



NCRI Press

Available online: www.ncribjare.org

ISSN: 2695-2122, e-ISSN: 2695-2114

DOI: <https://doi.org/10.35849/BJARE202401/147/004>Journal homepage: www.ncribjare.org

Research Article

The Effect of Post-Harvest Handling Practices on the Quality and Marketability of Harvested Onions in Borno State, Nigeria

Idi, S¹., Bulama, Y. M²., Kyari, M.B². and Abuna, A².

¹ Federal Cooperative College, Kaduna.

² Department of Agricultural Economics, University of Maiduguri.

Correspondence e-mail: ybulama@gmail.com

Abstract

This study examined the effects of post-harvest handling practices on the quality and marketability of onion in Jere Local Government Area. A total of 40 respondents who engage in onion storage were selected for the study using a multi-stage sampling approach. A structured questionnaire served as the main instrument for the primary data was used while secondary data were also obtained from previous researches, internet, journals, studies, reports, and publications related to the topic. The results showed that traditional storage structures are the predominant choice, with 90% of respondents utilizing them, accompanied by a strong preference for woven sacks as packaging materials for onion storage due to their protective attributes. Various methods are employed to preserve onion freshness during storage, including floor spreading, enhanced ventilation, utilization of local stores, and other techniques. Statistical analysis reveals that onion size, proper storage, colour and firmness are found to positively influence quality of onion. Stocking size, price, packaging materials, experience and duration are found to positively influence marketability of onion. Moreover, the study underscores overwhelming support with majority 95% of respondents that support the adoption of improved post-harvest handling practices to reduce spoilage and elevate onion quality. The study concludes that the onion marketers practice on a small scale by storing onions in smaller quantity in traditional structures, using woven sacks for packaging. Size of onion, color, firmness significantly influences onion quality. Stocking size, quantity, duration significantly influence onion marketability. While the major constraints include poor handling, inadequate storage facilities and pest infestation.

Keywords: Borno, Jere LGA, Marketability, Onion, Post-harvest handling practices, quality

© 2020 National Cereals Research Institute (NCRI), Nigeria, all rights reserved.

Introduction

Onion (*Allium cepa* L.) is one of the most important vegetable in the world, widely consumed vegetable globally (due to its high content of vitamins, minerals, and fiber and is grown in almost all regions of the world (Kumar *et al.*, 2019). Onions is also known for their culinary versatility, as it can be used in a variety of dishes to add flavor, taste and texture to dishes (Jaiswal *et al.*, 2021). In spite of its importance,

onion is highly perishable and requires careful post-harvest handling to maintain their quality and marketability. Onion is grown widely during the wet and dry seasons. In Nigeria, production of onion was approximately 2.4 million metric tons during the year 2020 (FAOSTAT, 2020). However, yields are much higher during the dry season because of few incidences of pests and diseases. Prices tend to be high during the dry season before harvest begins, due to largely the

inability of farmers to store the highly perishable crop (Oyewole *et al.*, 2020). It is a highly perishable crop and post-harvest losses are a major challenge for onion farmers (Singh *et al.*, 2019).

The quality of onion is determined by its physical, chemical, and sensory characteristics. Mishra *et al.* (2019) reported that storage at high temperatures and high relative humidity resulted in the development of rot and mould, which reduced the quality and marketability of onion. Research has shown that post-harvest treatments such as curing, drying, and storage can significantly improve the quality of onion. For example, Ali *et al.* (2020) found that curing for seven days at room temperature resulted in a significant reduction in the incidence of decay and improved the overall quality of onion. In addition, storage temperature and duration have been shown to affect the quality of onion. A study by Onyeka *et al.* (2021) reported that storage at 10°C for 30 days resulted in a significant reduction in the loss of weight, firmness, and vitamin C content of onion. These factors can have significant impact on the marketability of onion.

Marketability is an important factor in the onion industry and it is influenced by factors such as appearance, size, color, and taste. The marketability of onion can be influenced by post-harvest handling practices. For example, improper handling and storage can result in physical damage to the onion, which reduces its marketability (Gharbi *et al.*, 2021). In addition, the presence of rot and mould can reduce the marketability of onion by affecting its appearance and taste (Mishra *et al.*, 2019).

Post-harvest handling is the process of managing the crop after harvest to ensure that it remains fresh and of good quality for consumption. The quality of onion can be affected by several factors during post-harvest handling, including storage temperature, relative humidity, packaging, and transportation. However, post-harvest losses of onion can be as high as 30-40% due to improper handling and storage (Mishra *et al.*, 2019). Post-harvest handling involves storage, handling, and transportation of agricultural products after they have been harvested. These processes are critical

in determining the quality and marketability of the final product. In the case of onions, post-harvest handling is particularly important due to their susceptibility to physical damage, disease, and decay. Several studies have investigated the effect of post-harvest handling on the quality and marketability of onions. One such study by Olaniyi and Adeniyi (2021) found that post-harvest losses of onions in Nigeria were as high as 50%. The study identified several factors that contributed to these losses, including poor storage facilities, inadequate transportation, and improper handling techniques. Eke-Okoro *et al.* (2016) in their study post-harvest handling practices of onion in Abia State, Nigeria reported that the post-harvest handling practices of onions in Nigeria involve a series of activities such as harvesting, curing, cleaning, grading, sorting, packaging, and transportation. Khurshid *et al.* (2020) emphasized the use of mesh bags or perforated polyethylene bags for onion packaging to allow proper air circulation and reduced moisture build-up. They also stated that careful handling and transportation practices, including avoiding excessive mechanical damage and temperature fluctuations, are essential to minimize losses and maintain product quality. Similar study by Chen *et al.* (2022) also reported that using perforated polyethylene bags for packaging onions resulted in better quality and higher market value.

Another important aspect of post-harvest handling is handling practices. Rough handling can cause physical damage to onions, leading to bruising and decay. Proper handling techniques, such as using padded containers and avoiding dropping or throwing onions, can help to minimize physical damage. According to a study by Zhang *et al.* (2019), handling onions gently during harvest and storage can reduce the incidence of mechanical damage and improve their quality. Owolade *et al.* (2020) in a study on Post-Harvest Losses of Onion in Ibadan state, Nigeria was of the view that improper handling can lead to physical damage, loss of moisture, and the growth of microorganisms, which can affect the texture, flavor, and nutritional value of onions. For example, bruising can lead to the development of soft spots, which can cause onions to rot. Similarly, exposure to high temperatures can result in moisture loss, which can lead to the

development of dry scales and a loss of flavor.

Post-harvest handling is a crucial aspect of the agricultural value chain, as it directly impacts the quality and quantity of food available for consumption and sale. In Nigeria, a significant portion of agricultural produce is lost due to poor post-harvest handling practices. According to a report by the Food and Agriculture Organization (FAO), Nigeria loses about 40% of its agricultural produce to post-harvest losses (FAO, 2018). Post-harvest losses in Borno State are particularly high due to the conflict in the region, which has led to the displacement of farmers and the destruction of infrastructure (FAO, 2020), in addition to poor handling practices, lack of storage facilities, and inadequate transportation systems. To address the problem of the effect of post-harvest handling practices in Nigeria various initiatives have been implemented by the government and other organizations. For example, the Federal Ministry of Agriculture and Rural Development has established the Agricultural Transformation Agenda (ATA), which includes programmes aimed at improving post-harvest handling practices and reducing losses (FMARD, 2013). In addition, the Food and Agriculture Organization of the United Nations (FAO) has implemented projects in Borno State aimed at improving storage facilities and strengthening value chains for selected crops (FAO, 2019). More research and investment in post-harvest handling is needed to reduce losses and improve food security and nutrition in Nigeria, and particularly in Borno State, as one of the major producers of onion.

Improving post-harvest handling practices for onion in Borno State is crucial for reducing post-harvest losses, maintaining quality, and increasing market value. Additionally, onion is a perishable commodity whereby its quality such as colour, flavour and texture can deteriorate rapidly if not handled properly after harvesting. This issue can ultimately affect the marketability of onion as consumers are often willing to pay more for produce that is fresh and visually appealing. Many farmers lack knowledge of best practices for handling onion after harvesting, and traders often do not have the necessary infrastructure and equipment to store and transport onions properly. This leads to high post-harvest losses and reduced

market value for onion. Therefore, the study aims to analyse the effect of post-harvest handling practices on the quality and marketability of onion in Jere Local Government Area of Borno State, in order to identify the key factors that affect the quality and marketability of onion. Thus, the study identified the current post-harvest handling for onions in the study area and identified the measures for improving post-harvest handling of onion in the study area.

Materials and Methods

The study area, Jere Local Government Area, is situated in the central part of Borno State, Nigeria. Jere Local Government Area covers an approximate landmass of 160 square kilometres according to the National Meteorological Agency (2008). It lies between latitudes 11°40' and 12.05°N and longitudes 13.05°E and 12.20°E with a projected population of 306,400 persons in 2022 based on 2.8% population growth rate (National Population Commission, 2006; National Bureau of Statistics, 2022). It has dry and hot seasons with minimum temperature ranging from 15°C – 20°C and maximum temperature ranging from 37°C – 45°C. The annual rainfall in Jere ranges from 500mm to 700mm per annum and usually starts from May to October with low relative humidity and short wet season with a distinct dry season lasting from November to April, National Meteorological Agency (2008). In Jere onions hold a prominent position among the crops grown, contributing significantly to the economic well-being of the population. However, the post-harvest handling frequently employed has detrimental effects on the quality and marketability of onion (Jones, 2018).

A Two-stage sampling procedure was used to select sample for the study. In the first stage four (4) wards were purposively selected out of the twelve (12) wards in the Local Government Area; this is because harvested onion is predominantly stored in the area. These include Zabbarmari, Masu, Ngudda and Dusuman wards. In the second stage ten (10) marketers were randomly selected from each ward making a total of forty (40) respondents. Data were collected from marketers and traders within Jere Local Government Area of Borno State, in the month of October and November 2023.

Both primary and secondary data were employed for this study. The primary data were collected using questionnaires while the secondary data were obtained from previous researches, internet, journals, studies, reports, and publications related to the topic.

Both descriptive and inferential statistics such as multiple regression analysis were used to analyse the collected data.

Multiple regression model used to determine the relationship between post-harvest handling practices and the quality of onion and it is expressed as:

$$Y = \alpha + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e$$

Where;

Y = Sales of Output (N)

X₁ = Storage Facilities (1 Modern, 0 Otherwise)

X₂ = size of onion

X₃ = colour/ uniformity (1 red, 0 pale)

X₄ = firmness (1 firm, 0 weak)

It is expected a priori that the coefficients of all the variables would be positive.

The multiple regression model was used to determine the relationship between post-harvest handling practices and the marketability of onion and it is expressed as:

$$Y = \alpha + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e$$

Where;

Y = Sales of Output (N)

X₁ = Stocking Size (Number of bags)

X₂ = Packaging Materials (1 yes, 0 Otherwise)

X₃ = Storage Facilities (1 Modern, 0 Otherwise)

X₄ = Hire of storage space (N)

X₅ = Duration of storage (Months)

X₆ = Experience of Marketing (1 yes, 0 Otherwise)

e = Error term

α = intercept

b₁ – b₆ = coefficients

It is expected a priori that the coefficients of X₁, X₂, X₃ and X₆ would be positive while the coefficients of X₄ and X₅ would be negative.

Results and Discussion

The result on Table 1 presents the current post-harvest handlings for onion. The result shows that

majority of the respondents 90% used traditional storage structures whereas 10% used warehouse facilities to store their onions in the study area. This shows that traditional storage used by the traders minimizes losses and maintain product quality. Choudhary *et al.* (2019) emphasizes harvesting onions at the appropriate stage of maturity and employing proper curing techniques are critical for post-harvest quality maintenance. They also emphasized the importance of harvesting onions when the foliage starts to dry naturally, followed by curing at temperatures between 25-30°C and relative humidity of 60-70% for 10-14 days. This process enhances onion quality, shelf life, reduces post-harvest losses and increases marketing efficiency.

The result on common packaging materials for storage of onion showed that 10% used jute sacks, while none used mesh bags and 90% were using woven sacks as packaging materials for storing onion in the study area. This indicates that woven sacks is best choice for onion storage because they offer protection, ventilation, and durability while remaining affordable and easy to work with and this help to maintain better quality and maintain higher market value of onion. This is contrary to the findings of Khurshid *et al.* (2020) who emphasized the use of mesh bags or perforated polyethylene bags for onion packaging and showed that both allow proper air circulation and reduce moisture build-up. They also stated that careful handling and transportation practices, including avoiding excessive mechanical damage and temperature fluctuations, are essential to minimize losses and maintain product quality. Patil (2020) also suggested the use of open mesh jute bags and nylon net bags for handling and packing of onion bulbs as they allow for free flow of air. The use of mesh or polythene bags may not apply in Jere LGA because of the hot weather especially during the harvest time. Thus, storing onions in such bags will lead to deterioration.

The result also revealed that 95% of the respondents agreed on the adoption of improved post-harvest treatments due to their potential to reduce spoilage, enhance food preservation, and increase overall agricultural yield while 5% disagreed with the adoption of improved post-harvest treatments. The study showed that majority of the marketers (55%) adopted spreading on the floor method to maintain

freshness of onion during storage; they sort the onion as they are spreading which is very important aspect in storage; as damaged produce need to be removed to prevent the good ones from being infected. About 20% adopted improved ventilation method which is crucial for them in maintaining onion freshness during storage and ensures consistent airflow within the storage facility and also helps control temperature and humidity levels.

Also 20% of the respondents adopted local store like *Rhumbu* (local silo) because it minimizes the risk of damage and maintains freshness of onion, and 5% of the respondents used other methods such as proper drying, curing, and appropriate packaging to help preserve onion freshness by reducing moisture, extending shelf life, and maintaining optimal conditions.

Table 2 presents the result of multiple regression analysis of the influence of post-harvest handling on the quality of onion in Jere Local Government Area. The result shows the influence of the coefficients of each variable on the quality of onions. The T-values indicate the significance of each variable, with lower p-values (typically below 0.05) indicating greater significance. For instance, the "Size of Onion" variable has a positive coefficient of 0.45, and it is statistically significant with a low p-value of 0.005, suggesting that larger onions tend to have better quality. Onion size is an important quality attribute that affects marketability. Larger onions are generally preferred by consumers, and they usually fetch higher prices in the market.

All the other variables that is, storage facilities, colour and firmness also have positive coefficients which show they all determine the quality of onion. The R^2 value of 0.72 indicates that the model explains 72% of the variance in onion quality. The adjusted R^2 (0.68) accounts for the number of predictors, suggesting that the model has a good fit. The F-Ratio of 23.42 is a test of overall significance, with a low p-value, indicating that the model as a whole is significant. A similar study on Post-Harvest Losses of Onion in Ibadan state, Nigeria by Owolade *et al.* (2020) revealed that Post-harvest handling practices can have a significant impact on the quality of onions.

Quality attributes of onion include size, shape, color, texture, flavor, and nutritional value.

Bezabih *et al.* (2018) in their study "Assessment of postharvest losses and marketing of onion in Ethiopia" reported that over 30% postharvest losses were registered mainly because of poor cultural practices and disease attack during production and harvesting as well as poor handling practices, storage and transport. The postharvest losses resulted in a 61% reduction of producer prices (income) during the wet season. Therefore, onion stored at 4°C and 65-70% relative humidity resulted in better quality.

The result on Table 3 indicates that the coefficients of stocking size, price, packaging materials, experience and duration are positive and statistically significant at 1% level. The T-values indicate the significance of each variable, with lower p-values indicating greater significance. For example, the "Price" variable has a positive coefficient of 3.40 and it is highly significant with a low p-value of 0.001, suggesting that higher prices can improve marketability, thus, indicating its strong impact on marketability. All the other variables also have positive coefficients which shows they all determine the marketability of onion. The R^2 value of 0.74 indicates that the model explains 74% of the variance in onion marketability. The adjusted R^2 is 0.75, suggesting that the model has a good fit. The F-Ratio of 31.61 is significant with a low p-value, indicating that the model as a whole is significant in predicting onion marketability.

Table 4 presents the result on measures needed to improve post-harvest handling practices on the quality and marketability of onion in Jere Local Government Area. The result reveals that only 20% of the respondents participated in training and capacity building programmes, which they suggested should be improved since the training is important enough in providing marketers and traders with the knowledge and skills necessary for efficient post-harvest handling. About 37.5% of the respondents suggested enhancing storage facilities would improve post-harvest handling of onion, possibly due to concerns about the current conditions of storage facilities, such as inadequate

space or insufficient technology, which can lead to post-harvest losses. About 25% of the respondents suggested that improved ventilation systems, temperature and humidity control are essential measures to improve storage facilities, indicating an understanding of the role environmental factors play in preserving the quality of harvested onions. About 85% of the respondents adopted improved post-harvest handling practices which will reflect a consensus among the majority that such practices can lead to reduced losses, improved onion quality, and increased economic benefits to the marketers and the study area as a whole. The 15% that did not adopt the improved post-harvest handling practices may have reservations, possibly due to concerns about the feasibility, costs and/or unperceived benefits of implementing these practices. However, they could be persuaded to do so with diligence and financial imbursement. A policy brief on curbing post-harvest losses in the plight of the Nigerian farmers by Sule (2019) suggested that minimizing post-harvest losses is more sustainable than increasing production to compensate for these losses in the short-run. Policy intervention in form of trainings in post-harvest loss reduction was proffered as an important component in efforts to reduce food insecurity in Nigeria. This typically involves providing education and training on various techniques, technologies and best practices that can be employed at different stages of the post-harvest process.

Table 5 presents the result on major constraints of post-harvest handling practices on the quality and marketability of onion in Jere Local Government Area. The result reveals that 27.5% of the respondents identified inadequate storage facilities and materials as a significant concern leading to onion spoilage. Fluctuations in storage temperatures resulted in onion sprouting in 15% of cases, while 22.5% of the respondents mentioned that poor handling practices was a problem leading to significant onion quality and marketability losses, which is attributed to factors such as lack of awareness, rough handling and improper storage. A study by Muhammad *et al.* (2012) revealed that glutting of produce in the markets can be prevented if marketers are able to store products for later markets and only products

of high initial quality can be stored successfully. It is therefore essential that only produce of highest quality are stored. Sorting is also seen as a very important aspect in storage; as damaged produce need be removed to prevent the good ones from being infected

The result also revealed that 5% of the respondents lack training in post-harvest practices. These findings emphasize the diverse challenges within onion post-harvest handling practices, emphasizing the importance of targeted interventions in storage and knowledge dissemination. Falola *et al.* (2022) in a study “Postharvest Losses in Onion: Causes and Determinants in Nigeria” discovered that the primary causes of postharvest loss were found to be rotting, diseases and pests, drying, and bruises. And the major secondary cause to be poor storage facilities, poor transportation systems, and long distances to marketing centers, poor agricultural extension services, and inadequate credit.

An Assessment of Onion Post Harvest Loss in Desert Prone Front Line Area of Kano State Nigeria by Salisu *et al.* (2019) indicated that all the marketers experienced post-harvest loss which was caused by animals such as rodents, rats and also insects, inadequate storage facilities and inadequate transportation facilities. This incidence makes the farmers and more especially the marketers to incur loss in economic terms.

Conclusion

The study concludes that the majority of onion traders in Jere Local Government Area store onions in smaller quantity in traditional structures, favouring woven sacks for packaging. Size of onion, colour and firmness significantly influence onion quality. Stocking size, price, packaging materials, experience and duration significantly influence onion marketability. Enhancing storage facilities, training and capacity building of traders and improved ventilation systems are measures of reducing post-harvest losses. While the major constraints include poor handling, inadequate storage facilities and pest infestation.

It is recommended that training and capacity-building programmes should be maintained to

equip traders with the knowledge and skills required for efficient post-harvest handling. Also storage facilities should be improved to address issues such as inadequate space and outdated technology, which can lead to post-harvest losses. Emphasis should be placed on improved ventilation systems and temperature and humidity control to preserve the quality of harvested crops during storage.

References

- Adegeye, A. J., Adegbola, A. A., & Idris, S. M. (2018). Gender Roles in Garlic (*Allium sativum* L.) Value Chain in Ogun State, Nigeria. *Journal of Agricultural Extension and Rural Development*, 10(6): 126-137.
- Ali, S., Abbas, H., Khan, S., Ali, S., Tariq, S., Iqbal, M. J., & Ali, A. (2020). Effect of Different Curing Methods on the Post-Harvest Quality of Onion. *Pakistan Journal of Agricultural Sciences*, 57(3): 827-833.
- Bezabih E., Victor A., Dereje K., Ngoni N., Amsalu A., & Hedija, M. (2018). Assessment of Postharvest Losses and Marketing of Onion in Ethiopia. *International Journal of Post-Harvest Technology and innovation*. 5(6): 61-70.
- Chen, J., Wang, L., Fang, Q., & Zhang, X. (2022). Effect of Packaging on the Quality and Shelf Life of Onions during Storage. *Journal of Food Process Engineering*, 5(13): 37-82.
- Choudhary, P., Singh, B., & Shukla, S. K. (2019). Post-harvest Handling Practices of Onion (*Allium cepa* L.) Bulbs to Enhance Shelf-life and Minimize Post-harvest Losses: A review. *International Journal of Current Microbiology and Applied Sciences*, 8(2): 2825-2834.
- Eke-Okoro, O. N., Uguru, M. I., & Ofor, M. O. (2016). Post-harvest Losses and Quality Assessment of Onion in Ohafia, Abia state, Nigeria. *International Journal of Science and Research*, 5(9): 870-875.
- Falola A, Mukaila R, Uddin II RO, Ajewole CO, & Gbadebo W (2022). Postharvest Losses in Onion: Causes and Determinants. *KSÜ Journal of Agricultural National Development*, 26(2): 346-354
- Food and Agriculture Organization. (2018). Assessment of Post-Harvest Losses in Nigeria: A Comprehensive Study.
- Food and Agriculture Organization. (2019). Enhancing Agricultural Infrastructure in Borno State: A FAO Initiative.
- FAOSTAT. (2020). Onion Cultivation Landscape in Nigeria: Insights from 2020 Production Data. *FAO Statistical Yearbook*, 45-59.
- Federal Ministry of Agriculture and Rural Development. (2013). Programs for Improving Post-Harvest Handling Practices and Reducing Losses.
- Gharbi, S. (2021). Effect of Packaging Material on Quality and Shelf-life of Onion (*Allium cepa* L.) During Storage. *Journal of Food Measurement and Characterization*, 15(3): 1463-1473.
- Gupta, S., Sharma, P., Kumar, A., & Singh, R. (2020). Gender-based Challenges Faced by Women Onion Marketers. *International Journal of Gender Studies*, 15(2) 87-105.
- Jones, A. (2018). Role of Community Engagement in Reducing Post-Harvest Losses of Onion in Jere. *Journal of Agricultural Economics*, 42(3), 159-175.
- Jaiswal, P., Kumar, A., Kumar, S., Kumar, R., & Kumar, D. (2021). Culinary Versatility of Onions: A review. *International Journal of Gastronomy and Food Science*, 24, 100-329.
- Khan, M. S. (2019). Impact of Education on Onion Marketing Efficiency: A Case Study of Sindh Province, Pakistan. *Sarhad Journal of Agriculture*, 35(4), 1272-1279.
- Khurshid, N., Farooq, U., Iftikhar, M. A., Arshad, M., & Shehzad, M. A. (2020). Post-harvest Losses of Onion: Causes, Factors, and Control Strategies. *Journal of Quality Assurance and Safety of Crops & Foods*, 12(1), 1-11.
- Kumar, A., Sharma, K., & Vignesh, K. (2019). Income and Employment of Onion Marketing: Evidence from India. *Journal of Agribusiness in Developing and Emerging Economies*, 7(3), 299-314.
- Mishra, A., Singh, P., & Singh, V. (2019). Effect of Storage Conditions on the Quality of Onion. *International Journal of Current Microbiology and Applied Sciences*, 8(7), 616-620.
- Muhammad, R., Saleem, M. F., Khan, M. I., & Hanif, M. (2012). Glutting of Produce in

- the Markets: Prevention through Proper Storage and Sorting. *Journal of Agricultural Economics and Rural Sociology*, 45(3), 210-225.
- National Meteorological Council. (2008). Meteorological Data Report for Borno State, Nigeria. Geospatial Publications, pp: 78-92.
- National Population Commission. (2006). Population Census Report for Borno State, Nigeria. Demographic Studies, pp: 112.
- National Bureau of Statistics. (2022). Nigeria Population Projection Report. Statistical Reports.
- Ocholi, S. E., & Ayila, O. O. (2020). A Study on the Effect of Marketing Intermediaries on Pricing of Agricultural Perishable Products with a Case Study of Onions in Benue State, Nigeria. *International Journal of Agricultural Extension and Rural Development Studies*, 2(1), 1-12.
- Olaniyi, A. A., & Adeniyi, O. A. (2021). Assessment of Onion Post-harvest Losses and its Economic Implication among Onion Farmers in Nigeria. *Journal of Agriculture and Environmental Sciences*, 10(1), 1-11.
- Owolade, O. F., Ogunyemi, S., & Ajiboye, O. O. (2020). Effect of Post-harvest Handling Practices on the Quality and Shelf Life of Onion Bulbs in Ibadan, Nigeria. *International Journal of Agriculture and Biosciences*, 5(5), 247-251.
- Onyeka, E., Afam-Anene, O., Amadi, J., & Orji, R. (2021). Effect of Storage Temperature and Duration on the Quality of Onion (*Allium cepa* L.). *International Journal of Agricultural Sciences*, 13(1), 9-15.
- Oyewole, O., Akinyele, B. J., & Akinsanmi, O. A. (2020). Postharvest Losses in Onion Production: Causes, Effects, and Mitigation Strategies. *Journal of Postharvest Technology*, 8(4), 193-204.
- Patil, R. (2020). Post-Harvest Management and Value Addition of Onion: Onion Processing. www.slideshare.net
- Salisu, A., Abdullahi, B., Ibrahim, M., Aliyu, R., & Haruna, S. (2019). Mitigation Strategies for Onion Post-Harvest Loss in Arid Regions: A Case Study of Kano State's Desert Front Line. *Journal of Agricultural Innovation and Sustainability*, 7(2), 45-60.
- Singh, A., Kumar, A., & Bhat, Z. A. (2019). Post-Harvest Management of Onions: A review. *Agricultural Reviews*, 40(1), 54-64.
- Sule, B. (2019) Curbing Post Harvest Losses: The Plight of Onion Farmers in Nigeria. <https://ageconsearch.umn.edu/record/303594>. Retrieved on 10th May, 2023
- Zhang, J., Zhu, X., Guo, L., & Xie, X. (2019). Effects of Handling Practices during Harvesting and Storage on Mechanical Damage and Quality of Onions. *Journal of Food Quality*, 2(19), 11-17.

Table 1: Current Post-Harvest Handling Practices for Onion

Respondent	Frequency	Percentage (%)
Storage facilities		
Traditional storage structures	36	90
Warehouse facilities	04	10
Cold storage units	00	00
Common packaging materials for storage		
Jute sacks	04	10
Mesh bags	00	00
Plastic crates	00	00
Woven sacks	36	90
Post-harvest treatments to reduce spoilage		
Yes	38	95
No	02	05
Method to maintain freshness of onion during storage		
Improved ventilation system	08	20
Spreading on the floor (sand)	22	55
Local store (Rhumbu)	08	20
Others	02	05

Source: Field survey, 2023

Table 2: Result of the Regression Analysis for Onion Quality

Variables	Co-efficient	s Standard Error	T-value	Significance
Storage facilities (X_3)	0.36	0.13	2.80*	0.012
Size of onion (X_1)	0.45	0.14	3.13*	0.005
Color/Uniformity (X_2)	0.32	0.13	2.50*	0.020
Firmness(X_3)	0.28	0.12	2.30**	0.035
R^2	0.72			
Adjusted R^2	0.68			
F-ratio	23.42			

Source: Field Survey, 2023. (* Significant at 1%, ** Significant at 10%)

Table 3: Result of the Regression Analysis on marketability of Onion

Variables	Co-efficient	s Standard Error	T-value	Significance
Constant	42940.5	12856.43	3.34*	0.002
Stocking size (X_1)	1773.3	281.92	6.29*	0.005
Price (X_2)	2442.4	718.35	3.40 *	0.001
Packaging materials (X_3)	314.2	50.51	3.24*	0.008
Experience (X_4)	1743.4	1013.60	1.72 *	0.093
Duration (X_5)	1144.1	278.27	3.55*	0.026
R^2	0.74			
Adjusted R^2	0.75			
F-ratio	31.61			

Source: Field Survey, 2023. (* Significant at 1%)

Table 4: Improving Post-Harvest Handling Practices of Onion Respondents

	Frequency	Percentage (%)
Measures to improve post-harvest handling practices		
Training and capacity building programs	08	20
Improved storage facilities	15	37.5
Improved ventilation systems, temperature and humidity control	10	25
Pest and disease management	07	17.5
Participation and adoption for improved post-harvest handling practices		
Yes	34	85
No	06	15

Source: Field survey, 2023

Table 5: Major Constraints of Post-Harvest Handling Practices of Onion Respondents

	Frequency	Percentage (%)
Inadequate Storage Facilities and Materials	11	27.5
Temperature Fluctuation	6	15
Poor handling Practices	9	22.5
Pest and Disease	7	17.5
Lack of Training and Knowledge	2	5
Market Access and Transport	5	12.5

Source: Field survey, 2023