

Challenges of post-harvest losses among Tomato (*Solanium lycopersium*) farmers in Zing Local Government Area of Taraba State, Nigeria

Emodi, Angela Izukanne and Osilem, Message Chinweota

Department of Agricultural Economics and Extension, University of Port Harcourt,
Rivers State, Port Harcourt 500262 Nigeria
emodizee@gmail.com

Abstract: One of the great challenges in tomato production is to improve yield stability through post-harvest losses in its production. This study investigated the challenges of post-harvest losses among tomato farmers in Zing Local Government Area of Taraba state, Nigeria. Simple random sampling technique was used in selecting 35 tomato farmers from 2 randomly selected communities who participated in the study. Data were collected using structured questionnaire and interview schedule. Descriptive statistics such as percentage and mean were used for analysis. The findings show that all the farmers were learned, 65.7% of them were married, 71.4% had farming experience of 10 years and below. The majority 80.0% of the farmers used sodium hydroxide to preserve tomato, while 74.3% of them stored their tomato in native woven basket. High cost of storage facilities (\bar{x} =2.86); Poor packaging technology deepen the loss of farmers tomato at post-harvest (\bar{x} = 2.83) and pests and disease infestation (\bar{x} = 2.71), were the major constraints faced by farmers in tomato production. The average amount of tomato loss on the farm in monetary terms as a result of poor storage facilities was ₦30371.43k. Perceived strategies to enhance tomato preservation by farmers include: canning of tomato to extend shell-life (\bar{x} = 2.80), farmers arranging with buyers to buy-off tomatoes on timely basis (\bar{x} = 3.20). Based on the findings, the study recommended need for extension agents to teach farmers improved skills and knowledge required to overcome the challenges in tomato preservation, especially in pests management. The study further recommended the need for the government to make available refrigeration centers to farmers for quick tomato preservation.

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1. Introduction

Tomato is exposed to a wide-range of post-harvest constraints ranging from pests to disease, and poor storage to poor transportation. One of the great challenges in tomato production is to improve yield stability through the constraints in its production. Nevertheless, about 26% of crop production is lost every year due to pre-harvest pests and pathogens (Oerke, 2006). Growing human populations, loss of agricultural land due to erosion, drought, deforestation, climate change and land grabs entails that production losses be reduce as much as possible, especially those caused by human errors (Bebber, Ramotowski, Sarah, 2013; FAO,2016). Tomato (*Solanium lycopersium*) is about 16% of the world largest fruit consumed (Bayer, 2016). The global tomato production is about 130 million tons in 2016, of which 88 million sales are concentrated on the domestic market, with 42 million processed by the industries (EuroFresh distribution, 2016).

Tomato is a fruit, though could be considered as a vegetable when used in the preparation of various cuisines such as salad, sauces, jellof rice, African

stews. It is a vital component of the fresh perishable agricultural produce, consumed by most household because of its nutritional value and its multipurpose use (Joosten, Dijkxhoorn, Sertse and Ruben, 2015). Due to the versatility of its use, many farmers are into tomato production especially in the Northern Nigeria (Stan 2016), as an attempt to meet up with consumer's high demand of tomato consumption. Tomato has a high nutritional value and contains useful nutrients for body building. Potassium in tomatoes ensures that the muscles and the nervous system functions well and prevent high blood pressure. Tomatoes is also rich in vitamins such as vitamin B11 and vitamin C which is of importance for healthy bones, blood vessels, teeth and gum, and better immune system (Tommies 2016). Tomato contains lycopene, an anti-oxidant properties which lowers risk of cancer and cardiovascular disorders (Arah, Kumah, Anku and Amaglo, 2015). According to Innes (2014), lycopene in tomato enhances fertility by improving the quality sperm while reducing the number of abnormal sperm in men. Consumption of tomatoes prevents diseases like

dementia, osteoporosis, Parkinson's and Alzheimer's and other old-age related (Arah, et al., 2015).

Nigeria is the second highest producer of tomatoes in Africa with about 1 560 000 million tonnes with Egypt leading the continent with 8.625 million tonnes (Arah, Kumah, Anku, Amaglo, 2015). Nonetheless Nigeria is yet to be officially listed among tomato exporting countries, and shamelessly the country imports tomatoes to a tune of about ₦11.7 billion annually on processed tomato paste (University of Ibadan Research Foundation Funded Project, 2014). Tomato production and its economic importance in Nigeria is mired by number of factors, which makes its production difficult and weighty. Pests and diseases, storage facilities and poor transportation are major constraints that contribute to post-harvest losses. Tomato farmers need highly intensive management technique in its production and post-harvest handling. These are necessary at the peak of the season in excess tomato production in the period of glut to reduce very high losses.

There are post-harvest activities such as cleaning, sorting and grading, packaging, transporting and storage. In cleaning, fruits are washed to maintain good hygiene and limit food borne disease or illness. Sorting and grading is the removal of diseased or rotten fruit from the good ones to avoid contamination. Tomatoes storage help preserve tomato which will be supplied throughout the season, and supply raw material to processing industries. These are challenges in tomato harvesting among farmers in developing countries. As a perishable product with low shelf life, if not properly handled will definitely not reach the consumers fresh. The handling of harvested tomatoes can have a drastic effect on the post-harvest quality and shelf life of the produce. Rough handling of tomato during harvesting and post harvesting cause farmers to incur low yield, financial losses and low income gain and tomato wastes. This will affect the post-harvest quality or shelf life of the farm produce. Nevertheless, most farmers are quickly abandoning tomato production to other fruits and vegetables like orange, garden egg and cabbage. Thus, this could cause scarcity fresh tomato in the country. Therefore, constraints need to be checked because of so many post-harvest losses in tomato production. Farmers need to be encouraged to continue in tomato production and making them available in Nigeria market. It is relevant to ascertain the challenges of post-harvest losses in tomato production in Zing Local Government Area (LGA) of Taraba State, Nigeria. Specifically the study:

1. examined the socio economic characteristics of tomato farmers in the study area,

2. identified tomato preservation methods used by farmers in Taraba state;

3. ascertained the level of post-harvest losses in tomato production in the study area,

4. identified farmers' constraints to prevention of post-harvest losses in the study area, and

5. determined strategies to enhance tomato preservation in the study area.

2. Material and Methods

The study was carried out in Taraba state, which is located in the North-east geo-political zone of Nigeria. The State is bounded in the west by Plateau and Benue states and on the east by the Republic of Cameroun. It occupies a land area of about 54,428 sq km, and lies between latitudes $6^{\circ}25'N$ and $9^{\circ}30'N$, and between longitudes $9^{\circ}30'E$ and $11^{\circ}45'E$ (National Population Council (NPC, 2006). Taraba state has sixteen LGAs, namely: Ardo-Kola, Donga, Gashaka, Gassol, Ibi, Jalingo, Karim-Lamido, Kurmi, Lau, Sardauna, Takum, Ussa, Wukari, Bali, Yorro and Zing. The major occupation of the people is agriculture, and they are noted for production of fresh tomatoes.

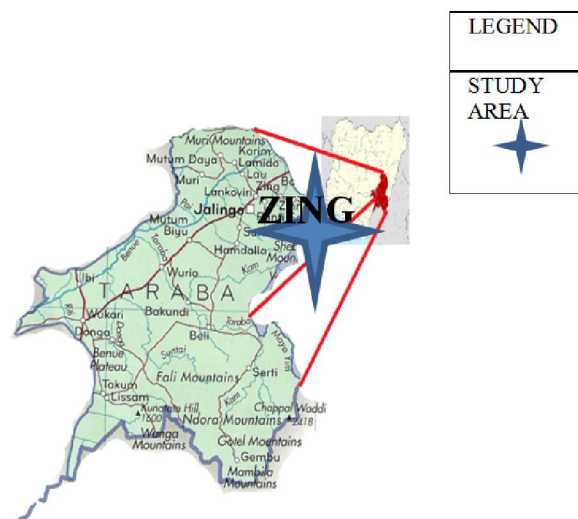


Fig 1: Map of Taraba State showing the study area
Source (<https://www.google.com.ng/map+local+govt+government=taraba+state>)

All farmers in tomato production constituted the population for the study. Purposive and simple random sampling techniques were used in the sample for the study. First, one (Zing) Local Government Area (LGA) was selected because of large number of backyard farmers involved in tomato production in the LGA. Secondly, two (Kakulu and Yakoko) main tomato farming communities were purposively selected from ten (Yakoko, Monkin, Lamma, Bitako, Bukka, Yali, Dingding, Bubong, Yonko and Kakulu)

communities of Zing LGA. The farmers in these communities seemed to invest more time to their tomato farm. Finally, stratified random sampling technique was used to select 29 tomato farmers from the selected communities. A total of 40 (forty) farmers were selected for the study, since the actual population frame of the tomato farmers was unknown. Nevertheless only 35 farmers who correctly completed the questionnaire were used for the study. For collecting relevant data from the farmers, structured questionnaire and personal interview schedule were used. Descriptive statistics such as frequency, percentage and mean score were used for analysis.

3. Results

Socio-economic characteristics of farmers in the study area

The results in Table 1 show that majority (68.6%) of the farmers were male while 31.4% were female. About 48.6% of the farmers were in the age range of 30 - 49 years. The mean age was 39.5years. The result also shows that about 45.8% of the farmers had tertiary education, 31.4% of them obtained secondary education while 22.8% of the farmers obtained primary education.

Table 1: Socio-economic characteristics of farmers in the study area

Variables	Frequency (n=35)	Percentage (%)	Mean (\bar{x})
Sex			
Male	24	68.6	
Female	11	31.4	
Age (years)			
20-29	7	20.0	39.5years
30-49	17	48.6	
50 and above	11	31.4	
Educational level			
Primary education	8	22.8	
Secondary education	11	31.4	
Tertiary education	16	45.8	
Marital status			
Single	4	11.4	
Married	23	65.7	
Widowed	3	8.6	
Separated	5	14.3	
Household size			
1-5	16	45.7	8persons
6-10	11	31.4	
11-15	5	14.3	
16 and above	3	8.6	
Farming experience			
10 and below	25	71.4	8years
11-15	9	25.7	
21-25	1	2.9	
Farm size			
Less than 1 ha	2	5.7	
1ha	5	14.3	
2ha	14	40.0	
3ha	6	17.1	
4ha and above	8	22.9	
Means of Transportation			
Motor bicycle	14	40	
Tricycle	4	11.4	
Pick up van	10	28.6	
Truck	7	20.0	

Source: Field survey, 2017

Furthermore, majority (65.7%) of the farmers were married with a mean household size of 8 persons. Greater proportion (71.4%) of farmers had farming experience of 10 years and below. The mean of the farming experience was 8 years. The results show that about 40.0% of the farmers had 2ha of land. Findings in Table 1 show that about 40.0% of the farmers' means of transportation was by motor bicycle, 28.6% of them was by pick up van, 20.0% used truck while 11.4% used tricycle.

Tomato preservation methods used by farmers

Entries in Table 2 show that majority (54.3%) of the farmers sprinkle cool water on tomatoes and set them in the evening dew. Greater proportion (60.0%) of the farmers do not preserve their tomatoes in refrigerator, while 40.0% of them preserve tomato in refrigerator.

The results also reveal that majority (54.3%) of the farmers preserve their tomato by sunning and drying method, while the remaining 45.7% farmers do not preserve their tomato by sunning and drying. Greater proportion (74.3%) of the farmers store tomato in a native woven basket, while 25.7% of them do not preserve their tomato in a native woven basket.

Native woven basket is an effective way to preserve tomato by the farmers. Majority (80.0%) of the farmers do not use sodium hydroxide to preserve their tomato while 20.0% do use sodium hydroxide in preserving their tomato. Majority (57.1%) of the farmers preserve tomato by spreading on bare floor (mud or cemented), while 42.9% do not preserve tomato on bare floor.

Entries in Table 2 show that majority (57.1%) of the farmers preserve their harvested tomato by packaging them immediately after harvesting, while 42.9% of the farmers do not package them immediately after harvest, but leave them for some time to cool. Greater proportion (68.6%) of the farmers do not preserve tomato by boiling and drying and when cool pour vegetable oil at the top, while 31.4% of the farmers do preserve by boiling and drying and then when cool pour vegetable oil at the top of the tomato. Findings in Table 2 show that majority (62.9%) of the farmers do not store their tomato at 10°C-15°C and 89°C-95°C to relative humidity while 37.1% of the farmers stored their tomato at 10°C-15°C and 89°C - 95°C to relative humidity.

Table 2: Tomato preservation methods used by farmers in the study area

Item	Frequency (n=35)	Percentage (%)
Sprinkle cool water on tomato and set out in the evening Dew		
No	16	45.7
Yes	19	54.3
Preserve tomato by refrigerating		
No	21	60.0
Yes	14	40.0
Sun and dry tomatoes		
No	16	45.7
Yes	19	54.3
Store tomatoes in a native woven basket		
No	9	25.7
Yes	26	74.3
The use of sodium hydroxide in preservation		
No	28	80.0
Yes	7	20.0
Tomatoes are spread on bare floor		
No	20	57.1
Yes	15	42.9
Packaging of products immediately after		
No	15	42.9
Yes	20	57.1
Boil, dry, and pour vegetable oil at the top of tomato		
No	24	68.6
Yes	11	31.4
Stored at 10^{0c}- 15^{0c} to relative humidity		
No	22	62.9
Yes	13	37.1

Source: field survey 2017

Level of post-harvest losses in tomato production

The result in Table 3 show the amount of loss on the farm in monetary terms as a result of poor storage facilities to ₦30371.43k on average, while the

estimate on the quantity of tomato lost last year was estimated to be 5kg at minimum and 200kg at maximum.

Table 3: level of post-harvest losses in tomato production in the study area

Item	Minimum	Maximum	Mean	Standard Deviation
Lose on the farm in monetary terms as a result of poor storage facilities in the last year	5000kg	120000kg	₦ 30371.43	24929.41
Estimate on the quantity of tomatoes lost in farm last year after harvest	5kg	200kg	₦ 43.74	43.86

Source: field survey 2017

Constraints to prevention of post-harvest losses as perceived by farmers

Table 4 reveals farmers perception of enlisted 7 items as constraints to prevention of post-harvest losses. They include: high cost of storage facilities (\bar{X} = 2.86), poor packaging technology (\bar{X} = 2.83), problem of pests and disease infestation (\bar{X} = 2.71), high cost of labour required (\bar{X} = 2.46), inadequate finance (\bar{X} = 2.31), low knowledge on various preservation methods (\bar{X} = 2.26), and by-products not recycled (\bar{X} = 2.11).

Table 4: Mean distribution of constraints to prevention of post-harvest losses as perceived by farmers

Items	Mean Score (\bar{X})
Problem of pests and disease	2.71
High cost of storage facilities	2.86
Poor packaging technology	2.83
Low knowledge on various preservation methods	2.26
Inadequate finance	2.31
High cost of labour required	2.46
By-products not recycled	2.11

Source: field survey 2017 mid-point: 2.50

Strategies to enhance tomato preservation as perceived by farmers

Strategies to enhance tomato preservation as perceived by farmers were analysed as follow: processing of tomato fruit into juice and drinks (\bar{X} = 2.57), canning of tomato to extend the shelf-life (\bar{X} = 2.80), oven drying of tomato to minimize losses (\bar{X} = 2.34), spraying with preservatives (\bar{X} = 2.11), arranging with buyers to buy off on timely basis (\bar{X} = 3.20), refrigerating of tomato in cold room (\bar{X} = 2.34).

Table 5: Mean distribution of strategies to enhance tomato preservation as perceived by farmers in the study area

Items	Mean Score (\bar{X})
Processing of tomato fruit into juice and drinks	2.57
Canning of tomato to extend shelf-life	2.80
Arranging with buyers to buy off product	3.20
Oven drying of tomato to minimize losses	2.34
Spraying tomato with preservatives	2.11
Refrigerating of tomato	2.34

Source: field survey 2017 mid-point:2.50

4. Discussions

The socioeconomic characteristics of tomato farmers in zing Local Government Area of Taraba State are presented in Table 1. The result reveals that tomato farming in the study area were dominated by

male. The dominance of males in tomato production could be due to tedious tasks required in tomato production (Usman and Bakari, 2015). It also reveals that the farmers' who for their active age (39.5years), were able to tackle tedious tasks entailed in tomato

production. The farmers have high educational attainment which might positively influence the farmers' to adopt an innovation. In support, Albert, Ikoro and Emodi (2015) revealed that education positively affects farmers' ability to understand new skills. Large households mean (8 persons) revealed in the result, implies that farm labour could be distributed with ease within the households without searching for extra labour. The mean (8years) of the farming experience, implies that the farmers are skilled and experienced in tomato production. The farmers are small scale holders, who practice subsistence farming with motor bicycle as major means of transportation.

In tomato preservation methods (Table 2), majority of the farmers (54.3%) indicates that cool water was used to set tomato to a preservation temperature against spoilage. Arah et al., (2015) mentioned that sprinkling of cold water on tomato is a cheap effective means of precooling harvested tomatoes for producers in developing countries. Tomatoes being spread on bare floor seem to reduce spoilage and injury on the tomato skin. This could result to cluster. These findings could imply that not all farmers had access to refrigerator. It could also denote that the farmers prefer traditional methods of tomato preservation than refrigerator which is an improved method.

Table 3 shows high amount of tomato loss on the farm, to ₦30371.43k on average. This implies that poor storage facilities affects tomato preservation amongst the farmers in the study area. High cost of storage facilities and Poor packaging technology constituted very major constraints to prevention of post-harvest losses (Table 4). This implies that storage and processing methods are ill developed and farmers relied on the crude methods employed by their forefathers in years past (Emodi, 2010). It could be that technologies exist to address these problems but, their adoption is constrained by lack of information, packaged in appropriate formats, with poor communication channels. This implies that the complexity of farmers needs should be distilled into viable tomato production system that is apparent, readily available, and sensitive to their environments.

In strategies to enhance tomato preservation (Table 5), farmers perceived, arranging with tomato buyers to buy off product on timely basis, as the highest strategy to enhance tomato preservation.

5. Conclusion

Farmers are challenged with inadequate finance and have low knowledge on various tomato preservation methods. Arranging with tomato buyers to buy off-product and canning of tomato to extend shelf-life were perceived by farmers as highest

strategies in tomato preservation. The study recommends that policymakers should incorporate building and developing centers where farmers can easily get information on new ideas on tomato post-harvest preservation techniques. There is need for extension workers to organize workshops and seminars for farmers, educate them on the need to only harvest tomato when ripe to reduce decay.

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Corresponding Author:

Dr. Emodi, Angela Izukanne
Department of Agricultural Economics and Extension
Faculty of Agriculture, University of Port Harcourt,
Rivers State, Nigeria
Telephone: +2348035536088
E-mail: emodizee@gmail.com

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