



Impact of COVID-19 Lockdown on Tomatoes and Scotch Bonnet Losses among Farmers and Marketers in Southwest Nigeria

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Abstract

The COVID-19 lockdown increased agricultural losses for farmers and marketers in Nigeria. This study assessed the impact of the COVID-19 pandemic on post-harvest losses of tomatoes and scotch bonnet along post-harvest value chain. We conducted a cross-sectional study among 60 farmers and marketers all selected from Oyo, Osun, and Ekiti States using interviewer-administered questionnaires targeted towards post-harvest experiences. Data were analyzed using SPSS version 25.0. The median price of baskets of tomatoes and bags of scotch bonnet before, during, and after the COVID-19 lockdown were compared using Related samples Friedman's Two-Way Analysis of Variance by ranks. The median number of baskets of tomatoes harvested and quantity harvested during COVID-19 lockdown was compared using Related samples Wilcoxon sign rank test, the same was done for scotch bonnet. P-values less than 0.05 were considered statistically significant. The mean age of the 60 respondents was 48.7 ± 13.6 years, and 27.6% were aged 40-49 years. Before the COVID-19 lockdown, the median price of a basket of tomatoes was ₦6,000 during the lockdown and ₦8,000 after the lockdown. ($p < 0.001$) The price of a bag of scotch bonnet was ₦7,000 before the lock down, ₦8,500 during, and ₦8,000 after the lockdown. ($p = 0.027$). To minimize farm losses, farmers should harvest tomatoes and scotch bonnet once ripe, not overripe. Tomatoes and scotch bonnets should be stored in a cool, dry place that is well-ventilated. The storage area should be free from pests and rodents that can cause damage to the farm produce.

Keywords: Agriculture, COVID-19, Farm produce, Farmers, Nigeria

Introduction

The COVID-19 pandemic, caused by the novel coronavirus, has had a significant impact on global economies and societies since its emergence in late 2019 (World Health Organization, 2021). Nigeria, like many other countries, implemented measures to contain the spread of the virus, including lockdowns and movement restrictions (Nigeria Centre for Disease Control, 2021). These measures have had significant effects on various sectors of the economy, including agriculture (International Monetary Fund, 2020). In particular, the lockdown measures have resulted in significant losses

for farmers and marketers of tomatoes and scotch bonnet, two critical crops in Southwestern Nigeria (Adedeji and Omoare, 2021; Oyebisi *et al.*, 2021). According to the Food and Agriculture Organization (2020a), Nigeria is the largest producer of tomatoes in sub-Saharan Africa and the 14th largest producer globally, with an estimated annual production of over 2.3 million tons (FAO, 2020a). Scotch bonnet, a variety of hot pepper commonly used in Nigerian cuisine, is also an essential crop, with Nigeria being one of the leading producers globally. The lockdown measures, however, disrupted the supply chain for these crops, leading to

significant losses for farmers and marketers (Olofinbiyi, 2020).

Farmers in Southwestern Nigeria faced several challenges during the lockdown measures (Omotayo and Olufemi, 2020). Movement restrictions meant that they could not transport their produce to markets or sell directly to consumers, resulting in significant losses due to spoilage (Fatokun *et al.*, 2020). The closure of borders and the reduction in imports also led to a shortage of essential agricultural inputs such as fertilizers and pesticides, which affected crop yields (Ogunniyi *et al.*, 2020). Marketers of these crops also faced significant losses during the lockdown measures. The closure of markets meant that they could not sell their products, leading to spoilage and financial losses (Fatokun *et al.*, 2020). Furthermore, the restriction of movement also led to a shortage of labor, which further impacted the supply chain. The impact of the COVID-19 lockdown on tomatoes and scotch bonnet losses among farmers and marketers in Southwestern Nigeria highlights the vulnerability of the agricultural sector to external shocks. It also underscores the need for effective policies and interventions to mitigate the impact of such shocks on farmers and the wider agricultural sector. It is important to strengthen the resilience of farmers and marketers in the face of future shocks, including the development of more efficient supply chains, improved access to essential inputs, and better market linkages. Based on the foregoing, this study assessed the impact of the COVID-19 lockdown on tomatoes and scotch bonnet losses among farmers and marketers in Southwestern Nigeria.

Methodology

Study area and population: The study was conducted in Oyo, Osun, and Ekiti States, Southwestern Nigeria. Oyo State is a major agricultural hub in Nigeria and plays a significant role in the country's agricultural economy, with its farmers contributing to both local food production and national exports (Oyo State Government, 2021). The State is home to several agricultural research institutes, such as the International Institute of Tropical Agriculture, Moore Plantation, and the Cocoa Research Institute of Nigeria, which focus on developing new farming techniques, improving crop yields, and conducting research on new crops and livestock breeds. Osun State is in the south-west region of Nigeria that is known for its agricultural potential. The state has a land area of 9,251 square kilometers and is endowed with vast arable land, which makes it suitable for crop cultivation (Osun State Government, 2021). Some of the major crops grown in the state include cocoa, yam, cassava, maize, and vegetables. The state is also home to several livestock, including cattle, sheep, and goats (Osun State Government, 2021). Ekiti State is a state in the south-west region of Nigeria known for its agricultural potential. The state has a land area of 6,353 square kilometers and is endowed with fertile soil suitable for the cultivation of various crops, including yam, cassava, maize, rice, vegetables, and cocoa (Adedipe *et al.*, 2020). The state is also a major producer of livestock, including cattle, sheep, and goats.

Additionally, Ekiti state is well-known for its honey production, which is considered one of the best in the country (Adedipe *et al.*, 2020). The government of Nigeria has also made efforts to support farmers in the Southwest geopolitical zone, providing them access to agricultural inputs, such as fertilizers and seeds, and improving rural infrastructure, such as roads and irrigation systems (Adedipe *et al.*, 2020). Study population were farmers and marketers of tomatoes and scotch bonnet in Oyo, Osun, and Ekiti States, Southwest Nigeria.

Study design: A cross sectional study design was used.

Sampling technique: Cluster sampling technique was used to enroll participants. In the first stage, all registered farmers and marketers in Oyo, Osun, and Ekiti States were identified. Desk reports from the Nigeria Stored Products Research Institute reveals that there are more than 30,000 of them, however only about 15,000 of them are registered. Next, we divided the population of farmers into clusters based on crop type. Overall, 140 farmers and 200 marketers were identified to be cultivators and marketers of solely market tomato and scotch bonnet. In Oyo State, there were 75 farmers and 90 marketers, in Osun State, there were 38 farmers and 60 marketers, and in Ekiti State there were 27 farmers and 50 marketers. In the third stage, participants were selected using systematic random sampling technique for an agricultural development meeting at the Oyo State Agricultural Development Program Office, Moore Plantation, Ibadan.

A previously conducted needs assessment by the Southwest zonal office of the Nigeria Stored Product Research Institute, Ibadan, Oyo State identified that farmers and traders in rural areas are less exposed to agricultural programs. As a result, farmers and marketers of tomato and scotch bonnet were included in the meeting and this research activity. In all, there were 28 farmers (12 from Oyo State, 9 from Osun State, and 7 from Ekiti State) and 38 marketers (18 from Oyo State, 11 from Osun State, and 9 from Ekiti State).

Sample size: We conducted a total survey of the 28 farmers and 38 marketers for tomato and scotch bonnet that were invited to the agricultural development meeting.

Data Collection

Primary data were collected using interviewer-administered questionnaires. Data were collected using a simplified set of written questions targeted towards postharvest handling practices. The questionnaire had four sections.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences version 25.0. Age was summarized using mean and standard deviation. Descriptive statistics such as frequency were done. Other information on the dataset was skewed, hence the median was selected as the best measure of central tendency. The median price of baskets of tomatoes and

bags of scotch bonnet before, during, and after COVID-19 lockdown were compared using Related samples Friedman's Two-Way Analysis of Variance by ranks. The median of the usual number of baskets of tomatoes harvested and quantity harvested during COVID-19 lockdown was compared using Related samples Wilcoxon sign rank test, the same was done for Scotch bonnet. P-values less than 0.05 were considered statistically significant.

Results and Discussion

The mean age of the respondents was 48.7 ± 13.6 years (Table 1). Farmers were 28 (42.4%) while 38 (57.6%) were marketers. The median farm size for tomatoes among the farmers was 10 plots (1-60), scotch bonnet 6 plots (1-60), and Spinach 6 plots (1-24). Figure 1 shows the support received by the farmers during the COVID-19 lockdown. Among the farmers, 89.3% were supplied improved seedlings, 35.7% were visited by extension workers and 64.3% received support from cooperative society (Figure 1). There is a growing body of literature that explores the impact of improved seedlings, extension worker visitation, and financial support from cooperative societies on reducing the spoilage of tomato and scotch bonnet. In their study, Oluwafemi and Babalola (2019) found that the use of improved seedlings led to a significant increase in tomato yields, which in turn reduced spoilage due to better storage and handling practices. In another study, it was demonstrated that extension worker visitation significantly increased the adoption of improved seedlings and good agricultural practices, leading to a reduction in post-harvest spoilage of tomatoes (Adeniyi and Akinnubi, 2020). Likewise, a study on the effect of membership of cooperative society on tomato production showed that financial support from cooperative societies, including access to credit and market information, increased the adoption of improved seedlings and post-harvest handling practices, leading to a reduction in spoilage of tomatoes and scotch bonnet (Onyia *et al.*, 2019).

Difference in the cost of tomatoes and scotch pepper before, during, and after the COVID-19 lockdown

Before the COVID-19 lockdown the median price of a basket of tomatoes was 5000-naira, 6000 naira during the lockdown, and 8000 naira after the lock down. ($p \leq 0.001$) The price of a bag of scotch bonnet was 7000 naira before the lock down, 8,500 naira during and 8,000 naira after the lockdown ($p = 0.027$) (Table 2). This study reported increased costs of tomato and scotch bonnet during and after the COVID-19 lockdown compared to the earlier period. According to a report by the Obayelu (2020), the COVID-19 pandemic has led to disruptions in food systems, affecting the production, distribution, and marketing of agricultural products. The report notes that the restrictions on the movement of goods and people, as well as the closure of markets, have impacted the availability of food and increased food prices (Obayelu, 2020). The increased cost of tomato and scotch bonnet during the COVID-19 lockdown can, therefore, be attributed to these disruptions. The

increase in the cost of tomato and scotch bonnet during the COVID-19 lockdown has implications for both producers and consumers. For producers, the increase in the cost of inputs such as fertilizer, seeds, and labor, as well as the disruptions in the supply chain, have resulted in reduced profitability (Obayelu, 2020). In some cases, producers have been forced to sell their produce at a loss due to the closure of markets and reduced demand. The pandemic has also exposed the vulnerability of small-scale producers who lack the resources to weather the disruptions caused by the pandemic.

For consumers, the increase in the cost of tomato and scotch bonnet during the COVID-19 lockdown has resulted in reduced access to these products. The increased cost has meant that some consumers are unable to afford these products, leading to reduced consumption. This reduction in consumption can have health implications, particularly for vulnerable groups such as children and pregnant women who require a balanced diet. The implications of the increase in the cost of tomato and scotch bonnet during the COVID-19 lockdown are not limited to the agricultural sector alone. The disruptions in the food system have a ripple effect on other sectors, such as the transport sector. The closure of markets and restrictions on the movement of goods have resulted in reduced demand for transportation services, leading to reduced income for transporters.

Storage technique among farmers and marketers of tomatoes and Scotch bonnet

All the farmers stored tomatoes in baskets while 92.9% of farmers stored scotch bonnet in bags. Among the marketers, 94.7% stored tomatoes in baskets while 28.9% stored scotch bonnet in bags (Table 3). Storing tomatoes and scotch bonnets in baskets and bags can have different implications for farmers and marketers. Storing tomatoes and scotch bonnets in baskets or bags can impact their shelf-life. According to a study by Singh and Singh (2015), tomatoes stored in baskets had a longer shelf-life than those stored in bags. Similarly, a study by Ogunlakin *et al.* (2019) found that storing scotch bonnets in bags increased their shelf life. The quality of the produce can also be affected by storage methods. A study by Ntawuruhunga and Ssebuliba (2011) found that storing tomatoes in baskets helped to maintain their quality better than storing them in bags. Meanwhile, a study by Onyeka *et al.* (2020) found that storing scotch bonnets in baskets helped to preserve their quality better than storing them in sacks. The type of storage used can also impact transportation. According to a report by the International Trade Centre (2016), baskets are commonly used for transporting fresh produce, as they are more durable and protect the produce better during transit. The appearance of the product can also affect marketability. A study by Onyeka *et al.* (2020) found that scotch bonnets stored in baskets had a better appearance than those stored in sacks, which could make them more marketable.

Quantity of tomatoes and scotch bonnet harvested and damaged before and during COVID-19 lockdown

The median quantity of tomatoes harvested per week was 10 baskets before and during the COVID-19 lockdown ($p = 0.221$). Before the COVID-19 lockdown, one basket of tomatoes was wasted per week, while during the lockdown period, three baskets of tomatoes were wasted per week ($p = 0.011$) (Table 4). Before the COVID-19 lockdown, the median number of bags of scotch bonnet harvested per week was 11, and during the COVID-19 lockdown, the median number of bags of scotch bonnet harvested per week was 2 ($p = 0.026$). Two bags of scotch bonnet were damaged both before and during the COVID-19 lockdown period ($p = 0.325$) (Table 4). The finding implies that during the COVID-19 lockdown period, there was an increase in the number of damaged and wasted baskets of tomatoes compared to the period before the lockdown. This suggests that the lockdown measures may have disrupted the supply chain and distribution of tomatoes, leading to spoilage and waste. The implications of this finding could also be interpreted in the context of food security and access to fresh produce during a crisis. The increase in waste could lead to higher prices and reduced availability of tomatoes for those who rely on them for nutrition.

To prevent future losses, 53.6% of the farmers suggested modern storage facilities, 25.0% recommended irrigation facilities, 7.1% stated the need for a processing centre, while others mentioned drying facilities for storage, improved seedlings, and funds. Among the 38 marketers, 14 (36.8%) suggested that storage facilities if provided will prevent future loss especially during future lock down, 6 (15.8%) suggested crates for storage and 5 (13.2%) felt appropriate drying facilities will prevent future losses, other felt that more funds will help to cushion the effect of their losses.

The provision of modern storage facilities, irrigation facilities, a crop processing center, drying facilities for storage, improved seedlings, and funds can significantly reduce tomato and scotch bonnet losses for farmers. Several studies have shown that these interventions improve the yield and quality of crops and reduce post-harvest losses. For instance, a study by Afolabi *et al.* (2020) found that the use of irrigation facilities increased the yield of tomatoes by 33%, reduced post-harvest losses by 10%, and improved the quality of the fruit. Similarly, a study by Onyeka *et al.* (2019) found that the provision of modern storage facilities reduced post-harvest losses of tomatoes by up to 25%. Another study by Oyelade *et al.* (2018) found that the use of improved seedlings increased the yield of scotch bonnets by 31% and reduced post-harvest losses by 15%. Similarly, the provision of drying facilities for storage reduced losses of scotch bonnets by up to 20% (Tijani *et al.*, 2018).

Furthermore, the provision of funds and credit facilities can enable farmers to purchase modern storage and processing facilities, as well as improved seedlings, and

can also help them to adopt better farming practices that reduce losses. A study by Ugochukwu *et al.* (2018) found that access to credit facilities increased the adoption of improved farming practices by farmers and reduced post-harvest losses.

Conclusion

Post-harvest losses of tomato and scotch bonnet were incurred among farmers and marketers in Southwest Nigeria during the COVID-19 lockdown. The disruptions in the food system, including the closure of markets and restrictions on the movement of goods, have impacted the availability and cost of these products. The pandemic has highlighted the vulnerability of small-scale producers and the need for measures to support them. To reduce the risk of damage during transportation and storage, farmers should harvest tomatoes and scotch bonnets at the right time. The farm produce should be picked when they are fully ripe but not overripe. Tomatoes and scotch bonnets should be stored in a cool, dry place that is well-ventilated. The storage area should be free from pests and rodents that can cause damage to the fruits. Proper packaging can help to reduce post-harvest losses. The packaging should be sturdy enough to protect the fruits from damage during transportation. To extend the shelf life of tomatoes and scotch bonnets, farmers and marketers should consider processing these products into sauces, paste, or dried products. The government should also support farmers and marketers by organizing training, providing subsidies, especially for rural farmers, and improving the road network.

Conflicts of interest

The authors declare no conflicts of interest.

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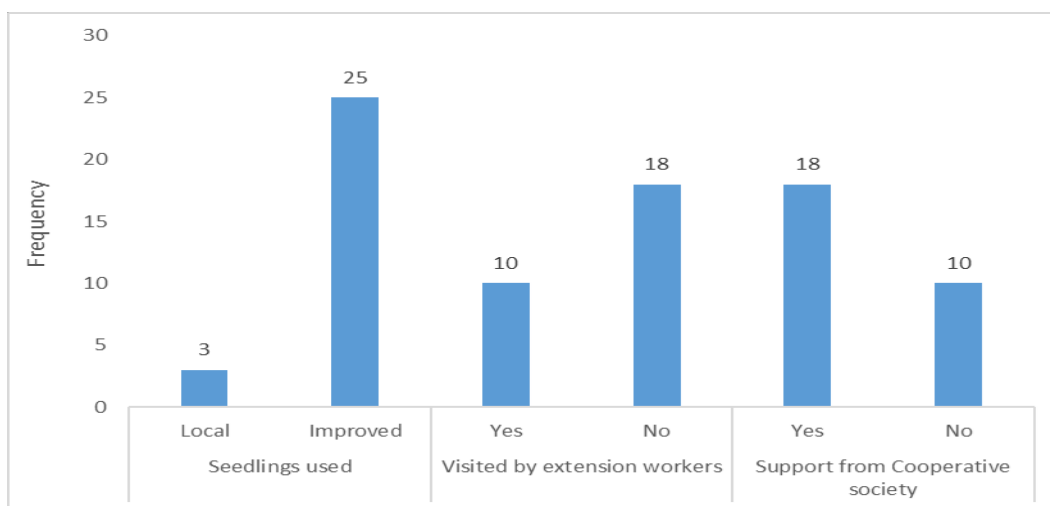


Figure 1: Support received by farmers during the COVID-19 lockdown

Table 1: Socio-demographic characteristics of selected farmers and marketers in Ibadan

Socio-demographic characteristics	Frequency	%
Age (Years)		
<30	6	9.1
30-39	10	15.2
40-49	18	27.3
50-59	16	24.2
≥60	16	24.2
Sex		
Male	20	30.3
Female	46	69.7
Marital Status		
Single	6	9.1
Married	52	78.8
Widowed/divorced	8	12.1
Level of Education		
None	6	9.1
Primary	13	19.7
Secondary	23	34.8
Tertiary	25	36.3
Occupation		
Farmer	28	42.4
Marketer	38	57.6
Duration of Occupation (Years)		
<15	30	45.5
≥15	36	54.5

Table 2: Median prices of tomatoes and scotch bonnet before, during and after the COVID-19 lockdown

	Median price in Naira	Range	p-value*
Price of a basket of tomatoes			
Before COVID-19 Lock down	5,000	4,000-10,000	<0.001
During COVID-19 Lock down	6,000	4,000-15,000	
After COVID-19 Lock down	7,000	4,000-20,000	
Price of a bag of scotch bonnet			
Before COVID-19 Lock down	7,000	2,700-15,000	0.027
During COVID-19 Lock down	8,500	3,200-22,000	
After COVID-19 Lock down	8,000	3,000-20,000	

* *Related samples Friedman's Two-Way Analysis of Variance by ranks*

Table 3: Storage technique among farmers and marketers of tomatoes and Scotch bonnet

Storage technique among Farmers	Frequency	%
Tomatoes		
Basket	28	100
Bag	0	0
Scotch bonnet		
Basket	26	92.9
Bag	2	7.1
Storage technique among Marketers		
Tomatoes		
Basket	36	94.7
Bag	2	5.3
Scotch bonnet		
Basket	27	71.1
Bag	11	28.9

Table 4: Quantity of tomatoes and scotch bonnet harvested and damaged before and during COVID-19 lockdown

	Weekly harvest			Weekly wastage			
	Median	Range	P-value*	Median	Range	P-value*	
Tomatoes (Baskets)				Tomatoes (Baskets)			
Quantity harvested before the COVID-19 lockdown	10	2-40	0.221	Quantity damaged before the COVID-19 lockdown	1	0-10	0.011
Quantity harvested during COVID-19 lockdown	10	1-65		Quantity damaged during COVID-19 lockdown	3	0-20	
Scotch bonnet (bags)				Scotch bonnet (bags)			
Quantity harvested before the COVID-19 lockdown	11	1-100	0.026	Quantity damaged before the COVID-19 lockdown	2	0-30	0.325
Quantity harvested during COVID-19 lockdown	2	0-30		Quantity damaged during COVID-19 lockdown	2	0-15	

**Related samples Wilcoxon sign rank test*