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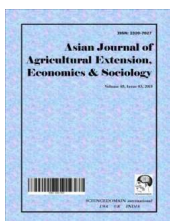
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Investigation in the Trading of Oranges (*Citrus sinensis* L.) in Côte d'Ivoire: Inventory of the Supply and Merchandising

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Authors' contributions

This work was carried out in collaboration between all authors. Author LVC designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft and the revisions of the manuscript. Author CKO managed the investigations of the study. Author ARR managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The oranges (*Citrus sinensis* L.) are diversely available on the markets along the months and seasons of the year. The current investigation, implemented in 10 communes from the district of Abidjan, focused on parameters dealing with the supply and marketing of these citrus fruits in Côte d'Ivoire. It was achieved using a questionnaire for collecting data regarding the sellers' profile, the main concerns in the fruits' acquirement and sale, as well as the oranges' customary. The results reveal that the oranges are especially marketed by Ivorian citizens (77%) against 23% foreign nationalities, namely from Mali, Burkina Faso, and Guinea. The oranges' trading is a female gender activity accounting 60% saleswomen. It's mainly practiced by 21-40 years old persons representing 77.77% traders, showing that the oranges' trading is a significantly profitable activity since youngers are really involved in. The local way of oranges production is bimodal, with 66.7% in the rainy season against 32.3% for the dry season. The oranges are generally routed from overall country regions towards the big city markets by haulage (80%). During the season of lower production, the

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markets are provided with oranges thanks to imports, especially from Ghana, a neighbouring country (87%). The potential customers of the oranges are consisted of 90% home consumers and fruits juice processors.

The investigation shows that the oranges' fruits channel is fitted with jobs supplying but remains casual. It therefore requires a better organization to become more profitable for overall stakeholders in the orange path. Also, the technological promotion of the oranges through the extensive juice processing and the valorization of the fruits residues, namely seeds, membranes, and peels could provide more incomes from this foodstuff.

Keywords: *Citrus sinensis*; diagnosis; trading; markets; Côte d'Ivoire.

1. INTRODUCTION

The orange (*Citrus sinensis* L.) tree belongs to the plant systematic family of *Rutaceae* and originates from the South-eastern Asia [1]. This plant supports various environmental and climate conditions and is so cultivated in many countries over the world. Its main usefulness consists in the production of fruits [2] known as oranges.

The production of oranges is estimated at 66,400,000 tons per year in the world, and Brazil is the greatest leader of this raw material [3]. In Côte d'Ivoire, the oranges are cultivated over 5,000 hectares providing about 500,000 tons of fruits per year [4].

However, over 90% of the local orange farms belong to agro-industrial factories and few individual farmers are accounted. Indeed, the oranges are grown as ornamenting plants, in opposition to more adopted industrial crops such as cocoa, coffee, and oil-palm, and even other intermediate cultures as coconut [5,6]. Nevertheless, the oranges are berry-fruits duly consumed in numerous circumstances: prior to lunches, along the streets, during ceremonies, etc. The raw orange fruit is usually consumed fresh or sometimes after processing into fruits juice (for 26% full oranges production), according to the USDA [2]. The orange juice represents a highly valuable foodstuff appreciated for its sensory traits since it's commonly consumed as refreshing drink. It also records nutritional interest resulting from the significant contents in vitamin C (22.5 to 50.4%), glucides (11% to 33%), and minerals as potassium [7,8]. In addition, the essences extracted from the oranges peels and seeds are usable as alternatives of chemical fungicides [9]. The orange peels also record important minerals and can be used as food additives for those suffering from mineral deficiency [10], whereas the consumption of the oranges pulp results in significant reduction in the risks of cardiovascular

concerns, colon cancer, and obesity [11]. Thus, the oranges have functional properties having various applications in the food, cosmetic, and health industries [12]. They are therefore significant food resource for populations and so considerable livelihood for farmers and other stakeholders.

Yet, in spite of the presence of oranges on the big markets (supermarkets, fruits shops), most of the oranges consumed in Côte d'Ivoire are provided from the hawkers. Also, the oranges markets are not supplied in quantity and quality fruits all year round. The fruits shops are more supplied in oranges during the rainy seasons (March - July and August-October) than at the dry seasons. So, the trading of oranges in Côte d'Ivoire is a real stake dealing with the consumption of this fruit by the local populations. The goal of this investigation is to probe the local trading of oranges fruits for revealing the main concerns in order to improve the development of this raw material industry in Côte d'Ivoire.

2. MATERIALS AND METHODS

2.1 Study Design

The survey consisted in a field investigation implemented from communal sellers of oranges fruits in the District of Abidjan, located at the South of Côte d'Ivoire in Western Africa. Ten (10) communes of the District, namely Abobo, Adjame, Attecoubé, Cocody, Marcory, Koumasi, Plateau, Port-Bouët, Treichville, and Yopougon were investigated. Ten (10) sellers were investigated per commune regardless of their gender and age.

2.2 Methods

2.2.1 Investigation implementation

The study was achieved for two (2) months, from March to April 2016. The data were collected

using dully filled questionnaires charted on investigations sheets and regarding the oranges sellers. The requested information focused on the nationality and the age of the traders, the selling mode, the market price, and the types of customers and their main preference and needs for oranges fruits. The period of production and the ways of supplying and routing of the oranges were also recorded.

2.3 Data Analysis

The outcomes were statistically treated using Statistica software (STATISTICA version 7.1). The statistical analysis consisted in Chi-square (X^2) non parametric test comparing the rating proportions resulting from each parameter at 5% significance level [13].

3. RESULTS AND DISCUSSION

3.1 Profile of the Oranges Traders

The main informations relating to the sale profile of the investigated persons are displayed in Fig. 1. The oranges sellers are significantly consisted of female persons (60%) against 40% male (Fig. 1a). Regarding their originating country, the sellers are mainly Ivorian citizens (77%). But other nationalities are accounted, namely 12% from Burkina Faso, 7% Guineans, and 4% Malians (Fig. 1b).

The oranges trading is worked by 77.77% individuals aged from 21 to 40 years old, major part of which are adults (42.4%) having between 31 and 40 years old (Fig. 2a).

The sedentary retailing is the most marketing plan (56%) of the oranges trade while the wholesale is practiced by only 11% traders (Fig. 2b).

3.2 Data from the Oranges Supply

The markets' supply in the oranges is significantly bimodal ($p < 0.001$). A great period of oranges provision (68.7%) is recorded during the rainy season from mid-March to mid-August, whereas the markets are supplied with oranges in the dry season between September and February for only 32.3% investigated traders. Thus, the fruits shops are more provided in oranges between March and July according to 82.8% sellers. Nevertheless, the frequency of the markets' supply in oranges is rather monthly (58.6%) either the production period; although about 40% investigated traders are daily or weekly provided.

The markets' supply in oranges is achieved by trucks according to 80% traders. These oranges are originating from numerous country regions. However, significant divergence ($p < 0.001$) is recorded between regions relating to their oranges production. Indeed, the Worodougou region provides about 53% oranges sold in Abidjan, followed by the South-Comoe region (22.3%). The outcomes also show that the Down-Sassandra and Lakes regions provide 17.1% and 7.1% oranges to Abidjan, respectively. In spite of these contributions, the oranges demand on markets is still over the local supply, according to 99% investigated traders (Table 1).

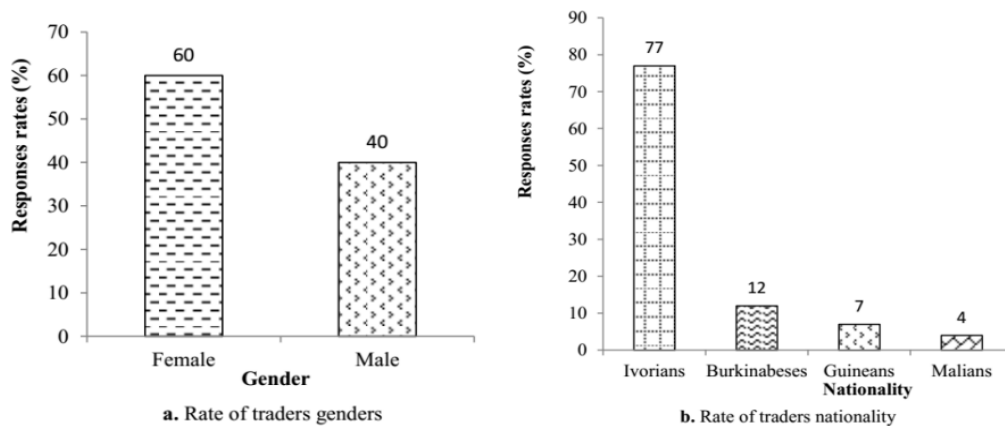


Fig. 1. Percentages of responses from oranges traders' profile in Côte d'Ivoire regarding gender and nationality

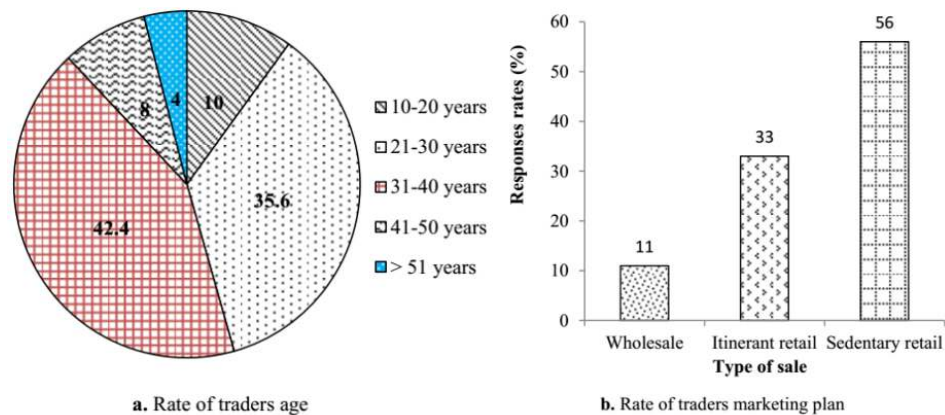


Fig. 2. Percentages of responses from oranges traders' profile in Côte d'Ivoire regarding age and marketing plan

Table 1. Data from the Ivorian markets' supply in oranges

Investigated parameters	Rate of answers (%)	Statistical values	
		χ^2	P-value
Local sources of oranges	Worodougou region (53.5%) South-Comoe region (22.3%) Down-Sassandra region (17.1%) Lake region (7.1%)	197.59	< 0.001
Period of local production of oranges	Rainy season (68.7%) - Dry (32.3%)	512.9	< 0.001
Means of oranges transports toward markets	Trucks (80%) - Waggon (11.5%) On foot (8.5%)	540.24	< 0.001
Frequency of markets supply in local oranges	Daily (7.1%) - Weekly (34.3%) Monthly (58.6%)	113.51	\leq 0.001
Possibility of supply from imports oranges	Yes (59.6%) - No (40.4%)	3.83	< 0.05
Country of imports	Ghana (87%) - Other countries (13%)	1163.02	< 0.001

χ^2 , Chi-square statistical value; P-value, value of statistical probability value

Consequently, many provisions of oranges are often afforded from neighbouring countries (59.6%) among which Ghana is the most solicited (87%). The oranges imports are generally monthly performed (68.7%) or sometimes weekly as mentioned by 16.2% traders (Table 1).

3.3 Data from the Oranges Customers

The investigation reveals that the prices of the oranges are related to the marketing plan practiced. From the wholesale, the orange is sold below 10 CFA Francs at the top production season and close to 15 CFA Francs in the weak one. But the oranges' price oscillates between 35 and 50 CFA Francs from the retailers according to the seasons.

The oranges clientele is also heterogeneous. It's mainly consisted of individual home consumers (47.5%) and traditional fruits juice producers (42.6%), against only 9.9% of industrials (Fig. 3a). These customers get their provisions generally monthly (60%) or weekly (30%), but only 10% sellers rated for daily oranges purchase (Fig. 3b).

According to 59.6% traders, the customers have preference for ripe oranges that generally display yellowish color. But other criteria are accounted in the oranges preferences. Indeed, the most delicious oranges and those having mean shape and weighting about 150 g to 200 g are the most preferred fruits according to 59% and 46.7% sellers, respectively. Besides, the oranges are sold over one month from 54% traders, while 35% and 11% of them sell their fruits each week and day, respectively (Table 2).

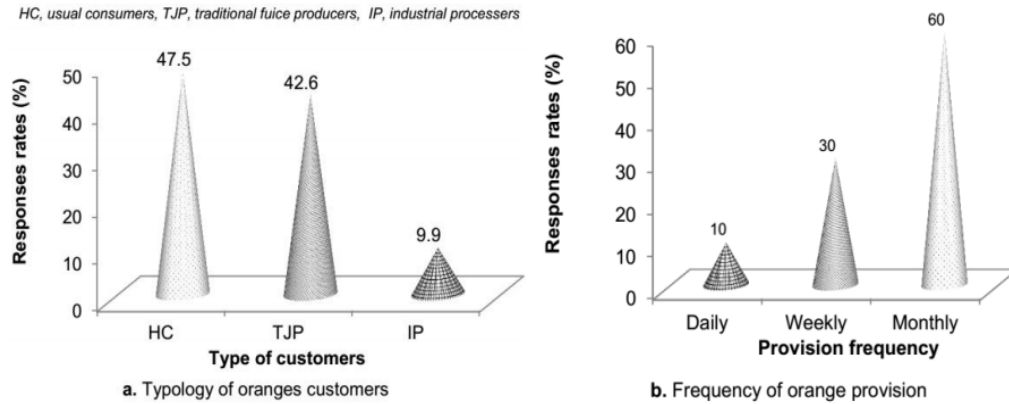


Fig. 3. Rates of the traders responses relating to the oranges customers in Côte d'Ivoire

Table 2. Data from the main parameters regarding the oranges preference by customers and their sale delay in Côte d'Ivoire according to the investigated traders

Investigated parameters	Rate of answers (%)	Statistical values	
		χ^2	P-value
Oranges maturity stage preference	Unripe (13%) - Fairly ripe (27.4%) – Fully ripe (59.6%)	197.18	< 0.001
Oranges sweetness preference	Sour (14.74%) - Fairly sweet (26.26%) - Very sweet (59%)	460.94	< 0.001
Oranges shape preference	Little shape (36%) Mean shape (46.7%) Big shape (17.3%)	218.15	< 0.001
Oranges sale delay	>1 month (54%) – 1 week (35%) – 1 day (11%)		

χ^2 , value of the statistical Chi-square test; P-value, value of the statistical probability test

3.4 Discussion

The investigation shows that the populations are really accustomed with the oranges in Côte d'Ivoire since they use these fruits for home consumptions or for processing into juice, with requirements of quality raw product. Such an observation corroborates reports from the USDA [2] accounting the oranges among the most known, marketed, and consumed Citrus fruits over the world. The trading of these fruits in Côte d'Ivoire is more devolved to the women, as reported by Blanck et al. [14]. The pre-adult and adult persons between 21 and 40 years old are more involved in the oranges selling. This observation could be related to the hardness of the tasks inherent to the marketing, namely the fruits availability in important volume and quality, the clients searching, the providing of ready to be consumed products, etc. But, it could also derive from the request of earn for financial autonomy from the jobless persons of which youngers are more concerned [15]. Indeed, the young people usually display more important needs, such as housing, marriage, giving birth, training, that are filled by only profitable livelihoods. Hence, the

great involvement of young orange sellers forecasts on the profitability of such a trading activity.

Regarding the orange supply, numerous local habits are involved, especially that overall Ivorian regions record tropical and humid climate, agreeing with the works drawn by Suryawanshi [16] who mentioned that the oranges are produced from the tropical and subtropical lands. However, the assessment of the local oranges yield is hardly affordable because the major part of the production is sold using casual ways. Nevertheless, according to the Ivorian Council for Struggle Life's Expensiveness [17], 112,700 tons of oranges are yearly harvested in Côte d'Ivoire and the production is still going ahead thanks to the official policies focusing on the improvement of the fruits sectors. Unfortunately, the current investigation evidences that the local production of oranges is not enough to fill the consumers' demand from the markets since significant volumes of oranges are imported from Ghana, a neighboring country of Côte d'Ivoire. Such statements reveal the great consumption of Citrus fruits by Ivorian populations from the urban

areas, whereas any real intensive culture of this crop is practiced, except from the industrial plantations for processing into oranges' essences [18].

Moreover, the oranges production is bimodal as the production of cola nuts, another ornamental plant [13]. Consequently, the oranges are provided with fluctuating sale prices relating to the production seasons and the marketing plan, accordingly to the supply and demand. Thus, the lowest prices are recorded from the wholesalers, especially between March and July, because of the great production of oranges and therefore their abundance in the fruits shops. In opposition, the lower production periods are correlated to massive imports of oranges whose quality could not be always optimal [19]. Indeed, from the traders' opinion, the customers usually buy the oranges caring their ripeness, sweetness, and shape. The mature and ripe oranges are sweet thanks to great fructose content of their pulp. Thus, they could be more delicious for consumption. According to Ramful et al. [20], the fruits of the Citrus species record various appearance, shape, and caliber. Besides, their juice composition is related to their ripeness appearance and maturity stage and the ripe fruits are as appreciated as they result in delicious juice [21].

4. CONCLUSION

The study evidenced that the distribution of oranges is still casual in Côte d'Ivoire, specifically in Abidjan. The oranges are not export products and significant imports are requested to fit the local demand. Considering the surrounding suitable environmental and climate conditions, the culture of orange should be more strengthened for providing sufficient and quality fruits to local consumers. Also, the technological promotion of the oranges, through the processing of fruits into safe juice, the valorization of the fruits by-products as seeds, membranes, and peels could be more profitable for farmers and other stakeholders of the oranges channel.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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