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EFFECTS OF FARMERS' ATTITUDES TOWARDS POST-HARVEST LOSSES OF CITRUS IN USHONGO, BENUE STATE, NIGERIA

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ABSTRACT

The study analyzed effects of farmers' attitudes towards post-harvest losses of citrus in Ushongo Local Government Area of Benue State, Nigeria. Primary data were collected from 90 citrus farmers randomly selected using a structured questionnaire. Data were analyzed using descriptive and inferential statistics. Results showed that farmers experienced high post-harvest losses during harvesting (M=2.96), storage (M=2.48), gathering of fruits (M=2.38), transportation (M=2.34), packaging and bagging (M=2.31), wholesale market (M=2.24) and sorting (M=2.12). The losses were caused by improper harvesting (M=4.99), poor sanitation (M=4.98), pest and disease attacks (M=4.96), exposure of fruits to sun (M=4.81), high rate of bruising (M=4.75), poor handling (M=4.62), among others. The effects of losses on citrus included reduction in output (M=2.00), reduction in farmers' income (M=2.00), poor taste (M=2.00) and so on. Farmers' suggested storage of fruits in cool places (M=2.00), removal of dirts before packaging (M=2.00), among others as measures for reducing post-harvest losses in citrus. The study revealed that household size (0.064; $p \leq$, 0.078), level of education (-0.068; $p \leq$ 0.045) and citrus farming experience (0.001; $p \leq$, 0.084) significantly influenced extent of losses of citrus among farmers. The study further found that there exists a relationship (r=0.209) between farmers' attitudes towards citrus production and extent of post-harvest losses of citrus. It was concluded that farmers experienced high post-harvest losses in citrus with great effects on their production and income but possessed positive attitudes for reducing losses of the fruits.

Keywords: effects, farmers' attitudes, post-harvest losses, citrus, Benue State, Nigeria

1. INTRODUCTION

Securing an adequate food supply has been the fundamental concern of mankind over the millennia and even in today's world of great scientific and technological achievement (Ayandiji,

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2010). The role of tree crop in the pattern of rural living is both complex and diverse. Almost everywhere a certain standing stock of different types of trees whether deliberately cultivated or allowed to grow naturally, has been recognized as necessary by farming communities (Manner, Bucker, Smith, Ward & Elevitch, 2006).

Citrus belongs to the family *Rutacceae* with about 150 genera (Opeke, 2005). According to Alva *et al. (*2006), global production of citrus was at 102 million metric tons per annum which far exceeded annual production value of other popular fruits such as banana, mango and apple. More recent estimates put annual citrus fruit production at 105 million metric tons and there has been a steady rise in the production globally due mainly to increase in hectarage, consumer preference for more health or convenience food and rising income (United Nations Conference on Trade and Development (UNCTAD, 2010).

Citrus is one of the most widely grown fruit trees in sub-tropical Africa which include oranges, lemon, grape fruits and tangerines. It is believed to have been introduced into Africa by the colonial administrations and missionaries (Olife, Ibeagha & Onwualu, 2015). There are several thousand trees of the crop being grown almost all over Nigeria. FAOSTAT (2014) estimated that the production of citrus in Nigeria in 2014 was about 3.4 million metric tons, making the country the world's 8th highest producer of the commodity and providing 2.7% of the world's total production. Major citrus producing States in the country include Benue, Nasarawa, Osun, Anambra, Ekiti, Imo, Kogi, Ebonyi, Edo, Delta, Oyo, Kwara, Ogun, Taraba and Kaduna (Olife *et al*., 2015), with Benue State giving the highest annual production of citrus fruits. Most citrus production in Nigeria is accounted for oranges but significant quantities of grape fruits, lemon and lime are also grown (Olife *et al*., 2015).

There is little investment in citrus processing in Nigeria despite the fact that investment in the processing of fruits has good economic returns (Jolaoso *et al*., 2011). According to Federal Ministry of Agriculture and Rural Development (FMARD, 2013), the national demand for fruit juice is estimated at about 550 million litres while current supply is less than 25% of the demand.

In agriculture, post-harvest handling is the stage of crop production immediately following harvest which includes storage, cleaning, packaging, transportation and sorting (Meena, Asshwani, Singh & Meen, 2002). The most important goals of post-harvest handling are to keep the produce cool, thereby avoiding moisture loss, slowing down undesirable chemical changes and avoid physical damage such as bruising to delay spoilage. This in turn will help to ensure increased food security, as food security goes beyond food production to include distribution and marketing, adequate and stable supply and accessibility of food (Idah, Ajiegiri & Yisa, 2007).

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Post-harvest losses can be described as measurable quantitative loss in a given product as a result of poor storage in the market and poor packaging during transportation (FAO, 2006). It also defined as decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption (Parfitt, Barthel & Macnaughton, 2010). According to Chukwunta (2014), post-harvest losses mean any change in the availability, edibility, wholesomeness or quality of the food that prevents it from being consumed by people.

Fresh fruits are highly perishable with some estimates suggesting post-harvest losses of 30-40 %. These losses occur due to poor pre-production and post-harvest management as well as lack of appropriate processing and marketing facilities (Azizah *et al*., 2009). As observed by Dahunsi (1992), one quarter of citrus produced never reached the consumer for whom it was grown and the effort and money put into production is lost forever. Therefore, reduction in this wastage would be of great significance to growers and consumers if it can be carried out.

Benue State is the highest producer of citrus in Nigeria and Ushongo Local Government Area tops the citrus producing areas in the state, involving small and large scale farmers who consume and sell the produce unprocessed in local markets (Benue Agricultural and Rural Development (BNARDA, 2000). Citrus fruits have economic, nutritional and industrial values but are left to waste away due to lack of processing facilities and other infrastructure. Therefore, it is important to analyze the effects of farmers' attitudes towards post-harvest losses in citrus production in the area and contribute to strategies for achieving food security and economic development in the state.

Recent literature show the existence of some work on post-harvest losses in citrus. For example, Moses (2012) assessed post-harvest losses of citrus in the Birim North District, Ghana and discovered that the extent of losses through field counts on the farm and at the wholesale market was 20.2% and 5.6% respectively. Ayandiji's (2010) study showed that post-harvest losses reduced the income generated from sale of citrus fruits by farmers in Ife zone of Osun State. Also, Sarem, Clarke & Jewith (2015) worked on factors influencing post-harvest losses of citrus along the value chain in Benue State. However, none of these studies dwelt on the effects of farmers' attitudes towards post-harvest losses of citrus. This necessitated the study on the effects of farmers' attitudes towards post-harvest losses in citrus production in Ushongo LGA of Benue State. The specific objectives of the study were: (i) describe the socio-economic characteristics of citrus farmers; (ii) determine the extent of losses of citrus fruits; (iii) assess the causes of post-harvest losses of citrus; (iv) determine the perceived effects of post-harvest losses on citrus production; (v) determine the attitudes of farmers towards post-harvest losses of citrus; and (vi) identify the measures for reducing post-harvest losses in citrus by farmers.

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The study hypothesized that: (1) there is no significant relationship between selected socio-economic characteristics of farmers and the extent of post-harvest losses in citrus; and (2) farmers' attitudes towards citrus production do not have significant relationship with the extent of post-harvest losses of citrus.

2. METHODOLOGY

The study was carried out in Ushongo Local Government Area of Benue State, Nigeria. The LGA is situated between latitude $6^0$30 and $7^0$10N and longitude $6^0$8 and 6^0 59E and is located in the middle belt region of Nigeria. It covers a land area of about 1,156 kilometres and has a population of about 188, 341 with population density of about 207 people per kilometer square who engage in farming activities. The climate of the area falls within a tropical wet and dry climate. The temperature is lowest from December- January where it ranges from an average of 17.5-18.5 ^{0}C while the maximum temperature fluctuates between 30 ^{0}C in July and 37 ^{0}C in March-April. The LGA is largely inhabited by the Tiv ethnic group who engaged heavily in agriculture which is their major source of income. The major arable crops produced by the inhabitants include cassava, yams, maize, groundnut, okro and pepper while the major tree crops are citrus, mangoes, cashew and pears (Tyozua, 2009).

The population for this study comprised all citrus farmers in Ushongo Local Government Area of Benue State. Multi- stage sampling procedure was employed for sample selection. In the first stage, three (3) council wards where citrus are most produced were selected from the eleven (11) council wards that constitute the LGA, using a purposive sampling technique. These council wards include Mbakuha, Mbagba and Mbagwaza. In the second stage, two (2) communities in each ward were selected using simple random sampling techniques, giving a total of 6 communities that were selected for the study. In the third stage, fifteen (15) citrus farmers were purposively selected from each community bringing the total sample size to 90. Data for the study were collected using a well-structured questionnaire. Data were analyzed using frequency, percentage and mean scores while the hypotheses were tested using logistic regression and correlation.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of Citrus Farmers

The socio-economic characteristics of citrus farmers are presented in Table 1. The results showed that majority (75.6%) of the respondents were males while a few (24.4%) were females. This implies that more males than females were involved in citrus production. This may be due to the labour intensive nature of the enterprise which could be very hectic and time consuming, especially for females who would have to combine these activities with domestic chores. Also,

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citrus are usually planted on large hectares of land in combinations with other permanent tree crops and most of these lands are family farms which are usually inherited by male members. It is only in a few cases that females inherited such lands.

Results also revealed that about 30.0% of the respondents were in the middle age bracket of 40-50 years, 21.1% were in the age group of 31-40 years, 18.9% of the respondents constituted the age bracket of 51-60 years, about 16.7% were in the age group of 21-30 years, while those above 60 years and below 20 years accounted for 6.7% each with the mean age 43.7 years. The findings indicated that majority (86.7%) of citrus farmers were within the age bracket of 21-60 years. It is likely that majority of the farmers above 60 years must have passed on, leaving their farms to their children in the lower age categories. It could be that those who are less than 20 years may still be in school and even the 6.7 % involved in citrus production might have inherited them from dead relatives.

Household size of those engaged in citrus farming was dominated by 6-10 individuals (46.7%), followed by those whose families composed of 11-15 persons (23.3%) and 1-5 people (21.1%) respectively. Household sizes of 15-20 accounted for about 7.8% while those with household sizes greater than 20 people were the least (1.1%) with an average of 10 persons per household. This shows that majority of those involved in this enterprise have large families which indicates the key role played by citrus farming in supporting family life as the respondents do not only provide for themselves but also for their dependants. This finding is in conformity with those of Ortese *et al.* (2012) who reported that 44.4% of citrus farmers in Benue State had 6-10 individuals in their households and Agea *et al.* (2008) who stated that most farm families in Nigeria are in the range of 6-10 persons.

Results on number of years of formal education indicated that most (53.5%) of the respondents had 1-6 years of formal education followed by those who had 7-12 (31.1%) and 13-17 (15.6%) years with an average number of years of formal schooling of 9 years. This implies that many citrus farmers have had considerable level of formal education that would enhance their understanding and methods of preventing post-harvest losses in citrus fruits. This finding agrees with the report of Ayandiji (2010) that 66.7% of citrus farmers had 1-12 years of formal education. According to the report basic skills required to control post-harvest losses in citrus fruits would have been acquired at the primary and secondary school levels.

Majority (32.2%) of the respondents had less than 200 stands while about 31.1% had above 1000 stands, those who had about 801-100 stands stood at 5.6% while those with 301-600 and 601-800 stands constituted 4.4% each with an average number of 884 citrus stands for the study area.

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Majority (67.8%) of the respondents were full time citrus farmers relying solely on citrus farming for their livelihood while 32.2% of the respondents were partial citrus farmers who had other sources of income other than citrus farming.

Citrus farming experience for majority (82.2%) of the respondents was between 1-20 years with an average farming experience of 14.9 years. Experience is important in farming business especially when dealing with perishable agricultural produce. An experience farmer will be aware of when to plant, harvest and store his produce. This finding agrees with that of Meena *et al*. (2009) who found average involvement in citrus farming to be 15 years which implies that the respondents were well experienced in their enterprise.

Results on income from citrus farming shows that majority (34.4%) of the respondents obtained less than100,000 naira annually followed by 32.2% who got above 500,000 naira while 14.4% obtained about 100,001-200,000 naira. 10.0%, 3.3% and 5.6% were those that obtained up to 200,001-300,000 naira, 300,001-400,000 naira and 400,001-500,000 naira respectively. The mean annual income from citrus production was 380,612. naira. This implies that the annual citrus fruits income was low for the study area. Low income from citrus production could serve as a disincentive for further investment in the enterprise.

Table 1: Socio-Economic Characteristics of Citrus Farmers (n=90)

Characteristics	Frequency	Percentage	Mean
Gender			
Female	22	24.4	
Male	68	75.6	
Age (years)			
<20	6	6.7	
21-30	15	16.7	
31-40	19	21.1	
41-50	27	30.0	43.7
51-60	17	18.9	
>60	6	6.7	
Household Size			
<5	19	21.1	
6-10	42	46.7	
11-15	21	23.3	10
16-20	7	7.8	
>20	1	1.1	

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Education (years)			
1-6	48	53.3	
7-12	28	31.1	9
13-17	14	15.6	
No. Citrus Stands			
<200	29	32.2	
201-400	20	22.2	
401-600	4	4.4	
601-800	4	4.4	884
801-1000	5	5.6	
>1000	28	31.1	
Occupation			
Partial Citrus Farmer	29	32.2	
Full time Citrus Farmer	61	67.8	
Citrus Framing Experience (years)			
<10	38	42.2	
11-20	36	40.0	
21-30	14	15.6	15
>30	2	2.2	
Annual Citrus Income (₦)			
<100,000	31	34.4	
100,001-200,000	13	14.4	
200,001-300,000	9	10.0	380,612
300,001-400,000	3	3.3	
400,001-500,000	5	5.6	
>500,000	29	32.2	

Source: Field survey, 2017

3.2 Extent of Post-Harvest Losses of Citrus

Results in Table 2 show that farmers experienced high losses of citrus fruits during harvesting (M=2.96) storage on the farm (M = 2.48), gathering (M=2.38), transportation (M= 2.34), packaging and bagging (M=2.31), wholesale market (M=2.24) and sorting after harvesting (M=2.12) while low losses occurred in degradation during handling (M=1.79). The finding implies that farmers in the study area suffered high post-harvest losses in various measures. The extent of losses differs from farm to farm but does not differ in the communities sampled. This is because farmers in the study area grow citrus as their major crop and experienced the same

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measure of losses. In addition, farmers are unable to calculate the quantity of fruits lost because they do not keep records of their farm activities.

This finding disagrees with the result of the field observations by Kitinoja (2002), Ray & Ravi (2005), which stated that the magnitude of losses varies greatly from place to place but agrees with the authors that losses are often difficult to control and most perishable produce are lost before they are consumed mainly because of high rate of bruising, water loss, and subsequent decay during handling. The level of post-harvest losses observed on purchase could be traced to overheating during transportation as Kader (2003) explained that overheating during transportation of fruits leads to decay and increases the rate of water loss. The finding also conforms to the World Bank (2011) report on 'Missing Foods' that approximately 30-40 percent of post-harvest losses occur during storage and significant amounts of the food produced in developing countries are lost after harvest, thereby aggravating hunger.

Table 2: Extent of Post-Harvest Losses of Citrus (n=90)

Variable	Mean	Std. Deviation
Harvesting	2.96	0.207
Gathering of fruits	2.38	0.646
Sorting after harvesting	2.12	0.650
Degradation during handling	1.79	0.682
Storage on the farm	2.48	0.690
Packaging and bagging	2.31	0.682
Transportation	2.34	0.673
Wholesale market (purchase)	2.24	0.723

Mean $\geq$2.0 = High losses

Source: Field survey, 2017

3.3 Causes of Post-harvest Losses of Citrus

Results in Table 3 show the factors that caused post-harvest losses of citrus as indicated by the respondents. They included improper harvesting (M = 4.99), improper sanitation (M= 4.98), pest and diseases (M= 4.96), exposure of fruits to the sun (M = 4.81), high rate of bruising (M= 4.75), poor handling (M = 4.62), poor road networks (M = 4.44), poor storage facilities (M = 4.36), lack of markets for fruits (M = 4.32). Other causes include poor packaging (M = 3.76), lack of know-how (M= 3.72), over loading of fruits (M = 3.64) and poor management (M = 3.41). This implies that the causes of fruits losses are many and diverse; therefore, farmers need training on prevention of post-harvest losses in citrus. Also, governments should provide modern storage

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facilities, establish rural fruit markets and provide access road to prevent fruit spoilage and enable farmers have more returns on their investment.

The finding is corroborated by the work of Olayemi *et al.* (2010), which indicated that farmers experienced serious post-harvest losses particularly due to improper harvesting techniques. This study also agrees with a review carried out by Agoda, Atanda, Usanga, Ikontun & Isong (2011) which showed that heaping of crops in one place or loading them in a sack for a long time causes mould to form. Also, poor storage structures, improper handling during harvesting, result in mechanical injuries that cause losses in fruits. The finding equally agrees with Mukaminega (2008) who reported that losses of fruits occur in transit due to long distance to markets, poor and inadequate infrastructure and the method of transportation. This is also in consonance with the study by FAO (2004) which showed that post-harvest losses occur as a result of careless handling of packed produce with packages often squeezed into the vehicle in order to maximize revenue for transporters. The finding of this study is similar to the work of Maziya-Dixon *et al*. (2004) who reported that households attributed their food losses largely to spoilage and insect/rodent attack of preserved foods. This finding also agrees with the study carried out by FAO (1997) which showed that 25% of all foods produced in developing countries are not consumed by humans; instead they spoil or are eaten by insects, rats and other pests. This conforms with the report of Idah *et al.* (2007) that improper post-harvest sanitation, poor storage and packaging practices and mechanical damage during harvesting, handling and transportation resulting from vibration by undulation and irregularities on the road can enhance wastages. This is equally in line with the work of Nigerian Institute of Food Science and Technology (NIFST, 2012) which stated that due to the dearth of infrastructural facilities such as good roads, processing and storage equipment as well as inadequate marketing information; huge quantities of citrus fruits waste uncontrollably.

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Table 3: Causes of Post-Harvest Losses of Citrus (N=90)

Causes	Mean	Std. Deviation
Improper harvesting	4.99	0.105
Improper sanitation	4.98	0.148
Poor handling	4.62	0.610
Poor storage facilities	4.36	0.783
Lack of markets for fruits	4.32	0.934
Lack of know-how	3.72	0.887
Over loading of fruits	3.64	0.939
Poor management	3.41	1.130
Poor packaging	3.76	1.112
Exposure of fruits to the sun	4.81	0.616
Poor road networks	4.44	0.875
Pest and disease attack	4.96	0.234
High rate of bruising	4.75	0.255

Mean ≥ 3.0
Source: Field survey, 2017

3.4 Effects of Post-harvest Losses on Citrus Production

Entries in Table 4 show the effects of post-harvest losses on citrus production by the respondents. All the citrus farmers agreed that reduction in output (M=2.0), reduction in farmers income (M=2.0), poor taste (M=2.0), increase in atmospheric pollution (M=2.0), and increase in mechanical damage (M=2.0), low prices of fruits (M=1.96), reduction in nutritional value (M= 1.63) and reduction in economic value of fruits (M= 1.62) constituted the effects of post-harvest losses in citrus in the study area. The implication of the finding is that the respondents experienced high effects of post-harvest losses in citrus in the study area and this could reduce farmers' output as well as their income. Low income from citrus production could be a disincentive for farmers' continuous engagement in the enterprise. .

This is in conformity with the work of Ayandiji (2011), which stated that the average gross margin with loss of citrus fruits is less than their average gross margin without loss, indicating that post-harvest losses reduce the income of farmers. This also conforms to the finding of Atanda *et al.* (2011), which showed that post-harvest losses have several adverse impacts on farmers' income, consumer prices and nutritional quality of the produce. This is equally in line with the study of Kader (2003), which stated that post-harvest losses not only affect output but reduce farmers' income all over the world. This also conforms to the findings of Mohammed & Afework (2016) that insect excrement and body parts left in the food may affect the taste and

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food safety, and consequently reduced the price consumers are willing to pay. The finding agrees with the study of Chukwunta (2014) which found that losses have several adverse impacts on farmer's income, consumer prices and nutritional quality of the produce.

Table 4: Effects of Post-Harvest Losses on Citrus Production (n=90)

Variables	Mean	Std. Deviation
Reduction in output	2.00	0.000
Reduction in farmers' income	2.00	0.127
Poor taste	2.00	0.000
Low prices of citrus fruits	1.96	0.234
Reduction in nutritional value	1.63	0.608
Increase in atmospheric pollution	2.00	0.000
Reduction in economic quantity of fruits	1.62	0.663
Increase in mechanical damage	2.00	0.367

Mean ≥ 1.0
Source: Field survey, 2017

3.5 Farmers' Attitudes towards Post-Harvest Losses of Citrus

Results in Table 5 show farmers' attitudes towards post-harvest losses of citrus. All the respondents agreed with the statements that improper preservation of citrus fruits increases losses (M= 2.00), proper handling of fruits reduces losses (M=2.00), inadequate harvesting period promote losses (M= 2.00), attitudes of farmers can be more favourable with the knowledge of diversification (M= 2.000) and attitudes of farmers can be more favourable with the knowledge on financial assistance to gain return with minimum risks (M= 2.00). Respondents also agreed with the statements that proper selection of technologies will encourage farmers to reduce post-harvest losses (M=1.97), lack of know-how can increase losses (M=1.87) and inadequate harvesting period promote losses (M= 1.82).

The findings of the study indicated positive attitudes of farmers to post-harvest losses of citrus. This finding is in line with the study of Meena *et al.* (2009) which stated that the attitudes of farmers can be more favourable if they are equipped with the knowledge on diversification, proper selection of appropriate technologies and financial assistance to gain more return with minimum risk.

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Table 5: Farmers' Attitudes towards Citrus Production (n=90)

Statements	Mean	Std. Deviation
Improper preservation increases losses	2.00	0.000
Proper handling reduces losses	2.00	0.000
Inadequate harvesting period promote losses	1.82	0.510
Lack of know-how increases losses	1.87	0.445
Attitudes of farmers can be more favorable if they are equipped with the knowledge on diversification	2.00	0.000
Proper selection of appropriate technologies encourage farmers to put more efforts in citrus production	1.97	0.210
Attitudes of farmers can be more favorable if they are equipped with the knowledge on financial assistance to gain return with minimum risk	2.00	0.000

Mean ≥ 1.0
Source: Field survey, 2017

3.6 Measures for Reducing Post-harvest Losses in Citrus

Results of the measures for reducing post-harvest losses in citrus are depicted in Table 6. The respondents agreed that the measures were important for reducing post-harvest losses in citrus. These measures include fruits should not be exposed to the sun (M = 2.00), remove dirts before putting into containers (M= 2.00), store fruits in cool places (M= 2.00). Other measures include use ventilated and covered vehicles for transportation (M= 1.99), fruits should be transferred promptly after harvesting (M= 1.97), reduce the number of times fruits are handled (M= 1.97) use smooth and well ventilated containers for packaging (M= 1.96), do not heap fruits at collection centres (M= 1.94), sort damage fruits before transportation (M= 1.94) and fruits should be transported during the cool part of the day (M = 1.94). This implies that post-harvest losses in citrus are avoidable and respondents should be educated on how to reduce them to obtain higher returns on their investment in citrus production.

The finding agrees with the work of Atanda *et al.* (2011) which suggested that reducing the number of times the fruits are handled reduces the extent of mechanical damage and fruits should not be heaped at collection centre on the farm as this will lead to rapid spoilage. This result corroborates the findings of Olife *et al*. (2015) which stated that preventing post-harvest losses is cheaper than to increase yield. They also opined that with proper post-harvest handling and post-

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harvest technologies, farmers can be sufficiently fed without bringing additional hectares under production or without changing present agricultural practices.

Table 6: Measures for Reducing Post-Harvest Losses of Citrus (n=90)

Statements	Mean	Std. Deviation
Reduce the number of times fruits are handled	1.97	0.234
Do not heap fruits at collection centres	1.94	0.313
Fruits should not be exposed to the sun	2.00	0.000
Fruits should be transferred promptly after harvesting	1.97	0.180
Use smooth and well ventilated containers for packaging	1.96	0.255
Sort out damage fruits before transportation	1.94	0.274
Use ventilated and covered vehicles for transportation	1.99	0.105
Fruits should be transported during the cool part of the day	1.94	0.230
Remove dirts before putting into the containers	2.00	0.000
Store fruits in cool places	2.00	0.000

Mean ≥ 1.0
Source: Field survey, 2017

3.7 Factors Influencing the Extent of Post-Harvest Losses of Citrus Fruits

The results of logistic regression analysis on the relationship between socio-economic characteristics of citrus farmers and the extent of post-harvest losses of citrus are presented in Table 7. Findings showed that household size has a positive coefficient (0.064) which is significant at (0.070) 10% level of probability. This implies that as household size increases the extent of post-harvest losses decreases by a factor of 1.066 (Exp (B) =1.066). The implication of this finding is that family labour will be readily available with larger household size. However, it should be noted that the number of persons in the household may not necessarily represent the size of people that could provide agricultural labour as some may either be too young or too old to participate in strenuous citrus farming operations.

Citrus farming experience was also found to have a positive coefficient (0.001) which is significant at (0.084) 10% level of probability. This implies that increase in the years of farming citrus decreases the extent of post-harvest losses. This means that an experienced farmer will carry out the measures for reducing citrus losses.

Education was found to have a negative coefficient (-0.068) which is significant at (0.045) 5% level of probability. This implies that decrease in education increases the extent of post-harvest

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losses. This is an indication that education is an important variable that improves an individual's ability to make informed decisions and acquire skills, particularly on basic knowledge of post-harvest technology in citrus.

Table 7: Relationship between Socio-Economic Characteristics of Citrus Farmers and Extent of Post-Harvest Losses of Citrus Fruits (n=90)

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Sex	0.728	0.639	1.298	1	0.255	2.071
Age	-0.027	0.033	0.676	1	0.411	0.973
Marital Status	-0.102	0.039	0.065	1	0.798	0.903
Household Size	0.064	0.088	2.522	1	0.070*	1.066
Education	-0.068	0.072	2.891	1	0.045**	0.934
Farm Size	0.001	0.001	0.484	1	0.487	1.001
Citrus Farming Experience	0.001	0.053	4.228	1	0.084*	1.001
Income	0.000	0.000	0.265	1	0.607	1.000
Constant	2.267	1.505	2.269	1	0.132	9.651

***** Significant at 10% level of probability
** Significant at 5% level of probability
-log likelihood ratio= 79.889; Nagelkerke R Square= 0.078
Chi-square statistic = 4.489, Sig = 0.811

Source: Data Analysis, 2017

3.8 Relationship between Farmers' Attitudes and Extent of Post-harvest Losses of Citrus Fruits

Result in Table 8 shows correlation analysis of the relationship between farmers' attitude and extent of post-harvest losses of citrus. The result showed that attitudes of citrus farmers and extent of losses have a correlation coefficient of 0.209 which means that both extent and attitudes are positively correlated but the strength of the association is low. This implies that at 20.9% level of probability there exist a relationship between farmers' attitudes and the extent of losses. The implication of this finding is that increase in positive attitudes of citrus farmers towards citrus production will reduce post-harvest losses in citrus.

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Table 8: Correlation Analysis of Relationship between Farmers' Attitudes and Extent of Post-harvest Losses of Citrus Fruits (n=90)

		EXTENT	ATTITUDES
EXTENT	Pearson correlation	1	0.209*
	Sig. (2-tailed)		0.050
	N	90	90
ATTITUDES	Pearson correlation	0.209*	1
	Sig. (2-tailed)	0.050	
	N	90	90

***** Correlation is significant at 0.05 level (2-tailed)
Source: Data Analysis, 2017

4. CONCLUSION AND RECOMMENDATIONS

The study concluded that majority of citrus farmers in Ushongo LGA of Benue State, Nigeria experienced high post-harvest losses of citrus fruits. The losses were attributed to a number of causes which had great effects on production and income of farmers as they hardly made enough money to re-invest in the entire enterprise. However, farmers had positive attitudes towards citrus production and suggested some measures that should be put in place to reduce the losses.

Recommendations

1. Agricultural extension agents should educate farmers on proper post-harvest handling of citrus in order to reduce losses.
2. The local and state governments should provide proper post-harvest technologies to farmers to reduce fruit spoilage.
3. Both local and state governments should encourage farmers to continue with citrus farming by establishing village fruit markets in order to reduce the burden of transportation on them.
4. A proper transportation system which will focus on the use of the right containers and vehicles to carry citrus fruits should be implemented by governments at both the local and state levels.

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