African Journal of Agricultural Research Vol. 8(5), pp. 468-474,15 February, 2013
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR12.1308
ISSN 1991-637X ©2013 Academic Journals

Full Length Research Paper

Marketing performance and efficiency of evaporative-preservation cooling system for fresh tomato marketing in Ondo State, Nigeria

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Accepted 17 October, 2012

This paper presents the marketing performance and efficiency of evaporative-preservation cooling system for fresh tomato as an update of the performance evaluation of the evaporative cooling system developed at the Federal University of Technology Akure, Nigeria. A total of one hundred and five (105) fresh tomato marketers were sampled. Marketing margin analysis was performed to determine the performance of the preserved tomato vegetable during dry season based on their mode of preservation. Shepherd's efficiency formula result analysis shows that fresh tomato market was efficient with average marketing efficiency of 17.65%. The two-independent samples t-test results (t-value = 74.014) further reveal that profit margin for users of evaporative cooling system is significantly different from users of traditional mode of preservation, at 5% level of significance. However, disaggregated wholesaler's profit margin of ₦6,261.6 per month for users of traditional preservation method implies that they are not efficient compared with users of evaporative cooling system averaging ₦12,381.4 per month. Given the wide tropical variability in temperatures and relative humidity, evaporative cooling system is of economic importance towards commodity marketing development in Ondo State, Nigeria.

Key words: Evaporative cooling system, tomato, marketing performance, marketing efficiency, marketing margin, wholesale market, Ondo State, Nigeria.

INTRODUCTION

Evaporative cooling system has prospective use for the short term preservation of vegetables soon after harvest with higher market value given a long term market supply. Most of the post-harvest losses incurred on fruits and vegetables in developing countries are due to lack of adequate storage facilities and perishable nature (Mitra and Baldwin, 1997). Hence, quality depends on post-harvest handling, transportation and storage (Haidar and Demisse, 1999). Kader (1992) estimated the extent of post-harvest losses in fresh fruit and vegetables at 5 to 25% in developed countries and 20 to 50% in the developing countries. Low temperature handling and storage have been described as the most important physical method for post-harvest loss control which can be achieved using less expensive method of evaporative cooling (Seyoum and Woldetsdik, 2004). This cooling system has been reported for achieving a favourable environment in the storage structure for fruit and vegetables (Helsen and Willmot, 1991; Umbarker et al., 1991). One of the cooling methods employed for extending shelf life and minimizing post-harvest losses of perishable produce is mechanical refrigeration, controlled atmospheres, and adiabatic cooling which is considered less expensive for small scale peasant farmers, retailers and wholesalers (Mogaji and Fapetu, 2011). The study was carried out in Ondo State, Nigeria with an

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approximated land area of 14,788.72 km^2 and living about 3.44 million citizens. It has a temperature range of 21 to 29°C and relatively high humidity throughout the year (Ondo State Government, 2011). The State is largely agrarian with existence of many rural and urban market centers designated for food commodity market, namely roots and tubers, fruits, and vegetables in commercial quantities. Ondo State is administratively sub-divided into Northern, Central and Southern Senatorial districts. Each Senatorial district has few major specialized wholesale produce markets available to it. Wholesale markets are usually located at the districts main urban centre, and are the main collection points for surplus produce from the area. Wholesale markets have better storage, transportation, communication for buyers and sellers.

Market efficiency and performance

In reality, given that market will not self-regulated in terms of efficient use of resources and that no excess profits will get to any operator under perfect competitive condition, economists face difficulty in defining the criteria for evaluating economic efficiency of markets. Agricultural economists have applied two approaches for analyzing market performance. The first approach analyzes the productive efficiency of well-defined marketing subsystems while the second approach focused on analyzing the market structure and the resulting performance. The methods and criteria used by both approaches are instrumental in identifying actual and potential inefficiencies in the marketing system and characteristically, lead to the development of marketing policy recommendations to government (Kilmer and Armbruster, 1999).

Marketing performance

Performance is a measure of pricing and operational efficiency. Individual producers as well as the public have a stake because the degree of efficiency attained affects producer's prices and profit, costs to the consumer and their real income, and the general resource utilization. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and society (Kohls and Uhl, 1985). Higher efficiency means better performance, while lower efficiency denotes poor performance. Markets are efficient when the ratio of the value of output to the value of input throughout the marketing system is maximized (Abbot and Makeham, 1981). Performance of the market is reflection of the impact of structure and conduct on product price, costs and the volume and quality of output (Cramers and Jensen, 1982). If market structure resembles monopoly rather than pure competition, one can expect poor market performance.

Marketing margin

Marketing margin is the most commonly used measure of market performance. It describes price differences between other points in the marketing chain, for example between producer and wholesale, wholesale and retail, prices. It measures the share of the final selling price that is captured by a particular agent in the marketing chain (Mendoza, 1995). Marketing margins consist of marketing functions such as grading, packing, loading, unloading, transportation, storage, and levies. They are the same as returns to all factors of production, that is, land, labour, capital and entrepreneurship involved in marketing (Adeyokumnu, 1973). The data on marketing costs are needed to disaggregate the gross marketing margin of an enterprise at different marketing stages. This provides information on the costs of particular marketing functions, which can be compared with costs incurred by other enterprises to assess the operational efficiency (Scarborough and Kydd, 1992).

Large gross margins may not necessarily express high profit, but increased qualities and quantities of service, low labour, capital and management productivity, leaving producers and consumers better off while small gross margins may co-exist with inefficient resource use, poor coordination and consumer satisfaction, and disproportionate profit elements due to low productivity (Trotter, 1992). This study therefore focused on the marketing performance and efficiency of evaporative-preservation cooling system for fresh tomato relative to the traditional mode of preservation.

METHODOLOGY

This study analyzed the marketing margin and performance of tomato wholesalers for users of evaporative cooling system and the traditional method of preserving fresh tomato vegetables. Figure 1a, b and c show the developed evaporative cooling system and the corresponding control samples. The work of Mogaji and Fapetu (2011) is suggested for further details about the developed system and methods.

A cross-sectional field survey through focus group discussions (FGD) and personal interviews were used to obtain relevant information from fresh tomato marketers in Ogbese wholesale market (Northern district), Iloro wholesale market (Central district), and Owena wholesale market (Southern district) which were purposively selected for the study.

The bulk of sales in these markets dominate food commodity marketing activities taking place in Ondo State. Data were collected in the dry season of November, 2010 to March, 2011, an appropriate period to capture the effect of marketing margin efficiency when supply of fresh tomato vegetable are usually associated with high temperatures, perishability rate and cost of storage. In each wholesale market, 10 wholesalers and 15 sub-wholesalers were randomly sampled among those who used traditional preservation method, while 5 in each category of wholesalers and sub-wholesalers were purposively selected as users of the evaporative cooling. Seventy-five (75) respondents from users of traditional preservation method and thirty (30) marketers from users of evaporative cooling system were selected for the study. The population for the study therefore numbered 105 fresh tomato

Figure 1a. Evaporative cooling system with the fresh tomatoes fruit.

Figure 1b. Test products inside cabinet after 14 days.

Figure 1c. Test Products in Ambient Air after 14 days (Control Sample).

marketers. The wholesalers were interviewed at one weekly interval to allow for sub-wholesaling and retailing activities during the week.

The marketing performance of tomato marketers was determined to measure the economic benefit of using evaporative cooling system for fresh tomato preservation over the traditional method in the study. Marketing margin analysis was performed to determine the efficiency of the tomato vegetable marketing system during dry season. Given that marketing margin equals the difference between what the consumer pays and the farm gate price per unit of commodity item (Kohls and Uhl, 1985), and the assumption that wholesalers buy directly from the farmers, marketing margin are estimated as follows:

$$Marketing\ margin = (Selling\ Price - Buying\ cost)\ per\ unit \quad (1)$$

$$Net\ marketing\ margin = (marketing\ margin - marketing\ cost\ )\ per\ unit \quad (2)$$

Table 1. Socioeconomic characteristics of tomato vegetable marketers in the senatorial districts.

Characteristics	Dominant indicators at aggregate level					
	Northern Sen. district	Mean value	Central Sen. district	Mean value	Southern Sen. district	Mean value
Age of marketers	68.6% between 41 and 50 years	43 years	55.2% between 31 and 40 yrs	38 years	47.7% between 41 and 50 years	46 years
Level of education	42.8% completed basic education	6 years	78.1% completed basic education	6 years	50.0% completed basic education	6 years
Marketing experience	40.4% between 21-30 years	22 years	38.6% between 11-20 years	13 years	52.2% between 21-30 years	23 years
Start-up capital	52.0% less than ₦50,000	₦46,500	36.8% between ₦40,000 and ₦80,000	₦65,000	45.5% between ₦40,000 and ₦80,000	₦68,000

Source: Field data, 2010.

Hence,

$$Wholesaler\ net\ marketing\ margin = (Wholesaler\ margin - marketing\ cost) \quad (3)$$

It should be noted that marketing costs were mainly from transportation, handling/labour, rent, security fees, association membership and local government levy as reported in the study area.

Marketing efficiency is given by:

$$Marketing\ efficiency = \left(\frac{value\ added\ by\ marketing\ activities}{marketing\ cost}\right) \times 100 \quad (4)$$

Sherpherd formula technique was used to estimate wholesaler marketing efficiency (Sherpherd, 1993):

$$Marketing\ efficiency = \left(\frac{Consumer\ price}{Total\ marketing\ cost}\right) - 1 \quad (5)$$

$$Profit\ margin, \pi = (pQ) - \alpha + \beta X \quad (6)$$

where, Total revenue (pQ) equals price by quantity; Total cost ($\alpha + \beta X$) equals total fixed and variable costs

Prices and margins were valued at the average prices in naira per basket (40 to 45 kg) of fresh tomato vegetable during the 2010/11 dry season.

The two-independent samples t-test was performed to analyze if the profit margin of tomato marketers using evaporative cooling system is not significantly different from marketers who use traditional method for fresh tomato preservation. The hypothesis is stated as:

$$H_0 = \overline{\mu_1} = \overline{\mu_2} = 0 \quad (7)$$

The t- test relationship was specified as:

$$t_c = \frac{\overline{\mu_1} - \overline{\mu_2}}{\sqrt{\frac{s_1^2}{n_1}} - \sqrt{\frac{s_2^2}{n_2}}} \quad (8)$$

μ_1, means of profit margin of marketers who used evaporative cooling system; μ_2, means of profit margin of marketers who used traditional preservation; n_1, number of sampled tomato marketers who used evaporative cooling system; n_2, number of sampled tomato marketers who used traditional preservation; s_1, sampled variance for marketers who used evaporative cooling system; s_2, sampled variance for marketers who used traditional preservation.

The H_0 is accepted when the decision criterion holds that $t_c < t_{(\alpha,\ (n_1+n_2-2)}$ at α =5% level of significance, but rejected if otherwise.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondents

Table 1 reveals that an average marketer of fresh tomato vegetable is middle aged. In the Northern and Southern districts, 41 and 50 years was the model age bracket, while it was 31 and 40 age bracket in the Central district. Most of the respondents are basically literate, having completed a 6-year basic education. Average marketing experience was between 21 and 30 years per respondent in both Northern and Southern districts (≥22 years), while 13 years was reported in the Central. The implication is that tomato vegetable trade requires adequate understanding of the market before entry. It was further revealed in Table 1 that start-up capital averaged over ₦65,000 in the Central and Southern districts while

Table 2. Net marketing margin and marketing efficiency at wholesale level in Ondo State, 2010/2011 dry season.

Variable	Estimates at senatorial district level			
	Ogbese market (North)	Iloro market (Central)	Owena market (South)	Average
Farm gate	4110.0	4570.0	4230.0	4303.3
Wholesale price	5040.5	5610.0	5100.0	5250.2
Consumer retail price	5720.8	6550.4	5840.2	6037.1
Marketing Cost	329.4	341.6	335.0	335.3
Marketing margin	930.5	1040.0	870.0	946.8
Net marketing margin	601.1	698.4	535.0	611.5

Costs and returns are valued in ₦ per basket (40 to 45 kg); Source: Field data, 2010.

Table 3. Sherpherd formula marketing efficiency of wholesale fresh tomato market.

Variable	Estimates at senatorial district level			
	Ogbese market (North)	Iloro market (Central)	Owena market (South)	Average
Consumer retail price	5720.8	6550.4	5840.2	6037.1
Selling price	5040.5	5610	5100	5250.2
Total marketing cost	329.4	341.6	335.0	335.3
Marketing efficiency (%)	16.37	19.16	17.43	17.65

Estimates are valued in ₦ per basket. Source: Field data, 2010.

<₦50,000 is reported in the Northern district. It can be concluded that start-up capital for fresh tomato vegetable market is considerably high, and volume of sales required to breakeven in the wholesale market.

Marketing performance analysis

Net marketing margin

As presented in Table 2, on aggregate, ₦698.4 wholesaler net marketing margin per basket (highest) was reported in Iloro market (Central) and ₦601.1 in Ogbese market (North) while the lowest was found in Owena market (South) districts. The average marketing cost at ₦335.3 per fresh tomato basket, resulted in average net market margin of ₦611.5 for wholesale market. However, a very high average farm gate price of ₦4303.3 per basket was observed due to the seasonal scarcity usually associated with tomato vegetable marketing especially during the dry copping season. The net marketing margins of Iloro and Ogbese wholesalers markets might be due to their lower purchasing prices due to their benefit of economies of scale. Major supplies usually come from the Northern part of Nigeria as local productions are not enough to meet consumer demands. A small difference between the highest and lowest net margins in the wholesale market was likely from similar economic characteristics of key players in the market, especially those that concerned distribution. The lowest net marketing margin of Owena market wholesalers reflects higher transportation and handling costs. This result agreed with previous study that inadequate marketing services such as transport, packing and handling represent major obstacles that face marketing activities (Altoum, 2008).

Marketing efficiency

Market efficiency of 19.16% was estimated for Iloro market (highest), Owena market recorded 17.43% efficiency and Ogbese market recorded 16.37% (lowest) as indicated on Table 3. Average marketing was 17.65% efficiency. A market that is efficient does not only bring sellers and buyers together, it enables entrepreneurs to take advantage of opportunities, to innovate and improve in response to demand and price changes (Fakayode et al., 2010). The high market efficiency implied that wholesalers in Iloro market got higher coefficients of marketing efficiency because they run marketing activities more efficiently than others, perhaps due to their closeness to the urban retailers and efficient price control. This result could therefore be seen as highest pricing efficiency in fresh tomato vegetable marketing in the study area.

Disaggregated wholesaler's profit margin by preservation techniques of fresh tomatoes

The profit margin of tomato wholesalers is presented in

Table 4. Averagely monthly cost, revenue and gross margin from sales of fresh tomatoes by preservation techniques.

Cost variable (₦)	Traditional system (₦)	Evaporative cooling (₦)
	Mean value of users (N=75)	Mean value of users (N=30)
Transportation costs	1020.00	680.00
Labour cost	294.00	195.20
Rent	400.00	400.00
Security levy	200.00	200.00
Association membership fee	200.00	200.00
Local government levy	80.00	80.00
Total marketing cost	2194.00	1755.20
Total buying cost	34426.40	60246.20
Total cost	36620.40	62001.40
Average revenue	7575.20	13256.60
Profit margins	6261.60	12381.40

Source: Field data, 2010.

Table 5. t-Test result of profit margin between users of evaporative cooling method and traditional system.

Null hypothesis	$t_{(0.05, 103)}$	t_{cal}	Decision
H_0: $\overline{\beta_1} = \overline{\beta_2} = 0$	1.980	74.014	Reject null

Source: Computed from Field Data, 2010.

Table 4. The average profit margin for users of primitive traditional system was ₦6,261.6 per month while that of users of evaporative cooling monthly reported average of ₦12,381.4. The higher average profit margin obtained by users of evaporative cooling was attributed to the scale of business transactions, in terms of number of tomato baskets that marketers were able to buy (at farm gate) during the dry season, preserved to retain its market value (Figure 1b), and sold, thereby resulted into higher profit over the traditional preservation system which allows for quick perishability. Users of traditional mode of preservation were unable to buy in large quantities for fear of loss in value (Figure 1c), over time. The positive influence of scale of market operations thus signify the higher returns to scale over traditional preservation among users of evaporative cooling system, which tend to further increase the margin.

Hypothesis testing

The summary result of the two-independent samples t-test is presented as shown in Table 5. The result presented in Table 5 reveals that profit margin of marketers who used evaporative cooling system is significantly different from those who use traditional method. The hypothesis tested shows that the computed t-value of 74.014 is greater than t-tabulated of 1.98 at 5% level of significance. The set hypothesis is rejected that profit margin of wholesalers using evaporative cooling system is not significantly different from marketers who use traditional method. This can be attributed to the higher quantities of tomato baskets that users of evaporative cooling were able to purchase at farm gate and store for longer days before being sold. This testifies to the improved marketing performance of wholesalers who store with evaporative cooling system over traditional preservation.

Conclusions

The study showed that fresh tomato wholesale market is efficient in Ondo State, Nigeria. The evaporative preservation cooling system developed is more efficient compared with the traditional preservation method as a cost effective means of preserving fresh vegetables through reduction of post harvest losses and increasing of income generated from agricultural produce. Given the same operational conditions, the average monthly profit margin for users of evaporative cooling method is twice that obtained by users of the traditional method. Marketing efficiency between users of traditional presser-vation and evaporative cooling system revealed that scale of market transactions among users of evaporative cooling system were higher, thereby resulted into higher profit margin over the traditional preservation system. Consequentially, evaporative cooling system is found

suitable for application in the farms at both retail and wholesale level along the market flow channel until the product reaches the consumer. Marketers are thus encouraged to take advantage of opportunities, to innovate and improve in response to demand and price changes.

The present analysis showed that the evaporative preservation cooling system is more efficient as compared to the traditional preservation method from both marketing efficiency and performance points of view. Subjecting to the same operational conditions of averagely monthly cost, revenue and gross margin from sales of fresh tomatoes, the average profit margin per month for the wholesalers who were users of evaporative cooling method is two times that obtained by the users of the primitive traditional system. However, average marketing efficiency of 17.65% was obtained in fresh tomato wholesale market by the users of the evaporative cooling system means. It can thus be concluded that the marketing performance and efficiency of the evaporative-preservation cooling system elucidated a cost effective means of preserving fresh vegetables through reduction of post harvest losses and increasing of income generated from agricultural produce.

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