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Postharvest management practices by roadside orange sellers in Oyo State, Nigeria

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ABSTRACT

Purpose: This study reported for the first time, the postharvest management practices and estimated lost by roadside orange sellers in Oyo state, Nigeria. **Research Method:** Multistage sampling procedure was employed to select 120 respondents. A structured questionnaire was used to collect data. Data collected for specific objectives were analyzed and presented in frequency, percentages, mean, and standard deviation while the multiple regression analysis was performed to assess hypothesis of the study. **Findings:** Results showed that the roadside orange sellers had low level of education as 25.0% had no formal education while 47.5% had primary education. Under tent/umbrella (60.8%) are the main tent used to display oranges long the roadside. High profitability (81.7%) was the leading factors motiving marketing of oranges along the road side. The marketers (95.8%) moderately used postharvest management practices (PHMPs). The orange sellers incurred high loss of oranges up to 14.2% stored. Unfavourable weather condition ($\bar{x}$=2.12) was the lead constraints to use PHMPs. Multiple linear regression showed that years of experience, average number of orange stocked and age showed significant relationship with the use of PHMPs. **Limitations:** There was no limitation. **Originality/Value**: Roadside orange sellers in Oyo state, Nigeria were moderate users (95.8%) of postharvest management practices and incurred 14.2% lost.

INTRODUCTION

A large portion of fresh fruits are lost worldwide after harvest. The main causes are physiological (wilting, shriveling and chilling injury, etc), pathological (decay due to fungi and bacteria) and physical (mechanical injury) (Adhikari, 2021). These causes, in most instances can be interrelated, that is, mechanical injury can lead to post harvest decay in many cases (Al-Dairi et al., 2022). Losses are estimated at 20 to 40% in developing countries and 10 to 15% in developed countries, depending on the crop and the season (Kahramanoğlu et al., 2021). The problem of postharvest loss is dreadful for fruits like orange. Oranges (*Citrus Sinensis*) is a member of the citrus family besides limes, lemons, tangerine and grapefruits.

Orange is one of affordable fruits in Nigeria, a major source of vitamin C and a choice fruit for roadside merchants and hawkers (Okungbowa et al., 2022). Its major products include orange juice, concentrates, fresh squeezed juice, smoothies and marmalades. Orange, like any other perishable fruits and is susceptible to wastage and losses in Nigeria. Postharvest loss in orange fruit production is due to improper care and use of inappropriate harvesting equipment with high postharvest losses occurring during harvesting, transportation, marketing, storage, display for sale and sometimes glut in the market with poor demand (James et al., 2017). Most of the packaging materials are not suitable for the fruits and this leads to mechanical damage. The use of public transportation for both passengers and commodities, over loading and stacking, high temperature, bad roads with high vibration and collision, lack of vehicle, high cost of transportation, lack of sorting the ripe and unripe fruit, poor storage facilities are factors that lead to most of the post- harvest loss of orange fruit (Aminu et al., 2021; James et al., 2017).

Orange selling is common among the roadside fruit sellers in Afijio Local Government area (LGA), Oyo State. Orange is sold as a major source of cash income for households (Aminu et al., 2021). Post-harvest losses of fruits are considered to be a major problem that affects many fruit sellers in Nigeria (Obayelu et al., 2022). It is based on this that the study sought to understand postharvest management practices of roadside orange sellers in Afijio LGA, Oyo state, Nigeria.

The general objective of this study is to assess the postharvest management practices of roadside orange sellers in Afijio local government area, Oyo state, Nigeria. The specific Objectives are to: (i) examine the socio-economic characteristics of roadside orange sellers, (ii) ascertain factors motivating roadside orange selling, (iii) identify the postharvest management practices used roadside orange sellers, (iv) estimate the quantity of oranges lost by roadside sellers, and (v) identify the constraints that hinder the use of postharvest management practices in Afijio, LGA, Oyo State. The hypothesis (null form) of the study states that there is no significant relationship between the socio-economic characteristics of roadside orange respondents and assessment of postharvest management practices. Even though studies have recently assessed postharvest management practices of orange sellers globally (Dooga et al., 2021; Pérez Romero et al., 2021; Strano et al., 2022), no empirical research has presented the management practices and the quantity lost by roadside orange sellers. Thus, this study is reporting for the first time, the postharvest management practices of roadside orange sellers and the quantity lost in Nigeria.

MATERIALS AND METHODS

This study was carried out at Afijio Local Government Area (LGA) in Oyo State, South-western geopolitical zone, Nigeria. Afiji LGA has an area of $722km^2$. The population for the

study comprises of all the roadside orange sellers in Afijio local government area, Oyo state, Nigeria.

Multistage sampling was used to select respondents for the study. The first stage involved the purposive selection of four (4) geographical wards in Afijio LGA. The selection is based on high rate of orange selling activities along the road side. Names of the selected wards were Fiditi, Ilora, Awe and Jobele. The population of orange sellers in the four selected wards was 245 persons distributed across Fiditi (51), Ilora (39), Awe (26), and Jobele (129). The second stage involved a random selection of 50% of the population, Fiditi (25), Ilora (20), Awe (13), and Jobele (65). This gave a total sample size of one hundred and twenty-two (122) sellers of orange along the road side used as respondents.

A structured interview schedule was used to collect data. Content validity was performed by experts in the field of agricultural extension and rural development. The instrument was considered reliable to collect data after a Cronbach alpha coefficient of 0.74 was obtained through test and re-test method. Of the 122 instruments administered, 120 were retrieved, completely filled and analysed. The interview schedule for postharvest management practices were developed by authors from review of similar studies (Aminu et al., 2021; Strano et al., 2022), and can be found in the supplementary file.

Postharvest management practices used by respondents were measured on 4 point Likert-type scales as: always used=3, sometimes used=2, rarely used=1, and never used =0. Constraints to use of postharvest management practices for orange were measured 3 point Likert-type scale as: very severe=2, severe=2, not severe=1. Data collected for specific objectives were analyzed and presented in frequency, percentages, mean, and standard deviation while the multiple regression analysis was performed to assess hypothesis of the study. Ordinary least square regression model was adopted. The model was specified implicitly thus:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 + \ldots + e_i \ldots \ldots (1)$$

Where; Y= postharvest management used by respondents, (X) = Independent variables, X_1 = Age (in years) , X_2 = sex (male=1, female =0), X_3 = Marital status (married=1, otherwise 0), X_4 = Household size (in numbers), X_5 = Education (Formal=1, no formal=0) , X_6 = Membership (yes 1, no 0) , X_7 = Average number of orange stocked (number) , e = Error term

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents
Results presented in Table 1 showed that the average age of the respondents was 43.3 years. This indicates that the marketers were still in their productive and economic age range. This buttressing the findings that orange farming and marketing activities were mostly practiced by middle-aged individuals in Nigeria (Ikwuba et al., 2019; Aminu et al., 2021). Majority (89.2%) were female, indicating that females dominate road side orange marketing in the study area. This is in line with report that similarly found orange marketing was dominated by females (Obayelu et al., 2022).

On their marital status, 19.2% were married 12.5% were single, 10.0% were divorced while most (58.3%) of the respondents were widowed with household size of approximately 5 persons. Regarding education of the respondents, 25.0% had no formal education while 47.5% had primary school education. This implies that the orange marketers had low level of education. This finding is in line with report by Dooga et al. (2021) who found that most orange marketers had primary school education. The average year of orange marketing

experience (years) was 5.8 years. Majority (97.5%) were not member of a marketers' group. The average monthly income was N7158.33 as majority (78.3%) borrowed to market orange and majority (60.8%) also perform the marketing under tent /umbrella.

Table 1. Socio-economic characteristics of respondents.

Variables	Frequency	Percentage	Mean (SD)
Age (years)			
≤ 30	12	10.0	
31 – 40	36	30.0	43.3(9.45)
41 – 50	39	32.5	
51 and above	4	27.5	
Sex			
Male	13	10.0	
Female	107	89.2	
Marital status			
Married	23	19.2	
Single	15	12.5	
Divorced	12	10.0	
Widow	70	58.3	
Level of Education			
No Formal Education	30	25.0	
Primary Education	57	47.5	
Secondary Education	3	2.5	
Tertiary Education	30	25.0	
Household size (persons)			
1 – 5	22	18.3	
6 – 10	70	58.3	4.9(1.94)
11 and above	28	23.3	
Orange marketing experience (years)			
1 – 5	67	55.8	
6 – 10	48	40.0	
11 and above	5	4.2	5.8(2.89)
Membership of any orange sellers association			
Yes	3	2.5	
No	117	97.5	
Average income from orange selling per month (Naira)			
≤ 5000	26	21.7	7158.33(226.06)
5001 – 10,000	94	78.3	
Source of finance			
Owned	26	21.7	
Borrowed	94	78.3	
Others			
Place of sales/ display ripened orange by road side			
Shop	4	3.3	
Under tent/umbrella	73	60.8	
Wheel barrow	43	35.8	

Source: Field survey, 2023.

Table 2. Factors motivating respondents into roadside orange selling.

Motivating Factors	Very True	True	False	Mean	SD	Rank
It is profitable	98(81.7)	13(10.8)	9(7.5)	2.73	0.62	1
It has many health benefits	84(70.0)	34(28.3)	2(1.7)	2.68	0.5	2
To increase their income	72(60.0)	46(38.3)	2(1.7)	2.58	0.53	3
There are no upfront processing cost	72(60.0)	44(36.7)	4(3.3)	2.57	0.56	4
Oranges are in high demand and there are supply for it	60(50.0)	49(40.8)	11(9.2)	2.41	0.65	5
Oranges are food	42(35.0)	69(57.5)	9(7.5)	2.28	0.59	6

Source: Field survey, 2023.

Perceived factors motivating roadside orange selling in Afijio LGA

Factors motivating them into roadside orange selling are presented in Table 2. Findings showed that majority of the respondents strongly agreed orange marketing is profitable (81.7%), It has many health benefits (70.0%), orange marketing increase income with no upfront processing cost (60.0%) while significant percentage also agreed that orange are in high demand and there are supply for it (50.0%) and orange are in the category of food industry (35.%). This finding indicates that profitability, health benefits and income with no upfront processing cost were the main factors motivating the road side orange marketers in the study area.

Postharvest management practices used by orange road side sellers

Postharvest management practices used in orange road side business of the respondents are presented in Table 3. Results shows that all (100.0%) of the respondents clean, sort and keep in fridge/freezer. Also, majority of the respondents always used harvesting at correct stage of maturity (98.3%), use sack to package for transport (86.7%), motor van to transport (76.7%), hanging in open space for fresh air (79.2%), cover with paper materials and woven sheet/sack (66.7%). These findings imply that the prominent postharvest management practices of road side orange marketers in the study area were harvesting/buying orange at correct stage of maturity, cleaning, sorting, packaged by sack, transport by motor van, preserve by hanging in open space for fresh air and keeping in fridge/freezer, and ripened by cover with paper materials and woven sheet/sack. Finding on mode of transportation agrees with report by studies who found that orange markers used pickup/truck van to transport orange (Aminu et al., 2021; Adekalu et al., 2019).

Individual respondents were grouped by score obtained on the postharvest management practices. Table 4 showed that 2.5% were grouped having low usage of orange postharvest management practices, 95.8% were grouped having moderate use of orange postharvest management practices while 1.7% were grouped having high orange postharvest management practices. This indicates that the road side orange marketers in the study area were moderate users of orange postharvest management practices.

Table 3. Postharvest management practices used by respondents.

S/n	Stage/activities of marketers	Postharvest management practices	Frequency of usage				Mean	SD
			Always used	Sometimes used	Rarely used	Never used		
1		Harvesting at correct stage of maturity	118(98.3)	2(1.7)			3.98	0.13
2		Harvesting at correct time of the day	37(30.8)	82(68.3)	1(0.8)		3.30	0.48
3	Cleaning	Cleaning	120(100.0)				4.00	0
4	Sorting	Sorting	120(100.0)				4.00	0
5	Packaging for transport:	Carton	8(6.7)	37(30.8)	74(61.7)	1(0.8)	1.43	0.63
		Wood box	0	2(1.7)	21(17.5)	97(80.8)	1.21	0.45
		Sack	104(86.7)	15(12.5)	1(0.8)		3.86	0.37
		Basket	38(31.7)	75(62.5)	4(3.3)	3(2.5)	3.23	0.63
4.	Transportation	Bicycle/motorbike	15(12.5)	38(31.7)	45(37.5)	22(18.3)	2.38	0.93
		Tricycle	2(1.7)	63(52.5)	30(25.0)	25(20.8)	2.35	0.83
		Motor van	92(76.7)	20(16.7)	5(4.2)	3(2.5)	3.68	0.68
		On head	5(4.2)	6(5.0)	64(53.3)	45(37.5)	1.76	0.73
5	Preservation	Clay pot	2(1.7)	118(98.3)	0	0	1.05	0.39
		Fridge/deep freezer	120(100.0)	0	0	0	1.00	0.00
		Under tree shade	36(30.0)	48(40.0)	10(8.3)	26(21.7)	2.78	1.10
		Hanging in open space	95(79.2)	24(20.0)	1(0.8)	0	3.78	0.43
6	Ripening:	Cover with leafy materials	2(1.7)	0	2(1.7)	116(96.7)	1.58	1.07
		Cover with paper materials	80(66.7)	32(26.7)	5(4.2)	3(2.5)	1.07	0.40
		Cover with woven sheet (sack)	80(66.7)	32(26.7)	5(4.2)	3(2.5)	3.58	0.69

Source: Field survey, 2023.

Table 4. Level of postharvest management practices.

Obtained score range	Level	Frequency	Percentage	Mean
19 – 38	Low	3	2.5	
39 – 57	Moderate	115	95.8	50.02±2.75
58 – 76	High	2	1.7	
Total		120	100.0	

Possible score range 19 –76.

Table 5. Estimate of postharvest loss of orange by respondents.

	Freq.	%	Mean (SD) Min. – Max.	Percent
Number of orange stocked			1,070.7 (1643.03) 3,30 -10,000	
≤ 1000	115	95.8		
Above 1000	5	4.2		
Number of orange sold			9,18.1 (201.38) 3,15 – 1,080	% sold= 85.8
≤ 400	9	7.5		
401 – 800	35	29.2		
801 and above	76	63.3		
Number of orange unsold/spoilt			152,04 (4.88) 10 – 180	% unsold= 14.2
1 – 10	8	6.7		
11 – 20	18	15.0		
21 and above	94	78.3		
Management of unsold/spoilt orange				
Throw-away	110	91.7		
Gift to people	10	8.3		

Source: Field survey, 2023.

Estimated quantity of oranges lost by roadside sellers

Information presented in Table 5 presents the estimate of postharvest loss of orange by respondents. Findings showed that that respondents stocked average of 1,070.7 oranges, sold average of 9,18.1 oranges which accounted for 85.8% sales while the unsold/spoilt oranges was 152,04 oranges which accounted to 14.2% lost. This finding suggests that 14.2% loss is high among the marketers, as the need to adopt more postharvest strategies to reduce the loss incurred. This value is lower than 18.24% postharvest loss of orange found by Okpe et al. (2022) in a study among orange marketers in Benue state. Management of the unsold/spoilt oranges showed that majority (91.7%) throw-away the unsold while few give it out to people. Throw-away practice that is common among the marketers may not be the best way to manage spoilt oranges, thus extension agents may need to train them on conversion practices that can still bring income.

Constraints to using post-harvest management practices

Constraints to use postharvest management practices were presented in Table 6. Findings showed that unfavourable weather condition ($\bar{x}$=2.12) ranked first position, insect pest infestation ($\bar{x}$=1.79) ranked second position, insufficient distribution and lack of ripening techniques ($\bar{x}$=1.65) ranked third position while inadequate supply of electricity ($\bar{x}$=1.29) ranked seventh position as the least constraints indicated by respondents. These findings showed that unfavourable weather condition, insect pest infestation and insufficient distribution and lack of ripening techniques were the main constraints hindering the use of postharvest management practices among roadside orange sellers in the study area.

Table 6. Severity of constraints to use of postharvest management practices.

Constraints	Very severe	Severe	Not severe	Mean	SD	Rank
Unfavourable weather condition	41(34.2)	52(43.3)	27(22.5)	2.12	0.75	1
Insect pest infestation	30(25.0)	35(29.2)	55(45.8)	1.79	0.82	3
Insufficient distribution and lack of ripening techniques	11(9.2)	57(47.5)	52(0.8)	1.65	0.66	4
Improve practices are not easier to use	4(3.3)	60(50.0)	56(46.7)	1.57	0.56	5
Lack of financial incentives from the government	7(5.8)	49(40.8)	64(53.3)	1.53	0.61	6
Inadequate supply of electricity	6(5.0)	23(19.2)	91(75.8)	1.29	0.56	7

Source: Field survey, 2023.

Table 7. Linear regression showing socioeconomic determinants of postharvest management practices used by respondents.

Use of postharvest management practices	Coef. (β)	Std. Err.	t-stat.	Sig (p-value)
Age (years)	-0.017*	0.007	-2.497	0.014
Sex	0.004	0.013	0.289	0.773
Marital status	0.008	0.03	0.253	0.801
Education	0.007	0.029	0.246	0.806
Household size (persons)	-0.031	0.028	-1.093	0.277
Experience (years)	0.041*	0.02	2.039	0.044
Membership of association	0.159	0.263	0.604	0.547
Average number of orange stocked	3.36E-05*	0	2.103	0.038
(Constant)	3.214	0.261	12.309	0.000

R square 0.595, R square Adjusted 0.529, Std. Error of the estimate =0.368.

Relationship between socioeconomic characteristics of respondents and postharvest management practices used by respondents

The results of linear regression showing socioeconomic determinants of postharvest management practices used by respondents in Table 7 showed that years of experience (β = 0.041) and average number of orange stocked (β = 3.36) showed positive significant relationship while age (β = 0.017) indicated negative significant relationship. This implies that increased years of experience in orange marketing and increase quantity of orange stocked when other variable remain constant leads to increase use of postharvest management practices among the road side orange marketers in the study area.

CONCLUSION

This study assessed postharvest management practices by roadside orange sellers in Afijio LGA Oyo State, Nigeria. Based on major findings, the study concluded that the roadside orange marketers in the study area were moderate users of orange postharvest management practices. The prominent postharvest management practices by roadside orange sellers in the study area were harvesting/buying orange at correct stage of maturity, cleaning, sorting, packaged by sack, transport by motor van and preservation by hanging in open space for fresh air and keeping in fridge/freezer, and ripened by cover with paper materials and woven sheet/sack. The orange sellers incurred high loss of oranges up to 14.2% stocked. Unfavourable weather condition, high spoilage and insect pest infestation were the main constraints hindering the use of postharvest management practices among road side orange sellers in the study area.

The following recommendations were drawn based on conclusions made: (i) This finding suggests that 14.2% loss is high among the marketers, thus, there is need for extension agents by the Nigeria Store Product Research Institutes (NSPRI) to disseminate affordable improved technology to control the unfavourable weather condition and insect pest infestations of oranges to the road sellers in order to reduce the high losses incurred. (ii) Throw-away practice that is common management practice for the unsold/spoilt oranges. This is likely no a productive way to manage spoilt oranges, thus extension agents may need to train the road side orange sellers on conversion practices that can still bring income.

Conflict of interest

The authors declare that there is no conflict of interest.

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QUESTIONNAIRE

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Research Instrument
Survey Identification Information
Questionnaire no: ………………..
Name of Community: …………………………..

SECTION A: Socio-economic characteristics of the road side orange sellers

1. Age ……………………. (years)
2. Sex: Male ( )   Female ( )
3. Marital status: Married (   )   Single ( )   Divorced ( ) Widowed ( )
4. Level of Education: Primary ( )   Secondary ( ) Tertiary ( )   No formal education ( )
5. Household size (total number of people): ……………..... (persons)
6. Orange marketing experience: …………………..(years)
7. Membership of any orange sellers association: Yes ( ) No ( )
8. Average income from orange selling per month ………………… Naira
9. Other sources of income: Farming ( ), Artisan ( ), Others …………………..
10. What is your source of finance? Owned ( ) borrowed (   ), Others……………………
11. Place of sales/ display ripened orange by road side: Shop ( ), under tent ( ), wheel barrow ( ) others
……………

12. Please indicate other fruits available for sales

OTHER FRUITS AVAILABLE FOR SALES	YES	NO
Apple		
Watermelon		
Citrus		
Banana		
Plantain		
Coconut		
Mango		
Pear		
Avocado		
Others:		

SECTION B: Factors motivating them into roadside Orange selling in Afijio LGA

13. Kindly indicate the extent to which the following constitutes factors motivating them into Roadside orange selling. **T- TRUE, VT- VERY TRUE, F- FALSE**

MOTIVATING FACTORS	VERY TRUE	TRUE	FALSE
It is profitable			
To increase their income			
Orange are in high demand and there are supply for it			
It has many health benefits			
Orange are in the category of food industry			
There are no upfront processing cost			
Others:			

SECTION C: Postharvest Management Practices Used by Orange Road Side Sellers
14. Please indicate Postharvest management practices you use in orange road side business

S/ n	Stage/activities of marketers	Postharvest management practices		Frequency of usage		
			Always used	Sometimes used	Rarely used	Never used
1		Harvesting at correct stage of maturity				

2		Harvesting at correct time of the day				
3	Cleaning	Cleaning				
4	Sorting	Sorting				
5	Packaging for transport:	Carton				
		Wood box				
		Sack				
		Basket				
		Others……………				
4.	Transportation	Bicycle/motorbike				
		Tricycle				
		Motor van				
		On head				
5	Preservation	Clay pot				
		Fridge/deep freezer				
		Under tree shade				
		Hanging in open space				
		Others.........				
6	Ripening:	Cover with leafy materials				
		Cover with paper materials				
		Cover with woven sheet (sack)				
		Others……………… …………				

SECTION D: Estimating quantity of orange loss among road side sellers in Afijio LGA
16. What quantity of Orange do you often purchase or harvest in stock for sales per month
………………………….... (Number)
17. What quantity of Orange sold per month: ………………... (Number)
18. What quantity of Orange spoilt and unsold per month: ………………… (Number)
19. Kindly indicate what you often do with spoilt unsold orange:…………………………

SECTION E: Constraints to use of postharvest management practices
20. Please indicate constraints that have hinder you to use postharvest management practices

Constraints	Very severe	Severe	Not severe
Inadequate supply of electricity			
Unfavourable weather condition			
Insufficient distribution and lack of ripening techniques			
Lack of financial incentives from the government			
Improve practices are not easier to use			
Insect and rodent bite			
High spoilage			