



<http://dx.doi.org/10.5154/r.ctas.2021.08.03a>

English version

Social, production and economic characterization of dried green pepper production in the micro-region of El Oro, Durango, Mexico

Jorge Luis Chavez-Barraza^{1,2}; Enrique Genaro Martínez-González^{1,*}; Jorge Aguilar-Ávila¹; Norman Aguilar-Gallegos¹; Leticia Myriam Sagarnaga-Villegas^{1,3}

¹Centro de Investigaciones Económicas, Sociales y Tecnológicas de la Agroindustria y la Agricultura Mundial (CIESTAAM), Universidad Autónoma Chapingo (UACH), Carretera México Texcoco km 38.5, Chapingo, Texcoco, Estado de México, C.P. 56230, México.

²Instituto Tecnológico Superior de Santa María de El Oro, Carretera a San Bernardo km 2, Fraccionamiento Puerto Pinto, Santa María del Oro, Durango, C.P. 35697, México.

³Departamento de Zootecnia. Universidad Autónoma Chapingo (UACH), Carretera México Texcoco km 38.5, Chapingo, Texcoco, Estado de México, C.P. 56230, México.

Article history:

Received: August 3, 2021

Accepted: September 17, 2021

*Corresponding author:

emartinezg@chapingo.mx

Abstract

This paper aims to analyze the production, transformation, and marketing system of dried green pepper in the microregion of El Oro, Durango, identifying its problematic and complex cause. For this purpose, information was collected from 30 growers, 16 consumers, and 10 marketers for analysis using descriptive statistics, social network analysis, and the problem tree approach. Our results indicate that the production system has three main stages: i) primary production is yielded by a familiar farm system where the participation of unpaid labor is high; ii) processing, which consists of roasting and drying; the average yield was of 130 kg per year; iii) marketing, which was characterized by not being the main source of income for families. The central problem related to sales is that growers are not taking advantage of the potential to increase sales in alternative markets, observing effects such as low yield and unsatisfied demand. However, due to the sample size, the results obtained are only exploratory. It is concluded that there is a need for management innovations that allow for creating functional organizations for growers, which generate competitive advantages for accessing new markets.

► **Keywords:** Family farming, social network analysis, dried green pepper, Durango, alternative markets.

Introduction

Mexico has a great diversity of peppers (*Capsicum annuum*), from varieties that are grown commercially to those that are native to certain regions and can also be found in the wild. It is the main ingredient in different traditional dishes and sauces, but it is also used industrially (Bravo Lozano, Galindo González, & Amador Ramírez, 2006). Peppers are a central part of Mexican cuisine. Some varieties are essential in the preparation of typical dishes, such as the poblano, serrano or jalapeño peppers. However, some types of peppers can only be found in micro-regions and, therefore, are only used in local or artisanal dishes, such is the case of the so-called *chile*

pasado, which is cultivated and processed in some localities of Durango and Chihuahua.

Mancera Valencia (2016) mentioned that the name "*chile pasado*" comes from the process of roasting the pepper on a *comal* or in the embers, removing the skin and letting it dry in the sun, which makes it look like a raisin after being processed. Thus, its elaboration is a simple process, taking advantage of the pepper varieties available.

Pepper production in the microregion of El Oro is not notable in commercial terms, as in 2018 only about 170 t of green pepper were collected, in a total of 13 ha; in pre-

vious years production has ranged between 400 and 1 200 t (SIAP, 2019). However, the microregion has been distinguished by its tradition in small-scale dried green pepper production and, currently there are about 100 small growers whose production is not recorded in official figures, but it is still very important in traditional cuisine and in the income of families, however, there is no research or reliable information on this production chain.

In this context, the present research is developed, focusing on the analysis of dried green pepper production in the region of El Oro, Durango and the problems surrounding its production, transformation and marketing, based on the following questions: what is the current state of the processes of production, transformation, innovation and marketing of small growers of dried green pepper in El Oro? and what is the problem in the network of access to commercial knowledge of small growers of dried green pepper?

Therefore, the aim of this research was to analyze the system of production, transformation, innovation and marketing of dried green pepper in El Oro, Durango, identifying the problematic and causal complex. In this sense, besides knowing the typical information needed in a process of characterization of a production system (grower profile and production unit), it is important to understand the adoption of innovations, the knowledge network, and then contextualize all of this within the commercial chain

of dried green pepper. This would allow us to have a more complete analysis of the problems of this product and, from there, identify possible strategies to strengthen the actors involved in this economic activity.

Materials and Methods

This study was carried out in the microregion of El Oro, located northwest of the state of Durango and includes the municipalities of El Oro, San Bernardo and Indé (Figure 1), it is characterized by a semi-dry temperate climate, with an average temperature of 17 °C and 600 mm of precipitation (INEGI, 2020). The period of analysis focused on the results of interviews and field research developed in the years 2016 to 2019.

For the development of this research, primary sources of information (information provided by growers, sellers, consumers and other important actors in the production of dried green pepper in the region) were used, as well as secondary sources (statistical information and documentary publications).

To identify the characteristics of growers and the production system, an in-depth survey was conducted with 30 dried green pepper growers selected by targeted sampling and by the snowball method (Aguilar-Ávila, Martínez-González, Aguilar-Gallegos, & Altamirano-Cárdenas, 2020;



Figure 1. Location of the study area.

Source: Compiled by the author using data from INEGI (2020).

Pérez Carrasco, Tornero Campante, Escobedo Garrido, & Sandoval Castro, 2017). The collection instrument included variables associated with the characteristics of growers (age, schooling), production activity (sources of income, experience in the activity), innovations used (“innovative” practices that generate value), production reached (volume, form of production), marketing method (channels and volume) and network of access to knowledge for innovation. Questions on growers' perceived production constraints were also included.

To identify the problems in the production and marketing of dried green pepper and, with it, build the problem tree, semi-structured interviews applied to 30 growers, 16 consumers (housewives), five managers of restaurants or small food restaurants and five managers of retail stores in the study region were used. Each of the instruments designed for this purpose had its own particularities; for example, consumers were asked about quantity, frequency of purchase and consumption habits. The managers of food stands, restaurants and self-service stores were asked about the quantity purchased, purchasing habits and problems perceived to access the product. The above information was supported by statistics from official sources such as SIAP (2019) and documents such as research articles, market research reports, among others.

The information was analyzed using tools such as descriptive statistics, calculation of frequencies and percentages to characterize growers and describe the dynamics of the production activity. With the support of key informants, a catalog was prepared to analyze the level of adoption of innovations and the network of access to knowledge available to growers. The catalog was proposed taking as a reference the “new” growing, processing and marketing practices carried out. A total of 19 innovations were selected and divided into four categories. Based on this catalog, the innovation adoption index (INAI, average innovation adoption index per category) and the innovation adoption rate (TAI, percentage of growers adopting each innovation) were calculated, according to the methodology proposed by Aguilar-Ávila et al. (2020).

The analysis and mapping of the knowledge network, as well as getting the network indicators such as density index, centralization index, input and output degrees were obtained with UCINET and NetDraw, as suggested by Aguilar-Gallegos, Martínez-González, y Aguilar-Ávila (2017). This was based on the information generated from the question: from who do you learn or consult for knowledge when you have technical or production problems? Likewise, the problems were identified using the problem tree methodology and objective tree proposed by Aldunate and Córdoba (2011).

Results and Discussion

Dried green pepper production

The production of dried green pepper uses a traditional process involving seedling production, establishment, crop management, and processing of green pepper. It generally begins in the months of February or March with the establishment of seedbeds for seedling production, and green peppers are collected from July to November (Figure 2).

Growers usually produce pepper seedlings on their own plots (90 % of the 30 growers surveyed, as indicated in the following practices), using seed selected from the best peppers from the previous production cycle (90 %), or from the best plants (13 %), and sometimes they get it from other growers or from different seeds brought from different regions to avoid genetic problems. These selection practices have led growers to have a type of pepper that is very characteristic of this micro-region.

For seedling production, they use rustic seedbeds (97 %) prepared directly in the field or near their homes. The soil is disinfected by fire or chemical products (83 %) or is moved from place-to-place year to year (27 %) to avoid disease problems. The crop is established in an open field with a gravity irrigation system when dams or dykes are common in streams and to transport water with a system of irrigation ditches or rustic canals.



Figure 2. Production process

Source: Compiled by the author.

Regarding weed control, the main method is by hand, with the help of hoe and yoke. Few use tractors or herbicides (10 %). For insect control, the main method is the use of insecticides (70 %) or by hand (20 %).

The transformation process of dried green pepper begins with harvesting, which is done by hand and with a very important participation of the whole family (53 %).

Green peppers are sorted then roasted or toasted, using rustic fire pits with metal or mesh screens fueled by oak, mesquite or charcoal wood, which most growers (73 %) use to provide a characteristic flavor to the product. Sometime larger growers choose to roast the green pepper with gas grills. The next step is to dehydrate the roasted and peeled peppers on a wire mesh, exposed to the sun and open air for an average of 5 days. Finally, the product is stored in bags, which are left to dry in the sun for a few days.

Profile of growers

There are about 100 growers producing dried green pepper in this micro-region. They are on average 48 years old, ranging from 23 to 84 years old. These results are similar to those obtained by Mendoza Orozco, Morales Flores, & Méndez Gallegos (2019) in a study on the typology of prickly pear growers in Zacatecas. This means that in this activity there are mature growers with experience in the production of dried green pepper, since on average they have 18.5 years developing this activity and studied 7.7 years of basic education, results similar to those mentioned by Rodríguez Licea (2019).

It was found that 7 % produce only for self-consumption and half of the growers (50 %), get less than 25 % of their total income from the sale of dried green pepper. Growers indicated that their main activity is growing maize, oats or sorghum (50 %), followed by pepper production (20 %), livestock (17 %), commerce (3 %) and other activities (10 %). Since they do not consider this activity as their main source of income, they have little incentive to innovate. On the other hand, the production of dried green pepper is not the responsibility of the growers alone, as the whole family is usually involved in the process. Meanwhile, 73 % of the interviewees mentioned that their wife and children had a high or very high participation in the production process, especially during harvesting and processing, which allows them to reduce the use of paid labor and their production costs. This profile is similar to that reported in other agricultural and livestock activities in the country (Martínez González et al., 2011).

Activity dynamics

Dried green pepper is usually carried out in small areas. For example, during 2017 each grower sowed 5 117 m² on

average. Some of the growers mentioned that production surfaces are small due to the lack of water for irrigation and because labor costs increase a lot with larger surfaces, so they prefer small surfaces that they and their family can manage.

Production obtained by each grower can be considered as small, since they obtained on average 130 kg of dried green pepper in dry weight, which implied an average yield of 276 kg of dried green pepper per hectare, while, for Durango, the average yield for dried green pepper was around 2 t·ha⁻¹ (SIAP, 2019). However, the average price of dried green pepper in 2017 was 200 pesos per kilogram, so there was a production value of 55 282 pesos per hectare or 26 thousand pesos per grower. If production costs estimated at 45 527 pesos per hectare or 19 240 pesos per grower are considered, profits are around 15 996 pesos per hectare or 6 760 pesos per grower. It is important to mention that, in addition to the production of dried green pepper, growers also receive income from the sale of green pepper and red pepper, but this study only consider the production of dried green pepper.

Marketing is mainly carried out using the shortest channel, i.e., grower - final consumer, since in 2016 marketing through this channel was around 83 % and for 2017 it was 73 % (Figure 3). Sales are mainly made at the grower's farm (87 %) or by taking the product directly to the buyer (30 %), while options such as direct sales on the street or public squares are made by 7 %, although they also manage another emerging channel based on parcel shipments, practiced by 3 %. In general, the marketing of dried green pepper is done through short marketing channels that are adequate for growers, because their production is small, but it generates some inconveniences for consumers. For example, they have to go to the growers' farms to buy the product, which is not always possible.

Adoption of innovations

Dried green pepper growers had, on average, an innovation adoption index (IAI) of 0.234, with a range of 0.05 to 0.47 (Figure 4).

Other studies such as that of Pacheco Almaraz, Palacios Rangel, Cervantes Escoto, Ocampo Ledesma, and Aguilar Ávila (2019), where they analyzed the adoption of innovations with coffee growers in Veracruz, reported IAI values higher than 0.6 on average and that of Aguilar, Muñoz, Santoyo, and Aguilar (2013), where cocoa, rubber and oil palm crops were analyzed finding IAI values below 0.25, which further reinforces the idea that the adoption of innovations by dried green pepper growers is low.

Regarding the innovation adoption rate (IAR), an average of 23.9 % have been adopted, the highest was seedbed disinfection (B4) with a IAR of 83.3 %. Other innovations that

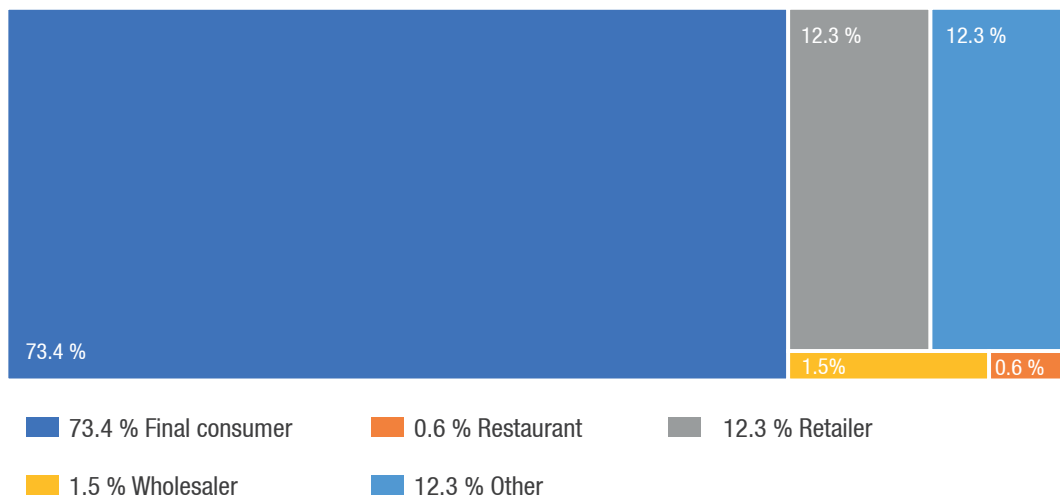


Figure 3. Importance of buyers in the network.

Source: Compiled by the author

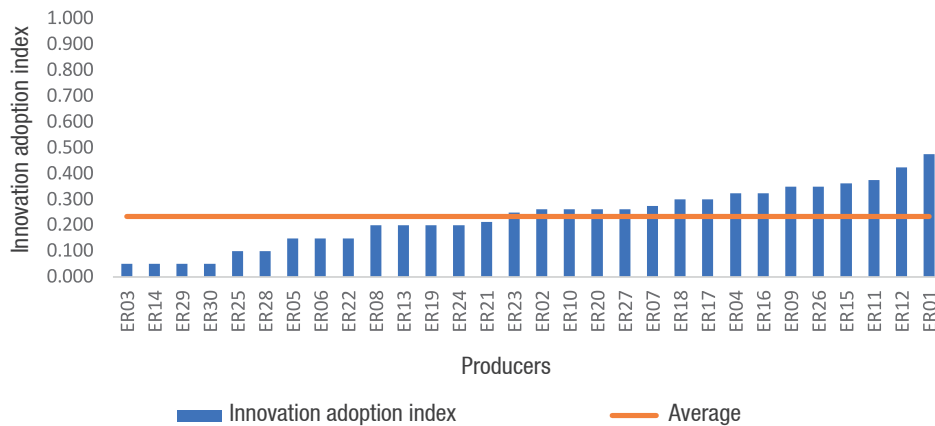


Figure 4. Grower innovation adoption index.

Source: Compiled by the author

have been adopted by more than half of the growers are adequate seed conservation (B2: 66.7 %), use of tractors in some part of the process (A2: 60 %) and crop rotation (A4: 56.7 %). Meanwhile, the least adopted innovations are the use of protected agriculture (A1), soil analysis (C1), use of dryers (D3) and packaging (D4), because no grower carries them out (Figure 5), which gives a perspective of the gap that exists to improve this production system.

The knowledge network

There is a knowledge access network formed by 48 actors or nodes, of which 30 correspond to the interviewed growers and 18 to other non-interviewed actors who were mentioned as sources of information. The network shows a structure formed by a main component, where most of

the actors participate and, in addition to six components of three or less actors, two loose nodes were found (Figure 6).

Growers with the highest IAI were not necessarily those who have the most sources of knowledge, i.e., who turn to more actors. For example, ER01, ER09, ER12 only turn to one person when they have problems, but they have a higher IAI than ER21 who turns to three sources or ER23 who turns to two. This indicates that more than the quantity of links, growers who are more innovative look for quality in the relationships they establish.

The density indicator for this network was 0.204, which denotes that there are 20.4 % of the relationships that could exist in the network. In this regard, Aguilar-Gallegos, et al. (2017) mentioned that the higher the density index,

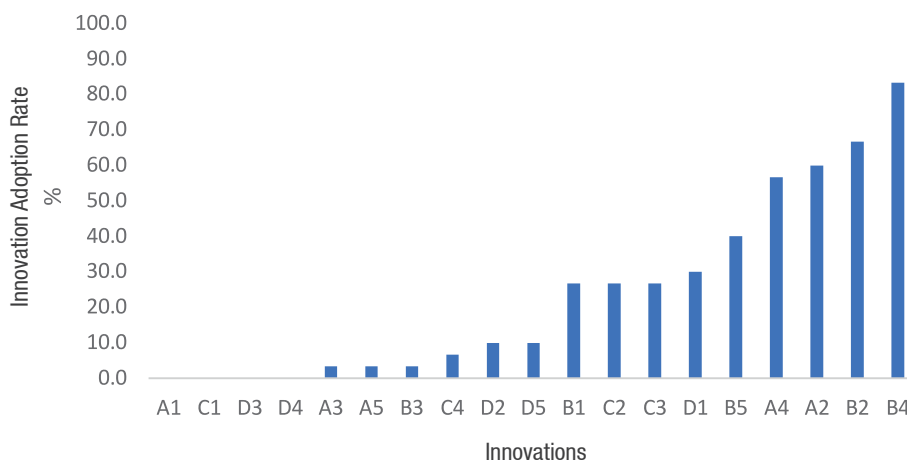


Figure 5. Innovation adoption rate.

Source: Compiled by the author.

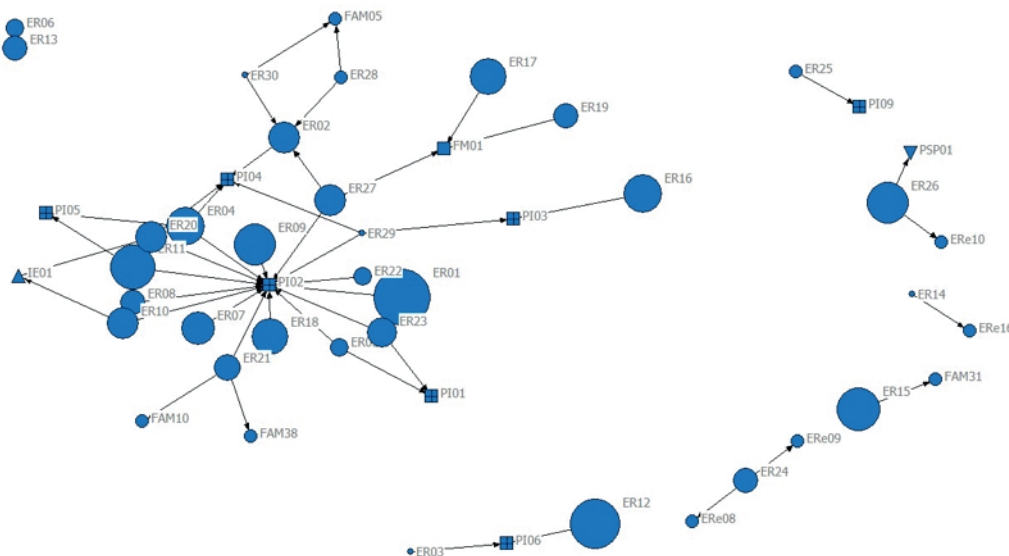


Figure 6. Knowledge network of dried green pepper growers. Note: The size of the nodes depends on the IAI of each grower, which ranged from 0.05 to 0.47.

Source: Compiled by the author.

the greater the possibilities of information and knowledge exchange between network actors. Therefore, the formation of new links between actors and the connection of small components should be promoted.

Another basic indicator for network analysis is the centralization index (Muñoz Rodríguez, Rendón Medel, Aguilar Ávila, García Muñoz, & Altamirano Cárdenas 2004), because it measures the degree to which the existing links in the network are focused on one or few actors (Aguilar-Gallegos, et al., 2017).

The results of centralization can be observed from two points of view: degrees of input and degrees of output.

When analyzing the degrees of input, a value of 30.51 was found, which indicates that growers consult few actors in the network when they have technical problems.

The actors with the highest input degree were PI02 with 31.915 and PI04 with 8.511, which are important input suppliers in the study region. Furthermore, actors FM01 and ER02 had 6.383 degrees of input, so they are also considered to be an important source of information within the network.

On the other hand, and in this case, output centralization indicates the extent to which one or few actors in the network are linking with other actors to access informa-

tion and knowledge. On this point, the dried green pepper network had an indicator of 4.44 %, which indicates that few growers are seeking information from various sources (Aguilar-Gallegos, et al., 2017). These indicators account for the low level of communication between growers and is reflected in the fact that few growers are mentioned as sources of information in the network.

It can be said that dried green pepper growers are small, focused on the local market, with low levels of adoption of innovations and form a network of access to knowledge with little exchange among themselves, but with significant participation of input suppliers in technical and innovation issues and with no presence of extensionists or agents of change to promote innovation management and optimal use of available technology in all links of this value chain. This situation can lead to the adoption of innovations that are profitable for input suppliers, but not necessarily for growers.

Analysis of the problem

Part of the logical framework methodology proposed by ECLAC (Aldunate & Córdoba, 2011; Ortegón, Pacheco, & Prieto 2015) was used in the analysis of the problem of dried green pepper value network to identify the causes and effects through the problem tree tool. This is a representation of a problem, its main causes and effects, where the problematic situation is represented in the center

and corresponds to the trunk of the tree, the branches and leaves of the tree are the effects and the causes are located at the bottom of the trunk representing the roots of the problem. The main problem identified in the dried green pepper network was that the growers in the micro-region of El Oro are not taking advantage of the potential that exists to increase their income from the sale of their product, because they are currently only earning an average of around 26 000 pesos per year for this activity. This problem causes effects such as low productivity, unsatisfied market demand, low product quality and untapped market segments (Figure 7).

Low yield growing dried green pepper

The first effect perceived as a consequence of the main problem refers to low yield per hectare per year of dried green pepper grown per year. On average, each grower obtains 130 kg of dried green pepper per year, while the average yield in dried green pepper for Durango was around 2 t·ha⁻¹. The main causes directly related to this effect are low yields obtained from primary production, the use of primarily traditional technology and limited equipment available.

The sowing area of each pepper grower is 5117 m² on average, so the yield per hectare obtained is around 276 kg of pepper per year. However, this situation can change a lot from one year to another, because most growers (53 %)

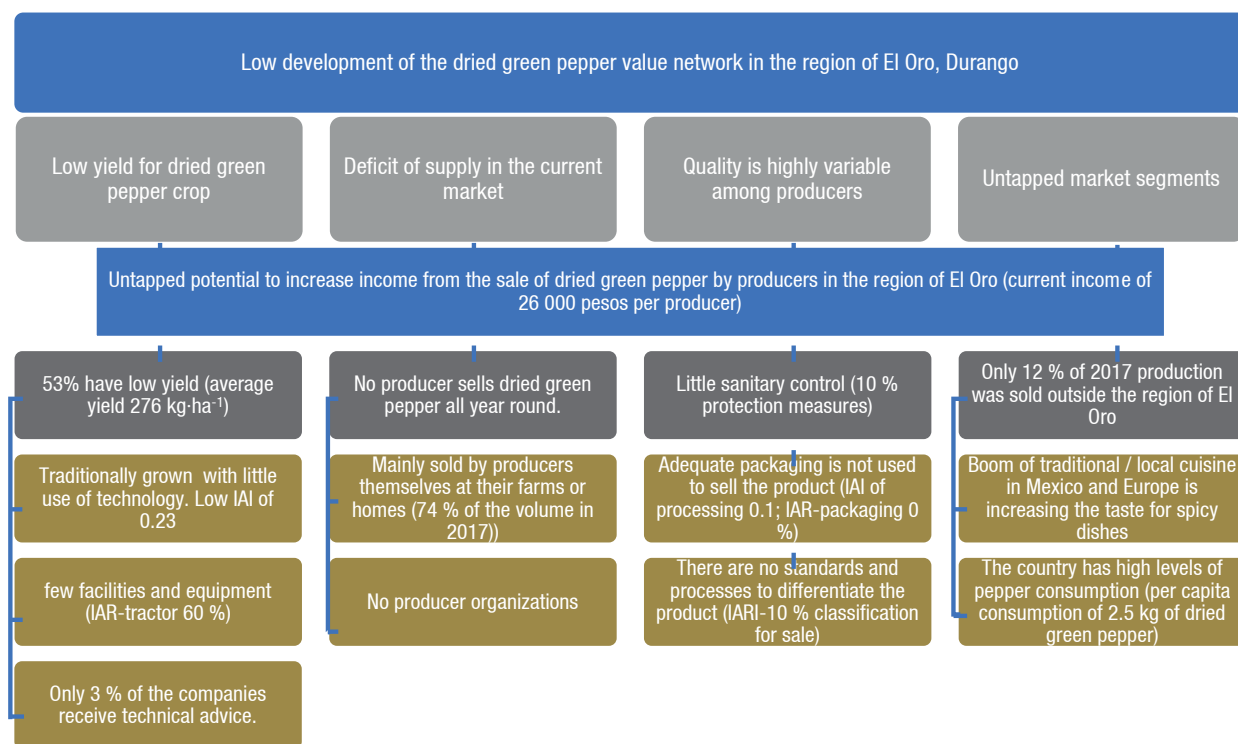


Figure 7. Problem tree.

Source: Compiled by the author.

mentioned that the weather is a factor that greatly affects production, mainly when climatic anomalies occur during the year, such as droughts, hailstorms, unseasonal frosts or even heavy rains.

Growers of dried green pepper generally use few innovations in their production process, and this is reflected in the low IAI in the analysis (0.234 on average). Most of them still use production techniques they learned from their parents or grandparents and few of them use any production technique supported by adequate technological advances. Only 3% mentioned having received crop advisory services.

Growers have few facilities and equipment for production. For example, none of the interviewees have adequate warehouses for storing dried green pepper. Instead, they store the product in bags and inside a room or porch of their own house, which can lead to losses due to contamination or humidity.

Growers also do not use infrastructures such as greenhouses, micro tunnels, shade nets, which would allow them to substantially improve the production process. In terms of machinery for production, only 6 % of dried green pepper growers mentioned having their own tractor and do not have specialized machinery for pepper production. Furthermore, for the processing of dried green pepper, growers do not have specialized facilities or machinery to roast or peel the pepper, so instead they use grills or rustic open-air stoves, and the peeling process is done by hand. For pepper dehydration process growers does not have special equipment or facilities, so it is done using rustic wire mesh and peppers are exposed to the open air for one or two days until they lose most of their moisture. In this part of the process, there is a risk that the product will get wet or remain with high moisture, causing the appearance of fungi that cause product losses and low yield. Thus, in the post-harvest process there is a need to develop low-cost, high-impact technologies to substantially improve growers' profits.

Supply deficit in the current market

The second effect of the main problem is that the current market demands more dried green pepper than growers are able to supply; in other words, there is a supply deficit. The causes associated with this effect are related to the fact that dried green pepper is only sold during one season of the year and most of it is sold by the growers on their farms. Although it is a type of dried pepper that is not perishable, it can usually only be purchased directly from growers during the production season and sometimes for a few months longer.

Another factor that contributes to the fact that dried green pepper is a product hard to find is that it is mostly sold

through the marketing channel as a short circuit; that is, directly from the grower to the final consumer. However, consumers are often the ones who have to spend time and money to buy the product.

Highly variable quality

In relation to the third effect, it was found that the quality of dried green pepper can be highly variable. The main causes are related to different sanitary controls among growers, there is no adequate packaging, and no standards or ways to differentiate the product. The main cause for quality to be perceived as different is related to the fact that it is a product that is grown and, above all, processed differently by each grower. In addition, seed and soils used are also different, which leads to the taste and spiciness of the product being different from one grower to another, or even for a single grower to have different tastes and spiciness in his product. On the other hand, few growers use innovations to protect product safety; for example, IAR for the use of insect protection nets was only 10 % (Figure 5). Of the growers interviewed, none used adequate packaging for their products, and they sell them in bulk, using plastic bags, cardboard boxes, or even sacks, so IAR for adequate packaging was 0 % (Figure 5) and IAI for the processing category was 0.1. This makes the product susceptible to contamination by fungi, insects and other animals, or that it may break or even get wet, reducing its quality.

By not using marks, labels or distinguishing marks to differentiate the different qualities of dried green pepper, consumers are sometimes dissatisfied with the quality of the product. For example, there are consumers who like the product to have high levels of pungency and when they buy a dried green pepper with a low pungency level they associate it with a bad product, which is not necessarily the case. Of the growers interviewed, none use a brand or any way to differentiate their product, although 10 % of them do some type of classification of their product for sale (IAR of 10 %).

Untapped market segments

The last effect refers to the fact that, nationally and internationally, the market for peppers and traditional products is expanding; however, growers have not taken advantage of this situation. Most of El Oro's dried green pepper production is sold within the micro-regional market and a small amount is sold in other markets. According to interviews with growers, in 2017, only 12 % of production was sold outside the region through family or friends of growers who live in other states or in the United States of America (Figure 3). Nor is it being taken advantage of the fact that, internationally, the taste for spicy food is increasing; for example, dishes with habanero or guajillo peppers have become popular in Europe (Esquivel, 2007; Spence, 2018) or that Mexican food as a whole has gained

acceptance in different parts of the planet (Lane, 2019; Sinclair & Carr, 2018) and that gastronomy has become an important variable when defining the place of travel for tourists (Hernández Rojas & Dancausa Millan, 2018). In fact, gastronomic tourism has grown significantly in different parts of the planet and there is a trend in haute cuisine promoting the use of local products (Aguirreitia Martínez & Fernández Poyatos, 2017; López-Guzmán Guzmán & Sánchez Cañizares, 2008), which also occurs in the case of dried green pepper.

Conclusions

Dried green pepper production in the micro-region of El Oro, Durango is an activity typical of family agriculture, because it is usually carried out on small extensions of their own farmland and where the family has a high level of participation. Dried green pepper growers use an eminently traditional production process, with manual or little mechanized production methods and a limited network of access to knowledge, which leads them to have low levels of adoption of innovations. In general, growers are not elderly and there is a good participation of young people in charge of the activity. In addition, the production of dried green pepper is a way of supplementing family income, because the main activities are cereal farming or livestock raising. The area of land used for this activity is small, so the production obtained per grower is small; but because the price of the product is high, the income from the activity is attractive and complements the family economy. Sales are made through short marketing circuits directly from the grower to the consumer, with little involvement of intermediaries. When sales are made to other markets, they are made in an informal way, sending the product to family and friends. The main problem identified and faced by dried green pepper growers is that they do not take advantage of the potential that exists to increase their income by selling their products in other markets. The analysis and characterization of dried green pepper production helps to show the social, economic and gastronomic importance of this type of local crop with commercial potential, among others. The research findings show how a local product detonates social, economic and innovation processes around it; where its production, commercialization and consumption involve knowledge and tradition that strengthen the identity of the actors in the territory. However, strengthening this type of initiative requires not only the actors directly involved in the activity, because there are structural barriers that limit its development, in this case, the convergence of public and private agents would be required to have a better chance of success.

References

- Aguilar-Ávila, J., Martínez-González, E. G., Aguilar-Gallegos, N., & Altamirano-Cárdenas, J. R. (2020). *Análisis de procesos de innovación en el sector agroalimentario y rural*. Serie: metodologías y herramientas para la investigación, Volumen 8. Centro de Investigaciones Económicas, Sociales y Tecnológicas de la Agroindustria y la Agricultura Mundial (CIESTAAM). Universidad Autónoma Chapingo (UACH).
- Aguilar-Gallegos, N., Martínez-González, E. G., & Aguilar-Ávila, J. (2017). *Análisis de redes sociales: Conceptos clave y cálculo de indicadores*. Serie metodologías y herramientas para la investigación, Volumen 5. Centro de Investigaciones Económicas, Sociales y Tecnológicas de la Agroindustria y la Agricultura Mundial (CIESTAAM). Universidad Autónoma Chapingo (UACH).
- Aguilar-Gallegos, N., Olvera-Martínez, J. A., Martínez-González, E. G., Aguilar-Ávila, J., Muñoz-Rodríguez, M., & Santoyo-Cortés, H. (2017). La intervención en red para catalizar la innovación agrícola. *Revista Hispana Para El Análisis de Redes Sociales*, 28(1), 9–31. <https://doi.org/10.5565/rev/redes.653>
- Aguilar, G. N., Muñoz, R. M., Santoyo, C. V. H., & Aguilar, A. J. (2013). Influencia del perfil de los productores en la adopción de innovaciones en tres cultivos tropicales. *Teuken Bidikay*, 4, 207-228.
- Aguirreitia Martínez, A., & Fernández Poyatos, M. D. (2017). La gastronomía como recurso turístico en la provincia de Alicante. *International Journal of Scientific Management and Tourism*, 3(3), 25-48.
- Aldunate, E., & Córdoba, J. (2011). Formulación de programas con la metodología de marco lógico. In *CEPAL-Serie Manuales* (Vol. 68, Issue 68). Comisión Económica para América Latina y el Caribe (CEPAL).
- Bravo Lozano, Á. G., Galindo González, G., & Amador Ramírez, M. D. (2006). *Tecnología de producción de chile seco*. Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP).
- Esquivel, L. (2007). *Picante rentabilidad*. Entrepreneur.Com.
- Hernández Rojas, R. D., & Dancausa Millan, M. G. (2018). Turismo gastronómico. La gastronomía tradicional de Córdoba (España). *Estudios y Perspectivas en Turismo*, 27, 413-430.
- INEGI. (2020). *México en cifras*. México.
- Lane, C. (2019). Reverse cultural globalization: The case of haute cuisine in one global city. *Poetics*, 101350. <https://doi.org/10.1016/j.poetic.2019.02.001>
- López-Guzmán Guzmán, T. J., & Sánchez Cañizares, S. M. (2008). La creación de productos turísticos utilizando rutas enológicas. *PASOS. Revista de Turismo y Patrimonio Cultural*, 6 (2), 159-171.
- Mancera Valencia, F. J. (2016). El trigo y la tortilla de harina: su diversificación y presencia en el septentrion mexicano. In M. del R. Jáquez Rosas (ED.), *Patrimonio*

- gastronómico de Chihuahua* (pp. 15-35). Instituto Chihuahuense de la Cultura.
- Martínez González, E. G., Muñoz Rodríguez, M., García Muñiz, J. G., Santoyo Cortés, V. H., Altamirano Cárdenas, J. R., & Romero Márquez, C. (2011). El fomento de la ovinocultura familiar en México mediante subsidios en activos: lecciones aprendidas. *Agronomía Mesoamericana*, 22(2), 367-377.
- Mendoza Orozco, M. E., Morales Flores, F. J., & Méndez Gallegos, S. D. J. (2019). Tipología de productores de nopal tunero en Pinos, Zacatecas. *Revista Mexicana de Ciencias Agrícolas*, 22, 77-88. <https://doi.org/10.29312/remexca.v0i22.1860>
- Muñoz Rodríguez, M., Rendón Medel, R., Aguilar Ávila, J., García Muñiz, J. G., & Altamirano Cárdenas, J. R. (2004). Redes de innovación. Un acercamiento a su identificación, análisis y gestión para el desarrollo rural. In *Fundación PRODUCE Michoacán, A. C./Universidad Autónoma Chapingo*. Fundación Produce Michoacán y Universidad Autónoma Chapingo.
- Ortegón, E., Pacheco, J. F., & Prieto, (2015). Metodología del marco lógico para la planificación, el seguimiento y la evaluación de proyectos y programas. In *CEPAL-Serie manuales* (Vol. 42). Comisión Económica para América Latina y el Caribe (CEPAL).
- Pacheco Almaraz, Palacios Rangel, M. I., Cervantes Escoto, F., Ocampo Ledesma, J., & Aguilar Ávila, J. (2019). La asociación cooperativa como factor de sostenibilidad del sistema cafetalero en comunidades marginadas. *REVESCO. Revista de Estudios Cooperativos*. <https://doi.org/10.5209/REVE.63563>
- Pérez Carrasco, L. J., Tornero Campante, M. A., Escobedo Garrido, J. S., & Sandoval Castro, E. (2017). El chile poblano criollo en la cultura alimentaria del Alto Atoyac. *Estudios Sociales*, 27(49), 47-66.
- Rodríguez Licea, G. (2019). Escolaridad y experiencia laboral en la diferencia salarial del mercado laboral en el sector agropecuario mexicano. *Revista Internacional de Estudios Sobre Sistemas Educativos*, 2(9), 395-416.
- SIAP. (2019). *Cierre de la producción agrícola*. Anuario Estadístico de La Producción Agrícola.
- Sinclair, J., & Carr, B. (2018). Making a market for Mexican food in Australia. *Journal of Historical Research in Marketing*, 10(2), 175-180. <https://doi.org/10.1108/JHRM-07-2017-0042>
- Spence, C. (2018). Why is piquant/spicy food so popular? *International Journal of Gastronomy and Food Science*, 12, 16-21. <https://doi.org/10.1016/j.ijgfs.2018.04.002>