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ORIGINAL

Diagnosis of the agronomic and phytosanitary management practices of cocoa producers in San José del Fragua: the case of the Cerafín Garcia property

Diagnóstico de las prácticas de manejo agronómico y fitosanitario de los productores de cacao en San José del Fragua: el caso del predio de Cerafín García

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ABSTRACT

Cocoa crops in San José del Fragua, Caquetá, present different problems that are the cause of low productivity that is attributed to pests and diseases, evidencing deficiencies in agronomic and phytosanitary practices. A study will address these difficulties, analyzing and systematizing management practices, as well as local knowledge about phytosanitary problems. It will focus on the Bocana Luna village, where diseases can reduce cocoa production by up to 80. The need for technical assistance and the adoption of appropriate agronomic practices to improve cocoa productivity in the region is highlighted.

Keywords: Cocoa; Moniliophthora Roreri; Phytophthora; Practices; Diseases; Production.

RESUMEN

Los cultivos de cacao en San José del Fragua, Caquetá, presentan diferentes problemáticas que son causa de la baja productividad que se atribuye a plagas y enfermedades, evidenciando deficiencias en prácticas agronómicas y fitosanitarias. Un estudio abordará estas dificultades, analizando y sistematizando las prácticas de manejo, así como el conocimiento local sobre los problemas fitosanitarios. Se enfocará en la vereda Bocana Luna, donde las enfermedades pueden reducir la producción de cacao hasta en un 80 %. Se destaca la necesidad de asistencia técnica y la adopción de prácticas agronómicas adecuadas para mejorar la productividad del cacao en la región.

Palabras clave: Cacao; Moniliophthora Roreri; Phytophthora; Prácticas; Enfermedades; Producción.

INTRODUCTION

Cocoa is mainly grown by small farmers in low-lying tropical areas, covering regions such as Latin America, West Africa, and Indonesia. Various studies, such as that by Maney et al.[13] affirm that this crop enhances biodiversity benefits.

The literature indicates that cocoa cultivation seeks to improve production on farms. However, attempts to increase productivity by eliminating shade and using agrochemicals present difficulties, which conflict with the desire to increase benefits for biological diversity.[7]

Cocoa producers in Colombia believe that their local knowledge is subject to practices and skills developed and preserved by peoples or communities with shared histories and experiences.[2,10] For this reason, it has become the basis for the livelihoods of rural families.

According to figures from FEDECACAO, as of 2019, this crop was part of the livelihood of more than 52 000 families in Colombia, particularly small, elderly producers with low levels of education.[5]

However, despite subsisting on this production, they indicate that the crop does not have a significant impact on their economy, which is attributed to its low productivity due to factors such as the presence of pests and diseases and, as mentioned by Maya et al.[14] in the department of Caquetá, "there are challenges, including the need to improve.

market conditions, incentivizing sustainable practices, and addressing infrastructure limitations."

Cocoa cultivation is one of the world's main agricultural components because it plays a fundamental role in economic, social, and cultural aspects.[18]

The municipality of San José del Fragua, Caquetá, has 791 hectares dedicated to cocoa cultivation.[1] However, its yield is low compared to what is estimated, considering the agroecological conditions of the study area. For this reason, it is necessary to evaluate which agricultural practices have prevented producers from achieving good crop yields.

It is inferred that the agronomic and phytosanitary management methodology used by cocoa producers in San José del Fragua is based on agricultural practices, pest and disease control, and the adoption of conventional practices, which may explain the variability in yields observed in these crops and the need to design a plan of recommendations to improve pest and disease management and control.

Evaluating agronomic and phytosanitary management practices for cocoa crops in San José del Fragua is timely and essential for several reasons, including the effects on local producers and the regional and national economies.

First, the crop is recognized worldwide as an important agricultural component due to its economic, social, and cultural relevance. Pérez et al.[18] highlight the global importance of this crop, which positions it as a significant asset for communities that depend on it for their livelihood and development.

Furthermore, although the municipality of San José del Fragua has a considerable area of 791 hectares dedicated to cocoa cultivation, the observed yield is lower than estimated, given the favorable agroecological conditions of the area. This low yield represents an economic loss and a limitation on the development potential for local producers and the region.

The difference between the productive potential and the actual results suggests deficiencies in cocoa producers' agronomic and phytosanitary management practices in San José del Fragua. These practices are estimated to be based mainly on conventional methods, which may not be suitable for maximizing yields in an agroecological context.

Therefore, evaluating the current agronomic and phytosanitary management practices used by two local producers is essential. Identifying deficiencies in these practices will allow for the development of a plan with specific recommendations that address the challenges and problems cocoa producers face in the region. This plan of recommendations could include introducing agronomic practices that are more suited to the local environment and more efficient and sustainable pest and disease control strategies.

In line with the above, this study focuses on diagnosing the agronomic and phytosanitary management practices of cocoa producers in the San José del Fragua region, specifically on the farm of producer Cerafín García. Exploring key theoretical foundations related to the research topic is crucial to understanding this topic correctly.

Cocoa cultivation and its economic and social importance

Cocoa (Theobroma cacao) is a crop of great economic and social importance in various tropical regions.[22] Its commercial value lies in producing cocoa beans, the raw material for manufacturing chocolate and other products.[26] In addition to contributing to international trade, cocoa cultivation provides livelihoods for millions of people in producing countries, being a significant source of income and employment in rural areas.[11]

Agronomic management of cocoa

Agronomic management is practices that optimize crop conditions to maximize production and quality.[16] In the case of cocoa, agronomic management involves aspects such as site selection, soil preparation, planting, fertilization, irrigation, weed control, and pruning.[9] Properly implementing these practices can significantly improve the yields and health of cocoa plantations.[15]

Phytosanitary management of cocoa

Phytosanitary management focuses on preventing, controlling, and managing diseases, pests, and other biotic problems that affect crops.[21] The most common cocoa diseases are Moniliasis, Phytophthora, and pests such as Monalonion.[25] Phytosanitary management involves selecting resistant varieties, monitoring pests and diseases, and implementing integrated management practices.[17]

Diagnostic approach in agriculture

Agricultural diagnosis is a systematic process for identifying problems and opportunities in agricultural production and determining the underlying causes of these problems.[29] This approach involves collecting data,

analyzing relevant information, and making recommendations to improve the performance and sustainability of agricultural production systems.[27] In the case of cocoa in San José del Fragua, the diagnosis of agronomic and phytosanitary management practices will identify areas for improvement and develop specific strategies to increase crop productivity and profitability.

The overall objective of this study is to comprehensively analyze agronomic and phytosanitary management practices for cocoa crops in San José del Fragua to understand their impact on productivity, sustainability, and production quality in that region. It also aims to characterize local knowledge of agricultural practices related to pests and diseases in cocoa plantations, systematize local practices implemented for pest and disease management and control, and design a plan of recommendations for pest and disease management and control in cocoa crops in San José del Fragua.

METHOD

Location

The study will be conducted in the village of Bocana Luna, located in the rural area of San José del Fragua, Caquetá, Colombia. This municipality is located in the south of the country at a latitude of 1°19′43″ North and a longitude of 75°58′22″ West, with an average altitude of 312 meters above sea level. The municipal capital is located 58 km southeast of Florencia. To the north, it borders the Department of Huila; to the east, the municipalities of Belén de los Andaquíes and Albania; to the south, the city of Curillo; and to the west, the municipality of Piamonte, Cauca .[4]

Population

The study includes the participation of a producer who lives in a rural area near the municipality of San José del Fragua, specifically in the village of Bocana Luna. This farmer is mainly engaged in cocoa cultivation. Therefore, he was selected as a potential study population to diagnose agronomic and phytosanitary management practices in his cocoa crops.

Methodological approach

Paradigm

This document focuses on a historical-hermeneutic research paradigm, which allows for an understanding of social and human reality through language. This paradigm thus involves interpretive processes and the possible analysis of methodological traditions used in rural communities (Maldonado, 2016).

Type of Research

The study will adopt a descriptive approach. Its objective is to identify and detail the characteristics and properties of a particular group, which will provide relevant information.[12]

Approach

The research approach is qualitative because it analyzes how different productive activities are carried out; therefore, it involves interpreting human actions.[28]

Characterize local knowledge of agricultural practices around pests and diseases in cocoa plantations in San José del Fragua.

Two cocoa producers from the village of Bocana Luna in the San José del Fragua municipality will be interviewed about aspects of planting, maintenance, harvesting, and post-harvesting.

Systematize local practices implemented for managing and controlling pests and diseases in cocoa crops in San José del Fragua.

A survey will address general aspects of cocoa cultivation in the context of pests and diseases (figure 2).

Design a plan of recommendations for managing and controlling pests and diseases in cocoa crops in San José del Fragua.

A plan will be designed based on three phases: Phase 1: diagnosis of damage caused by pests and diseases; Phase 2: recommendations for pest and disease management and control practices; and Phase 3: evaluation of the effectiveness of the recommendation plan.

Phase 1. Diagnosis of damage caused by pests and diseases: To carry out this activity, the cocoa crops of the two producers will be visited to diagnose the level of infestation of the main pests and diseases in the crop. To measure the damage caused, the following protocol will be followed:

- A plot measuring 20 m wide by 50 m long will be marked out in each production unit.
- Once the experimental plot has been marked out, the number of pods with Monilia, Phytophthora, and Monalonion will be counted on each tree.
- We will diagnose the level of infestation based on the criteria for defining the severity of pests and diseases in cocoa plantations (figure 4) and the Phytophthora symptom classification scale (figure 4).
- The results will be systematized in a field table (figure 4).

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Phase 2 Recommendations for pest and disease management and control practices. The plan's main objective is to promote sustainable agricultural practices that minimize the impact of pests and diseases on crops, thereby maximizing production and long-term profitability (figure 4).

Phase 3. Evaluation of the effectiveness of the recommendation plan. The results of Phase 1 and Phase 2 will be correlated.

RESULTS

Exploratory analysis

The diagnosis of agronomic and phytosanitary management practices for cocoa and local strategies for pest and disease control on the farm of the producer interviewed was linked to the terms "cultivate," "cocoa," "pod," and "disease." It was evident that, for the cocoa farmer, his crop is associated with diseases, representing one of the main constraints on cocoa production. According to Hidalgo et al.[23] this situation is typical because diseases are responsible for losses that could represent up to 80 % of cocoa production. In periods of severe infection, these losses could reach up to 100 %, representing significant economic importance for the producer (figure 1).

In line with the above, words such as "technical," "monilia," "prune," "production," "fertilize," and "need" reveal the importance that producers assign to technical and practical knowledge to address phytosanitary challenges in their crops. This highlights the imperative need for specialized assistance and the acquisition of adequate agronomic skills to effectively manage cocoa plantations and control the pests and diseases that affect them.[19]

In line with the above and the importance of cocoa cultivation for those who produce it, control strategies must be implemented to reduce the impacts caused by different diseases in cocoa plantations.[6] This explains why producers mentioned terms such as "manage" and "practical," which provide insight into the possible management practices they use in their production units.

It was also identified that the producer requires targeted assistance to train him in what he needs to know about controlling these problems.[24]

Figure 1. Word cloud

Deductive analysis

The interviewee's account of his knowledge of agronomic and phytosanitary management of cocoa cultivation allowed us to group three families of codes, the findings of which are described below:

- **Family Start:** the perception of the interviewed producer is determined by the agronomic practices that must be considered when implementing a cocoa crop and how they influence the prevention of phytosanitary problems that could cause different difficulties in its cultivation. For this reason, Rodríguez and [11] mention that good agricultural practices are created to grow food safely and in an environmentally friendly way, protecting the health of farmers. For the producer, the most important thing when establishing his crop was to have an interest in cocoa. He sought information from technical assistants with experience in the ideal methodology for implementing his crop. As a result, the producer could plant different clones that were recommended to him. Through several trials, it was confirmed that these clones were the most suitable given the agroclimatic conditions (figure 2).

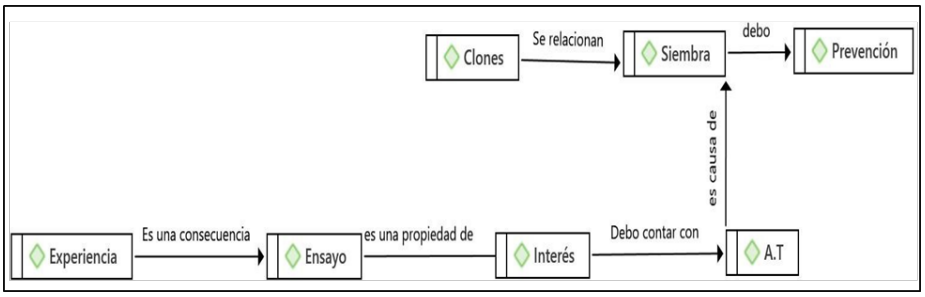

Figure 2. Home Family

- **Family Crop Management:** the interviewee's knowledge has been built up through the crop's growth and development. He believes that this knowledge provides cocoa producers with the necessary learning to obtain excellent harvest results (figure 3). For this reason, producers need to know the climatic conditions that allow their crops to thrive. Therefore, shade, sun, different types of controls (chemical and mechanical), defoliation, pruning, pod cutting, weed control, fertilization, and all other management practices are important because they allow for healthy and productive cocoa pods. In line with the above, for [8], the correct learning of cocoa maintenance practices or tasks should be based on promoting sustainable agriculture, as it generates positive economic, social, and environmental impacts.

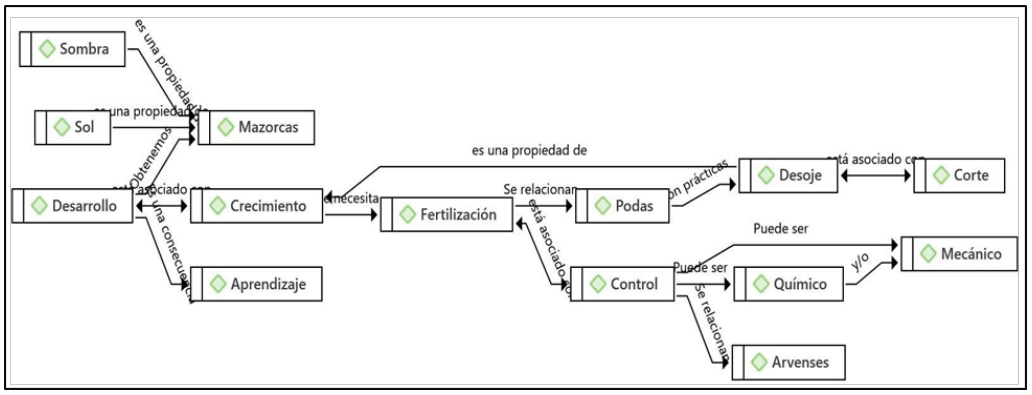

Figure 3. Crop management

- **Family Challenges:** the producer considers that the main challenges he faces in his cocoa cultivation are pests and diseases that cause production losses, which are related to a lack of knowledge that makes it impossible to sustain the crop properly. Another reason is the different occupations that producers have, which significantly hinders the possible transformation of the product and the transport needed to take the cocoa to market. Sandoval et al.[22] agree that the limited availability of labor causes limitations in cocoa production, diseases, and low market prices.

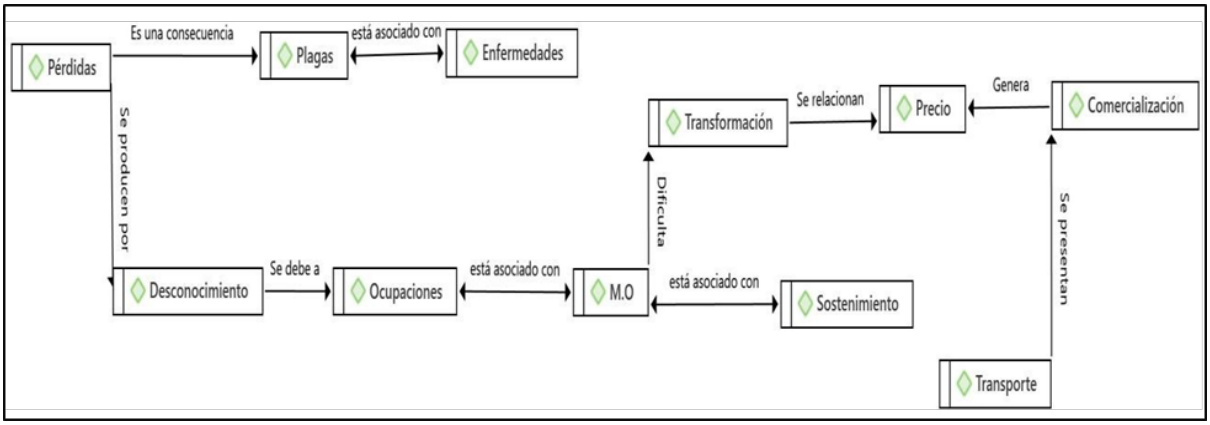

Figure 4. Retos family

CONCLUSIONS

The literature on cocoa cultivation reveals a dilemma centered on improving farm production. On the one hand, there is a significant effort to increase productivity, often involving intensively removing shade and using agrochemicals. These practices may lead to higher yields in the short term, but they present serious challenges

in terms of long-term sustainability. On the other hand, there is growing recognition of the importance of maintaining and promoting biological diversity in growing areas. Shade and reduced use of agrochemicals benefit biodiversity, helping to conserve local ecosystems and promoting an ecological balance that can provide agronomic and environmental advantages. In summary, the main challenge lies in finding a balance between the need to increase cocoa productivity and the desire to preserve and enhance biodiversity, thus ensuring the long-term sustainability of the crop.

On the other hand, phytosanitary problems in cocoa cultivation pose a significant threat to sustainable production and producer profitability. The literature suggests several solutions to mitigate these losses, focusing on integrated pest and disease management practices. Among these solutions, resistant cocoa varieties stand out, as they can reduce the incidence of diseases such as moniliasis. In addition, proper shade management is crucial, as a controlled shade environment can reduce pest proliferation and improve crop health. Implementing agroecological practices, such as crop diversification and biopesticides, also plays a vital role in reducing dependence on synthetic agrochemicals and promoting a more balanced agricultural ecosystem. Continuous education and training of farmers in pest monitoring and control techniques is equally essential for early detection and management of threats. In other words, the combination of genetic resistance, shade management, agroecological practices, and farmer training constitutes a comprehensive and effective strategy to minimize cocoa crop losses due to pests and diseases, thus ensuring the sustainability of the crop.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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