

Mango marketing chains and export potential in Costa Grande, Guerrero

María Xochitl Astudillo-Miller
Rayma Ileri Maldonado-Astudillo[§]
Héctor Ramón Segura-Pacheco
Yan Pallac Maldonado

¹Universidad Autónoma de Guerrero. Calle Pino s/n, Col. El Roble, Acapulco, Guerrero, México. CP. 39650. Tel. 744 4877740. (xmiller@uagro.mx; hsegurapa@gmail.com; yanpallac@hotmail.com).

[§]Corresponding author: rimaldonado@uagro.mx.

Abstract

The state of Guerrero is the first mango producer in Mexico. However, it occupies the last place in export. The objective of the present work was to analyze the mango marketing chains and the export potential in the Costa Grande Region. The methodology was exploratory and descriptive in nature with a mixed qualitative-quantitative approach; through a sequential exploratory design in two stages. In August 2016-March 2017, semi-structured interviews were conducted with key actors of the mango product system in Guerrero and a structured questionnaire was applied to 84 mango producers from six municipalities in the region. The information was analyzed with SPSS version 23 and Atlas.ti version 6 softwares. The results showed that the producers have not been able to specify an efficient commercialization of mango because of different internal and external factors such as disorganization, hoarding and lack of industrialization, problems of pests and crop diseases, access to sources of financing, among others. In addition, all respondents showed interest in export issues, but only four have the necessary standards for that purpose. The identification of the main characteristics of the producers and their production systems, as well as the understanding of the mango marketing chain in the region will provide knowledge to integrate the mango product system in a more efficient and effective way.

Keywords: controls and records, export standards, production unit.

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Introduction

Mango (*Mangifera indica* L.) is one of the most important agricultural products worldwide (National Mango Board, 2017). Mexico is the fifth largest producer in planted area and production, with 1.91 million tons, 7.6% higher than the previous year, which represented a record historical volume for this fruit (SIAP, 2017).

In the United States of America, the main importer of Mexican mango, six out of 10 mangoes consumed are produced in Mexico (Infante *et al.*, 2011). Nationally, Guerrero occupies the first place in mango production with an estimated 364 thousand tons and a value of 1 526 million pesos (SAGARPA, 2018); however, it also occupies the last place in export, with only 1% of national production (SENASICA, 2016). The Costa Grande region of the state of Guerrero produces 68% of the state mango (SIAP, 2016), whose main varieties are Ataulfo, Creole, Haden, Kent and Tommy Atkins, with a total area of 15 278.91 ha.

Mango is grown in seven of the eight municipalities in the region, being Tecpan de Galeana the main producer, as well as the only exporter with 15 registered orchards (SENASICA, 2016). Mango is produced practically all year round due to favorable climatic conditions in the region, which allows exporting during periods of high demand and having a presence during periods of low production.

With a good quality product (SAGARPA, 2018); hence the importance of promoting its cultivation and providing options for its industrialization and export, since in 2015 little more than 30% of the 370 thousand tons that were obtained was wasted (President of the Mango Product System; Radilla, D. Com Pers., 2016). The objective of the research was to analyze mango marketing chains and export potential in the Costa Grande Region of Guerrero.

Materials and methods

The research was exploratory and descriptive in nature with a mixed approach, predominantly quantitative and with a sequential or two-stage exploratory design (Creswell, 2014; Hernandez Sampieri *et al.*, 2014). In the first stage qualitative data were collected and analyzed; in the second, quantitative data were collected and evaluated.

The mixed mix is methodologically robust when the initial qualitative results inform and suggest new topics to explore by collecting quantitative information. Finally, the findings of both stages are integrated into the interpretation and writing of results (Creswell, 2014) with the purpose of deepening the information by using the qualitative results to assist in the interpretation of the initial findings obtained with the quantitative approach. The study was conducted during the period August 2016-March 2017.

The qualitative stage consisted of the application of semi-structured interviews and the realization of group dynamics. Eleven key actors were interviewed: the president of the National Council of the Mango Product System, AC, the manager of the State Council of Mango de Guerrero, as well as the nine main producers in the region, for their volume of production and experience in the sector.

This allowed to guide the interviewees' discourse based on arguments of greater interest for the study, such as the account of the links of the marketing chains, their experiences and perceptions about the situation of mango production and commercialization. The interviews were recorded in audio prior authorization of the interviewees and then transcribed to analyze their content from the qualitative perspective (Denzin and Lincoln, 2018).

For the group dynamics, two participatory workshops were held based in the cities of Atoyac de Alvarez and Petatlan, where a total of 56 producers were gathered in order to obtain relevant information, as well as incorporate all the considerations and recommendations that the informants defined as important to characterize the marketing chain and the export potential of mango in the region. The information was analyzed in the Atlas.ti version 6 software.

For the quantitative stage, considering the poor accessibility to the population due to the geographical location and dispersion of the producers, the sample was intentional, consisting of 84 producers: 12 from the municipality of La Unión de Isidoro Montes de Oca, 18 from Tecpan de Galeana, 31 from Petatlan, 11 from Atoyac de Álvarez, 2 from Benito Juárez and 10 from Coyuca de Benítez; from a total of 5 398 producers registered in the Mango State Council in Guerrero, AC within the region considered (Radilla, D. Com. Pers., 2016).

The questionnaire was divided into five sections with multiple, dichotomous and open answers, previously submitted to the trial of six experts: four academics from the areas of biotechnology, agricultural sciences and administration, a certified consultant in food safety and the president of the National Council of Mango Product System, AC. In addition, pilot tests were conducted with multiple questions to assess the clarity of the concepts used in the study and detail the final instrument. The information was captured and analyzed with the IBM SPSS v. 23. software.

Results and discussion

Characteristics of the production units within the marketing chain. Small land ownership is predominant, since 97.3% of producers work and produce their own garden, the rest are tenants. The average age of the orchards is 19 years, with 5.6 hectares planted, 444 trees and a yield of 16.37 t ha⁻¹. 85.1% of the producers manage the garden in a single unit, whose main irrigation systems were: pumping, hose, temporary, with sprinkler, rehilete, cajete, micro sprinkler 52.7% of the producers use leased machinery, while 36.5% own machinery (tractor, trailer, van, pump, pruning machine, agrochemical sprinkler).

For the production process, 93.3% use some type of machinery, 63.5% use it for the harvest. The estimated annual production (SAP) was 19 334 t; of which 12% was lost as part of the production decline (Table 1).

Of the Manila and Ataulfo cultivated varieties, the municipality of Tecpan registered the highest levels of production (267 and 124 t, respectively), while the Kent mango showed Petatlan with 100 t. Tecpan registered the largest production losses, with 91% (243 t) of Manila mango and 61% (75.6 t) of Ataulfo, followed by the municipality of La Unión, with 35% (1.75 t) of Manila mango.

The main causes of the reduction in mango production are pests, the most serious of which is the *Anastrepha ludens* fruit fly (Carrillo *et al.*, 2017), which affects 57.9% of the orchards, also, the diseases such as anthracnose, rust and stain, which affect 19.3% of the orchards. The municipalities most affected by these phytosanitary problems are Tecpan and Petatlan.

Table 1. SAP and production losses.

Cultivate	SAP (T) average	Declines in production (%)
Manila	8 639	33.5
Ataulfo	5 434	24.7
Kent	3 040	0.34
Tommy Atkins	1 286	4.1
Haden	900	9.53
Creole	35	0

The average yield that was found was 16 t ha⁻¹ and 536 ha boxes, higher than the 14.35 t ha⁻¹ registered by the National Master Plan of the Mango Product System (CONASPROMANGO, 2012). 80.6% of the production is oriented to the sale through intermediary (Petatlan 94.9% and Atoyac de Álvarez 81.4%), direct sale to the consumer represented 17.5% and the rest is destined for self-consumption. The main destination of the fruit is the local collector (70.3%), followed by the local market, fruit processors or outlets (21.6%) and the packers (8.1%).

As for the contracted workforce, each producer generates two direct and 13 temporary jobs in production, 95% are paid by wages; the rest is technical staff and professionals. According to the schooling of the manager of the garden, 45.9% have primary school, 22.9% high school, 5.4% high school and 14.9% without studies. These levels of schooling are similar to those that occur among mango producers in India, the main producing country, for example, where a high correlation was found between this variable and low business capacity (Baria *et al.*, 2012).

63.6% had access to loans granted by packers, 6.8% received government support, 4.5% from commercial banks and 25% said they had not received credit support. In relation to certifications and standards for export, only one producer has good practices in pollution risk reduction systems (SRRC), without specifying validity or auditor.

35.9% make logbooks for the use of agrochemicals; 28.1%, work logs; 21.9% perform physicochemical analyzes (water/soil), 4.7% follow standardized sanitization processes (POES), 4.7% perform microbiological analyzes (contact surface); and 4.7% make traceability records in their orchards, of which 41.4% keep their records per cycle. No producer said it had operating manuals. Only one respondent exports to the United States of America and Canada but does so through a local collector.

The main reasons that were pointed out for not exporting were: ignorance of what they have to do to export, they do not meet the requirements, lack of government support that encourages them, as well as lack of advice. However, all producers expressed interest in exporting. 68% do not know the potential markets to export their product.

Only eight producers indicated knowing the procedures and requirements to export, such as phytosanitary certifications, SAGARPA certificates, safety certificates and garden regulations. Despite the great economic and social importance of mango production in the study region, the main producer in Guerrero, the export has a marginal role and has not received the momentum that the producers would like to have.

There are countries with less development than Mexico and where mango is also produced, such as Burkina Faso, Mali and Ivory Coast -ranked among the poorest in Africa- where there is a significant number of producers that not only export fresh mango and dehydrated mainly to the European Union, but a proportion commercialize it with organic and fair trade certification towards special markets (Van der Waal and Zongo, 2011; Vayssieres *et al.*, 2012; Biard *et al.*, 2018).

Five of the interviewees (two from Tecpan and three from Petatlan) have received guidance, training, advice and technical assistance for export by experts from CONASPROMANGO (National Committee for the Product Handle System). Only two producers of Tecpan said they had links with the National Institute of Forestry and Agricultural Research (INIFAP). In Tecpan, five producers said they had participated in innovation or technological development projects with the National Institute for the Development of Capacities of the Rural Sector (INCA Rural), on issues such as good use and management of agrochemicals (BUMA), child mango and mango industrialization.

The situation described shows that in these municipalities of Guerrero there is a low level of development in production and little access to soft loans and technical assistance for producers. This situation is not exclusive to the Costa Grande region, as it is consistent with what happens in other states in Mexico, such as Chiapas (Mazariegos-Sánchez *et al.*, 2017) and in other important mango producing countries such as China (Zhang *et al.*, 2019). India, the world's leading producer, also has low productivity due to reduced producers' access to technology (Thorat *et al.*, 2012), as is the case in the main mango producing areas of Ethiopia (Chaudhari *et al.*, 2017).

The answers offered in the semi-structured interviews and in the participatory workshops made it possible to contrast the information obtained in the survey, as well as to investigate more complex issues that the quantitative instrument did not include. The use of Atlas.ti software facilitated the discovery of the semantic relations between the elements found in the analysis of the interviews and their connection in a network graph.

Accordingly, it was found that productivity is associated with training, technical assistance, infrastructure, production costs, environmental factors, marketing channels, strategy and technology. Important and necessary elements that were identified by the participants as factors to increase the quality of production are training and technical assistance that allow the adoption of new forms of cultivation, efficient soil management, technology transfer and a business vision.

Producers do not have it because of the shortage of specialized technicians and their insufficient time to meet the needs. On the other hand, the inefficient use of resources and the overdue portfolio in which some producers find themselves due to the lack of financial support, cause a considerable lag that reduces the use of production.

The importance of greater federal government support for the entire chain, especially for primary production, processing and marketing, was noted. In African countries such as Benin, Burkina Faso and Ghana, among others, government intervention for the support of the mango value chain has produced good results (Van Melle and Buschmann, 2013).

The findings of the participatory interviews and workshops are reflected in some of the responses obtained. 'Four to five technicians are sent throughout the state, therefore, specialists are very limited, since many times it is a single technician who is dedicated to intensive training among several producers' (informant 1). Another problem is that they hire you every four or five months and the other months that the producer manages as he can and wants, INIFAP gives training to producers on technology transfer, ranging from 30 to 50 producers.

'It is necessary who replicates the training, because there it stays, another problem is that there are no agronomists, the government does not support, does not hire or does it for a short time when they should be hired for two years of plant' (informant 2). The lack of specialists causes that cultivation techniques, soil management, harvesting and postharvest techniques are inadequate, mainly translated into poorly selected seeds and that will give trees with low yield (Toledo-Manzur *et al.*, 2003).

Inadequate fertilization due to ignorance of soil and crop requirements, inadequate management of irrigation, as well as minimal use of machinery and specialized equipment, finally causing all these factors to affect the efficiency of the production chain and the quality of the fruit. Also, technology is much more than machines; are the resources and procedures that contribute to give value to the mango by industrializing it.

Some producers said they participated in innovation projects or technological development for the industrialization of mango, only two producers dehydrate the fruit, but in an artisanal way; however, the adoption of new technology packages will increase the quality of production, benefiting both producers and their families and the municipality.

'In addition to the ideal technological package, the appropriate infrastructure for the selection, packaging and packaging of the mango that allows access to new national and international markets is necessary. There is a problem here, in the region there is no company to transform the mango or give it an added value as a juicer or a dehydrator, it is very unfortunate that we do not have it, because the mango has to be mobilized towards Querétaro or towards the north, towards juicers, why should we take the raw material to Querétaro, Guanajuato and Sonora that do not produce mango? and why not make one here?, nobody wanted to invest' (informant 1).

Given the economic and social importance of mango production, the construction of value networks is essential to boost industrialization (Sumaya-Martínez *et al.*, 2012; Mmemon *et al.*, 2015).

Productivity is also associated with environmental factors such as hurricanes, which are increasingly intense due to climate change and that sometimes cause roadblocks, floods and landslides (Villaseñor-Franco *et al.*, 2017) in various places in Guerrero and in municipalities of the Costa Grande region, causing transport vehicles to suffer damage due to the poor condition of the roads, and a delay in the transportation of the crop.

In addition to these indirect effects, phenology and mango production are being affected by climate change (Normand *et al.*, 2015; Makhmale *et al.*, 2016). Marketing channels. In relation to the diagnosis of commercialization chains, the main channel is the one that occurs between the producer and the intermediary, which means that most of the benefits are not obtained in primary production, but later in the chain.

Each season, the producer sees how the fruit rots in his orchards, is not sold in its entirety, is used as food for livestock or given away due to lack of market. All this causes that it is in the hands of the hoarders that buy the mango at low cost to later resell it much more expensive in Michoacan, Mexico City, Puebla, State of Mexico, Morelos and Sinaloa; or that the packing and exporting companies of Michoacan sell it as an export product, while the producer is paid at the price of national consumption.

Some producers sell their production on the tree due to the inability to cope with the expenses caused by the harvest, coupled with the climate of insecurity and low prices in the season of maximum fruit production. 'What is harvested is bought by the hoarders, but unfortunately because they offer very low prices to the producer (while they resell our product much more expensive), it is often decided not to sell the mango, since it is not profitable in terms economic and spoils in the tree because it is not invested in its cut, thrown away, used as feed for livestock or even given away' (informant 4).

This commercial abuse by hoarders is associated with the lack of organization of producers, causing low competitiveness and that much of their production is exported via Michoacan without them benefiting. The intermediaries are those who have control both in the distribution, marketing and pricing. Unfortunately, a big problem we have in the state is that we are disorganized, so the hoarder takes advantage of that by having the producer squander his mango (informant 1).

In the plain, there are not producers or owners of packaging who set the prices, but buyers or marketers of the CDMEX, Guanajuato, Michoacán, etc., they are the ones who at the end of the day take the guerrerense mango to give added value or to supply convenience stores or stores like WalMart or Sam's Club. 'Other hoarders buy the crop in advance, leaving out the original producer' (informant 6).

Producers require a business strategy that changes their vision and perspective of the environment and takes advantage of national and international market opportunities. 'There are only a few people who make mango-based products by hand. Lack of support to establish an agribusiness and add value (for example, mango paste, powder, dehydrated, etc.) and thus avoid throwing the product in the orchards. I know that there are many ways in which the mango can be exploited and its shelf life can be increased, we only need help and financial support' (informant 9).

Thus, the strategy is associated with the technological packages adopted, the financing provided by some government support, the lack of public security that has affected Guerrero and the country in the last decade, public policies that involve the agricultural sector, competition (by other producers, integrators, marketers, exporters and packers) and culture.

Culture is an important variable that was associated with resistance to change, it is also associated with the advanced age of the producers, the low schooling of those in charge of the gardens and the limited access to sources of scientific and technological information, among others. Which was still referred to by the producer as a factor that affects the quality of mango in his orchard.

‘This region had very strong income thanks to the mango, but because there were conflicts of interest between various product systems, the rumor circulated that the mango of the Union could cause cancer due to the tar emitted by the Petacalco Thermolectric Power Plant and that it was absorbed when the mango cracked, with that the subsidies went down, nobody bought or wanted mango from that municipality’ (informant 4 in tune with informant 5).

There are different channels for the commercialization of mango, which vary according to the production area, time of year, destination market, variety and type of producer in question, among other factors (EMEX, 2007). Mango marketing chains were characterized as shown in Figure 1. The existing distribution channels are mainly intermediate type (90%).

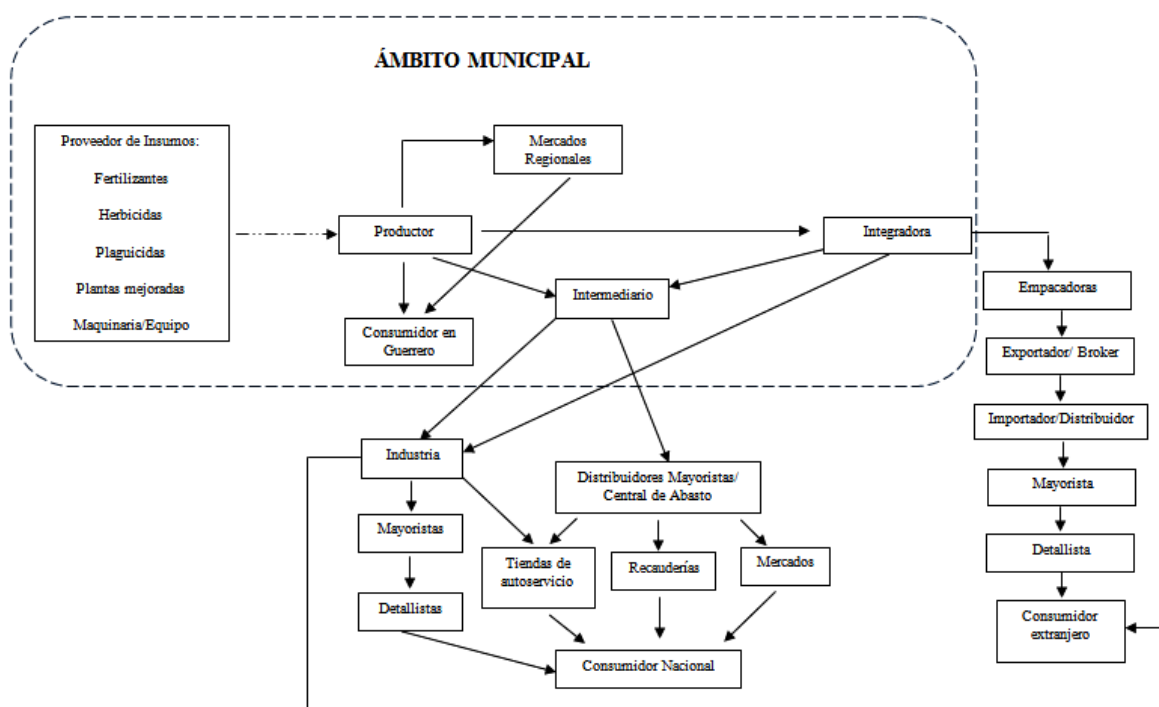


Figure 1. Mango marketing chain.

The links that characterize the region as a whole are: Mango producers: there are 5 398 producers with small (1-10 ha), medium (11-20 ha) or large (greater than 20 ha) orchards with an average surface area of 7.5 ha planted per producer. The orchards are managed as a single unit and mainly with a drip irrigation system.

The average age of the producers is 54 years and the schooling are of basic level, the majority with lack of integration and organization in their productive, economic and commercial activities. Generally low technological level, minimum infrastructure and what is acquired in their orchards is generally with own capital. This characterization is similar to that presented by the mango-producing sector in southwest Ethiopia (Teka *et al.*, 2019).

Intermediaries: they are natural persons mainly from Michoacán, Mexico City, Sinaloa, State of Mexico, Morelos, Guanajuato and Puebla, who buy the production of the orchard by box or rent the orchards of the producers, usually give an advance of 50% and liquidate the rest in a deferred way. They offer very low prices to the producer, while they resell the mango much more expensive in the national markets. They distribute to wholesalers such as convenience stores, membership stores and supply centers.

Suppliers of supplies and services: various actors provide plants of improved varieties, agrochemicals, machinery, equipment, research, technical assistance, financing, inspection services and labor. In the case of agrochemicals for plant nutrition, foliar fertilizers and control of pests and diseases (Malathion, hydrolyzed protein, tribasic copper sulfate, Mancozeb, Benomil, wettable sulfur, ammonium phosphonitrate, diammonium phosphate, potassium chloride, Agromil plus Phyto regulator, Paclobutrazol (PBZ) and potassium nitrate), are acquired mainly locally, in some cases it is the hoarder himself who offers and supplies the supplies needed by the garden.

A strong dependence of the producers on the substances used for the chemical control of pests and diseases was observed. The existence of agroecological practices for the management of phytosanitary problems and cultivation in general is practically null. This is a disadvantage factor compared to organic production or that practiced with the minimum use of agrochemicals (Deguine and Penvern, 2014).

In some cases, machinery and equipment such as chainsaws, hydraulic pumps, hoists, desvaradoras, sprinklers, nebulizers and fumigators are acquired with support from the Mexican federal government, which covers 50% of the purchase through resources delivered to the State Council of Mango Guerrero for the Concurrence program. There are also other federal execution programs administered through SAGARPA, where a 100% purchase subsidy is granted, from a fertilizer package to a backpack sprinkler.

Another example is the PESA program, aimed at fighting poverty (100% subsidy). It provides a technological package consisting of seed, an herbicide, two insecticides, a fungicide, five fertilizer packages and a hand sprinkler. As for labor, these are local day laborers who carry out activities such as land preparation, fertilization, chemical control of pests, cajeteo, pruning and harvesting and who are paid from 120 to 300 Mexican pesos per day.

Integrators: business organization that associates natural or legal persons of micro, small and medium scale, formally constituted in order to sell the production in a consolidated manner, carrying out the packing or transformation of the fruit. They function as collection centers to concentrate high volumes of mango, select it and pack it (or send it to the packers) to allocate it to national and international markets or sell it to supermarket chains.

Balers: they are actors of the chain that condition mango for shipment to export markets or to the national market. Within this link, exported mango packers are attached to the organization EMEX, AC (Empacadoras de Mango de Exportacion AC), which concentrates 65 packagers distributed in Baja California, Campeche, Chiapas, Guerrero, Jalisco, Michoacán, Nayarit, Nuevo León, Oaxaca and Sinaloa. Integradora Costa Grande, SA de CV, located on the Acapulco-Zihuatanejo Highway 146.5 km in Rancho Alegre del Llano, is operating for the US market and in February 2018 exported 12.5 t of Manila mango to Laredo, Texas, thanks to the alliance with two North American companies: Foods Imports and Nueva Era Produce.

Marketers (wholesalers and retailers): they constitute the points of sale to take the product to the national consumer. They can be wholesalers, such as those in the supply centers of Mexico City, which supply greengrocers, grocery stores, etc. Similarly, they can be people who mango small volumes for direct sale to the public, such as self-service stores, supermarkets, groceries, tianguis, public markets and fruit shops.

Final consumer: It is the national and international public that acquires and consumes fresh or processed mango. The scheme described presents similarities with the mango marketing chain that Karyani *et al.* (2016) found in West Java, Indonesia. Few are the producers (5%) that sell mango directly to the final consumer and its scope is only limited at the regional level; 90% use intermediaries to take their product to the national and international market. As Kotler and Armstrong (2016) refer.

It is the members of the distribution channel that are adding value to the handle filling the main gaps of time, place and position. The intermediaries and packers place the product in the places where consumers are located, at the right time and adapting it to their tastes and needs, taking with it most of the economic benefits that the marketing chain brings. In the case of mango, like any other product, properly planning the marketing process with specific goals, objectives and strategies (Galan Saucó, 2004) is a very important step in competitiveness and access to potentially feasible markets.

The situation of the mango product system in the Costa Grande region is similar to what Mali had in Africa before the introduction of innovations and the strong governmental impulse to the sector, which resulted in the design of export diversification policies for high value products, within which mango occupies a prominent role (Sangho *et al.*, 2011).

Technical assistance and timely access to sources of financing are essential to boost exports in the region, working on achievable goals. First, on basic issues such as integrated crop management, control and record management, it would be desirable for them to have the SRRC (Reduced Risks and Contaminants System) and BUMA (Best Use and Handling of Agrochemicals) certifications (Mayett-Moreno and López-Oglesby, 2018).

Thus, producers may be trained in the administrative procedures necessary to increase the yield in the orchards and stop the attack of pests and diseases and thereby achieve in the medium term the planning, capacity, tools and instruments required by the international market.

In Guerrero, and especially in the Costa Grande region, there are good producers who, despite not having a high educational level, have the practical experience of the field (average of 16 years) and cultivate the most accepted mango varieties nationwide and international (Ataulfo, Manila, Tommy Atkins and Haden).

But, during all those years, the producer has continued to carry out his activities with practices that even passed from generation to generation, dragging problems of lack of innovation. The low technology transfer and the lack of incorporation of new knowledge translate into low competitiveness and productivity, which does not allow producers to aspire to add value to production to direct it towards the correct primary and post-harvest handling of mango, as well as administrative and organizational aspects, including existing quality certifications (Ruiz-Diaz and Muñoz-Rodríguez, 2016).

Effectiveness determines obtaining a competitive advantage and being able to make better decisions (Velázquez-Velázquez, 2012). Producers need to develop those competitive advantages that allow them to reach national and international consumers efficiently to position themselves in the market.

Conclusions

The marketing channels were characterized by an intermediary market (90%), which means that most of the benefits are not obtained in primary production, but in the commercialization process. The intermediaries are the ones who have control over both the distribution and the pricing. The factors that limit the commercialization of mango and that have diminished the productive, commercial, organizational and financial capacity of the producers in the region are the technological lag, the lack of organization, debt problems (past due portfolio), the lack of infrastructure for Improve shelf life and product quality.

Also, the lack of training and technical assistance, the lack of programs that support production, standards and standards of fruit quality and available information (research, marketing and technology). In the case of export, despite the productive potential and the high quality of the product, the main weakness is the lack of knowledge of markets to export, the lack of advice on procedures and requirements for export, the lack of certification and health safety standards, poor access to technology packages, advanced age of producers and limited capital to invest.

Tecpan de Galeana is one of the few municipalities in the state that export mango to other countries because of the experience that producers have. However, the lack of integration of their productive, economic and commercial activities prevents them from adding value to their production, having greater control over it and obtaining economic gains as a result of having better product marketing conditions. Thus, producers in the region are marketing mango derivatives only in local, regional and national markets.

It is necessary to design a strategy that promotes the commercialization, transformation and export of the product, increase productivity in the gardens, increase competitiveness and boost the development of economic activity. For this, it is important to promote entrepreneurship among producers in the region.

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