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Investigation note

Coffee cultivation in Paraje Montero, Malinaltepec, Guerrero

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Abstract

Coffee crops in the region of La Montaña of Guerrero are cared for by indigenous families, which have poor management of the orchard, which is influenced by the low economic solvency and lack of institutional support, hence the importance of knowing what factors limit production. The objective of the research was to systematize the coffee production process of Paraje Montero to detect the critical points that allow the improvement of production. In 2019, 83 coffee farmers were interviewed to gather information on the production process. The average age of the producers was 55 years, with seven years of schooling; 94% of them were engaged in agriculture. On average, they had 2.6 ha with coffee as monoculture and polyculture with fruit trees, ornamental and medicinal plants. Ninety-eight point eight percent grew the Typica variety (landrace) with plantations of 34 years on average and 493 plants ha^{-1}. The activities in the coffee plantation are carried out mainly with family labor. The problems detected were poor orchard management (poor pruning, fertilization, and pest and disease control), which causes low yields; there are low prices, a lack of institutional support, and low economic solvency. It is important to address these factors through the organization, managing the participation of producers for technical assistance and training as an alternative to improve coffee crop production.

Keywords:

commercialization, management, organization, production.

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At the national level, from 2019 to 2021, the state of Guerrero ranked fifth as a coffee producer, and in importance, this crop ranked twelfth at the state level compared to other crops (SIAP, 2019; SIAP, 2021). Atoyac de Álvarez, San Luis Acatlán, Malinaltepec, Coyuca de Benítez and Iliatenco and Técpan de Galeana are the municipalities with the highest coffee production, contributing 90% of state production (Landeta *et al*., 2011; SIAP, 2019; SIAP, 2021).

These municipalities are located in the regions of Costa Grande, Costa Chica, and La Montaña, characterized by high marginalization, poverty, smallholdings, scarce basic services, lack of sources of employment, insecurity, deterioration of natural resources, and predominance of indigenous population (Tlapanecs, Mixtecs, Amuzgos and Nahuatl). For producers, the coffee orchard is a space for the generation and transmission of knowledge; in this place, family roles by gender and age are well differentiated (Tablas *et al*., 2021).

However, the crop is affected by factors such as pests and diseases, low profitability, lack of stimuli for production (Morales *et al*., 2019), and low prices that put it at risk (Cardeña *et al*., 2019). Despite these problems, producers continue to care for the crop as a survival strategy, as they do not have local production alternatives (Tablas *et al*., 2021).

In Paraje Montero, Malinaltepec, Guerrero, the coffee crop has social, economic, and ecological importance, as it contributes to the household economy of peasant families. In addition, the crop involves the family in the activities of the production process and generates social relationships at the time of selling the product. Nevertheless, it is perceived that producers have lost interest in the crop due to low profitability, lack of labor, presence of pests and diseases, aging plantations, and advanced age of producers.

Under these assumptions, documenting and systematizing the coffee production process of Paraje Montero, located in La Montaña of Guerrero, Mexico, was the objective of this research, where the critical points were detected as an empirical reference for decision-making aimed at improving the production of this crop.

The number of producers to be interviewed was selected based on a simple random sampling with maximum variance, using the equation: n=(NZ2#/2Pnqn)/(Nd2+Z2#/ 2Pnqn). Where: n= sample size; N= total population or number of elements of the target population; Z2= reliability; Pn= proportion of individuality with the characteristics of interest; qn= proportion of individuals with the characteristic; d2= precision (percentage of the deviation from the mean); #/2= half the value of alpha.

The research was descriptive based on Padua *et al*. (2004) and Tamayo (2004). Eighty-three producers who had coffee plantations were interviewed, to whom a questionnaire was applied to capture information on socioeconomic characteristics, varieties, weed control, fertilization, shade trees, grain yield, and market. The information collected was categorized and coded in an Excel 2010 spreadsheet and analyzed using descriptive statistics. A correspondence analysis was also carried out between the available area per producer and the percentage allocated to coffee using the Statistical Analysis System (SAS) version 9.1 program.

Regarding socioeconomic characteristics, 100% of producers are Tlapanec indigenous. In this regard, Moguel and Toledo (1999) mention that 60% of coffee producers in Mexico are indigenous, while Aguirre-Cadena *et al*. (2012) add that 60% are ejidatarios (shareholders of communal land) and indigenous. The interviewees were between 25 and 88 years old, with an average of 55 years. Cardeña *et al*. (2019) in the Sierra Norte of Puebla and Escamilla-Prado *et al*. (2021) in Chiapas report average ages of 53 and 50 years, respectively.

Producers had seven years of schooling on average, 15.7% had no degree of study, while 14.5% had up to three years of university. For their part, Apodaca-González *et al*. (2014) in Coatepec, Veracruz, and Cardeña *et al*. (2019) in Hueytamalco, Puebla, reported that producers had 5.5 and 4.9 years of schooling, respectively. The family nucleus of the producers was made up of 6.6 members. Tablas *et al*. (2021) reported 4.8 members per family in Ojo de Agua de Cuauhtémoc, Guerrero, Benítez-García *et al*. (2015) 3.8 in Cuetzalan and Cardeña *et al*. (2019) 4.3 in Hueytemalco.

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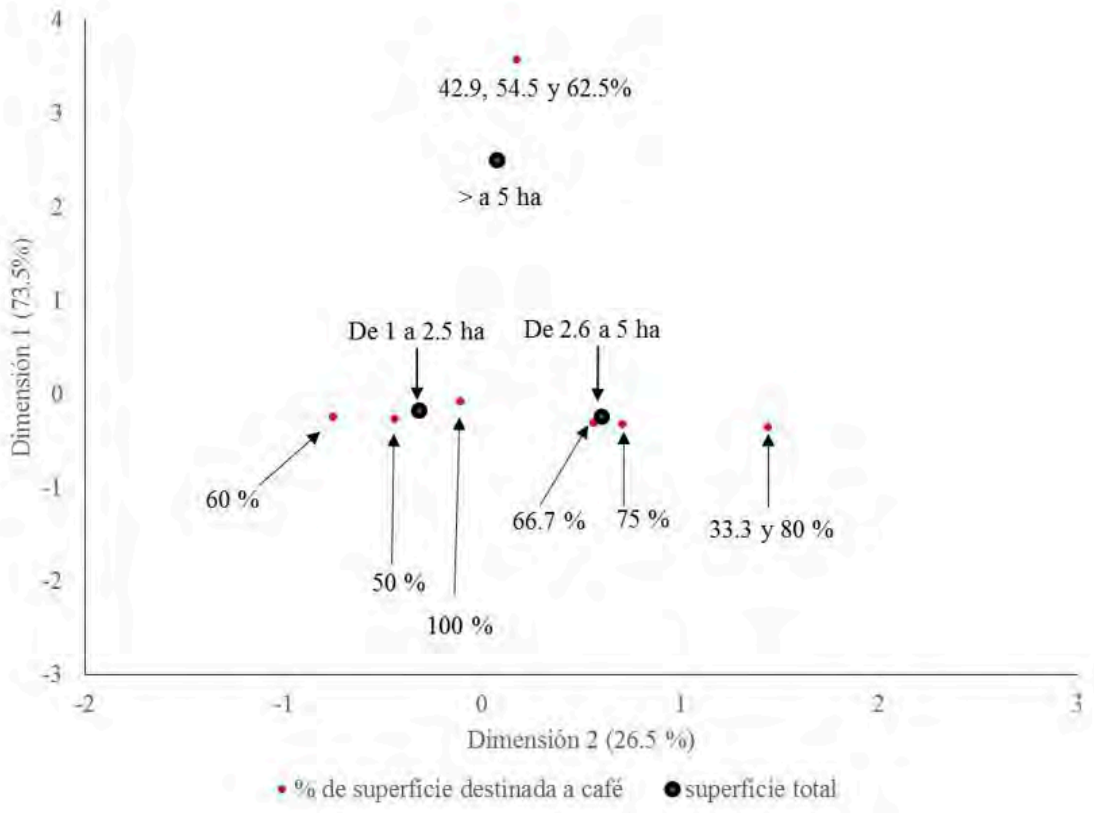
Ninety-four percent of the producers were engaged in agriculture. According to Robles (2011), Mexico's coffee-growing regions have little productive diversification. In contrast, Benítez-García *et al*. (2015) found in Cuetzalan, Puebla, that 72.8% of coffee producers are employed in non-agricultural activities.

One hundred percent of producers have communal land, 2.6 ha on average. Fifty-four point two percent have less than 2 hectares, 38.6% from 2.5 to 5 ha, and 7.2% more than five ha. According to Cortés *et al*. (2007), this type of producer is small-scale and self-consumption. Seventy-one percent of them have one to two farms; in Ojo de Agua de Cuauhtémoc, Guerrero, Tablas *et al*. (2021) found that 85.7% of coffee producers had a farm and 14.3% from 2 to 3.

Seventy-one point one percent of the producers had coffee crops throughout their land; while 8.5 and 6% only occupied 50 and 66.7% of the area. In addition, it was found that the less agricultural land they had (1 to 2.5 ha), the higher the percentage they allocated to coffee crops (50 to 100%of the area they have), and those with more than 5 ha allocate approximately 50% of the area to coffee production (Figure 1).

Figure 1. Analysis of correspondence between total available area per producer and percentage allocated to coffee crops in Paraje Montero, municipality of Malinaltepec, Guerrero.



On the other hand, 100% of producers have other species along with coffee, mainly fruit (guava, lime, lemon, pomegranate, banana, peach, mango, among others), ornamental (poinsettia and bougainvillea), and some medicinal species. Polyculture in coffee crops predominates because it is a way in which producers obtain food for self-consumption and the sale of surpluses at different times of the year. Moguel and Toledo (2004) point out that coffee is associated with many useful species, which are used by the peasant family to improve their diet and well-being.

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Shade trees are an important component in the coffee agrosystem, 94% of producers have trees such as Andean alder (*Alnus acuminata* Kunth.), cuajinicuil (*Inga spuria* Humb. & Bonpl.), netleaf oak (*Quercus rugosa* Née), river red gum (*Eucalyptus camaldulensis* Hehnh.), rose apple (*Syzygium jambos* L.), elderberry (*Sambucus nigra* L.) and ash (*Fraxinus excelsior* L.). The total number of trees per hectare varied from 100 to 1 600, with 412 on average, these, in addition to providing shade, are used to obtain firewood and wood for the construction of rustic houses.

Ninety-eight point eight percent of the producers grew the Typica variety (landrace), the 30.1% Mundo Novo and 9.6% Caturra. Sixty-six point three percent of the interviewees produce Typica as monoculture, 1.2% Caturra, 26.5% the landrace and Mundo Novo, and only 3.6% the three varieties. For their part, Benítez (2014); López-García *et al*. (2016) point out that in Mexico, coffee production is made up of the varieties Typica, Bourbon, Maragogype, Caturra, Mundo Novo, Garnica, Catauai and Catimor. In Paraje Montero, Typica is the one that has best adapted to the ecological conditions and somehow guarantees greater production of cherry coffee, despite poor management of the orchard.

Coffee plantations up to 62 years old were found, with an average of 34. Fifty-seven point three percent with more than 25 years and a third (32%) between 10 and 25 years; according to Arcila *et al*. (2007), the profitable production of coffee plants is between 20 and 25 years; Tomás-Torres *et al*. (2018) mention that in Cerro Cuate, Iliatenco, Guerrero, the maximum production is obtained from 5 to 10 years. Undoubtedly, several factors participate in the productive, useful life of coffee plants, so each producer must renew the coffee plants when they deem it appropriate.

The density of coffee plants per hectare fluctuated between 200 and 1 100, with an average of 493 plants, 50% of the orchards had between 350 and 500 plants, and only 8% had more than 700. According to INIFAP (2013), these densities are low, 2 000 to 2 666 plants ha^{-1} are recommended for the Huasteca Potosina, while López (2013) indicates 2 500 plants ha^{-1}.

In Paraje Montero, the low density of plants is attributed to reasons such as scarce advice and technical training, and that the plants that die are not replaced. This causes low production of cherry coffee and a lack of interest on the part of producers to care for the coffee orchards.

Regarding fertilization, producers do not apply chemical fertilizer, some of the reasons are the high price of the product, low economic solvency, and lack of culture to fertilize; only 17% use leaf litter from coffee trees and trees that they have as shade for coffee, 7.2% apply it as compost. Twenty-five percent apply between 1 and 2 kg of leaf litter or compost per tree, 66.7% more than 2 and less than 4 kg $tree^{-1}$, and 8.3% more than 5 kg. This coincides with Robles (2011) and Villavicencio-Enríquez (2013), who mentioned that most coffee production units do not use fertilizers. Chemical fertilization increases and maintains coffee production, but being a traditional crop, due to uses and customs, it is not fertilized.

One hundred percent of interviewees control weeds twice a year; at the beginning of the rains and at the beginning of the harvest (November). Eighty-five point five percent do it manually with a machete, hoe, and garabato (wooden stick), and 14.5% manually and with herbicide application (Paraquat Dichloride 'Gramoxone'). In this regard, Robles (2011) pointed out that in Mexico, 7%of coffee producers use herbicides for weed control. In Paraje Montero, family labor is used for weed control (64.4%), and 35.6% employ family and contracted labor (on average, four days of work per agricultural cycle). Aguirre-Cadena *et al*. (2012) found that 90% of coffee producers control weeds with a machete and that 65% perform two weedings per cycle.

In relation to pruning, 69.9% of producers perform it, and 10.8% practice agobio (bending the plant). Sixty-one point three percent employ family labor, 26.7% hire, and 12% mixed (family and contracted). For his part, Villavicencio-Enríquez (2013) reported that coffee producers in San Miguel, Veracruz, occasionally perform pruning; in contrast, Rendón (2020) mentions that coffee requires the renewal of plants to maintain production and facilitate agronomic management. Undoubtedly, pruning is crucial, but performing it depends on several factors such as technique, advice, training, inclination of the land, plant size, labor, and economic capital, in addition to a local culture to carry out the activity.

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Forty-two percent of producers recognize the coffee berry borer (*Hypothenemus hampei* Ferr.) as the main pest, which is controlled by 14% of producers. According to Bustillo (2006), the fruit borer is the pest of greatest economic importance, Cardeña *et al*. (2019) in Hueytemalco, Puebla, found that 55% of the interviewees mentioned it as the main pest.

On the other hand, 90% of producers identify rooster's eye (*Mycena citricolor* Berkeley & Curtis) and 10% anthracnose (*Colletotrichum gloeosporioides* Penzig) as the main diseases of coffee. Cardeña *et al*. (2019) reported an incidence of rooster's eye in 28% in the Sierra Norte de Puebla, and Tablas *et al*. (2021) in 66% in La Montaña of Guerrero. This means that the diseases manifest themselves with different intensity in each coffee-growing region, in the case of Paraje Montero, the producers indicated that the presence is related to a lot of shade, little ventilation, and the presence of rain, but 98.8% of them do not carry out any activity to control them.

Regarding coffee yield, 171.6 kg ha^{-1} was obtained on average. Forty-eight point two percent of producers obtain a yield below this average; 45% mentioned having a yield between 171 and 250 kg ha^{-1}, and 2% produce more than 300 kg ha^{-1}. The low yield is due to poor management of the coffee plantation, the following were mentioned as causes: the lack of advice and training, low economic solvency, institutional support, and advanced age of producers. The yield is low compared to other regions, as Cardeña *et al*. (2019) reported 422.3 kg ha^{-1} in the Sierra Norte of Puebla and Benítez-García *et al*. (2015) 1.79 to 2.58 t ha^{-1} in Cuetzalan, Puebla.

In relation to the commercialization of coffee, 98.8% of producers market it as cherry and 1.2%as gold coffee. This is sold to the organization 'La Nueva Luz de la Montaña', in 2019, 21.7% of producers sold at $10.00 per kg, 7.2% at $12.00, 49.4% at $15.00, 12.0% at $16.00 and 3.6%at $18.00. The sale price of coffee is a condition for the producers of Paraje Montero to decide whether or not to care for the orchard, as they mentioned that the crop is no longer profitable. According to Cardeña *et al*. (2019), when the price of coffee is very low, producers do not recover production costs and abandon the crop until prices improve.

In Paraje Montero, it is important to value coffee crops to improve management, mainly to increase the density of plants per hectare, adequate fertilization, renewal of plants, pruning, address pests and diseases, and introduction of new varieties. This implies involving producers in the management and action of activities in favor of coffee production through advice, training, and organization of these.

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