. <https://ec.europa.eu/jrc/en/institutes/ies>
- Kader, A.A. (2002). Postharvest technology of horticultural crops. 3rd ed. Univ. Calif. Agr. Nat. Resources, Oakland, Publ. 3311.
- Kimbongium,A, Silou, T.H, Limder,M and Desobry,S. (2009). Chemical Composition on The Seed and Oil of sesame grown in Congo Brazzaville. *Advanced journal of food science Nigeria*
- Mitcham, B (2014). The Horticulture Innovation Lab and Its Focus on Improving Postharvest Practices. A paper presented at the Feed the Future Innovation Lab Collaborative Research on Horticulture titled "Postharvest in Horticulture: Reducing losses and improving quality to capture high-value crops" at the University of California, Washington Center in Washington, D.C. on July 24, 2014.
- National Population Commission, NPC (2006). National Population Census Report, Abuja.
- Nebechukwu, A.N. (2007) Work Skills Needed by Secondary School Graduates for Entering into Cocoyam Production Enterprise in Enugu State, Nigeria. An Unpublished M.Ed Thesis, Nsukka, University of Nigeria

- Oketoobo, E.A. and Onipede, O. (2011). Entrepreneurial Skills required by Graduates of School of Agriculture for Commercial Cucumber (*Cucumis Sativa*) Production in Southwest Nigeria. *Nigerian Vocational Association Journal*, 16(1). 44 – 52
- Okoro, F. And Asogwa, S. O. (2011). Perceived Significant Business Workskills – A panacea for the Corporate Collapse Dilenma of Nigerian Businesses. *Nigerian Vocational association Journal*, 16(1). 31 – 37
- Singh, R.B., Kushwaha, R.K., & Verma, S. K. (2008), An economic appraisal of post-harvest losses in vegetable in Uttar Pradesh. *Indian Journal of Agricultural Economics*, 63(3): 378.
- Verma, A., and Singh, K.P. (2004), An economic analysis of post-harvest losses in fresh vegetables. *Indian Journal of Agricultural Marketing*, 18(1): 136-139.
- Yusufe, Mawardii, Mohammed, Ali, Satheesh, Neela, 2017. Effect of duration and drying temperature on characteristics of dried tomato (*Lycopersicon esculentum* L.) cochoro variety. *Acta Universitatis Cibiniensis. Series E: Food Technol.* 21 (1), 41–50.