

Full Length Research Paper

Effects of post harvest losses on income generated in citrus spp in ife adp zone of Osun state, Nigeria.

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The improvement of product quality and reduction in post-harvest losses became the main concern of producers, middlemen, marketing specialists and consumers. This study intends to examine the effect of post harvest losses on income generated from sale of citrus fruits. Random sampling technique was employed where 10 villages each were selected from Ile-Ife town. Agricultural Development Project (ADP) Zone Osun state, and a total of 100 respondents were examined. The data of the study were analyzed using descriptive statistics and multiple regression. Result shows that 75.6% of the respondents were male, 66.7% of the respondents had formal education, 61.1% of the respondents were middle aged, and 61.1% had household size of 6-8. The result also shows that the labour cost for harvesting operation constituted 43.4%, while the transportation cost constituted 51.8% of the total variable cost. The result from the loss analysis revealed that the highest loss (44.6%) was incurred in transit. Losses from harvest technique, market and transportation constituted 14.4% of the potential total revenue. The regression analysis revealed that pre-harvest working days, number of days that citrus fruits spent on the ground before being collected for transportation, number of days citrus spent in the market before sales were the significant determinant of losses in *Citrus spp*. Hence this study recommends that farmers should have more access to micro-credit to reduce losses.

Key words: Post Harvest, Losses, Income generated, Potential Total Revenue.

INTRODUCTION

Securing an adequate food supply has been the fundamental concern of mankind over the millennia, and, even in today's modern world of great scientific and technological achievements, diets are inadequate for about five hundred million people all over the world. A study by Food and Agricultural Organization (FAO, 1979) referring to 90 developing countries representing 98% of the population in the developing world (excluding China) reveals that the most striking share of increases in food demand will be caused by expanding world population. By the year 2000, 50% more food was expected to be available to meet present intake levels; yet additional food supplies will be needed by the end of the century to conquer famine and malnutrition. With respect to the material production inputs, which include land, water, minerals, organic substances, and energy, to meet these production targets, the availability of land will be the most limiting factor.

Attention to the concept of post-harvest food loss reduction as a significant means to increase food availability was drawn by the World Food Conference held in Rome in 1974. The 7th Special Session of the U.N. General Assembly in 1975 passed a Resolution calling for a 50 per cent reduction of post-harvest losses by 1985 (Anonymous, 1979). The potential value of post-harvest loss reduction has found practical expression in the continuing debate among a number of International Organizations and Institutions. As a result several initiatives at the international level have been taken with the special aim of making a concerted effort to reduce unnecessary losses at all the post-harvest stages of the food production process. Also FAO, after consultation with its Governing bodies, food loss prevention became a priority area and an Action Programme became operational in early 1978. (Anonymous 1979)

Citrus, grapes, and banana represent the 3 major fruit crops in the world with an annual production averaging 80 million metric tonnes each. (Aubert and Vullin, 1998). This is due to the fact that besides being consumed as

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fresh produce these fruits are also used in industrial and domestic food processing.

After the World War II citrus production has increased considerably for over a period of 40 years now. Citrus harvest has also increased at a rate of 5.3% per year. (Aubert and Vullin, 1998) During the last decade from 1985-1995 the demand suddenly went from 48 to 80 metric tonnes corresponding to an actual growth of 8.7%. The main centers of production in the world are southern Africa, Israel, United States, Brazil, Japan and Mexico grown primarily between the latitude 40° N to 40° S.

Citrus trees are subtropical to tropical in nature. They are broad leaved evergreen with variation in height. There are large numbers of citrus species which differ greatly in size and fruit characteristics. Citrus is one of the most important tree crops in Nigeria utilized for both fresh consumption and industrial processing. It is rated among the ten most important fruit tree crops in Nigeria and so is widely cultivated. They are grown either as compound tree, boundary tree, or in orchards. (Adelaja and Olaniyan, 2000). Citrus tree may be regarded as permanent or cash crop with a lot of economic potential. High yielding matured citrus tree attract good prices at the market. Citrus fruit falls among the group of perishable commodities and thus needs special treatment and storage to prevent losses. In West Africa there are no special storage facilities such as cold ware houses for most of these food commodities and thus great losses are therefore sustained.

The need for post harvest technology expressed by farmers suggests that they may want to reduce post harvest losses regularly experienced by transforming the Citrus fruit into value added product such as jams, marmalades and fruit juices. These products could be sold off during the off season to generate more income for farmers.

Dahunsi, (1992), Raji, (1992) noted that one-quarter of what is produced never reaches 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 avoided. It is distressing to note that so much time is being devoted to the culture of the plant, so much money spent on irrigation, fertilization and crop protection measures only to be wasted about a week after harvest. It is, therefore, important that post-harvest procedures be given as much attention as production practices.

The main objective of the study is to determine the effects of Post Harvest Losses on income generated in *Citrus spp* in Ile-Ife ADP Zone. While the specific objectives include: 1, to identify the socio-economic characteristics of citrus farmers. 2, to determine the effect of post harvest losses on income generated in citrus fruit sales.

Materials and Methods

This study was carried out in Ile-Ife ADP zone, Osun state of Nigeria. Data were obtained from selected villages which cut across the 3 Local Governments Area under Ile-Ife ADP zone which are Ife-East, Ife-North, and Ife-Central. Structured questionnaire containing open and close ended questions were used in gathering primary data. One hundred (100) questionnaires were administered. Descriptive statistics analysis was used in analyzing the personal characteristics of the respondents. The following will be determined through the use of regression equation: 1, the effect of number of days the *Citrus spp* fruit spent on the farm and in the market on the post harvest value; 2, the effect of transportation on the post harvest loss in value; 3, the effect of pre-harvest working days, harvest working days, collection working days, and distance from market on the post harvest loss; 4, the degree of relationship between the loss cost and the revenue generated (independent variable).

Multiple regression was carried out between the total cost (cost incurred from harvesting to marketing stage) dependent variables and pre-harvest working days, age of respondents, harvest working days, distance of farm from market, number of days that fruit spent on the farm, number of days that the fruit spent in the market before it was sold off, transportation cost, collection working days and storage cost (independent variables)

Average number of citrus in a medium sized basket = 250

Selling price per basket (Average) = ₦350.00
 Cost of head load to Ibadan = ₦3000.00
 Cost of head load to Lagos = ₦6000.00
 Cost of head load to Ife and environs = ₦1500.00
 Number of basket in full load = 40

Transportation cost = $\frac{\text{Number of basket}}{\text{Ibadan}}$ X 3000
 = $\frac{\text{Number of basket}}{40}$ X 1500 (Ife and environs)
 = $\frac{\text{Number of basket}}{40}$ X 6000 (Lagos)

Cost of a unit of labor for pre-harvest operation = ₦600.00
 Cost of a unit of labor for harvesting operation = ₦800.00
 Cost of a unit of labor for fruit collection = ₦600.00
 Labor cost for each operation = No of workers x No of working days x cost per unit operation.

RESULTS AND DISCUSSION

Table 1 below shows that a lot of the farmers are in the middle age class (45-64 years), while we have few young farmers who were in citrus production. This is indicative of the reducing population of young farmers into citrus production. Also majority of the respondents (75.6%) were male. This is an indicator that there are more male farmers than female farmers in the study area. Table 1 also shows that majority of the citrus farmers (51.1%) have large families that help them in the various operations in the farm. However a major characteristic of labor being used on the farm for pre-harvest, harvest and fruit collection is hired. The respondents confirm that their children go to school and they only help occasionally.

Table 1: Socio Economic Distribution of Respondents

| Age | Frequency | Percentage (%) |
|---------------------------|------------------|-----------------------|
| <35 | 5 | 5.56 |
| 35 – 44 | 15 | 16.67 |
| 45 – 54 | 23 | 25.56 |
| 55 -64 | 32 | 35.56 |
| 65 -79 | 15 | 16.67 |
| Total | 90 | 100 |
| Sex | Frequency | Percentage (%) |
| Male | 68 | 75.6 |
| Female | 22 | 24.4 |
| Total | 90 | 100 |
| Family size | Frequency | Percentage (%) |
| 3 -5 | 24 | 26.7 |
| 6 – 8 | 46 | 51.1 |
| 9 – 12 | 20 | 22.2 |
| Total | 90 | 100 |
| Level of education | Frequency | Percentage (%) |
| Primary | 32 | 35.6 |
| Secondary | 26 | 28.9 |
| Tertiary | 2 | 2.2 |
| None | 30 | 33.3 |
| Total | 90 | 100 |

Table 2. Sales location distribution

| Sales location | Frequency | Percentage (%) |
|-----------------------|------------------|-----------------------|
| Ife and environment | 35 | 38.9 |
| Ibadan | 29 | 32.2 |
| Lagos | 26 | 28.9 |
| Total | 90 | 100 |

Table 1 still indicated that 66.7% of the respondents have formal education and few of the citrus farmers (2.2%) had tertiary education, the basic skills required to control post-harvest loss in *Citrus spp* fruit would have been acquired at the primary and secondary school levels. Majority of the farmers know that the pre-harvest operation of spraying trees with chemicals is necessary but rarely carried it out. This may be due to technical and financial constraint leading to failure to secure inputs. The farmers however utilize their knowledge in that they usually clear the base of the citrus tree to prevent it from being choked up by weeds. They also cut the epiphytes that grow on the tree. In the same vein, the 33.3% that have acquired informal education are aware of indigenous practices.

Table 2 and 3 shows that majority of the citrus farmers (38.9%) sell their fruits in Ife, while 32.9% and 28.9% sell theirs at Ibadan and Lagos respectively. The nearness to points of sale is a bid to reduce loss in transit and minimize transportation cost which ultimately affects income from sales.

The total variable cost in citrus includes the labor cost

(pre – harvest, harvest, and fruit collection) and the transportation cost. It could be seen that labor cost for harvesting constitute the highest (44%). This shows the significance of labor in the harvest operation.

Table 4 shows the transportation cost for the different classes of the range of citrus baskets sold. The transportation cost is greatly dependent on the number of baskets sold as it increases as the average number of baskets increases per farmer.

Table 5 below also shows the percentage of each component of variable cost. That is the transportation cost took a substantial share in the total variable cost, (51.2%) compared with the labor cost (47.7%) and this reduced the income realized at the end of the day.

Table 6 shows the percentage total for each of the losses indicates that the highest loss is incurred during transportation (44.6%). It also shows the averages for the harvest, storage, and transportation losses. These losses are incurred within a period of 3month.

Under the analysis of revenue, the following items will

Table 3: Estimate of labor Cost

| Range of harvested baskets | Frequency | Average number of basket farmer | of per | Labor cost | | | Total (₦) |
|--------------------------------|-----------|---------------------------------|--------|--------------------|-----------------|---------------|----------------|
| | | | | Pre – harvest (₦) | Collection (₦) | Harvest (₦) | |
| <95 | 7 | 88 | | 3500 | 5500 | 6600 | 12600 |
| 95 – 114 | 11 | 102 | | 4080 | 6200 | 7700 | 17980 |
| 115 – 134 | 15 | 125 | | 4500 | 6500 | 10270 | 21270 |
| 135 – 154 | 31 | 144 | | 6300 | 7200 | 10500 | 24000 |
| 155 – 174 | 21 | 162.5 | | 7000 | 7500 | 10900 | 25400 |
| 175 -185 | 5 | 178 | | 9600 | 7800 | 11200 | 28600 |
| Total | 90 | 799.5 | | 34980 | 40700 | 57170 | 129850 |
| Average= Total/6 | | | | 5830 | 6783.3 | 9528.3 | 21641.7 |
| Percentage of total (%) | | | | 25 | 31 | 44 | 100 |

Table 4: Estimate of Transportation Cost

| Range of harvested baskets | Frequency | Average number of basket per farmer | Average transportation cost (₦) |
|----------------------------|-----------|-------------------------------------|----------------------------------|
| <95 | 7 | 88 | 16400 |
| 95 – 114 | 11 | 102 | 19500 |
| 115 – 134 | 15 | 125 | 23350 |
| 135 – 154 | 31 | 144 | 25250 |
| 155 – 174 | 21 | 162.5 | 26500 |
| 175 -185 | 5 | 178 | 30400 |
| Total | 90 | 802.5 | 141400 |

Table 5: Estimate of Total Variable Cost

| Range of Harvested Baskets | Frequency | Average Number of Baskets Farmer | Average Transportation Cost (₦) | Total Labor Cost (₦) | Total Variable Cost (₦) |
|------------------------------|-----------|----------------------------------|----------------------------------|-----------------------|--------------------------|
| <95 | 7 | 88 | 16400 | 12600 | 29000 |
| 95 – 114 | 11 | 102 | 19500 | 17980 | 37480 |
| 115 – 134 | 15 | 125 | 23350 | 21270 | 44620 |
| 135 – 154 | 31 | 144 | 25250 | 24000 | 49250 |
| 155 – 174 | 21 | 162.5 | 26500 | 25400 | 51900 |
| 175 -185 | 5 | 178 | 30400 | 28600 | 59000 |
| Total | 90 | 802.5 | 141400 | 129850 | 271250 |
| Percentage of Total % | | | 52.1 | 47.8 | 100 |

be considered; namely:

Potential Total Revenue

The amount that would have been realized had there been no losses, that is, the value of all harvested fruits

Actual Total Revenue

The amount realized after all losses have been taken care of.

From Table 7, 8 and 9, it could be seen clearly that losses constitutes a substantial percentage (14.4%) of

Table 6. Estimate of Total various losses incurred by farmers (N)

| <u>Range of Harvested Baskets</u> | <u>Frequency</u> | <u>Average Number of Baskets Farmer</u> | <u>Average of Transportation Losses (₦)</u> | <u>Average Market Losses (₦)</u> | <u>Average Harvest Losses (₦)</u> | <u>Total Losses (₦)</u> |
|-----------------------------------|------------------|---|--|-----------------------------------|------------------------------------|--------------------------|
| <95 | 7 | 88 | 2250 | 1250 | 1750 | 5250 |
| 95 – 114 | 11 | 102 | 2500 | 1350 | 1850 | 5700 |
| 115 – 134 | 15 | 125 | 2450 | 1350 | 2125 | 5925 |
| 135 – 154 | 31 | 144 | 3300 | 1500 | 2550 | 7350 |
| 155 – 174 | 21 | 162.5 | 4000 | 1950 | 2730 | 8680 |
| 175 -185 | 5 | 178 | 5040 | 2300 | 3600 | 10940 |
| Total | 90 | 133.25 | 3256.7 | 1616.7 | 2434.2 | 43845 |
| Percentage of Total % | | | 44.6 | 22.1 | 33.3 | 100 |

Table 7: showing the Potential Total Revenue and the Actual Total Revenue

| <u>Range of Harvested Baskets</u> | <u>Frequency</u> | <u>Average Number of Baskets Farmer</u> | <u>Potential Total Revenue (₦)</u> | <u>Actual Total Revenue (₦)</u> | <u>Total loss (₦)</u> | <u>Actual total revenue as a % of potential TR</u> | <u>Total loss cost as a % of potential TR</u> |
|-----------------------------------|------------------|---|-------------------------------------|----------------------------------|------------------------|--|---|
| <95 | 7 | 88 | 31200 | 25950 | 5250 | 83.2 | 16.8 |
| 95 – 114 | 11 | 102 | 40875 | 35175 | 5700 | 86.1 | 13.9 |
| 115 – 134 | 15 | 125 | 49750 | 43825 | 5925 | 88.1 | 11.9 |
| 135 – 154 | 31 | 144 | 59750 | 52400 | 7350 | 87.7 | 12.3 |
| 155 – 174 | 21 | 162.5 | 68000 | 59320 | 8680 | 87.2 | 12.8 |
| 175 -185 | 5 | 178 | 76500 | 65560 | 10940 | 85.7 | 14.3 |
| Total | 90 | 133.25 | 3260075 | 282230 | 43845 | 85.6 | 14.4 |

Table 8: Results of the Regression Analysis

| <u>Independent variables</u> | <u>Coefficients</u> | <u>Standard error</u> | <u>t-value</u> |
|------------------------------|---------------------|-----------------------|----------------|
| Constant (X_0) | 0.4011 | 0.4158 | 0.9647 |
| PHWD (X_1) | 0.8185 | 0.3520 | 2.3255* |
| AOR (X_2) | 0.0161 | 0.0217 | 0.7459 |
| HWD(X_3) | -0.1595 | 0.4221 | 0.3779 |
| DIST(X_4) | 0.001 | 0.0102 | 0.0107 |
| STF (X_5) | 0.7594 | 0.2273 | 3.3401** |
| SDM (X_6) | 1.1185 | 0.2804 | 3.9895** |
| TC (X_7) | -0.0001 | 0.001 | 1.5180 |
| WD (X_8) | -0.2069 | 0.3772 | 0.5444 |

the Potential Total Revenue. This indicates that losses

during harvest, storage, and transportation cause

Table 9: Values of the Statistical Parameters

| Statistical parameter | Coefficient determination (R^2) | of Adjusted (R^2) | F - value |
|-----------------------|-------------------------------------|-----------------------|-----------|
| Value | 0.907 | 0.897 | 87.2 |

a significant reduction in the total revenue of the farmers.

Regression Analysis for Loss

Dependent variable

(Y) = Total loss incurred (in basket) from pointing of harvesting till marketing stage.

Independent variables

(X_0 X_8): The independent variables are listed below

- Educational status (constant) - X_0
- Pre- harvest working days (PHWD) – X_1
- Age of respondents (AOR) – X_2
- Harvest working days (HWD) - X_3
- Distance from farm to market (DIST) – X_4
- Number of days that citrus spent on farm before transporting (STF) – X_5
- Number of days that citrus spent in the market before sales (SDM) – X_6
- Transportation cost (TC) – X_7
- Collection working days – X_8

$n = 90$, $K = 9$; $df (n-K) = 81$; *Significant at 2%; ** Significant at 1%; F+value significant at 1%; Significant variables were chosen based on t-values greater than $2(t > 2)$

Regression Equation

$$Y = 0.401 + 0.819 X_1 + 0.016 X_2 - 0.159 X_3 + 0.001 X_4 + 0.759 X_5 + 1.119 X_6 - 0.0001 X_7 - 0.207 X_8$$

The result of the regression shows that pre-harvest working day, number of days that citrus spent on farm before being transported, number of days citrus spent in the market before sales are the most significant and they all show a positive relationship.

As the coefficient of pre-harvest working days(X_1) increases by 1 unit (100%) the value of total loss incurred (Y) increases by 0.82unit (82%). This is evident because pre-harvest operations (such as weeding, pest and diseases control, etc.) could be delayed as a result of lack of adequate funds to finance the operations.

As the number of days that citrus spent on farm before transporting (X_5) increases by 1 unit (100%) the value of the total loss incurred increases by 0.759 units (76%). This is due to the fact that citrus fruit are left to stay on the farm for a long period after harvesting. This reduce the quality of the fruits and reduce the price.

As the number of days that citrus spent in the market before sales(X_6) increases by 1unit(100%) the value of total loss incurred increases by 112unit(11.2%). This is due to the fact that the fruits also spent some days in the market before they are sold off, losses in this case result from exposure of fruits to excessive heat which results in a deterioration in fruit quality and reduce income generated by the farmer.

The coefficient of determination (R^2) is 90.7%. This implies that 90.7% of the variation in total loss is jointly explained by the independent variables. When this value was adjusted for error, the value becomes 89.7%, which is still a considerably high value.

CONCLUSION

The farmers spend much money on the harvest operation. The labour cost also constitute a high percentage of the total variable cost, which means that farmers spend money on pre-harvest, harvest, and fruit collection operation all together than on transportation, but when considered singly, transportation cost is enormous. Furthermore, farmers loose more produce in transit than they do during harvesting and at the market. The total revenue is low considering 14.4% of the losses therefore government, through extension agents, had not been helping the situation because the enlightenment of the citrus farmers on the use of chemicals for insects, pest and disease prevention is not yet adequate. Storage facilities are also not in place.

It is worthy of note that the respondents do not have good packaging and handling culture during transportation of the citrus fruits. They either load the citrus fruits in bags or pour them in baskets or into the vehicles and these could be responsible for high losses observed.

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