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# Analysis of costs and competitiveness in avocado production in Michoacán, Mexico

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## Abstract

The process of globalization has forced avocado producers in Michoacán to improve their competitiveness, be more efficient and control their production costs to adapt to market demands. Cost accounting provides data to monitor the activities of a company, provides tools for making corrective decisions and achieve goals, to maintain or increase profits production costs, profitability and competitiveness of three representative production units (URP) avocado, two of export and for domestic market in Michoacán, in 2013. The USDA's proposed methodology was used were estimated adjusted to analyze the agricultural profitability in Mexico. To recover the direct information of the technical coefficients, yields, prices of inputs and products, the technique of producer panels was used. The results indicate that the URP smaller scale, which allocates 100% of its production to the domestic market, presented the costs of higher production and a return of \$51 655.10 $ha^{-1}$, compared to the URP larger scale, which spend between 80 and 90% of its production export, with yields of \$243 779.10 and \$217 570.80 $ha^{-1}$. In addition, the costs of private resources confirmed the high proportion saved by variable costs, mainly pesticides and fertilizers. Avocado production in Michoacán was a profitable activity in 2013; however, only the URPs that export are guaranteed their economic viability and long-term permanence.

**Keywords:** *Persea americana* L., competitive advantage, export, private profitability.

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## Introduction

The last 25 years of the world economy have been characterized by numerous scientific and technological advances, which have modified the patterns of consumption, production and commercialization, creating a strong interdependence that encompasses the total of activities of an economic sector, whether local or global (Gómez, 2006). In Mexico, the production and trade of fruits and vegetables has become the most dynamic sub-sector of agriculture, as a result of changes in national and international supply and demand. In the period from 2000 to 2011, exports of mexican fruits and vegetables grew by 9.6% on an annual average, while the production of fruit trees has shown a growth of 3.3% from 2000 to 2012 (Macías, 2010; Cruz *et al*., 2012; FAOSTAT, 2016).

For the specific case of avocado, in 2014 Mexico was the leader in production and sales abroad, exporting 806 367 (t), which represented 53% of national production and 66.2% of world trade. The US market is the main destination, absorbing 85.5% of total Mexican exports. The state of Michoacán is the main avocado producer in Mexico, in 2014 it participated with 80.2% of national production and 63.7% of national exports. The economic importance of this activity in terms of job creation and indirect links with other activities is significant in this state, which has exported on average more than 514 000 t in the last five years to the United States alone, generating forty thousand to fifty thousand permanent jobs, nine million wages a year and sixty thousand seasonal jobs linked to indirect activities (Echanove, 2008; Bravo *et al*., 2009; Torres, 2009; FAOSTAT, 2016).

However, the success of the Mexican avocado export sector is at risk, as the advantages of the North American Free Trade Agreement (NAFTA) are disappearing, due to the US firm of free trade agreements with other countries with more competitive labor and legal conditions than the Mexican one (Gómez, 2006; Moreno-Ocampo *et al*., 2015) and the recent authorization of Colombian avocado to the US. This has forced producers to improve their competitiveness, be efficient, control their production costs and adapt to market demands. To achieve this, they have made changes in their infrastructure and the adoption of new technologies to optimize production processes, resulting in an increase in their production costs (Calo and Méndez, 2004; Bifani, 2007).

Cost accounting provides data to monitor the activities of a company, provide the necessary support to achieve goals and is an aid in making corrective decisions, and helps maintain or increase profits. The basic elements of these costs are direct raw material, labor and indirect costs of production, such as equipment rental, irrigation water quota, depreciation of machinery and equipment, among others (Chacón *et al.*, 2006; Burbano, 2008; Molina, 2009). The objective of this study was to estimate the costs, profitability and competitiveness of three representative units of avocado production, located in the state of Michoacán, two for export and one oriented to the national market, to provide information that allows decision makers to increase the economic efficiency of the production units and maintain the presence of Michoacán avocado in international markets.

## Materials and methods

The present investigation was carried out from August to November 2014 in the municipality of Periban, which occupies the fourth place in production volume in Michoacán, with 136 158 t reported in 2013, with a planted area of 12 403 hectares (ha) and an average yield of 11 t $ha^{-1}$ (SIAP, 2016).

The estimation of production costs was made by means of the theoretical bases proposed by the American Association of Agricultural Economics (United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), 2000), adjusted to be applied in agricultural activities in Mexico by Sagarnaga *et al*. (2010); Sagarnaga and Salas (2014). The economic costs were considered as the total costs (cash and non-cash) necessary for the operation of the garden, as well as the opportunity costs of the factors used in production (land, labor and capital).

The financial cost was considered as the total of the charges attributed to all the resources, except the own funds and the farmer, as well as to the family workforce and the business management. The cash flow was the real sum in money that a company receives or pays for operating expenses in a specific period and includes all cash expenses, in addition to the payment of capital and interest on short-term debt (Sagarnaga *et al*., 2010; United States Departament of Agriculture-Economic Research Service (USDA-ERS), 2012; Sagarnaga and Salas, 2014).

The analysis of profitability was made based on the matrix of policy analysis (MAP), proposed by Monke & Pearson (1989), which estimates the effects of government policy on the private profitability of production systems and on efficiency in the use of resources (Salcedo, 2007; Yercan and Isikli, 2009; Morales-Hernández *et al*., 2011; Briones, 2014). The following indicators were used:

Private extraordinary income (D). It is the net private gain or benefit that the producer obtains after paying the total production costs (commercial, indirectly commercial, and production factors). It is equal to the difference between private income (A), minus the cost of tradable and indirectly tradable inputs (B) and internal factors of production (C). This is estimated based on private or market prices; that is, the income and costs faced by the producer.

$$D= A-B- C$$

Private profitability ratio (RRP). According to Morales-Hernández *et al*. (2011), this indicator represents the level of extraordinary gain obtained by the producer as a proportion of the total costs; it is the relationship between private profit and total production costs. For its determination, the following formula is used:

$$RRP= \frac{D}{B+C}$$

Value added to private prices (VAP). It is the amount expressed in monetary terms that remains as net income after liquidating the cost of marketable and indirectly tradable inputs (B), without considering the cost of the internal factors of production (C). The added value is the net income that is available to compensate the internal factors used in production and is obtained as follows:

$$VAP= A-B$$

Private cost ratio (RCP). This indicator allows to compare the private cost of the production factors against the added value generated at market prices by the productive activity. The result indicates whether the technology is competitive (capable of generating profits) in the economic environment in which it is applied (result less than 1).

$$RCP= \frac{C}{A-B}$$

Intermediate consumption in total income (CIIT). It represents the fraction of the total income generated by the activity that is destined to the acquisition of the necessary inputs for the production generated by other sectors of the local, regional, national or international economy; it is also called Intermediate consumption of the activity.

$$CIIT= \frac{B}{A}$$

Value added in total income (VAIT). It indicates the fraction of the total income generated by the activity that remains available after covering production costs to remunerate the internal factors of production, as well as the extraordinary profit of the producer.

$$VAIT= \frac{A-B}{A}$$

**Technique of panels and representative production units (URP)**

The panel technique consists of bringing together a group of producers through a non-probabilistic sampling of expert selection (Pimienta, 2000). They chose producers of the same production system, same technological level, similar scale, with knowledge and information on technical parameters and production costs, recognized as opinion leaders, to participate in the panels. With the help of an expert facilitator, staff of the Local Board of Plant Health of the municipality of Periban, the three most common URP producers of avocado in the region were defined. A URP is a model company not necessarily in existence, which as an abstract construction is used to illustrate the operations of a market as a whole (Robbins, 1928).

The panels of producers are an adaptation of the "Delphi" technique, used with the purpose of obtaining reliable and consensual answers from a group of "experts" (Dalkey and Helmer, 1962), who represent the relevant population to study (Domínguez-Torreiro and Gómez-Rodríguez, 2013). Being a study of income and production costs, the results lack statistical significance;

however, they are indicative of the economic and financial situation of companies with characteristics similar to the URPs analyzed, located in the area under study. This methodology was the most appropriate due to the limited resources available to carry out the research (Pimienta, 2000; Sagarnaga and Salas, 2014).

### Process

The study was developed in three stages. In the first, the URPs to be analyzed were identified. In the second, panels with at least three producers were organized by URP, in which detailed information was gathered through a consensus process of technical production coefficients, prices of products and inputs, as well as production levels and with them were determined revenues, costs and transfers of the URPs, corresponding to the 2013 agricultural year. In the third, the information was processed to generate the financial statements of the year of study, later panels were held for the second time to present the results to the producers and validate them (Zavala-Pineda *et al.*, 2012; Salas *et al.*, 2013

## Results and discussion

### Description of the URPs included in the study

Three URPs were analyzed, each one representing a production unit characteristic of a particular scale and production system. Its characteristics are the following: MCAGMN03, MCAGEX20 and MCAGEX40, where MC refers to the state of Michoacán, AG to avocado cultivation, MN or EX as the case may be, it refers to the destination of the production, whether national or export market and numbers represent the area of the URP expressed in hectares.

### Characteristics of the URP

Modeled URPs are of low, medium and large scale, with high technological level, characterized in general by the use of chemical and organic fertilization, application of pesticides, training pruning and sanitation. The URAG MCAGMN03 and MCAGEX40 have a pressurized irrigation system. The water regime of the URP MCAGEX20 is temporary. The above indicates that there are differences in the production conditions between the selected URPs. This coincides with Anaya and Burgos (2015), which indicate that there are different ways to produce avocado in Michoacán, from small (<5 ha), medium (5-10 ha) and large (> 10 ha) producers; plantations young (< 20 years), mature (20-30 years old) and advanced (> 30 years old), density of low plantation (100 trees $ha^{-1}$), medium (100-150 trees $ha^{-1}$) and high (> 150) trees $ha^{-1}$), conventional, organic or mixed management, rainwater regime, low efficiency irrigation and technified irrigation, scarce, moderate or complete equipment level.

The age of the plantation in the URP MCAGMN03 is 5 years, in the MCAGEX20 it is 30 and 40 for the MCAGEX40. The density of plantation per hectare is 366 trees in the URAG MCAGMN03, 115 in MCAGEX20 and 100 in MCAGEX40. The high density of plantation in the URP MCAGMN03, is due to the new production techniques, based on the establishment of new improved varieties such as the Hass-Méndez. The MCAGEX20 and MCAGEX40 URPs have all

Hass conventional variety trees. This coincides with that reported by Institutional Trusts in Relation to Agriculture (FIRA, 2007), where it indicates that high planting densities are observed in orchards under 10 years.

## Yield per hectare

The URAG MCAGMN03, presented the lowest yield in the order of 11 t $ha^{-1}$, in comparison with those of 25 t $ha^{-1}$ in the MCAGEX20 and 21 t $ha^{-1}$ in the MCAGEX40. These are located within what was reported by FIRA (2007), which reports yields of 7 to 30 t $ha^{-1}$ in Michoacán. It is important to mention that the yields obtained by the three URPs were higher than the state average reported by the SIAP (2016), which was 10.59 t $ha^{-1}$ in 2013.

The destination of 100% of the production in the URP MCAGMN03 is the national market. The URAG MCAGEX20 and MCAGEX40 send 80 and 90% of their production to the United States of America and only receive income from the sale of this proportion of production. The remaining 20 and 10% corresponds to fruit that does not meet export quality standards. The commercialization, harvesting and packaging of the fruit in the three URPs is carried out through local intermediaries or packers, of which some producers are partners. The superior yields in the MCAGEX20 and MCAGEX40 URPs are explained by the efficient use of production factors, mainly fertilizers and pesticides; likewise, in the MCAGMN03, production has not yet been stabilized due to the short age of the plantation.

## Production costs per hectare

The main component of the variable costs for the three URPs, excluding land, were the pesticides, which represented 31.6% of the total costs in the URAG MCAGMN03, 50% in the MCAGEX20 and 40.8% in MCAGEX40. Fertilizers was the second most important concept within the variable costs, which represented 17.7% in the URAG MCAGMN03, 18.6% in the MCAGEX20 and 15.1% in MCAGEX40. Labor represented 9.7% of the total cost of the crop in the URAG MCAGMN03, 8.3% in the MCAGEX20 and 6.2% in MCAGEX40 (Table 1).

The cost of fuels and lubricants presented a similar percentage in the URAGs MCAGMN03 and MCAGEX20 (6.2 and 5.8%), in the MCAGEX40 it was higher (7.6%), due to the greater use of agricultural machinery in the cultivation work. According to Anaya and Burgos (2015), there is a positive relationship between the consumption of fossil energy in agronomic operations and the yield in avocado orchards. Likewise, they indicate that 54.4% of the fossil energy consumed is used in fertilization, 39.9% in pest control, 5.6% for herb control and 0.2% for irrigation. The main component of the fixed costs was the depreciation of vehicles, machinery, tools and facilities, which represented 16.9% of the total cost in the URAG MCAGMN03, 9.4% in the MCAGEX20 and 19% in MCAGEX40 (Table 1).

Variable costs, with respect to total cost without considering land, represented 71.9% in the URAG MCAGMN03, 86.3% in the MCAGEX20 and 71.1% in MCAGEX40. When including the cost of land, the variable costs represented 47.1% in the URAG MCAGMN03, 41.8% in the MCAGEX20 and 40.4% of the total cost in MCAGEX40. The fixed cost per hectare including land, represented 52.9% in the URAG MCAGMN03, 58.2% in the MCAGEX20 and 59.6% in MCAGEX40.

Land rent represented 34.6% in the URAG MCAGMN03, 51.6% in the MCAGEX20 and 43.1% in MCAGEX40 (Table 1), which is close to that indicated by FIRA (2007), which indicates that land rent represents 49% of the total cost in production units under rainfed conditions and 54% for irrigation and in general reports costs of $83 728 ha$^{-1}$ under rainfed conditions and $108 071 ha$^{-1}$ under irrigation conditions including land.

**Table 1. Breakdown of production costs per hectare of avocado in URP in Michoacán, Mexico, 2013.**

| Concept | MCAGMN03 ($ ha$^{-1}$) | | MCAGEX20 ($ ha$^{-1}$) | | MCAGEX40 ($ ha$^{-1}$) | |
|---|---|---|---|---|---|---|
| | ET[1] | IT[2] | ET | IT | ET | IT |
| | | | Variable costs | | | |
| Fertilizers | 12 272.7 | 12 272.7 | 10 482.8 | 10 482.8 | 9 975 | 9 975 |
| Pesticides | 21 961 | 21 961 | 28 126 | 28 126 | 26 891 | 26 891 |
| Fuels and lubricants | 4 280 | 4 280 | 3 234 | 3 234 | 5 041.7 | 5 041.7 |
| Replacement of tools | 2 333.3 | 2 333.3 | 650 | 650 | 375 | 375 |
| Maintenance of facilities | 2 333.3 | 2 333.3 | 1 399.2 | 1 399.2 | 499.8 | 499.8 |
| Contracted labor | 6 700 | 6 700 | 4 650 | 4 650 | 4 080 | 4 080 |
| Total, variable costs | 49 880.3 | 4 880.3 | 48 542 | 48 542 | 46 861.5 | 46 861.5 |
| | | | Fixed costs | | | |
| Depreciation | 11 731.2 | 11,731.2 | 5,300.2 | 5,300.2 | 12,546.2 | 12,546.2 |
| Insurance | 3 000 | 3 000 | 900 | 900 | 925 | 925 |
| Taxes | 166.7 | 166.7 | 50 | 50 | 25 | 25 |
| Services pay | 4 566.7 | 4 566.7 | 1 428.7 | 1 428.7 | 5 571.5 | 5 571.5 |
| Income from land | 0 | 36 667 | 0 | 60 000 | 0 | 50 000 |
| Total, fixed costs | 19 464.6 | 56 131.2 | 7 678.9 | 67 678.9 | 19 068 | 69 067.7 |
| Total | 69344.9 | 106011.5 | 56220.9 | 116220.9 | 65929.2 | 115929.2 |

[1]ET= excluding land; [2] IT= including land. Source: elaboration based on field information.

## Production costs, sale price and net profit per ton of avocado

The cost of production per ton of avocado, excluding land in the URP MCAGMN03, was 6 304.1 $ t$^{-1}$ and was 80.7% higher than the cost obtained by the MCAGEX40 and 124.3% higher than the cost shown by the MCAGEX20. The cost of production per ton obtained by URP MCAGEX20, whose water regime is temporary, was the lowest of the three. The price per ton of avocado at the foot of the average garden, which received the URAGs MCAGEX20 and MCAGEX40 for the year of study (2013), was $4 000 t$^{-1}$ higher, compared to the price received by the MCAGMN03, which sold its production in the national market (Table 2).

**Table 2. Production costs, sale price and net profit per ton of avocado in URP in Michoacán, México, 2013.**

| Concept | Production costs ($ t$^{-1}$) | | Sale price ($ t$^{-1}$) | | Net income ($ t$^{-1}$) | |
|---|---|---|---|---|---|---|
| | ET | IT | ET | IT | ET | IT |
| MCAGMN03 | 6 304.1 | 9 637.4 | 11 000 | 11 000 | 4 695.9 | 1 362.6 |
| MCAGEX20 | 2 811 | 5 811 | 15 000 | 15 000 | 12 189 | 9 189 |
| MCAGEX40 | 3 488.3 | 6 133.8 | 15 000 | 15 000 | 11 511.7 | 8 866.2 |

Source: elaboration based on field information.

Regarding the net profit excluding land, it was observed that the URAGs MCAGEX20 and MCAGEX40 obtained similar gains, unlike the MCAGMN03, which registered a lower profit in $7 493.10 $t^{-1}$ with respect to the URP MCAGEX20 and $6 815.80 $t^{-1}$ less compared to the MCAGEX40, which indicates greater efficiency in the use of production factors, together with the price difference received by the URAG MCAGEX20 and MCAGEX40.

The net gain observed when including the cost of land rent was $9 189 $t^{-1}$ in the URAG MCAGEX20, which was $322.80 $t^{-1}$ higher than the MCAGEX40, a situation contrary to that shown by the MCAGMN03, whose net profit was $7 503.60 $t^{-1}$ lower, compared with the MCAGEX40 (Table 2). This differs from that pointed out by Cruz *et al*. (2014), who indicate that in traditional coffee-plantain-citrus agroforestry systems in Tlapacoyan, Veracruz, the smaller the surface of the production units, the greater the productivity obtained.

The highest values of net profit in the MCAGEX20 and MCAGEX40 URPs, which comply with the quality and safety standards of the US market, are explained by their lower production costs and higher sales prices, in comparison with the MCAGMN03. This coincides with Maldonado *et al*. (2005), who assure that, the benefits of the implementation of the system of analysis of hazards and critical control points (HACCP) in meat processing plants of federal inspection type (TIF) in Mexico, are: increase in sales of the product, the company's ability to retain existing customers, increase the ability to attract new customers, increase prices and reduce production costs.

**Extra income (D)**

The three URPs obtain positive extraordinary gain. Excluding the cost of land, the URP MCAGEX20 obtained the highest profitability, followed by the MCAGEX40 and finally the MCAGMN03. By including the cost of land, a reduction in the profitability of the three URPs was observed (Table 3). This coincides with Leos *et al*. (2010), who found that, before including land rent, six of seven bread wheat production technologies evaluated at the national level are profitable and, when the cost of rent is included, only three of the seven technologies are profitable.

**Private profitability ratio (RRP)**

It was observed that the URAG MCAGEX20 presented the highest RRP, followed by the MCAGEX40 and finally the MCAGMN03 (Table 3). This coincides with Morales-Hernández *et al*. (2011), who indicate that medium and large potato producers in the State of Mexico obtained higher values of RRP, compared with small producers, as a result of an efficient use of production factors.

**Private cost ratio (RCP)**

The three URPs presented positive CPR, all values were greater than zero, indicating that the three URPs were competitive and receive extraordinary gains. When excluding land, the RCP in the MCAGEX40 was 0.1, in the MCAGEX20 0.05 and in the MCAGMN03 of 0.36, which indicates that the first two URPs were more competitive and with greater private efficiency than the last URP (Table 3).

**Intermediate consumption in total income (CIIT)**

The CIIT in the URAG MCAGEX40 was 15%, for the MCAGEX20 14.2% and in the MCAGMN03 of 33.8%; according to Morales-Hernández *et al*. (2011), these values indicate the fraction of income generated by this sector that goes to the rest of the economy for the acquisition of goods and inputs mainly; in relative terms, MCAGMN03 is the one that generates the most dynamism to the economy of the region (Table 3).

**Table 3. Summary of the budget at private or market prices per hectare of avocado in URP in Michoacán, Mexico, 2013.**

| Variable | MCAGMN03 | | MCAGEX20 | | MCAGEX40 | |
|---|---|---|---|---|---|---|
| | ET | IT | ET | IT | ET | IT |
| A ($ ha$^{-1}$) | 121 000 | 121 000 | 300 000 | 300 000 | 283 000 | 283 000 |
| B ($ ha$^{-1}$) | 40 847 | 40 847 | 42 492.8 | 42 492.8 | 42 281.7 | 42 281.7 |
| C ($ ha$^{-1}$) | 28 497.9 | 65 164.5 | 13 728.1 | 73 728.1 | 23 647.4 | 73 647.4 |
| D ($ ha$^{-1}$) | 51 655.1 | 14 988.5 | 243 779.1 | 183 779.1 | 217 570.8 | 167 570.8 |
| RRP (%) | 74.5 | 14.1 | 433.6 | 158.1 | 330 | 144.5 |
| RCP | 0.36 | 0.81 | 0.05 | 0.29 | 0.10 | 0.31 |
| VAP ($ ha$^{-1}$) | 80 153 | 80 153 | 257 507.2 | 257 507.2 | 241 218.3 | 241 218.3 |
| CIIT (%) | 33.8 | 33.8 | 14.2 | 14.2 | 15 | 15 |
| VAIT (%) | 66.2 | 66.2 | 86 | 86 | 85 | 85 |

Source: elaboration based on field information.

**Value added in total income (VAIT)**

The VAIT in the URAG MCAGEX40 was 85%, in the MCAGEX20 86% and in MCAGMN03 it was 66.2%; These values indicate that avocado production is an important source of agricultural PIB growth in the region, since a very important fraction of the income of the three URPs is used to remunerate the factors of production and as an extraordinary gain for the producer (Table 3).

## Target sale prices

In the Table 4 shows the sale prices per kilogram (kg) of avocado, required to meet different objectives.

The URP MCAGMN03 presented the highest sale price required to obtain private profit, including return to risk. The sale price required to obtain profits in the URAG MCAGEX20 and MCAGEX40, is lower in \$13.83 $kg^{-1}$ and \$13.11 $kg^{-1}$ with respect to URP MCAGMN03. It was observed that the smaller the URP, the economic cost tends to increase; however, in the MCAGEX40 this cost was higher than that obtained by the MCAGEX20, due to the decrease in performance. The above, coincides with Vargas-Canales *et al*. (2015), who indicate that the smaller the unit of production in rubber cultivation, the economic cost tends to increase.

**Table 4. Target sale prices, to obtain gains in the URPs analyzed in Michoacán, Mexico, 2013.**

| Prices per kilogram required for: | MCAGEX40 | MCAGEX20 | MCAGMN03 |
|---|---|---|---|
| Earn profits including return to risk | >11.56 | >10.84 | >24.67 |
| Earn profits including return on capital invested and cover all costs. | 11.56 | 10.84 | 24.67 |
| Cover all obligations in cash, including fixed and variable costs, payments to principal, and withdrawals from the producer. | 4.09 | 4.11 | 9.6 |
| Cover all fixed and variable costs (disbursed and not disbursed), producer/family labor, business management, and "0" recovery of depreciation, capital and risk. | 4.88 | 5.61 | 14.12 |
| Cover fixed and variable disbursed costs, producer/family labor, business management and "0" recovery of depreciation, capital and risk. | 2.54 | 2.04 | 5.24 |
| Cover only variable costs disbursements (it should not occur if the market price is lower than this price). | 2.23 | 1.94 | 4.53 |
| Current sale price | 15 | 15 | 11 |

Source: elaboration based on field information.

## Balance prices

The results indicate that the MCAGMN03 does not obtain economic gains, it only covers its production costs. The MCAGEX20 and MCAGEX40, when receiving a higher price at the economic equilibrium price, obtain economic gains (Table 5). According to Leos-Rodríguez *et al*. (2005), a 10% increase in the price of Mexican avocado increases the 3% offer to the United States of America.

**Table 5. Equilibrium prices of the URPs analyzed in Michoacán, Mexico, 2013.**

| Type of producer | Balance price ($ kg$^{-1}$) | | |
|---|---|---|---|
| | Economic | Financial | Cash flow |
| MCAGMN03 | 24.67 | 6.3 | 9.6 |
| MCAGEX20 | 10.84 | 2.81 | 4.11 |
| MCAGEX40 | 11.56 | 3.49 | 4.09 |

Source: elaboration based on field information.

On the other hand, FIRA (2007) indicates that avocado producers in Michoacán are able to support a 23% reduction in the sale price for the case of rainfed and 25% in irrigation conditions.

## Conclusions

In 2013, the production of avocado in the municipality of Periban, Michoacán, was a profitable activity due to favorable movements in the rural average prices and the export market. The production of avocado with export quality, under sanitary and innocuous standards is highly competitive, due to the increase in yields, optimization in the use of production factors and the higher sale price.

The cost estimate confirmed the high proportion saved by the variable costs, which are mostly made up of pesticides and fertilizers. Of the three URPs analyzed, only the MCAGEX20 and MCAGEX40 sell at a price higher than the economic equilibrium price and use production factors with greater efficiency, which guarantees their permanence in the long term. The permanence of URP MCAGMN03 is guaranteed only in the medium term, since it receives a sale price lower than the economic equilibrium price but higher than the financial one.

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