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FARMERS' ENGAGEMENT IN TOMATO POSTHARVEST HANDLING ACTIVITIES AND RATE OF LOSSES IN KADUNA STATE, NIGERIA

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ABSTRACT

Tomato is an important fruit vegetable which provides numerous nutrients to the body. Despite the level of production, postharvest loss is frightening at the rate of 30-50% annually as a result of poor handling. The previous studies have not investigated the level of engagement in tomato handling. Therefore, this study investigated the level of engagement of farmers on tomato postharvest handling activities. Multistage sampling procedure was used to select 231 respondents. Structured questionnaire was used to obtain data on farmers' socio-economic characteristics, level of engagement in tomato postharvest handling activities and rate of losses, while descriptive (Frequency distribution, mean and standard deviation) and inferential (PPMC) statistical tools were used for analysis. Majority of tomato farmers (94.8%) were found to be male with 15 years of farming experience (63.6%). Larger proportion (41.6%) had 1-2 acres of tomato farm and majority (54.1%) produced less than 5000kg of tomato annually. Most (65.4%) had low engagement level in postharvest handling of tomato and majority (58.9%) incurred high rate of losses. There was significant relationship between years of experience ($r = -0.163$, $p < 0.05$), farm size ($r = 0.279$, $p < 0.05$), quantity of tomato produced ($r = 0.272$, $p < 0.05$) and losses incurred. Significant relationship also existed between level of engagement ($r = -0.163$, $p < 0.05$) and the rate of losses incurred. The study therefore recommends that government and other NGOs should assist tomato farmers with processing and storage facilities. Also extension agents should organise workshop and training for farmers on modern techniques of postharvest handling of tomato to improve their level of engagement in order to reduce the rate of losses incurred.

Keywords: Level of engagement, Postharvest handling activities, Tomato postharvest losses, Tomato farmers

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most widely grown vegetables in the world and an important component of the daily diet, consumed both in its fresh and paste forms. It is a good source of Vitamins A and C and other essential minerals and cultivated over vast area of land in the world. Tomato losses of up to 50% is recorded in fresh tomato between the harvesting and consumption stages of the distribution chain in tropical countries (Mashav, 2010). About thirty-two percent of food produced globally was lost and not eventually consumed by intended people due to the problem of inadequate postharvest handling activities which eventually results in greater losses (FAO, 2014). Mostly, fruits, vegetables and root crops are much less hardy and are quickly perishable if not properly handled along the supply chain of food distribution and these losses have enormous undesirable economic and ecological effects (FAO World Bank, 2010). Therefore, reducing the food losses and waste could be one of the important global approaches for realizing a sustainable food future. In Africa, the losses are even higher between 30 and 50% which occur mainly along the supply chain, where fruits and vegetables losses are estimated to be fifty percent or more and this estimate is increasing because losses occur at every stage of the supply chain (FAO, 2011)

There are numerous factors that contribute to losses of tomato which include environmental conditions (heat, drought, and mechanical damage during harvesting) and inappropriate postharvest

handling activities (unsuitable packaging materials, poor pre-cooling methods, poor sorting and grading techniques, inadequate storage facilities and poor methods of transportation and marketing). Fresh tomato fruits are vulnerable to postharvest losses immediately after harvest, because they are highly perishable with high moisture content, have short shelf-life and highly prone to fungal and microbial attacks and are very challenging to store for a long period without incurring losses (Ewekeye, Oke, Quadri, Isikalu, Umenwaniri and Durosimi, 2013).

Nigeria ranks 16th among the leading producers of tomato in the world and has the proportional benefits and prospect to top the world in both production and exports. The production of tomato in Nigeria in 2010 was about 1.8 million metric tonnes, which accounts for almost 68.4 percent of West Africa, 10.8 percent of Africa's total output and 1.28 percent of world output (Weinberger and Lumpkin, 2007). Regrettably, Nigeria still experiences ineptitude in serious inputs, inadequate improved technology, poor yield and productivity and high level of postharvest losses. The demand for tomato and its byproducts surpasses the supply as a result of losses incurred annually. Almost forty percent of tomato is lost to inadequate handling activities, leaving a short fall of 1.22 million metric tonnes for man's use. In addition, about fifty percent of the local tomato produced in Nigeria rot because of inadequate storage and processing facilities, which has prompted many farmers to stop producing tomato (Daniel, 2016). More so, postharvest losses of food has been a great

challenge to food security in Nigeria, nonetheless increased yield has been found to be possible but inefficient handling activities has become a major problem (Arowojulo, 2000). It is therefore pertinent to examine the relationship between level of engagement in various postharvest handling activities of tomato among farmers in Kaduna State and the rate of losses incurred by farmers, in order to proffer solutions for adequate food security. Specifically, the study;

1. Described the socio-economic characteristics of tomato farmers in the study area.
2. Ascertained the level of engagement in postharvest handling activities by the respondents.
3. Determined the rate of postharvest losses of tomato incurred by the respondents in the study area.

The following are the hypotheses of the study

H₀₁: There is no significant relationship between the respondents' socio-economic characteristics rate of postharvest losses incurred.

H₀₂: There is no significant relationship between respondents' level of engagement in postharvest handling activities and rate of losses incurred.

METHODOLOGY

The study was conducted in Kaduna State, North Western zone of Nigeria. Agriculture is the main stay of the economy of Kaduna state with about 80% of the people actively engaged in farming. Cash and food crops are cultivated and the produce include: yam, cotton, groundnut, tobacco, maize, beans, guinea corn, millet, ginger, rice and cassava. Over 180,000 tonnes of groundnut are produced in the state annually (NigeriaGalleria, 2017). The sector is dominated by wet season planting and an irrigated dry season planting. Most farmers produce cereal crops such as maize, sorghum, millet and rice during the rainy season. The State is also an important producer of fruits and vegetables that are supplied to Southwest Nigeria. The study population comprised all farmers in Kaduna states, Nigeria.

Multi-stage sampling procedure was adopted to select respondents for this study. Local government areas (LGAs) that produce more of tomato were purposively selected. Purposive sampling technique was also used to select 20% of LGAs prominent in tomato production to give a total of two LGAs. Thereafter, 10% of the wards were randomly selected to give a total of two wards (Jere and Galma). Lastly, 10% of the registered tomato farmers in each ward were randomly selected to give a total of 231 respondents. Respondents were presented with forty-four items on postharvest

handling activities. These were sub - divided into seven main groups; Harvesting, Precooling, Sorting and Grading, Packaging, Storage, Processing and Transportation. Respondents' extent of engagement in postharvest handling activities was measured on a-three scale point of always, occasionally and never and were scored 2, 1 and 0 respectively. The maximum score obtainable was 88 while the minimum was 0. Scores of each of the respondent were summed to obtain a composite score for postharvest handling activities engaged in. The mean value of 22.69 was then used as benchmark to categorize into high and low such that those below the mean score were assume to have low level of engagement in the activities and those within and above mean score was assumed to have high level of engagement in postharvest handling activities. The rate of losses was measured by deducting the sum of quantity of tomatoes sold, quantity consumed, and quantity given out as gifts from the main quantity of tomato produced by individual farmers per annum.

RESULTS AND DISCUSSION

Socioeconomic characteristics

The result from Table 1 reveals that a little above the average (51.5%) of tomato farmers were within age range of 41 to 50 years with the mean age of 47.8 years. This suggests that tomato farming is dominated by young people, who are considered to be in their productive and active years. They will thus be capable of undertaking any economic activities to adequately cater for their families and possibly others. This agrees with the findings of Joel, Girei, Jongur and Umaru (2016) in a study carried out in Adamawa state where the mean age of farmers was 47.5 years.

The results (Table 1) further reveals that majority of tomato farmers (94.8%) were found to be male. This signifies that men dominated tomato farming activities in the study area. This could be linked with the major roles men play in crop production most especially fruits and vegetables because of direct ownership of land required for farming in which men have higher advantage than women. This finding is in line with that of Ojo, Ibrahim and Muhammad, (2009). A larger percentage (89.2%) of the farmers were married. This is suggestive of the need to make more money to meet up with numerous family responsibilities. The findings corroborate the report of Suleiman and Jafar (2010) who stated higher percentage of respondents in a related geographical locality in Northern Nigeria were married. Table 1 also shows that larger proportion (43.7%) of farmers had primary school certificate as their highest level of education attained, while few (28.6%) had above primary education as their highest level of education. This suggests that the respondents' level of education is very low.

The results from Table 1 further shows that few (41.6%) farmers had between 1 – 2 acres of tomato farmland. The total number of acreages cultivated by the farmers denotes that food production in Nigeria is characterized mainly by small scale farmers. This is consistent with the findings of Daudu, Chado and Igbashal (2009) in a related study in terms of farm size. The result (Table 1) reveals that little above half (54.1%) of farmers produced tomato of between 5001 and 10,000kg in the year 2016, while only 1.3% produced above 20,000kg. The low production could be attributed to the outbreak of *Tuta absoluta* (Leaf miners) in the Northern part of Nigeria. The result from Table 1 shows that larger proportion (56.3%) of farmers

earned income of between ₦50, 001 and ₦100, 000 annually, while 9.5 percent earned above ₦150, 000 annually. This implies that majority of the respondents were low income earners which can influence the way they handle tomato. The distribution of respondents according to the farming experiences as shown on figure 1 reveals that majority (63.6%) of farmers had 15 years of experience in average. This implies that tomato farming is an age long profession of the respondents in the study area. This agrees with the report of Ajayi *et al* (2010), who stated that larger proportion (68.9%) of farmers had the same years of farming experience.

Table 1: Distribution of respondents' socio-economic characteristics

Variable description	Tomato Farmers (n=231)		
Age (Years)	F	%	Mean
≤ 30	3	1.23	47.8± 7.8
31 – 40	42	18.18	
41 – 50	119	51.52	
51 – 60	56	24.24	
≥ 61	11	4.76	
Sex			
Male	219	94.81	
Female	12	5.19	
Marital status			
Single	10	3.33	
Married	206	89.18	
Widowed	15	6.49	
Educational level attainment			
Primary school	101	43.72	
Secondary school	60	25.97	
Tertiary education	6	2.60	
Non-formal	64	27.71	
Size of tomato farm (acres)			
≤ 1	65	28.14	4.2±28.5
1.0 – 2	96	41.56	
> 3	70	30.30	
Quantity produced (kg)			
≤ 5000	48	20.77	53.06±37.45
5001 – 10000	125	54.11	
10001 – 15000	30	12.98	
15001 -20000	25	10.83	
> 20000	3	1.30	
Income from farming / Year (N)			
≤ 50,000	49	21.21	101,936.3± 82,956.2
50001 – 100,000	130	56.28	
100,001 – 150,000	30	12.98	
≥ 150,001	22	9.52	

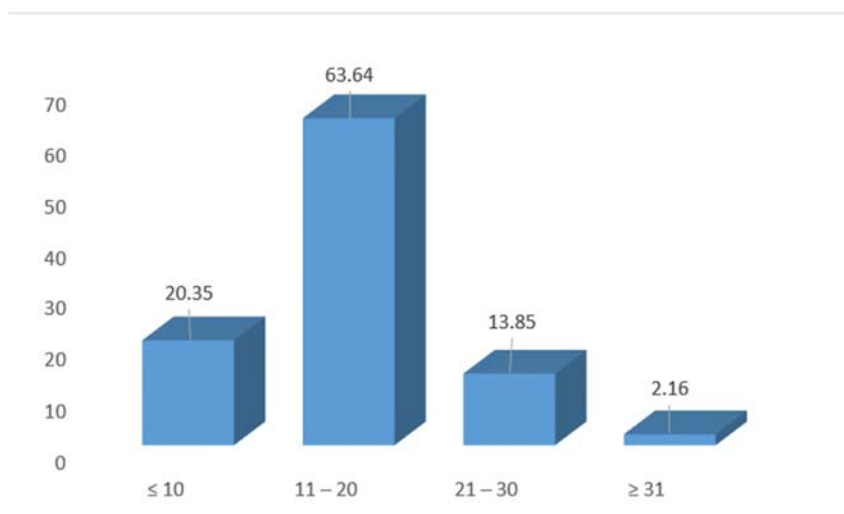


Figure 1: Respondents' years of farming experience

Tomato farmers' level of engagement in postharvest handling activities

The result from Table 2 shows that farmers were highly engaged in; harvesting tomato at the cool period of the day ($\bar{x} = 1.98$), while the level of engagement was low in the use of sharp knives for harvesting tomato ($\bar{x} = 0.06$) and cutting of fingernails before harvesting tomato on the farm ($\bar{x} = 0.10$). This is line with Olayemi, Adegbola, Bamishaye and Daura (2012) in a related study. The respondents' low level of engagement in various postharvest handling activities contributed greatly to high rate of losses incurred. The result (Table 2) further reveals that respondents' level of engagement were low in; spreading of freshly harvested tomato under the trees immediately after harvesting to remove excess heat ($\bar{x} = 0.24$), spreading of fresh tomato on a verandah at home ($\bar{x} = 0.05$) and keeping harvested tomato in a well-ventilated shops to remove excess heat ($\bar{x} = 0.04$). This implies that as a result of low level of engagement in precooling activities, the respondents incurred high rate of tomato losses. More so, respondents' level of engagement were low on these activities (sorting and grading); sorting of tomato according to different sizes before packaging ($\bar{x} = 0.81$), sorting and grading of tomato based on the colour (ripeness) ($\bar{x} = 0.67$).

On the packaging activities of tomato, it was revealed that the level of engagement was low in packaging fresh tomato with the use of collapsible slatted wooden box ($\bar{x} = 0.06$) and Packaging fresh tomato with the use of use of Nestable plastic crates ($\bar{x} = 0.26$), while they were highly engaged in the use of use of woven baskets for packaging tomato ($\bar{x} = 1.97$). The result from Table 2 further reveals that farmers' level of engagement was low in storage

of fresh tomato in the cold room ($\bar{x} = 0.06$), storing fresh tomato in the refrigerator ($\bar{x} = 0.05$), preserving fresh tomato using pot - in- pot method ($\bar{x} = 0.03$). However, the result (Table 2) shows that level of engagement in piling of tomato baskets in the truck during transportation was very high ($\bar{x} = 1.88$) which leads to high rate of losses, while their engagement level was low in transportation activities that will reduce the rate of losses; Transporting of fresh tomato during the cool period of the day ($\bar{x} = 1.22$) and transporting with the use of cool van ($\bar{x} = 0.29$). It was observed that farmers' level of engagement was low in the processing activities that ensure reduction in the rate of losses; Slicing and Sun drying ($\bar{x} = 1.08$). They were not engaged at all in use of hybrid dryer and multipurpose dryer ($\bar{x} = 0.00$).

The rate of postharvest losses incurred by tomato farmers

The distribution on the losses incurred by the respondents from Table 3 shows that 58.9% of farmers incurred high rate of tomato losses while only 41.1 percent incurred low rate losses. The high rate of losses incurred could be linked to their low level of engagement in various postharvest handling activities required for tomato. This is in agreement with Ladapo (2010) in a related study determining the postharvest losses of plantain among farmers and wholesalers in Southwestern Nigeria, where it was reported that farmers incurred high rate of losses than the marketers. This implies that farmers in the study area need to be educated to be highly engaged in various postharvest handling activities in order to ensure reduction in the rate of postharvest losses of tomato among the producers.

Table 2: Distribution of tomato farmers' level of postharvest handling activities of tomato

Postharvest handling activities parameters	Tomato Farmers (n = 231)			Mean
	Frequency of engagement			
	Always	Occasionally	Never	
Harvesting activities	%	%	%	
Harvesting of tomato in the cool part of the day	95.7	2.6	1.7	1.98
Use of sharp knives for harvesting fresh tomato	4.3	1.30	94.4	0.06
Cutting of sharp fingernails before harvesting	0.9	17.7	81.4	0.10
Precooling activities				
Spreading tomato under the trees immediately after harvesting	3.9	31.2	64.9	0.24
Spreading the tomato on a verandah at home	8.7	2.6	88.7	0.05
Keep harvested tomato in a well-ventilated shops to remove excess heat	5.2	8.7	86.1	0.04
Sorting and Grading Activities				
Sorting of tomato according to different sizes before packaging	13.0	42.4	44.6	0.81
Sorting and grading of tomato based on the colour (ripeness)	7.5	52.0	41.1	0.67
Packaging Activities				
Packaging fresh tomato with the use of collapsible slatted wooden box	4.3	2.2	93.5	0.06
Packaging fresh tomato with the use of use of woven baskets	97.4	2.2	0.5	1.97
Packaging fresh tomato with the use of use of Nestable plastic crates	0.5	23.7	75.8	0.26
Storage Activities				
Storing fresh tomato in the cold room	0.5	5.2	94.3	0.06
Storing fresh tomato in the refrigerator	0.5	4.3	95.2	0.05
Preserving fresh tomato using pot - in- pot method	0	0	100	0.03
Transportation Activities				
During the cool period of the day	26.8	69	3.9	1.22
Use of cool van	1.3	26.4	72.3	0.29
Piling baskets of tomato in the truck	91.3	6.1	2.3	1.88
Processing Activities				
Slicing and Sun drying	16.0	72.3	11.7	1.08
Use of hybrid dryer	0	0	100.0	0.00
Use of multipurpose dryer	0	0	100.0	0.00

Table 3: The rate of losses incurred among tomato farmers

Rate of losses incurred	Tomato farmers n= 231)	
	F	%
Low rate of losses	95	41.13
High rate of losses	136	58.87
Mean	12.51	
SD	8.90	
Minimum	0.60	
Maximum	74.60	

PPMC analysis of relationship between selected enterprise characteristics and losses incurred

The result from Table 4 shows that there was a significant relationship between farmers' years of experience ($r = -0.163$, $p < 0.05$), size of tomato farm ($r = 0.279$, $p < 0.05$), quantity produced ($r = 0.272$, $p < 0.05$) and the rate of losses incurred. This suggests that years of experience, size of tomato farm and quantity produced have significant influence on the rate of tomato losses among farmers in the study area. The positive relationship between

the quantity produced and the high rate of losses indicated that the more the tomato is produced the higher the rate of losses incurred. More so, the larger the farm size the more the rate of losses incurred. These losses could be as a result of inadequate processing centers around the production centers and storage facilities where fresh tomato could be either processed or stored for future use in order to militate against losses of the tomato to achieve food security.

**Table 4: Correlation analysis between tomato farmers selected personal and enterprise characteristics and rate of losses incurred**

Variables	r- value	p-value
Age	0.050	0.467
Household size	0.095	0.168
Years of experience	-0.163	0.032
Income from tomato	0.081	0.240
Income from other sources	0.006	0.929
Size of tomato farm(acres)	0.279	0.042
Quantity produced / bought last year (kg)	0.272	0.045

Note: r = correlation coefficient, p = significance level

Relationship between levels of engagement in postharvest handling activities of tomato and the rate of losses incurred among farmers

The result from Table 5 shows that there was significant relationship between farmers' ($r = -0.163$, $p < 0.05$) level of engagement in various postharvest handling activities of tomato and the rate of losses incurred. The negative relationship

between level of engagement and rate of losses implies that the more the tomato farmers engage in various postharvest handling activities of tomato, the less the rate of losses to be incurred and vice-versa. This implies that to reduce the rate of losses of tomato, the respondents need to be highly engaged in various postharvest handling activities of tomato in the study area.

Table 5: Correlation analysis between respondents' level of engagement in postharvest handling activities and the losses incurred

Variables	r – value	p – value
Level of engagement in postharvest handling activities and losses incurred	-0.163	0.037

Note: r = correlation coefficient, p = significance level, Sig = Significant

CONCLUSION AND RECOMMENDATION

The tomato farmers incurred high rate of postharvest losses in tomato, probably due to their low level of engagement in postharvest handling activities. The rate of tomato losses incurred tend to decrease with small farm size and low quantity and increase with large farm size and high quantity of tomato produced. Therefore, tomato farmers should be enlightened and more engaged in the use of modern ways of postharvest handling activities to reduce the rate of postharvest losses of tomato.

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