Social and Economic Analysis of the Production of Maradol Papaya (*Carica papaya* L.): Case study in the coast of Oaxaca, Mexico

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ABSTRACT

Objective: To analyze the social, production, and profitability indicators of a conventional agribusiness producing Maradol papaya in the coastal region of Oaxaca.

Methodology: This research was conducted at the agribusiness "Productores de la Costa Posa Verde, S.P.R. de R.L" from June 2020 to August 2021. Semi-structured interviews with the producer and his family were conducted. The economic analysis was done using the activity-based budgeting method.

Results: The studied company is a family agribusiness run by the head of the family, a 47-year-old man with a high school education and approximately 35 years of experience in the cultivation of papaya. During the period of study, the production cost was \$365,190.01 ha^{-1}. From the total variable costs, the largest expenditures per cultivated ha went to harvesting (38.2%), irrigation (17.5%), and phytosanitary control (14.3%). The cost-benefit relationship (CBR) obtained by the agribusiness was 1.31. A net profit of \$117,633.6 ha^{-1} was observed, together with a profitability of 24.4%, and an equilibrium point of 31,268.86 kg.

Conclusions: This papaya farming agribusiness is profitable. Moreover, papaya farming is an important source of work, which contributes to improving the quality of life among the region's inhabitants.

Keywords: Economic indicators, Production costs, Production profitability.

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INTRODUCTION

The papaya (*Carica papaya* L.) is a fruit native to Central America [1]. It is well-known for its medical and gastrointestinal qualities, and as a source of antioxidants, vitamins, minerals, and fiber [2]. It is currently cultivated in tropical and subtropical countries. The papaya is the third most consumed tropical fruit in the world and is therefore economically important [3].

The cultivation of the Maradol variety predominates in Mexico [2, 4], with a yield of 1,134,753.09 t in 2021. This production was led by Oaxaca, Colima, Chiapas, Veracruz,

Image by Ben Bernard at Pixabay

and Michoacán, who together represent over 80% of the country's total production [5]. During the last years, this activity has faced difficulties that hinder is competitiveness. Producers are tackling financial problems, low availability of technology and infrastructure, lack of training and organization for production and commercialization, as well as a lack of strategies to develop human capital, all of which affects production yield [3].

In this scenario, the papaya producers of tropical regions must improve their production systems and make them efficient and profitable. One way of achieving this is by identifying their costs, withouth ignoring the social and production aspects [6].

Based on all of the above, the objective of this research was to analyze the social, production, and profitability indicators of a conventional agribusiness that produces Maradol papaya in the coastal region of Oaxaca.

MATERIALS AND METHODS

Study area

The research was conducted at the papaya farming agribusiness "Productores de la Costa Posa Verde, S. P. R. de R. L.", located in José María Morelos, municipality of Santa María Huazolotitlán, Oaxaca (16° 12' 54" N, 97° 54' 45" W, at 46 masl). The region has a hot sub-humid climate, with summer rains (Aw_1), an average temperature of 27 °C, and an average annual rainfall of 1,237 mm [7]. The agribusiness had 15 ha of Maradol papaya (Figure 1), with an initial density of 8,250 plants ha^{-1} and a final one of 1,571 plants ha^{-1}.

Data collection

Data were collected from June 2020 through August 2021. First, a semi-structured interview with the producer and the relatives who help him with the activites was conducted based on a number of elements taken from Vasilachis's qualitative research [8]. The following aspects were considered: 1) participation of family members in the

Figure 1. Delimitation of the Maradol papaya field at the study area. Source: Own elaboration.

agribusiness; 2) hired labor; 3) technical assistance and financing; and 4) organization and commercialization.

Second, we conducted an economic analysis using the activity-based budgeting methodology [9], whereby we determined the total cost (TC) for the main agricultural supplies, hired labor, fuel, as well as the fixed costs (FC) and variable costs (VC) involved in the activities of the production process: 1) land preparation; 2) seedling production; 3) transplanting; 4) irrigation; 5) weed control; 6) phytosanitary control; 7) fertilization; 8) cultural tasks; and 9) harvesting. This data correspond to the 2020-2021 production cycle and were modelled based on the current prices of the period.

The unit cost (UC) per t and per ha was estimated based on the TC and then classified in VC and FC. The total income (TI) from papaya sales was subsequently obtained by adding the total cost of each cut at different times, and considering a current average sales price of \$7.54 kg^{-1}. This information served as a basis to estimate the structure of costs and incomes, which led to the cost-benefit relationship (CBR), the net income, the unit cost, and the equilibrium point, by using the formulas described by Granados-Rivera *et al.* [10].

RESULTS AND DISCUSSION

Social analysis

The studied company is a family agribusiness run by the head of the family, a 47-year-old man with a high school education and approximately 35 years of experience in the cultivation of papaya. Some authors report that most papaya small-scale producers of the Loma Angosta region in Veracruz have a primary education [11]. In this regard, the producer's educational level and experience are key points related to his capacity to identify areas of opportunity that will allow him to improve his company's net profit [10]. Alongside the producer, two family members (father and brother) —who are mainly in charge of sowing— are involved in the company's activities. This observation is consistent with researches conducted in the state of Veracruz, where finding a maximum of three activity partners, related by kinship, is common [11]. Besides producing papaya, the studied agribusiness allocates part of its land to cultivating coconut palm (*Cocos nucifera*) and plantain (*Musa balbisiana*), as well as to breeding cattle.

The agribusiness's hired labor comprises workers that come from neighboring places and are hired mainly during harvest time (June and November). This contributes to the region's social benefit through the creation of jobs; however, the producer mentioned a current lack of labor that has hindered the expansion of papaya crops in the region. The agribusiness receives sporadic technical assistance, chiefly regarding crop nourishment and health. It is important to consider that pests and diseases are some of the main problems for the cultivation of papaya in Mexico [12].

To date, the producer has not received any credit or aid to improve his company's infrastructure, facilities, or production processes. This is due to the fact that papaya producers lack the necessary contacts to establish ties or relationships with other social actors outside their hometowns [11]. Therefore, macroeconomic policies and research development leave them on the margins.

Until some years ago, the agribusiness commercialized its fruit through retailers or buyers from the supply centers in Mexico City, Puebla, and even Tijuana —the latter catering for the North American market. This observation resembles reports by another author, according to whom the production of papaya in the state of Tabasco is mainly sold in the national market, *e.g.* in Mexico City, Guadalajara, and Monterrey. The product is transported to the final destination warehouse by the retailers [13], which is detrimental for producers, since it is the former who get the greatest profit [2]. For this reason, five years ago the agribusiness decided to deliver its production directly to commercial companies (AGROMOD and AGROCARICA) who distribute the product in supermarket chains in Monterrey, Nuevo León.

Production costs and income

During the studied period, the agribusiness had a yield of 69.0 t ha^{-1} and an income of \$482,823.67 ha^{-1} (considering an average sale price of \$7.54 kg^{-1}). The yield obtained was higher than the one reported by some authors for the state of Veracruz, which was of 41.52 t ha^{-1} [2]. For its part, the yield reported for the state of Campeche was of 100 t ha^{-1}, with a total income as high as \$400,000.00 ha^{-1}. The observed variation was due to fruit quality, the season, and market cost [14]. There is evidence that the fertilization type affects the crop yield directly: observed average yields varied depending on whether fertilization was chemical (95.16 t ha^{-1}), organic (56.58 t ha^{-1}), or biological (48.56 t ha^{-1}) [15].

Table 1 summarizes the VCs required to produce 1.0 ha of Maradol papaya in the studied agribusiness. These costs correspond to goods that cannot be imported or exported, and include manual and mechanized labor, land, and hired services (irrigation and water, among others). The total sum of these goods plus the commercial supplies represents 100% of the total cost structure [16].

The production cost was \$365,190.01 ha^{-1} which includes materials and equipment deprecitation. From the total VCs, the largest expenditures per cultivated ha went to harvesting, irrigation, phytosanitary control, and fertilization. These results coincided with the findings for the state of Campeche, where the TC per ha of cultivated papaya was \$103,687.50 (without depreciation), with the largest expeditures going to harvesting (27.18%), fertilization (22.86%), and phytosanitary control (14.06%) [14]. Similar observations were reported for other economically important fruits in Mexico, such as the pinapple. In this case, the costs related to crop establishment and maintenance represent the production unit's larger expenditure [16,17].

Economic profitability

The CBR obtained for the studied agribusiness was 1.31, which means that it is economically profitable: for each Mexican peso invested in the production of 1.0 ha of papaya, approximately 1.31 pesos are recovered, which means that the producer earns 31 cents. Similarly, a net income of \$117,633.6 ha^{-1} and a profitability of 24.4% were observed. The equilibrium point was 31,268.86 kg; this indicates the quantity of fruit that the agribusiness would have to sell in order not to lose or gain. The expected income

Table 1. Production costs of 1.0 ha of Maradol papaya in the coast of Oaxaca, Mexico. Source: Own elaboration.

Concept	Amount ha^{-1} ($MX)	Participation (%)
Variable costs		
Land preparation	$19,522.61	5.4
Stockpile preparation	$1,993.33	0.5
Transplant	$1,755.00	0.5
Irrigation	$63,065.57	17.5
Weed control	$16,653.76	4.6
Phytosanitary control	$51,523.53	14.3
Fertilization	$46,287.90	12.8
Cultural work	$22,508.67	6.2
Harvest	$137,805.27	38.2
Subtotal	$358,709.01	100
Fixed costs		
Depreciation	$6,481.00	100
Subtotal	$6,481.00	100
Total cost	$365,190.01	-

One dollar equivalent to 20 Mexican pesos ($MX).

would be $235,767.22. As the agribusiness goes past the equilibrium point, the difference between income and cost will be increasingly greater, which in turn will generate a positive balance (Figure 2). The economic profitability (CBR) value observed in this research was lower than the one reported to produce papaya in the states of Tabasco (2.1) [13] and Campeche (1.93) [14].

Two papaya farming models were recently assessed. The authors observed that the sustainable model achieved a CBR of 2.24 and an equilibrium point of 38.47%, while the conventional model allowed a CBR of 1.08 and an equilibrium point of 90.11% [4]. The authors conclude that the conventional model is economically unfavorable, while

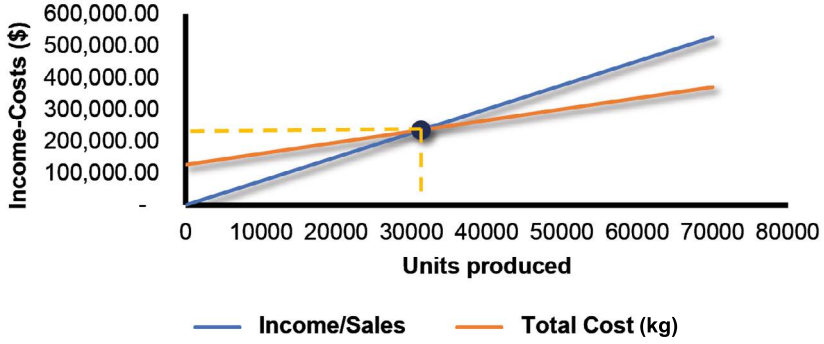

Figure 2. Equilibrium point observed in the production of Maradol papaya in the coast of Oaxaca. Source: Own elaboration.

the sustainable model is economically attractive and presents a better use of local natural resources. The observed differences in the studies might be due to market conditions (price), offer and demand at the time of the transaction, as well as to environmental and technical factors during the agronomic management of the crop [4].

CONCLUSIONS

Based on the results of the research, we can say that the papaya-farming agribusiness "Productores de la Costa Posa Verde, S. P. R. de R. L." is profitable. Besides being economically viable, papaya farming is an important source of work since the demand for labor is high in every activity of the production process. This contributes to improve the quality of life of the region's inhabitants.

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