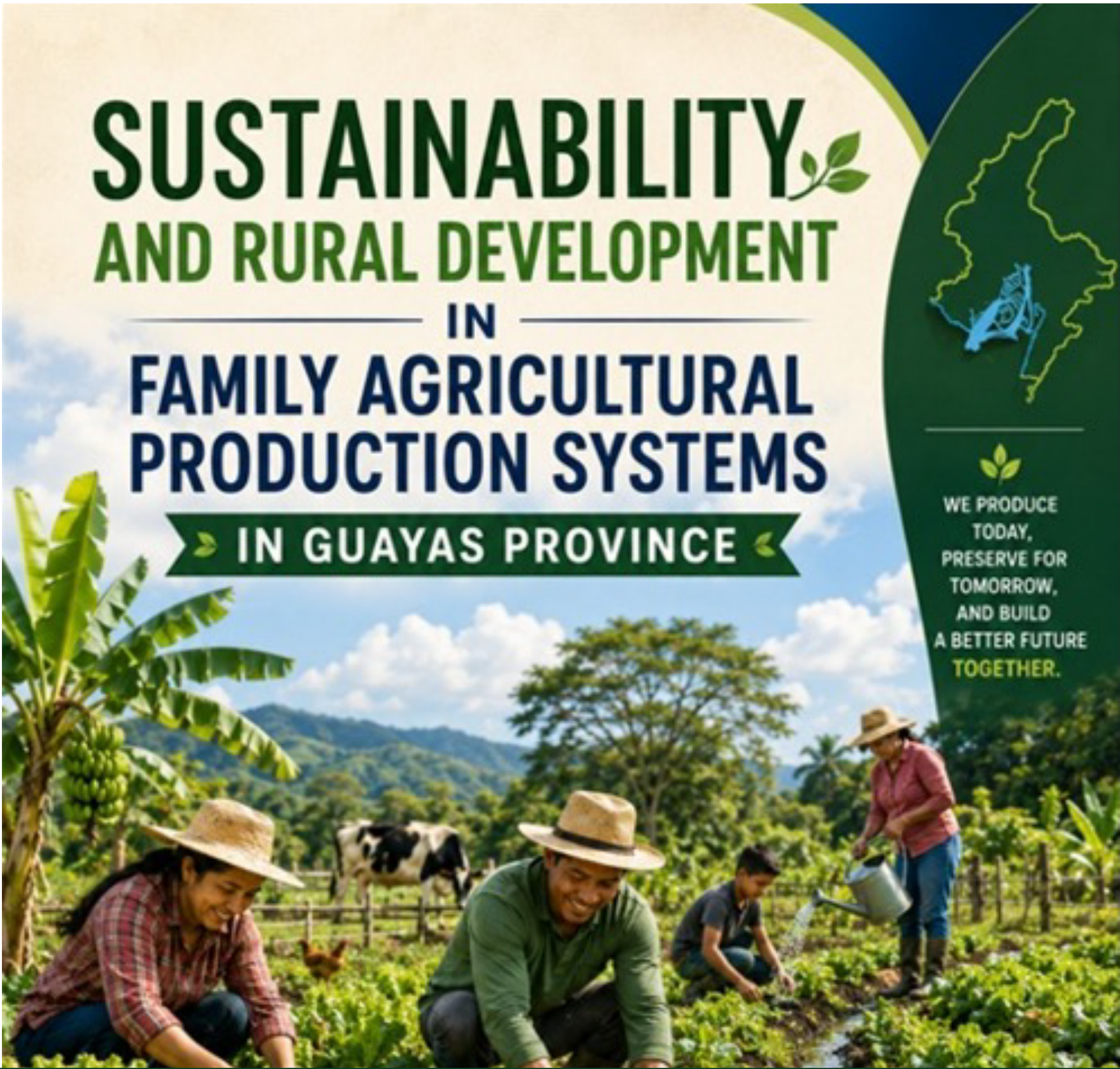
SUSTAINABILITY AND RURAL DEVELOPMENT IN FAMILY AGRICULTURAL PRODUCTION SYSTEMS

IN GUAYAS PROVINCE



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Colloquium

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ABSTRACT

Currently, the production systems face major issues such as low productivity, the use of recycled seeds, the corrective rather than preventive use of pesticides, fertilization based on empirical practices, and low market prices. These factors negatively impact the financial income and quality of life of the members of the agricultural center. The objective of this research was to develop an improvement plan based on the sociocultural, economic, and ecological sustainability analysis of the producers from the Cantonal Agricultural Center of Colimes, in the province of Guayas. Evaluating 200 members, the study utilized the Sarandon (2009) methodology adapted to the local reality, applying the Sustainable Development Index (SDI) method to determine the economic, ecological, and social dimensions.

The results showed that, in the economic sphere, incomes are below the unified basic wage; additionally, poor agricultural practices—mainly monoculture (0.95), lack of commercialization channels (0.93), and a high dependence on agricultural inputs (0.38)—were observed. Regarding the ecological dimension, the systems were found to be unsustainable across all evaluated components, with ground cover management receiving the lowest score (0.14). Within the sociocultural parameters, evidence showed a high level of satisfaction regarding their production systems (3.43), followed by associativity relations (2.06). The sustainable development plan incorporated specific objectives, goals, and indicators. In conclusion, it was determined that the most important activity highlighted by the farmers of the agricultural center is the cultivation of rice or corn; meaning these are not diversified production systems. Therefore, the proposed action plan serves as a foundation to improve decision-making.

Keywords: Associativity, environmental degradation, water pollution, health impact.

Contents

INTRODUCTION

To be sustainable, agriculture must meet the needs of present and future generations while ensuring profitability, environmental health, and social and economic equity. Sustainable food and agriculture contribute to the four pillars of food security—availability, access, utilization, and stability—as well as to the three dimensions of sustainability: environmental, social, and economic. The FAO promotes sustainable food and agriculture to help countries worldwide achieve the Sustainable Development Goal (SDG) "Zero Hunger" (FAO, 2024).

The pandemic caused by the Covid-19 virus, along with other external factors, has heavily impacted the global economy across all sectors, particularly the agricultural industry. In developing countries like Ecuador, this sector is highly vulnerable because an increasing number of farmers are abandoning rural areas, jeopardizing food production, food sovereignty, and the national economy (Carvajal, 2022).

Currently, agricultural activities that rely on modern machinery, hybrid seeds (genetically improved), and chemical synthesis products lead to considerable damage to natural resources, food safety, and health. This makes the application of alternative practices necessary to improve the population's quality of life (Brito, 2022)

In the San Jacinto de Colimes parish, the main products of economic importance are rice and corn, which are sold to intermediaries. Additionally, the rural population cultivates tomato, banana, soy, and mango for self-consumption (Jacinto, 2023).

The factors affecting production are agronomic, commercial, and social in nature, generating major issues that impact the country's output. In recent years, low productivity and scarce economic profitability have become evident among producers nationwide. This research aims to evaluate the environmental, economic, and social sustainability of producers from the agricultural association of Colimes Canton, with the purpose of designing an improvement plan for production processes in favor of agricultural sustainability.

Characterization of the Topic

Statement of the Problem

The agricultural sector is one of the main pillars of the Ecuadorian economy, as it not only provides food and raw materials but also offers job opportunities to a large portion of Ecuador's population (Herrera, 2018).

Currently, production systems face problems such as low productivity, the use of recycled seeds, the corrective rather than preventive use of pesticides, fertilization based on empirical knowledge, and low prices.

The present research aims to develop an improvement plan based on a sustainability analysis regarding the issues faced by producers at the Cantonal Agricultural Center of Colimes, province of Guayas.

Delimitation of the Problem

This work was carried out at the Cantonal Agricultural Center of Colimes, located in the Cantón of Colimes, province of Guayas, at the UTM coordinates X: -1.831239, Y: -78.183406, with a duration of approximately 7 months. A total of 250 producers from the Cantonal Agricultural Association of Colimes benefited from this study.

Formulation of the Problem

Is the situation of the producers at the Cantonal Agricultural Center of Colimes unsustainable?

Objectives

General Objective

To characterize the sustainability of the producers at the Cantonal Agricultural Center of Colimes through surveys, interviews, and secondary data, in order to improve production processes.

Specific Objectives

- Identify the environmental, economic, and social profile of the producers at the Cantonal Agricultural Center of Colimes.
- Evaluate the economic, ecological, and social sustainability of the producers at the Cantonal Agricultural Center of Colimes.
- Develop a sustainable development plan to improve sustainability conditions at the Cantonal Agricultural Center of Colimes.

Hypothesis or Thesis to Defend

The development project will allow an increase in the sustainability of the producers at the Cantonal Agricultural Center of Colimes.

Theoretical or Conceptual Contribution

Upon completion of this research work, it is expected to generate alternatives that benefit the producers of the agricultural center.

Practical Application

Through the results obtained in this study, the intention is to share information with the producers of the Cantonal Agricultural Center of Colimes and farmers in general, as well as with professors and students at the Agrarian University of Ecuador (*Universidad Agraria del Ecuador*).

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CHAPTER 1

THEORETICAL FRAMEWORK

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THEORETICAL FRAMEWORK

1.1. State of the Art

In research aimed at determining the sustainable development index (S) in agricultural communities within the state of Zulia, Venezuela, a descriptive cross-sectional design was utilized. The target population consisted of 506 producers, and the results revealed that the evaluated communities were at a critical sustainable development level of less than one. These findings highlighted the need to design and execute rural development plans and programs to promote and improve the sustainability of these communities, thereby ensuring their long-term permanence (Perez, Rincon, Materan, Montiel, & Urdaneta, 2002).

A study conducted in Valle del Cauca, Colombia, implemented various public policies to support rural producer organizations, yielding unsatisfactory results. The objective was to identify sustainability factors in the processes of strengthening rural associativity. However, the process failed to achieve organizational sustainability, mainly due to individualism, low commitment, and a lack of financial capital. It concluded that to achieve sustainability in rural associativity processes, economic, technical, environmental, political, and social aspects must be comprehensively addressed. This approach guarantees the construction of social capital through relationships of trust among members via collective action (Rodriguez, 2016).

Regarding the development and use of indicators to evaluate the sustainability of smallholder agroecosystems in the Province of Misiones, Argentina, farms dedicated to self-consumption production were analyzed. Indicators were constructed to evaluate the fulfillment of economic, ecological, and sociocultural objectives. The use of these indicators revealed clear trends in overall sustainability as well as in economic, ecological, and sociocultural aspects, showing a high interdependence among the different dimensions of sustainability. It concluded that developing indicators is an appropriate method to detect critical points in

sustainability, establish their causes, and propose medium-term solutions (Sarandon, 2008).

In a study carried out in the San Jacinto parish of Colimes Canton, province of Guayas, the goal was to implement an action plan to address the main issues of the parish, thereby boosting development and improving the population's well-being. A SWOT matrix analysis was applied to the core problems of the area, analyzing internal aspects (Strengths and Weaknesses) and external aspects (Opportunities and Threats), which allowed for the elaboration of territorial development strategies (Bolaños, 2021).

In a diagnostic assessment conducted at the "Macul" Autonomous Agricultural Workers Association in the El Porvenir sector, El Empalme Canton, an agro-socioeconomic analysis of smallholders was performed. It was determined that the farmers' ages ranged from 41 to 60 years, 80% were men, 60% had completed primary education, and monthly incomes ranged from $201 to $400. These smallholders are engaged in traditional production systems, with their main crops being corn (83%), cocoa (67%), plantain (43%), and rice (3%). The main problem producers encounter when commercializing crops is low market prices, which consequently affects their economic income (Briones, 2019).

Research conducted in the San Jacinto parish of Colimes Cantón, province of Guayas, during the 2015–2019 period established that farmers operate under an inefficient production system. This is characterized by a lack of financing for agricultural production and a shortage of water resources due to inadequate irrigation infrastructure, which prevents proper supply. Additionally, a lack of financial literacy hinders farmers from achieving productive results. Therefore, it was proposed to improve institutional frameworks through public policies to establish and consolidate socio-productive relationship networks within the rural organization (Arana & Mero, 2020).

In the municipality of Urique, located within the state of Chihuahua, a technical-productive diagnostic research was carried out. The objective was to understand the technical characteristics of the region, using producer surveys as a

methodological foundation. The main characteristics included: producers with an average age of 51 years, agricultural lands averaging 1.5 hectares (mostly receiving government support), and main crops consisting of corn and beans using animal traction and native landrace seeds (*semilla criolla*). Furthermore, 93% owned livestock (55% cattle, 18% goats, 9% horses, 2% swine, 14% poultry, and 1% fish farming) (Anchondo, 2021).

A sustainability study on Sustainable Food Self-Sufficiency was conducted in the province of Esmeraldas, Ecuador, through the characterization, measurement, and evaluation of indicators related to soil quality and soil conservation practices, given that land is the fundamental means of production in agriculture. The evaluation demonstrated that sustainability in the province is at a medium level due to the erosion of soils dedicated to the three selected crops (rice, banana, and corn). The percentage of affected surface area across all three crops was above 50% (rice: 75.6%, banana: 55.6%, and corn: 50.3%); low fertility was observed in a similar order (57.1%, 49.1%, and 47.2%, respectively). Additionally, there were limitations in compliance with practices to conserve the soil's productive functions; two of the eight evaluated practices are not performed in any crop: the conservation of soil organisms and the predominant use of organic fertilizers. Two other practices are carried out across all three crops, but with restrictions (Castro, 2022).

An analysis of the rice sector in the province of Guayas identified the factors influencing its production and profitability. The research results suggest that rice production in the province of Guayas has remained stable in recent years, despite various challenges faced by the industry. A series of factors affecting profitability and competitiveness were identified, such as a lack of access to cutting-edge technology, a lack of investment in infrastructure and machinery, market price volatility, a lack of access to financial credit, and the illegal entry of foreign rice (Basurto, 2023).

In the Julcuy parish, Los Laureles community has a farmers' association composed of 29 members dedicated to corn cultivation. However, due to climate change, many have lost their crops, facing total losses and becoming unable to pay their loans to banking institutions, which negatively affects their quality of life. The

objective was to determine how associativity impacts the organization's agricultural activities. Results showed that associativity does impact agricultural activities; members purchase agricultural inputs collectively, thereby obtaining better prices. However, the commercialization of products is done individually, selling primarily to intermediaries. The socioeconomic situation of the members was evaluated based on their final production and market price, showing monthly incomes of $100–$200, which are heavily affected particularly by climate change (Lino, 2021).

In the Febres-Cordero sector of Babahoyo Canton, specifically in "Rio Chico," research was conducted to determine production sustainability across three producing farms using the Sustainable Management Index (SMI/IGS) matrix. This method integrated a dialogue of knowledges, future workshops, direct observations and measurements, surveys, and informal interviews with farmers, alongside a SWOT analysis and sustainability evaluation. Evidence showed that among the three farms, Farm 1 was closest to achieving sustainability, presenting higher values than the rest. This was due to the fact that this system utilizes minimum tillage for soil preparation, applies organic matter and biological fertilizers, maintains greater genetic diversity on-site, and implements crop rotation, polycultures, and crop associations to a higher degree (Goyes, 2019).

A social and economic diagnostic study was carried out in the Amazonian Kichwa territory within the provinces of Pastaza and Napo as a contribution to establishing a sustainable development strategy. Surveys were conducted among inhabitants, leaders of the six communities, and heads of the 64 scattered households. Indicators were measured regarding the annual percentage of dependence on local forest and cultivated resources, alongside education, health, utilities, and housing condition indicators, to draft a strategy proposal to boost sustainable local rural development for Ecuadorian Amazonian indigenous communities. The results revealed high illiteracy percentages and families maintaining a dependence on local resources, which prompted the formulation of a strategy proposal for the sustainable agroecological development of these communities (Arias, 2015).

A work executed by Villaflores and La Trinitaria, Mexico City, the objective of the research was to measure the sustainability of the corn production system to determine sustainability levels that balance productivity with social equity and natural resource conservation. Management systems were evaluated by incorporating sustainability indicators. The sustainability values for the municipalities of Villaflores and La Trinitaria were 3.78 and 4.81, respectively, with a limited sustainable level predominating. Therefore, it was concluded that in the economic sphere, the production system reflected a strengthened sustainable level in the categories of economic benefit, but remained vulnerable and fragile in the social and environmental dimensions (Gonzalez, 2020).

A study conducted in Yaguachi Cantón aimed to characterize rice production systems. Economic, social, and ecological indicators tailored to the rice systems under study were developed. The sustainability evaluation through indicators allowed for the objective detection of critical points in this sector. The results indicated that one of the most critical aspects to achieving sustainability was the environmental dimension. According to the salinity indicator, physicochemical analyses performed on the irrigation water showed a medium-to-high risk of salinity. The agrochemical application indicator displayed low indices due to the intensive use of pesticides and fertilizers. In the economic dimension, the minimum sustainability level was not met because they maintain a monoculture system, which generates losses of additional income and a lack of product diversity available for sale and self-consumption. In the social aspect, the most sustainable indicators were housing quality, degree of satisfaction, and relationships with other community members. Regarding the sustainability level of rice cultivation, the Overall Sustainability Index was 2.07 (Farah, 2022).

1.2. Scientific and Theoretical Foundations of the Topic

1.2.1. Sustainable Agriculture

Nowadays, it is necessary to convert agricultural production systems to increase resilience against risks caused by climate change and the growing need for

food production. The objective is to establish efficient, diversified, and environmentally friendly agricultural mechanisms that provide ecosystem services (Aguirre, 2022).

1.2.2. Dimensions of Sustainability: Economic, Social, and Environmental

The dimensions of sustainability consist of the economic dimension, which focuses its actions on maximizing profits; the social pillar, which directs institutional efforts toward the community; and the environmental dimension, which manages operations aimed at environmental care (Hernandez, 2023).

1.2.3. Sustainable Agricultural Practices

Sustainable agricultural practices allow for a more efficient use of natural resources and mitigate the impact of agriculture on the environment.

1.2.4. Family Farming

The poor rural population is mostly composed of family farmers who depend on agriculture and natural resources for their subsistence. Family farmers are integrated into territorial networks and local cultures, and they spend their income in local and regional markets, generating employment opportunities in agricultural and rural areas. For these reasons, they are fundamental to boosting local economies and accelerating progress toward a world without poverty or hunger. The FAO helps family farmers increase their yields and income, as well as adopt sustainable agricultural practices and become more resilient to climate change (FAO, 2024).

1.2.5. Fair Trade

Fair trade emerged from the need to eliminate peasant exploitation by reducing the large losses that producers must absorb when sales are unfavorable, decreasing the abuse of intermediaries, and regulating excessive discounts. Its objective is to build solidarity and fairness among consumers, delivering quality

products in return, produced through environmentally friendly systems at fair prices. The Fair Trade trend began after World War II as a prospect to support the poorest nations, when the aid approach for devastated countries generated inequalities and a constant differentiated economic growth for some nations. The fair trade movement was born as a South-North commercial alternative, aiming to limit the negative aspects of international trade. Its goal was a humanized and solidarity-based commercialization, the elimination of intermediaries and speculators, and the payment of a fair production price. Decreasing the commercialization chain generates greater benefits for the producer, guaranteeing their sustainability (Alcocer, 2020).

1.2.6. Associativity

Based on these definitions, associativity can be understood as a process through which several individuals or organizations unite to achieve common goals, joining forces to become more efficient in administrative, financial, and commercial processes. It also increases productivity and competitiveness, which ultimately translates into higher income. In this manner, and based on the reviewed authors, business associativity can be defined as a process by which organizations or individuals voluntarily unite to improve their capabilities, achieve common objectives, and become more competitive in the market (Figueroa, 2020).

1.2.7. Members of the Colimes Cantonal Agricultural Center

All agricultural producers may belong to the Cantonal Agricultural Center and, through it, to the Provincial and Zonal Chamber of Agriculture in accordance with the law. This includes owners of rural properties or those in charge of their exploitation by virtue of a lease contract or any other contract permitted by law, which must be duly protocolized. Groupings or associations of agricultural producers who express their desire to affiliate and are accepted after fulfilling the corresponding requirements will also belong to the Cantonal Agricultural Center as affiliated members (Colimes, 2017).

1.2.8. Socioeconomic Characterization

Socioeconomic characterization has the distinctive feature of describing variables such as: age, sex, educational level, number of rooms in the household, primary floor material in the residence, fuel used for cooking, cell phone ownership, income generated, production methods, importance of the crop to overall income, plot sizes, changes in yields, access to credit, participation in training sessions, proportion of income from other activities, livestock production, rearing of cattle, swine, or poultry, access to formal or informal support, access to healthcare, level of participation in the organization, participation in organizational decision-making, training in agricultural management, access to market information, access to climate information, and access to health and nutrition information. The purpose of incorporating these described variables into socioeconomic characterizations is to provide the researcher with a working tool to develop improvement plans when necessary (Castillo, 2023).

1.2.9. Rural Development

According to Villalobos (2021), rural development is a process of a territorial nature because it takes place within a space where a series of social, cultural, economic, political, and institutional conditions and variables amalgamate and shape it.

1.2.10. Sustainable Development

According to the Brundtland Report, Sustainable Development is based on three pillars: economic development, social development, and environmental protection, recognizing the profound interconnections that exist among these systems (United Nations, 1987). In its economic dimension, it proposes maintaining and optimizing economic development to maximize human well-being while considering the limitations of natural capital, transforming economic resources into profitable working systems through the achievement of business self-fulfillment. In its social dimension, it seeks an equitable and balanced satisfaction of

intergenerational and intragenerational needs, encouraging a balance in consumer objectives and aspirations. Finally, in its environmental dimension, it emphasizes that Nature is not an inexhaustible source of resources and that the future of development depends on its knowledge and proper management, ensuring its protection and rational use (Tapia, 2020).

1.2.11. Soil Management

For proper soil management, the following aspects must be taken into consideration: land slope; improving soil aeration through the incorporation of organic matter or zero-tillage; preventing erosion and compaction; utilizing appropriate tillage techniques (manual, mechanical, or animal); applying well-decomposed organic fertilizers before incorporating them into the soil; and, in the case of soil disinfection, accounting for the chemical's action time before sowing (Agrocalidad, 2024).

1.2.12. Water Management

Water is a fundamental input for agricultural production and plays an important role in food security. Irrigated agriculture accounts for 20% of the total cultivated land and contributes 40% of the total food production worldwide. On average, it is at least twice as productive per unit of land as rain-fed agriculture, allowing for greater production intensification and crop diversification (World Bank, 2022).

SUSTAINABILITY AND RURAL DEVELOPMENT IN FAMILY AGRICULTURAL PRODUCTION SYSTEMS IN THE PROVINCE OF GUAYAS

CHAPTER 2

METHODOLOGICAL ASPECTS

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2.1. Characteristics of the Experimental Site

This experimental work will be carried out on the properties of each agricultural producer, who in turn are active members of the Cantonal Agricultural Association of Colimes. The coordinates of Colimes Cantón are: UTM X: -1.831239, Y: -78.183406. The population consists of 23,423 inhabitants, with a population density of 30.93 inhabitants/km².

Less than 50% of its cultivated area is under irrigation, despite being an area where agriculture is the main source of employment. The zone features a humid megathermal tropical climate. Throughout the year, the temperature typically varies from 21 °C to 33 °C, and it rarely drops below 19 °C or rises above 35 °C. It has an average temperature of 25.6 °C, an annual precipitation ranging from 1,400 to 1,600 mm, a relative humidity of 70% to 90%, and 12 hours of daylight (Guayas, 2021).

2.2. Research Design

The design of this research is non-experimental, utilizing convenience sampling on a population of 200 producers from the agricultural association of Colimes Cantón. Valid information was gathered through survey techniques regarding the socioeconomic and environmental situation of the study area.

2.3. Research Modality

- Basic Research: Research based on fundamental theoretical concepts.
- Field Research: Research based on extracting data that is as natural and realistic as possible.
- Descriptive Research: Describes the phenomena occurring within the research scope.

2.4. Type of Research

Descriptive, Observational, Inductive–Deductive.

2.4.1. Descriptive Research

This research allowed for the gathering of detailed information about the problems faced by the agricultural association's producers. This type of research will facilitate data collection, which in turn will streamline the study and analysis of the different socioeconomic, environmental, and production aspects confronting the association's producers.

2.4.2. Observational Research

The use of this method allowed for a more specific analysis of the information compiled for the development of the study. This technique seeks to examine the factors influencing the producers of the Colimes Cantonal Agricultural Association using data obtained from surveys, with the objective of studying the core problem and proposing alternatives that benefit the producers.

2.4.3. Inductive Research

Based on the data gathered during the investigation, the necessary information was obtained to formulate conclusions and potential proposals to improve the situation of the producers in the study area.

2.4.4. Deductive Research

The purpose of employing this method in the development of this project was to implement reasoning strategies based on the current socio-productive situation of the parish, in order to determine the specific problems faced by the local producers.

2.5. Research Methodology

The execution of this research took place at the Cantonal Producers Association of Colimes. For this purpose, a survey was designed and developed based on the framework set forth by Sarandón (2009). The Sustainable Development Index (SDI) method was applied to determine three evaluation dimensions of sustainability: Economic, Ecological, and Social. The formulas and the indicators to be determined are presented below:

Economic Indicator (IK):

$$\frac{2((A+B)/2+(C1+C2+C3+\mathrm{C4})/4}{3}$$

Food Self-Sufficiency.

A- Food Self-Sufficiency

A1-Production diversification

B- Economic Risk

B1-Monthly income

C- Monthly Income

C1-Commercialized product

C2-Commercialization channels

C3-Dependence on agricultural inputs

C4-Cultivated hectares

Ecological Indicator (IE):

$$\frac{(A1 + A2)/2 + (2B1 + B2)/3 \ + \ (\mathrm{C1} \ + \ \mathrm{C2}) \ /2 + (\mathrm{D1} + \mathrm{D2})/2}{4}$$

A- Soil Life Conservation

A1-Vegetation cover management

A2-Crop diversification

B- Erosion Risk

B1-Predominant slope

B2-Vegetation cover

C- Biodiversity Management

C1-Temporal biodiversity

C2-Spatial biodiversity

D- Crop Nutrition

D1-Fertilization criteria

D2-Fertilizers used in cultivation

Sociocultural Indicator (ISC):

$$\frac{2\left((\mathrm{A1} \ + \ 2\,\mathrm{A2} \ + \ 2\,\mathrm{A3} \ + \ 2\,\mathrm{A4}) \ /7\right) \ + \ 2\mathrm{B} \ + \ \mathrm{C} \ + \ \mathrm{D}}{6}$$

A- Satisfaction of Basic Needs

A1-Housing

A2-Access to education

A3-Access to healthcare and sanitation coverage

A4-Services

B- Acceptability of the Production System

C- Social Integration

D- Ecological Knowledge and Awareness

2.6. Methods, Techniques, and Instruments

2.6.1. Methods

2.6.2. Techniques

The technique utilized for this research involved assigning values based on a scale from 0 to 4, where 0 represents the least sustainable category and 4 the most sustainable. The values for each dimension or indicator are contained within this scale. A value of 2 is established as an acceptable level for crop sustainability.

2.6.3. Instruments

To obtain the sociocultural, economic, and ecological data, a structured survey was implemented with a specific number of questions designed to determine the current sustainability reality of the producers in Colimes Cantón. With the information obtained, a database will be developed, which will subsequently be tabulated and processed.

The methodology used in this study is the "multicriteria" framework proposed by Sarandón (2002), which simultaneously incorporates the guidelines of Smyth and Dumansky (1995). Quantifiable indicators, sub-indicators, and variables were

employed to facilitate the analysis of the economic, ecological, and sociocultural dimensions. The economic indicator will consider the following sub-indicators: food self-sufficiency, monthly net income, and economic risk. The ecological indicator will consider the following sub-indicators: biodiversity management, soil management, and pest management. The sociocultural indicator will consider the following sub-indicators: satisfaction of basic needs, acceptability of production systems, social integration, and ecological knowledge and awareness. The General Sustainability Index (ISGen) will be calculated using data from the economic (IK), ecological (IE), and sociocultural (ISC) indicators.

2.7. Population and Sample

2.7.1. Study Universe

The study universe comprises the producers of the Cantonal Agricultural Association of Colimes, which is integrated by a total of 250 members dedicated to the production of rice and corn.

2.7.1.1. Study Sample

Convenience sampling was conducted, selecting a total of 200 members.

2.8. Variables

- **Independent Variables:**

  Economic Index, Sociocultural Index, Ecological-Environmental Index.

- **Dependent Variable:**

  Characteristics of the farms belonging to the producers of the agricultural association of Colimes Cantón.

2.9. Data Collection

2.9 Resources

Human Resources

2.10. Bibliographic Resources

To gather bibliographic information, scientific articles, theses, virtual libraries, and books related to the research topic were reviewed.

2.11. Financial Resources

The economic resources utilized in the project were funded entirely by the researcher. These included expenses for transportation, photocopying, computer use, printing, pens, and other materials necessary for the execution of the project.

2.12 Human Resources

The development and execution of this research were carried out by the author. Additionally, it involved the participation of the producers from the Cantonal Agricultural Association of Colimes, who were surveyed to gather data for the study. Support was also received from the faculty advisor from the Agrarian University of Ecuador (*Universidad Agraria del Ecuador*), who was in charge of reviewing and evaluating the research to ensure the fulfillment of each established objective.

SUSTAINABILITY AND RURAL DEVELOPMENT IN FAMILY AGRICULTURAL PRODUCTION SYSTEMS IN THE PROVINCE OF GUAYAS

CHAPTER 3

RESULTS

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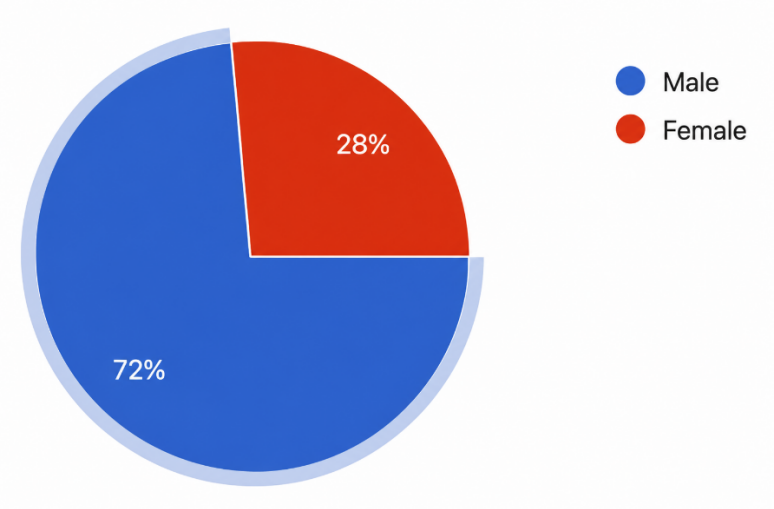
RESULTS

Identify the environmental, economic, and social profile of the producers at the Cantonal Agricultural Center of Colimes.

To fulfill this objective, a survey consisting of 24 questions was designed and administered, taking into account the social, ecological, and sociocultural dimensions.

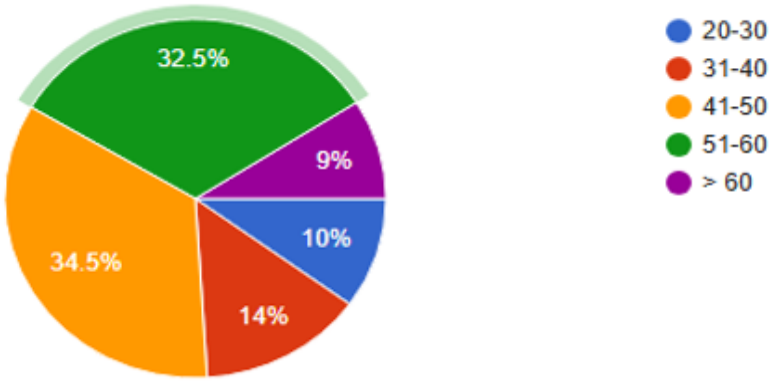
Figure 1. Gender of the farm manager



Source: Authors

Of the 200 surveyed individuals, it is evident that 72% of the farm managers are male, while 28% are female.

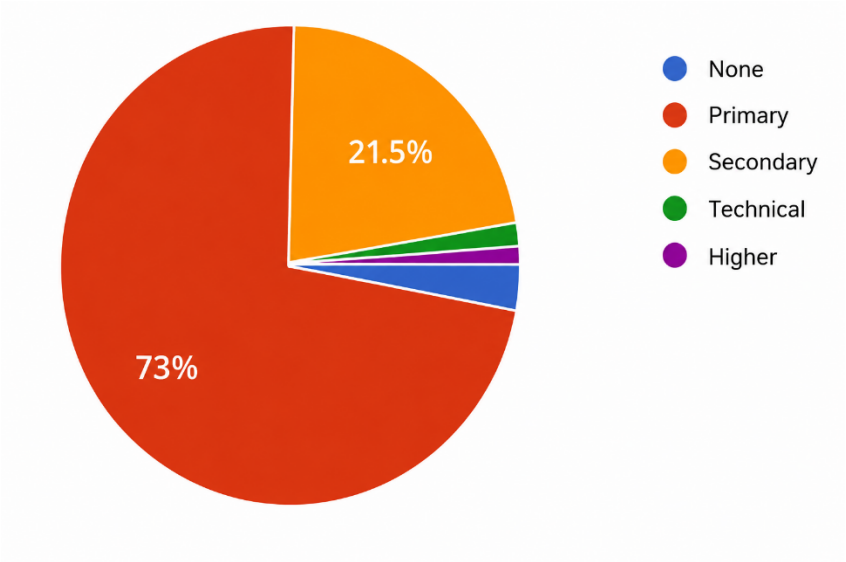
Figure 2. Age of the farm manager



Source: Authors

Of the 200 surveyed individuals, it is evident that the ages of the farm managers fall within the ranges of 41–50 years with 34.5%; 51–60 years with 32.5%; 31–40 years with 14%; 20–30 years with 10%, and over 60 years with 9%.

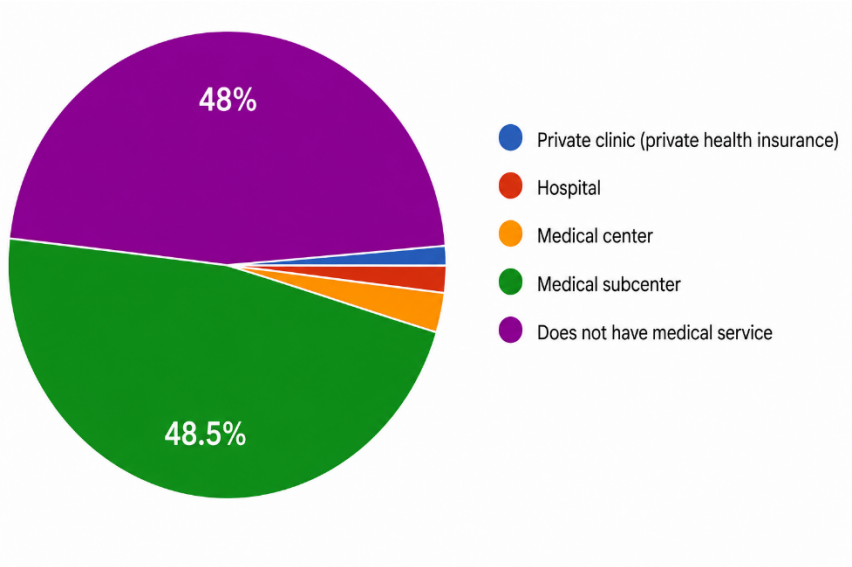
Figure 3. Educational level of the farm manager



Source: Authors

Of the 200 surveyed individuals, it is evident that 73% have primary education; 21.5% have secondary education; and 5.5% is distributed among technical education, higher education, and none.

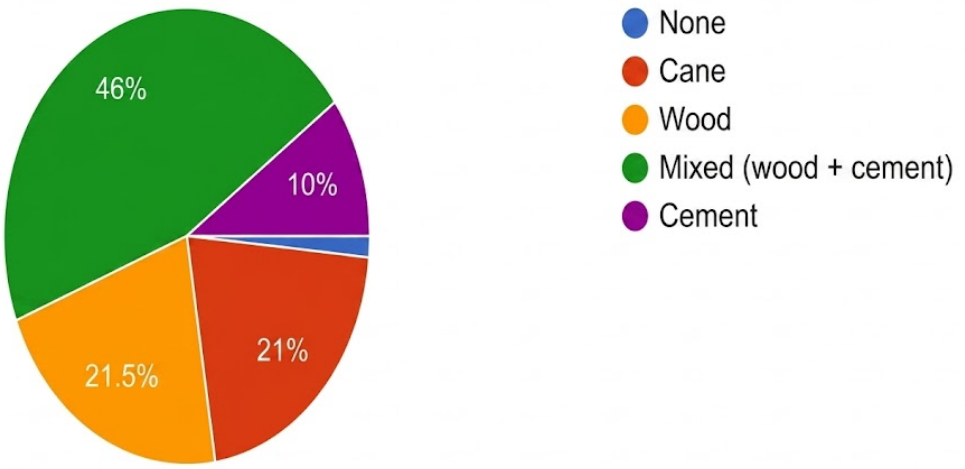
Figure 4. Do you have access to medical services?



Source: Authors

Of the 200 surveyed individuals, 48.5% stated that they do not have access to medical services; 48.5% indicated that they have access to local health sub-centers; and 3.5% attend hospitals, medical centers, and private clinics.

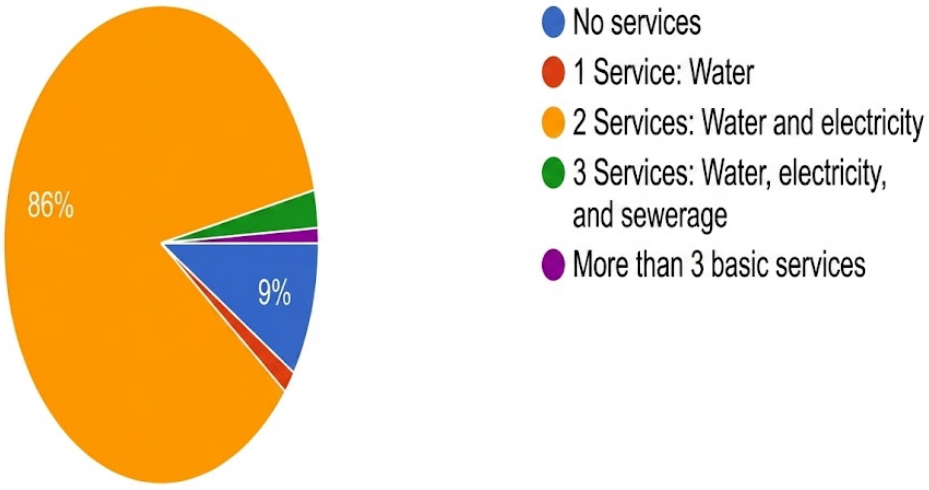
Figure 5. Housing condition on the farm



Source: Authors

Of the 200 surveyed individuals, they indicated that 46% have mixed-construction housing; 21.5% wooden; 21% bamboo; 10% concrete, and 1.5% do not own housing.

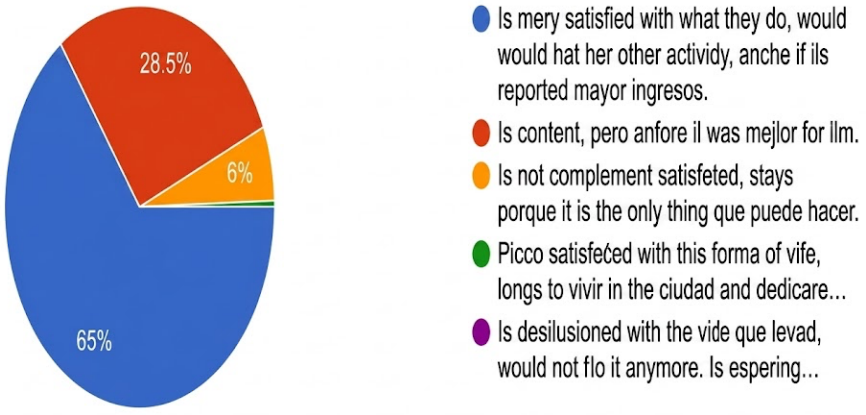
Figure 6. Basic utilities of the household



Source: Authors

Of the 200 surveyed individuals, it is observed that 86% have drinking water and electrical energy services; 9% do not have basic utilities; and 5% do not have water, electricity, and sewage services.

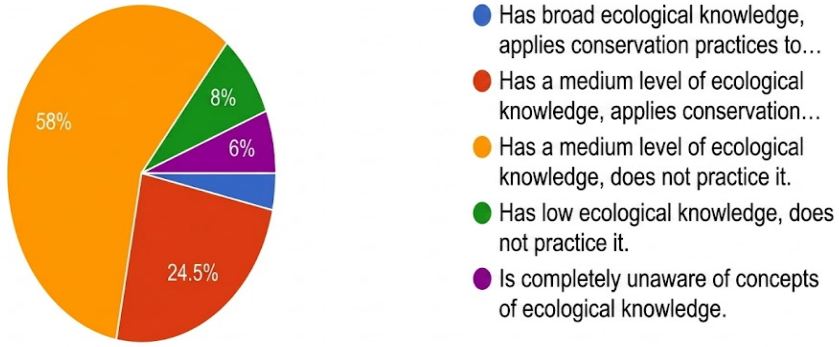
Figure 7. Farmer satisfaction level



Source: Authors

Of the 200 surveyed individuals, it is evident that 65% are highly satisfied with what they do and would not change to another activity, even if it provided higher income; 28.5% are content but acknowledge that they fared better in the past; and 6% are not entirely satisfied and remain because it is the only thing they know how to do.

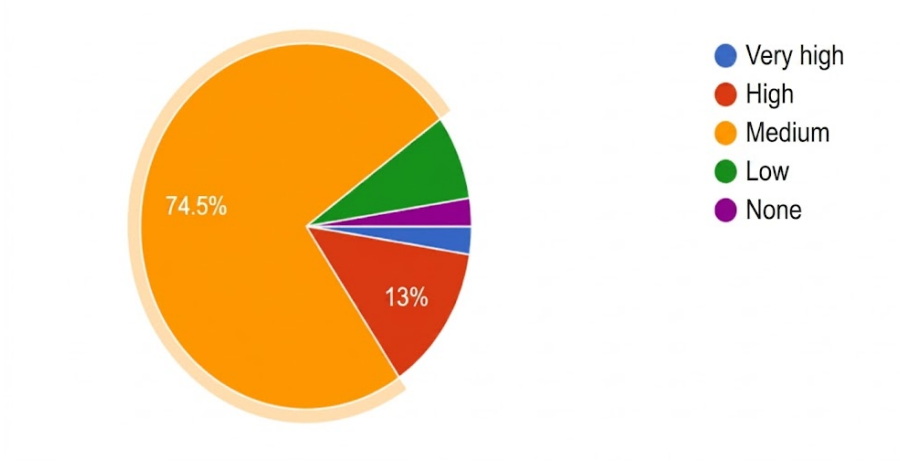
Figure 8. The producer possesses ecological awareness



Source: Authors

Of the 200 surveyed individuals, it is evident that 58% possess a medium level of ecological knowledge but do not practice it; 24.5% possess a medium level of ecological knowledge and apply conservation practices; 8% possess a low level of ecological knowledge and do not practice it; and 6% are completely unaware of ecological knowledge concepts.

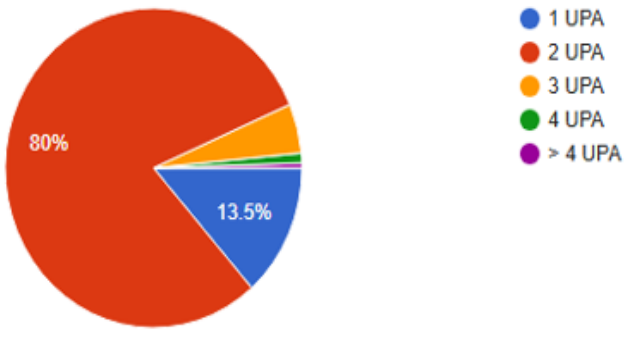
Figure 9. Relationship with associations



Source: Authors

Of the 200 surveyed individuals, it is observed that 74.5% have a medium relationship with the association; 13% possess a high relationship with the association; and 12.5% possess a low or non-existent relationship.

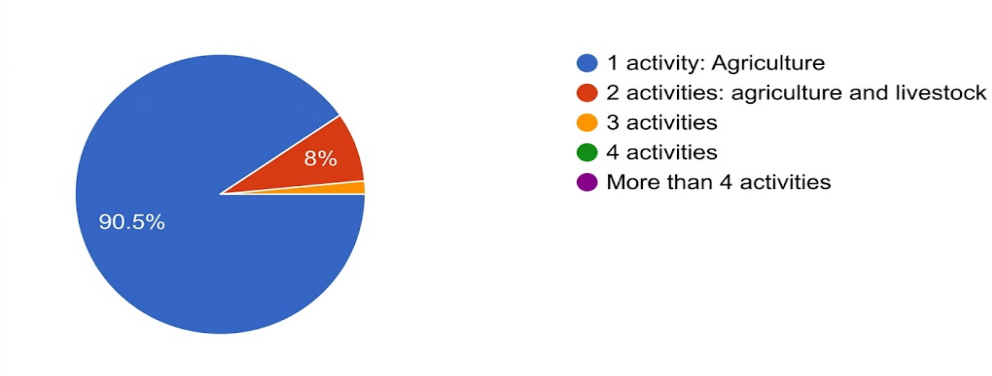
Figure 10. What is the source of your monthly income?



Source: Authors

Of the 200 surveyed individuals, it is evident that 80% state their income comes from owning 2 UPA; 13.5% from 1 UPA; and 6.5% expressed that their income comes from owning 3 to 4 UPA.

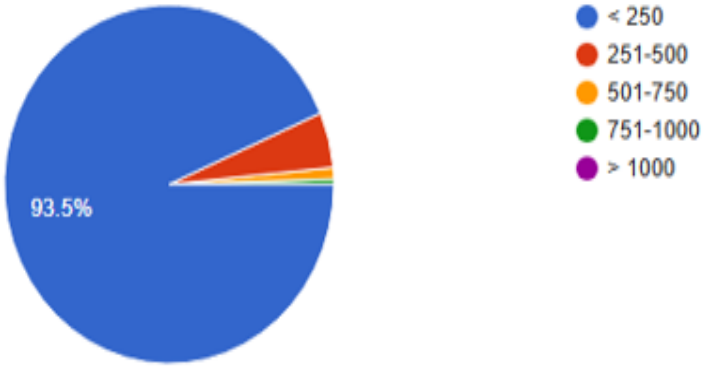
Figure 11. Activity to which the family is dedicated



Source: Authors

Of the 200 surveyed individuals, it is observed that 90.5% are dedicated to agriculture; 8% are dedicated to agriculture and livestock; and 1.5% are dedicated to three activities.

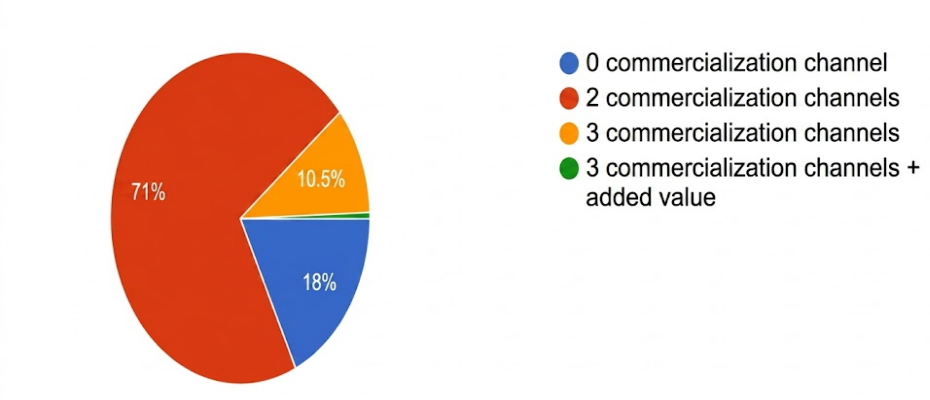
Figure 12. Monthly income in USD (dollars)



Source: Authors

Of the 200 surveyed individuals, it is evident that 93.5% possess a monthly income level of less than $250; approximately 24.5% possess incomes between $251–$500.

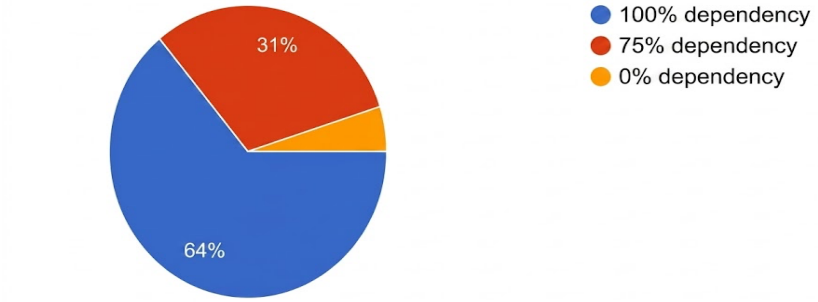
Figure 13. What are the commercialization channels?



Source: Authors

Of the 200 surveyed individuals, it is observed that 71% of the farmers possess 2 commercialization channels; 10.5% possess 3 commercialization channels; 18% possess 0 commercialization channels; and 0.5% possess 3 commercialization channels.

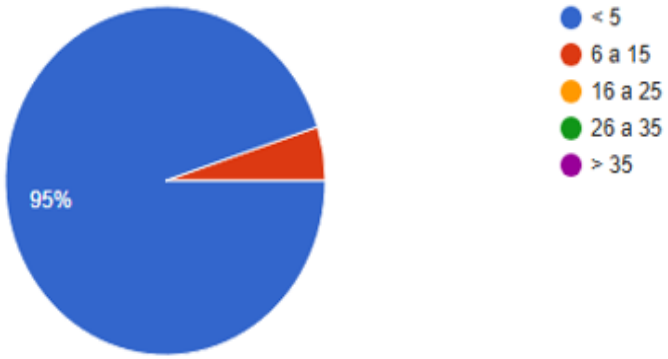
Figure 14. Dependence on agricultural inputs



Source: Authors

Of the 200 surveyed individuals, it is evident that 65% have a 100% dependence on chemical inputs; 31% possess a 75% dependence on agricultural inputs; and 5% have a 0% dependence on inputs.

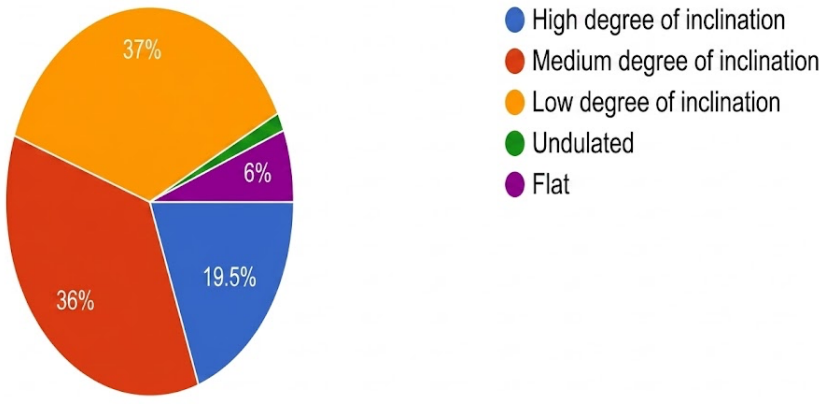
Figure 15. Number of cultivated hectares



Source: Authors

Of the 200 individuals surveyed, it is evident that 95% possess land extensions of less than 5 cultivated hectares, and 5% possess from 6 to 15 cultivated hectares.

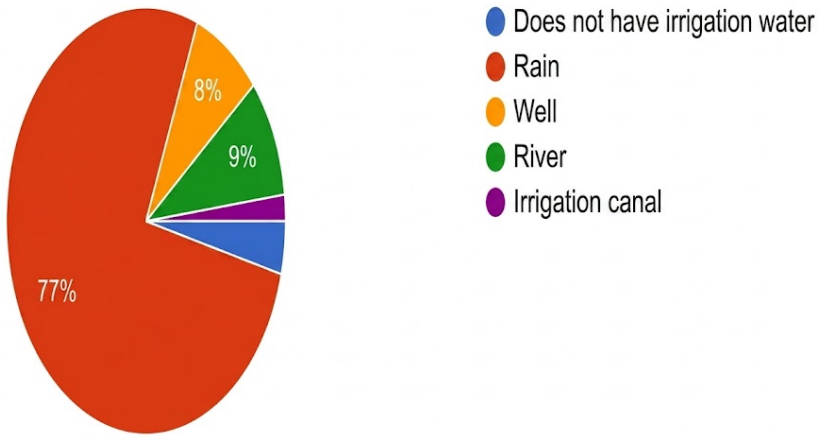
Figure 16. Topography of the farm



Source: Author

Of the 200 surveyed individuals, it is evident that 37% possess a low degree of slope; 36% possess a medium degree of slope; 19.5% possess a high degree of slope; 6% have flat topography, and 1.5% have rolling topography.

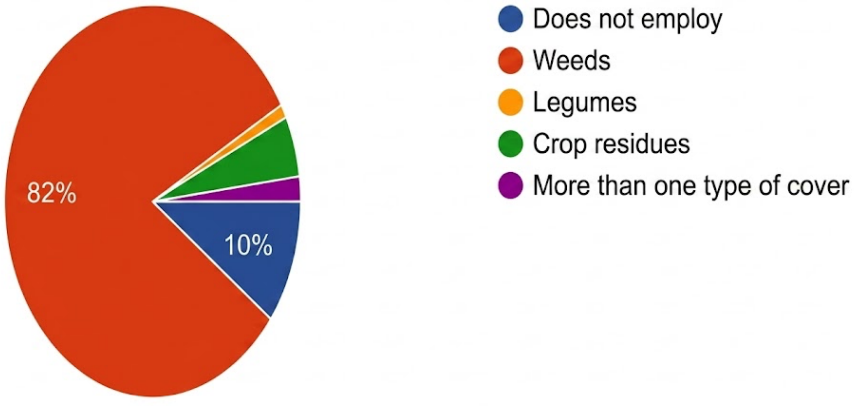
Figure 17. Source of water supply



Source: Authors

Of the 200 surveyed individuals, it is observed that 77% have rainwater as their source of water supply; 9% are supplied by river water; 8% by well water; 6% are supplied by an irrigation canal, and others do not have a source of supply.

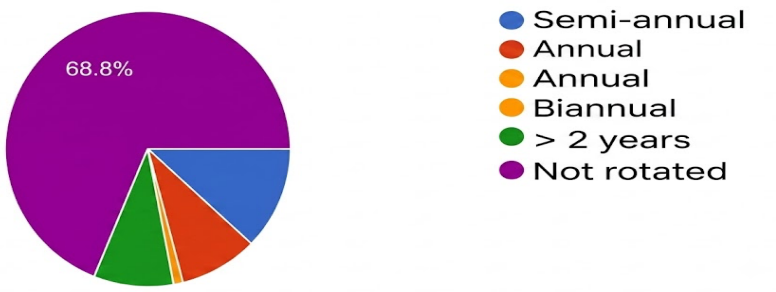
Figure 18. Cover crops or soil covers used



Source: Authors

Of the 200 surveyed individuals, it is observed that 82% use weeds as cover; 10% do not use cover; and within the remaining 8%, there are cases of farmers who use more than one type of cover, crop residues, and legumes.

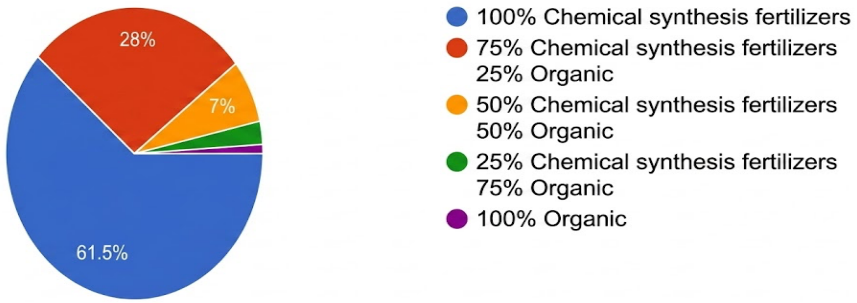
Figure 19. How frequently do you practice crop rotation?



Source: Authors

Of the 200 surveyed individuals, it is evident that 63.8% do not practice crop rotation; 12.1% practice semi-annual rotation; 9% practice rotation on an annual basis; and 9% practice rotation over a period greater than 2 years.

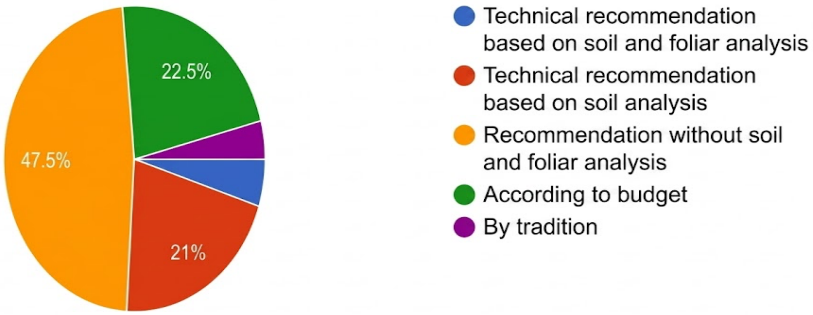
Figure 20. Fertilizers used in the production systems



Source: Authors

Of the 200 surveyed individuals, it is observed that 61.5% use 100% chemical synthesis fertilizers; 28% use 75% chemical synthesis fertilizers and 25% organic fertilizers; 7% use 50% chemical synthesis fertilizers and 50% organic fertilizers; and within the remaining 3.7%, they use 25% chemical synthesis fertilizers and 75% organic fertilizers, or 100% organic fertilizers.

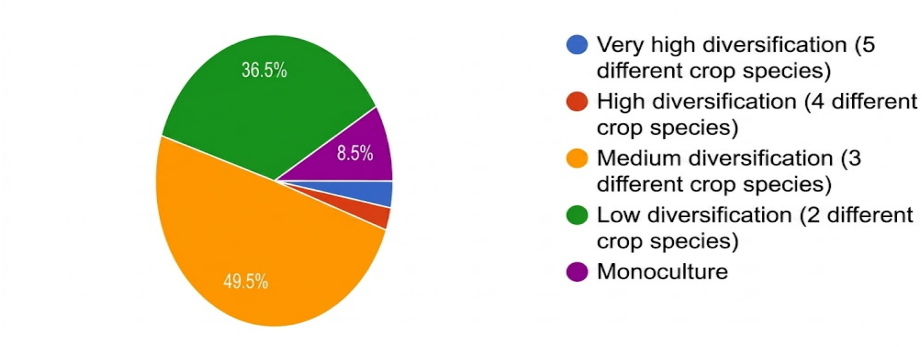
Figure 21. Fertilization criteria of the farmer



Source: Authors

Of the 200 surveyed individuals, it is observed that for 47.5%, the fertilization criterion is based on recommendation without soil and foliar analysis; 22.5% fertilize according to budget; 21% follow a technical recommendation based on soil analysis; and 8% fertilize by tradition, while others do so by technical recommendation based on both soil and foliar analysis.

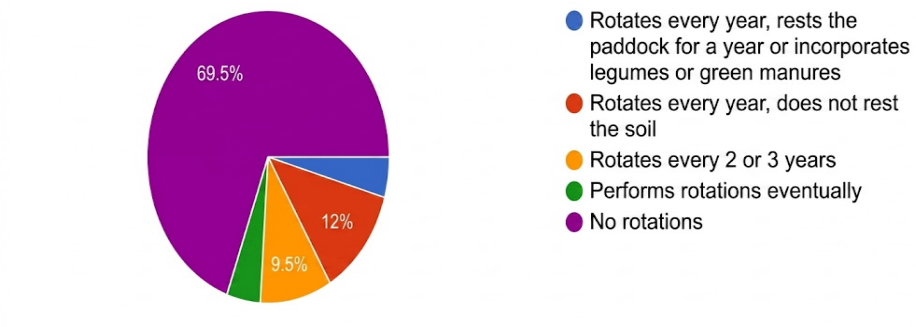
Figure 22. Crop Diversification



Source: Authors

Of the 200 surveyed individuals, it is observed that 49.5% diversify with three different crop species; 36.5% diversify with two different crop species; 8.5% practice monoculture; and 5.5% diversify with 4 to 5 crop species.

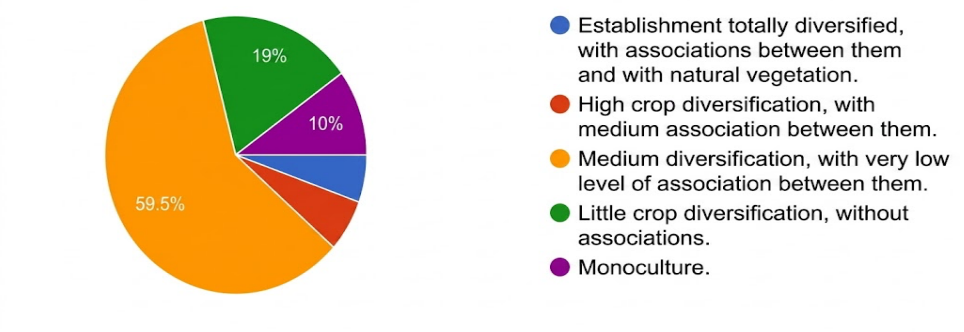
Figure 23. Temporal biodiversity



Source: Authors

Of the 200 surveyed individuals, it is observed that 69.5% do not practice rotations; 12% rotate every year without letting the soil rest; 9.5% rotate every 2 or 3 years; 8% practice rotations occasionally; and others rotate every year, leaving the pasture to rest for a year or incorporating legumes or green manure.

Figure 24. Spatial biodiversity



Source: Authors

Of the 200 surveyed individuals, it is observed that 59.5% possess a very low level of crop association; 19% have low crop diversification; 10% practice monoculture; within the remaining 11.5%, a medium level of association is utilized among them; and others have a fully diversified establishment.

Evaluating the economic, ecological, and social sustainability of producers at the Colimes Cantonal Agricultural Center

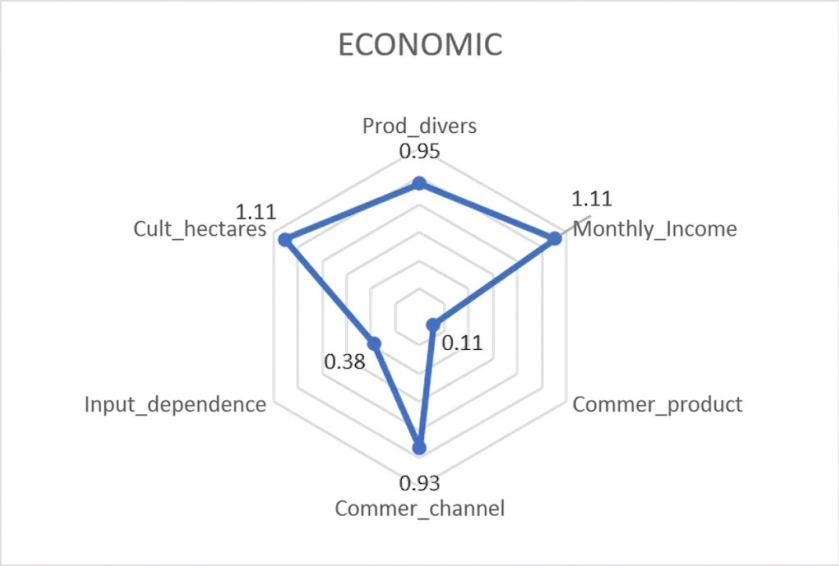
To carry out this objective, specific formulas were applied according to the local reality in order to evaluate the social, ecological, and socio-cultural dimensions.

Table 1. Evaluation of economic sustainability

Economic (IK)	**Food Self-Sufficiency**	**Economic Risk**	**C.- Monthly Income**			
	A	**B**	**C1**	**C2**	**C3**	**C4**
	Productive Diversity	Monthly Income	Marketed Product	Marketing Channels	Dependence on Inputs	Cultivated Hectares
	0.95	1.11	0.11	0.93	0.38	1.11
	4	4	4	4	4	4

Source: Authors

Figure 25. Graphical representation of the economic sustainability evaluation



Source: Authors

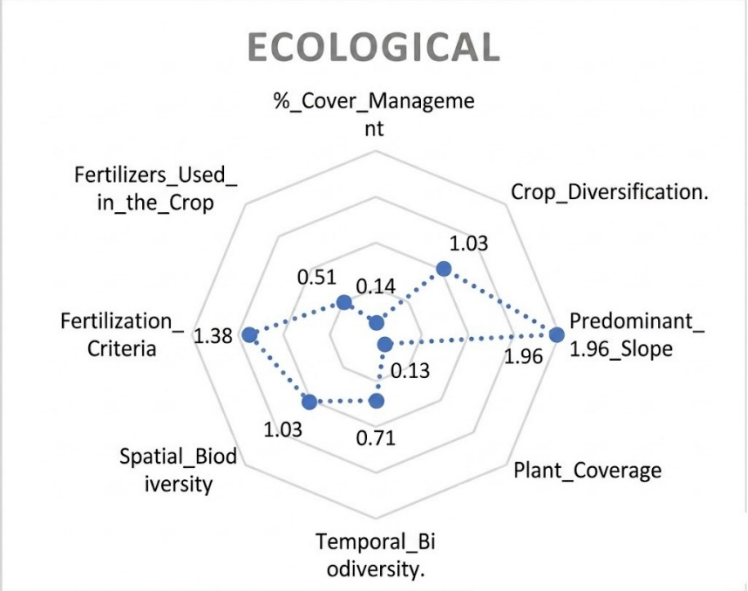
In the economic sphere, it was evident that incomes fall below the unified basic salary. Compounding this are poor agricultural practices, principally monoculture scoring 0.95, a lack of marketing channels scoring 0.93, and a high dependence on agricultural inputs, especially nitrogen-based ones, scoring 0.38—which generate low productivity and a low rate of return.

Table 2. Evaluation of ecological sustainability

	A – Soil Life Conservation		**B – Erosion Risk**		**C. Biodiversity Management**		**D. Crop Nutrition**	
Ecological (IE)	Ground Cover Management	Crop Diversification	Predominant Slope	Vegetation Cover	Temporal Biodiversity	Spatial Biodiversity	Fertilization Criteria	Fertilizers Used in the Crop
	0.14	1.03	1.96	0.13	0.71	1.03	1.38	0.51
	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Source: Authors

Figure 26. Graphical representation of the ecological sustainability evaluation.



Source: Authors

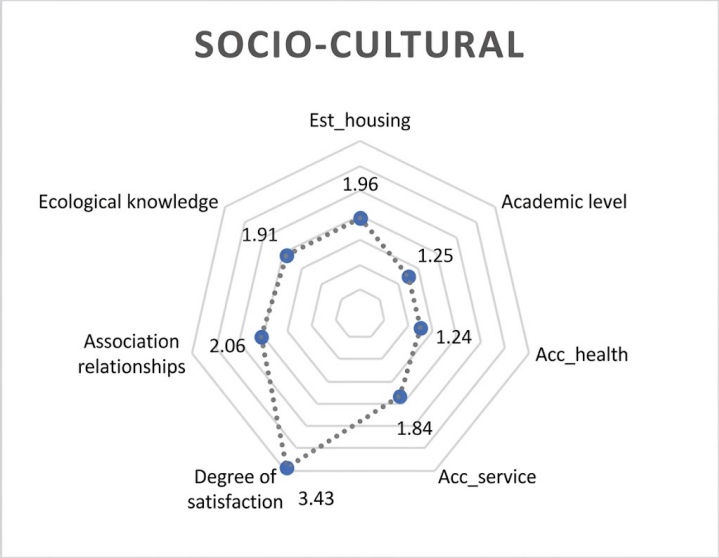
Generally speaking, the ecological dimension is not sustainable in any of the evaluated components. The management of soil cover obtained the lowest valuation at 0.14. Similarly, fertilization criteria—regarding both the sources used and their application methods—indicate a complete lack of technical criteria for managing these inputs, which explains the low productivity observed in these production systems.

Table 3. Evaluation of socio-cultural sustainability

Sociocultural (ISC)	**A – Satisfaction of Basic Needs**				**B – Acceptability**	**C. Integration**	**D. Ecological Awareness**
	Housing Condition	Educational Level	Access to Healthcare	Access to Basic Services	Degree of Satisfaction	Relationship with Associations	Ecological Knowledge
	1.96	1.25	1.24	1.84	3.43	2.06	1.91
	4	4	4	4	4	4	4

Source: Authors

Figure 27. Graphical representation of the socio-cultural sustainability evaluation



Source: Authors

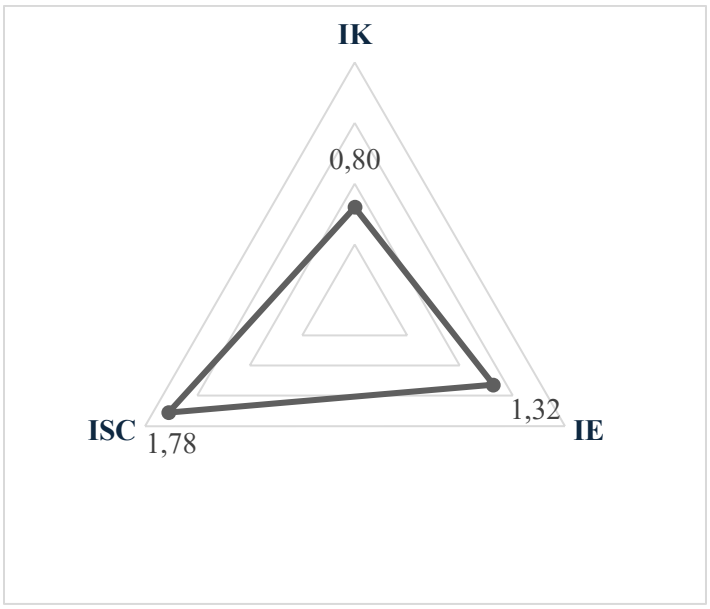
Within the socio-cultural parameter, it was evident that there is a high degree of satisfaction with the production systems they are dedicated to, scoring 3.43, followed by a score of 2.06 for associational relationships, which makes these variables sustainable. However, a level of ecological knowledge below the sustainability parameter is noted at 1.91, meaning they possess a medium level of ecological knowledge but do not put it into practice.

Table 4. Sustainability index of the economic, ecological, and socio-cultural dimensions

IK	IE	ISC
0,8	1,32	1,78

Source: Authors

Figure 4. Graphical representation of the sustainability evaluation of the economic, ecological, and socio-cultural dimensions



Source: Authors

Table 5. General sustainability index of the economic, ecological, and socio-cultural dimensions

ISG	1,3

According to the results obtained through tabulation, the lack of sustainability among producers in the production systems managed at the agricultural center is evident. The results showed an economic index of 0.80, an ecological index of 1.32, and a socio-cultural index of 1.78, resulting in an average general sustainability index of 1.30, which, according to the framework described by Miguel Altieri and Sarandón, classifies the system as unsustainable.

Develop a sustainable development plan to improve sustainability conditions at the Colimes cantonal agricultural center.

The sustainable development plan is based on the results obtained. In the economic sphere, it was evident that incomes fall below the unified basic salary. Compounding this are poor agricultural practices—principally monoculture scoring 0.95, a lack of marketing channels scoring 0.93, and a high dependence on agricultural inputs, especially nitrogen-based ones, scoring 0.38—which generate low productivity and a low rate of return. In the ecological sphere, it is not sustainable in any of the evaluated components, with soil cover management obtaining the lowest valuation at 0.14. Similarly, fertilization criteria—regarding both the sources used and how to apply them—indicate a lack of technical criteria for managing these inputs, which explains the low productivity observed in these production systems. Within the socio-cultural parameter, it was evident that there is a high degree of satisfaction with the production systems they are dedicated to, scoring 3.43, followed by a score of 2.06 for associational relationships, which makes these variables sustainable. However, a level of ecological knowledge below the sustainability parameter is noted at 1.91, meaning they possess a medium level of ecological knowledge but do not put it into practice.

With the aforementioned background, the action plan is presented, which contains desired objectives, expected goals, and actions that must be taken, all logically articulated. Their purpose is to enhance the economic, social, and ecological sustainability of the production systems of the users at the Colimes agricultural center.

Table 6. Sustainable Development Plan for Improving Sustainability Conditions at the Colimes Cantonal Agricultural Center

#	DESIRED OBJECTIVES	EXPECTED GOALS	ACTIONS TO BE TAKEN	INDICATORS	ASSUMPTIONS
1	Promote production diversification among members of the Colimes Agricultural Center.	A 10% increase in the diversification of economically important crops is expected, improving members' income.	Diversify cultivated areas with economically important crops.	% = Number of members who have diversified / Total number of members × 100	Lower production, lower income, greater soil degradation, increased dependence on inputs, reduced market demand, and negative impacts on the environment, health, and food security.
2	Establish areas dedicated to subsistence crops within cultivated land.	By the end of the first year, a 15% increase in cultivated areas allocated to self-consumption is expected.	Cultivate at least 0.5 hectares with vegetables, fruit trees, and other species that contribute to producers' self-consumption.	% = Number of members who have established self-consumption areas / Total number of members × 100	Producers would become 100% dependent on market products and would be unprepared for food shortages, affecting economic and social conditions.
3	Increase crop yields on farms.	Rice and maize yields increase by 10% compared to the production levels found at the beginning of the study.	1. Identify factors limiting agricultural productivity. 2. Propose measures to mitigate the negative effects of factors limiting rice and maize production.	% = Kilograms produced per hectare / Total cultivated hectares × 100	Abandonment of agricultural activities, migration to cities, and economic losses.

#	DESIRED OBJECTIVES	EXPECTED GOALS	ACTIONS TO BE TAKEN	INDICATORS	ASSUMPTIONS
4	Expand marketing channels for producers associated with the Agricultural Center.	Rice and maize producers market 30% of their production at fair prices by the end of the first year of implementation.	1. Conduct a market study. 2. Consider collective sales through the Association to obtain better market prices. 3. Train producers in commercialization and marketing topics. 4. Identify market niches (e.g., marketing their own rice brand).	% = Number of trained members / Total number of members × 100. % = Number of members participating in collective marketing / Total number of members × 100.	Abandonment of agricultural activities, migration to cities, and reduced income.
5	Gradually integrate nutrient sources with effective microorganisms that enhance nutrient performance without degrading soils or contaminating water sources.	By the end of the first year, 25% of producers will be applying effective microorganisms as an alternative to improve crop performance.	1. Reduce fertilizer application intervals, especially nitrogen fertilizers . 2. Identify alternative products (organic or others) that are effective for pest management in crops managed by the Colimes Association. 3. Train and raise awareness among producers about the advantages of using environmentally friendly products that contribute to production.	% = Number of members using nutrient sources with microorganisms / Total number of members × 100	Reduced productivity and crop quality, greater dependence on synthetic inputs, economic impacts, and negative effects on the environment, health, and food security.

#	DESIRED OBJECTIVES	EXPECTED GOALS	ACTIONS TO BE TAKEN	INDICATORS	ASSUMPTIONS
6	Implement sustainable crop management methods.	By the end of the first year, 20% of members will adopt environmentally friendly practices.	Introduce agroecological, organic, and conservation-oriented practices into the production systems of Colimes Agricultural Center members.	% = Number of members implementing conservation practices / Total number of members × 100	Water contamination affecting human consumption, soil degradation, and reduced crop productivity.
7	Conduct soil evaluations to determine appropriate land use according to land capability.	Soil mapping and classification are completed for 20% of producers during the first year.	Conduct soil studies that promote site-specific management in production systems.	% = Number of members who have characterized their soil / Total number of members × 100	Dependence on external inputs, low productivity, and economic losses.

Source: Authors

DISCUSSION

In the present research conducted on producers from the Cantonal Agricultural Center of Colimes in the Province of Guayas, the survey results regarding the environmental factor show that 58% of farmers have a medium level of ecological knowledge, considering that 65% depend on synthetic agricultural inputs, including pesticides and fertilizers, for crop management. This relates to the results obtained by Cadena et al. (2021), which mention that over 50% of farmers depend on the use of synthetic agricultural inputs for management in rice cultivation systems.

Over 60% of the farmers at the Cantonal Agricultural Center of Colimes do not practice crop rotation as part of their production system management, taking into account that the majority do not have crop diversity; thus, 49.5% have only three different crops in their production units. In a study conducted by Morán et al. (2021) on corn production systems, it is indicated that in the environmental aspect, 59.7% of farmers practice monoculture and have low crop diversity, which is considered a deficiency in the ecological dimension.

Regarding the economic aspect, the majority of farmers at the Cantonal Agricultural Center of Colimes have production unit sizes of less than 5 hectares, considering agricultural activity as the main economic income for 90.5% of family members, with 93.5% of surveyed farmers receiving less than 250 US dollars as part of their monthly remuneration for this activity. These results match those obtained by Morán et al. (2021), where the sizes of the production units are smaller than 5 hectares for corn farmers in the Province of Los Ríos. Similarly, Cadena et al. (2021) mention that the net income obtained from rice agricultural activity in the Babahoyo canton is below the basic food basket.

The results of the social analysis in reference to the surveys conducted on the farmers of the Cantonal Agricultural Center of Colimes show that 72% of the agricultural labor activity is male, with an average age between 41 and 50 years. The

educational level of the surveyed farmers is primary school for 73%. For access to medical services, 48% of the farmers primarily have healthcare sub-centers available. In reference to housing, 46% have mixed-construction homes, and 86% have basic electricity and drinking water services. Of the surveyed farmers, 65% feel satisfied with the economic activity they perform. These results agree with those obtained in a study conducted by Morán et al. (2020) on the sustainability of rice cultivation in the Daule Canton, showing that men represent 84% of those responsible for agricultural activity, with ages above 31 years. On the contrary, educational instruction is at 51% for high school studies and 24% for university studies. This same study shows that access to basic services is available for more than 95% of the surveyed farmers.

Regarding sustainability, the results show that for the users of the Colimes cantonal agricultural center, values in the economic sphere are low, evidencing that incomes fall below the unified basic salary, alongside a lack of marketing channels and a high dependence on agricultural inputs. In the ecological sphere, it is not sustainable in any of the evaluated components, denoting a lack of technical criteria for managing these inputs, which explains the low productivity in these production systems. These results match those shown in the work conducted by Cadena et al. (2021) for the CEDEGE rice production system, which shows values below 2 and is therefore not sustainable. Similarly, it is mentioned that in the ecological aspect where the production system has a value greater than 2, it is therefore sustainable; however, low levels of education and ecological awareness are reflected.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The most important activity evidenced by the farmer users of the Colimes agricultural center is the planting of rice or corn; that is to say, they are not diversified production systems.

The studied production systems are similar regarding the high levels of nitrogen fertilizers applied; however, their agricultural yields are low, which is why an improvement in production processes is necessary.

The production systems managed by the studied users of the Colimes agricultural center are not sustainable in any of their dimensions. A fundamental element in this is the environmental dimension, with soil cover management obtaining the lowest valuation at 0.14. Similarly, fertilization criteria—regarding both the sources used and how to apply them—denote a lack of technical criteria for managing these inputs, which explains the low productivity in these production systems.

The action plan contributes to supporting decision-making; during its analysis and prior to its implementation, it must be discussed with the users to secure their support and contribution. In the short and medium term, the action plan will leverage the objectives, goals, and actions for the parameters that limit sustainability within the production systems of the users at the Colimes agricultural center.

Recommendations

It is recommended that training be provided on the following topics: diversification of areas with crops of economic importance; implementation of areas with vegetables, fruit trees, and species that contribute to the producer's self-consumption; measures to increase crop yield; ways in which marketing channels

can be expanded for producers associated with the Agricultural Center; the gradual use of nutrient sources with efficient microorganisms that improve the performance of the former without degrading the soil or contaminating water sources; and the importance of soil evaluation to determine what type of fertilizers can be used.

That the action plan proposed in this work be implemented in the short or medium term, with the purpose of contributing to the sustainability of the production systems of the agricultural center's users.

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APPENDYX

Figure 1. Authorization letter to conduct the thesis at the agricultural center

A QUIEN INTERESE

Ciudad.

De mis consideraciones:

Yo, Walter Hugulino Alvarado Briones, con CI: 0918554577, en calidad de **PRESIDENTE DE LA ASOCIACIÓN AGRÍCOLA DEL CANTÓN COLIMES**, Autorizo a la Ing. Dioselina Clemencia Navarrete Chévez, con CI: 0918665977, estudiante de la Maestría en **Agroecología y Desarrollo Sostenible**, de la Escuela de Posgrado "Ing. Jacobo Bucaram Ortiz, PhD", para que realice su tesis titulada **"CARACTERIZACION DE LA SOSTENIBILIDAD DE LOS PRODUCTORES DEL CENTRO AGRÍCOLA CANTONAL DE COLIMES, PROVINCIA DEL GUAYAS".**

Con sentimientos de distinguida consideración

Atentamente,

CENTRO AGRICOLA CANTONAL COLIMES PRESIDENTE

.....

Walter Hugulino Alvarado Briones.
PRESIDENTE DE LA ASOCIACIÓN AGRICOLA DEL CANTÓN COLIMES
CI: 0918554577

Figure 2. Survey format for producers

ENCUESTA PARA OBTENER DATA DE LOS PRODUCTORES DE LA ASOCIACION AGRICOLA CANTONAL PERTENECIENTE AL CANTON COLIMES

DIMENSION SOCIAL

Nombre y apellido del agricultor entrevistado:

_____

Aspectos sociales del productor/a

1. Sexo del responsable de la finca:

Hombre Mujer

2. Edad del del responsable de la finca (años)

( ) 20-30

( ) 31-40

( ) 41-50

( ) 51-60

( )> 60

A-Satisfacción de necesidades básicas

3. Nivel de instrucción del responsable de la finca

( ) Ninguno

( ) Primaria

( ) Secundaria

( ) Tecnico

( ) Superior

4-Cuentan con servicio medico ?

( ) Clinica privada (seguro medico privado)

( ) Hospital

( ) Centro medico

( ) Subcentro medico

( ) No cuenta con servicio medico

5. Estado de vivienda en la finca

( ) No posee ( ) Caña ( ) Madera

( ) Mixta (madera + cemento) ( ) Cemento

6. Servicios básicos en la vivienda

( ) Sin servivios ( ) 1 servicio: Agua potable ( ) 2 servicio; Aagua y Energia electrica ( ) 3 servicios: Agua, energia y Alcantarillado ( ) mas de 3 servicios basicos

B- Aceptabilidad

7. Satisfacción del agricultor

( ): Está muy satisfecho con lo que hace, no haría otra actividad, aunque ésta le reporte mayores ingresos

( ) Está contento, pero antes le iba mejor

( ) No está del todo satisfecho, se queda porque es lo único que puede hacer

( ) Poco satisfecho con esta forma de vida, anhela vivir en la ciudad y dedicarse a otra actividad

( ) Está desilusionado con la vida que lleva, no lo haría más. Está esperando que se le presente una oportunidad para dejar la agricultura.

C- Conciencia Ecológica

8.- El productor posee conciencia ecológica

( ) Posee un amplio conocimiento ecológico, aplica prácticas de conservación.

( ) Posee un nivel medio de conocimiento ecológico, aplica prácticas de conservación.

( ) Posee un nivel medio de conocimiento ecológico, no practica.

( ) Posee bajo conocimiento ecológico, no lo practica

( ) Desconoce totalmente conceptos de conocimiento ecológico

D- Integración con asociaciones

9.- Relacion con asociaciones

( ) Muy alta ( ) Alta ( ) Media ( ) Baja ( ) Nula

DIMENSION ECONOMICA

A- Autosuficiencia alimentaria

10: De donde provienen sus ingresos mensuales (USD)

( ) 1 UPA; ( ) 2 UPA, ( ) 3 UPA; ( ) 4 UPA; ( ) > 4 UPA

11. Ingreso mensual en USD

( ) < 250 ( ) 251-500 ( ) 501-750 ( ) 751 - 1000 ( ) >1000

B- Riesgo Económico

12. Actividad a la que se dedica su familia

( ) 1 actividad: agricultura ( )2 actividades: agricultura y ganaderia ( )3 actividades ( ) A 4 actividades ( ) Mas de 4 actividades

13. Cuales son los canales de comercializacion?

( ) 0 canal de comercializacion ( ) 1 canal de comercializacon ( ) 2 canales de comercializacion

( ) 3 canales de comercializacion ( ) 3 canales de comercializacon + valor agregado

14. Dependencia de insumos agricolas

( ) 100% de dependencia ( ) 75% de dependencia ( ) 50% de dependencia ( ) 25% de dependencia ( ) 0% de dependencia

15. Numero de hectareas cultivadas

( ) < 5 ( ) 6 a 15 ( ) 16 a 25 ( ) 26 a 35 ( ) > 35

DIMENSION ECOLOGICA

A- Riesgo de erosion

16. Topografia de la finca

( ) Alto grado de inclinacion ( ) Mediano grado de inclinacion ( ) Bajo grado de inclinacion

( ) Ondulado ( ) Plano

17. Fuente de abastecimiento de agua

( ) No posee agua de riego ( ) Lluvia ( ) Pozo ( ) Rio ( ) Canal de riego

B -Conservación de la vida de suelo

18. Tipo de coberturas empleadas

( ) No emplea ( ) Malezas ( ) Leguminosas ( ) Resduos de cosechas ( ) Mas de una

19. Con que frecuencia realiza la rotacion de cultivos?

( ) Semestrales ( ) Anuales ( ) Bianuales ( ) > 2 años ( ) No rota

20. Fertilizantes empleados en los sistemas productivos

( ) 100 Fertilizante de sintesis quimica ( )75% Fertilizante de sintesis quimica 25% organicos ( ) 50% Fertilizante de sintesis quimica 50% organicos ( ) 25% Fertilizante de sintesis quimica 75% organicos ( ) 100% organicos

21. Criterios de fertilizacion del agricultor

( ) Recomendación técnica en base a análisis de suelo y foliar

( ) Recomendación técnica en base analisis de suelo

( ) Recomendación sin analisis de suelo y foliar

( ) Según presupuesto

( ) Por tradicion

22. Diversificacion de cultivos

(4) Muy alta diversificación 5 especies de cultivos diferentes

(3) Alta diversificación 4 especies de cultivos diferentes

(2) Media diversificación 3 especies de cultivos diferentes

(1) Baja diversificación 2 especies de cultivos diferentes

(0): Monocultivo

C. Manejo de la Biodiversidad

23. Biodiversidad temporal.

(4) Rota todos los años, deja descansar un año el potrero o incorpora leguminosas o abonos verdes

(3) Rota todos los años, no deja descansar el suelo

(2) Rota cada 2 ó 3 años

(1) Realiza rotaciones eventualmente

(0) No rotaciones.

24. Biodiversidad espacial.

4) Establecimiento totalmente diversificado, con asociaciones entre ellos y con vegetación natural

(3) Alta diversificación de cultivos, con asociacion media entre ellos.

(2) Diversificación media, con muy bajo nivel de asociación entre
ellos

(1) Poca diversificación de cultivos, sin asociaciones

(0) Monocultivo.

Source: Author

Table 8. Data from 200 members of the agricultural center who were surveyed.

No	Surveyed members
1	Amparo Beatriz Molina Molina
2	Abad Burgos Jeferson Israel
3	Abad Burgos Viliardo Ricardo
4	Abad Castro donatila Delia
5	Alvarado Cabello Miguel Santos
6	Alvarado Chilan Glerida Deidamia
7	Alvarado Martinez Hernan
8	Alvarado Montiel Edith Agustina
9	Alvarado Zambrano Lorenzo Liborio
10	Álvarez Mora Bella Pabla
11	Andreina García España
12	Antonio de Jesús Rivas Burgos
13	Arias Mantuano Pedro Antonio
14	Arteaga Alvarado Narcisa de Jesús
15	Arteaga Plúas Angelica María
16	Avares Manzano Enrique Jacinto
17	Bacilio López
18	Baque Baque María Elizabeth
19	Baque Baque Wiliam Norberto.
20	Betsy Leonela Triviño Macías

21	Braulio Medardo Ruiz Sellán
22	Brillity Isabel Holguin Rosado
23	Briones Franco Eufemia Armira
24	Briones vera Florencio Alejandro
25	Briones Vera Rosa Isabel
26	Burgos Almeida José Oswaldo
27	Burgos Burgos Kennedy Nahon
28	Burgos Burgos Mercy Graciela
29	Burgos Manzano Mariana de Jesús
30	Cabrera Sellan Jaime Manuel
31	Cabrera Sellan Luis Armando.
32	Calderón Quijije Alejandro Leandro
33	Casquete Mora Nohemí Guillermina
No	**Encuestados**
34	Castellano Avilés Felipe Cesáreo
35	Castro Zambrano Santos Mauro
36	Castro Zambrano Wilson Benjamín
37	Cecilio Paul Tinoco Salazar
38	Cedeño Mora Manuel Ginardo
39	Choez Zambrano Luis
40	Christian Vidal Rivas Burgos
41	Coque Guerra Patricia Fabiola
42	Cruz Reyes Pedro Daniel
43	Daniel Triviño Castro
44	Eduardo Triviño Guerrero
45	Elvio Triviño Castro
46	Ernesto Nolberto Baque Baque
47	Espinoza Almeida Juan Manuel

48	Estalino García
49	Eugenia emperatriz Zambrano Rendón
50	Fajardo Hidalgo Francisco Viliardo
51	Fausto Agapito Reyes Heredero
52	Felix Gregorio Sánchez Manzaba
53	Félix Sánchez
54	Ferruzola Morales José Javier
55	Figueroa Solís Luciano Severo
56	Franklin Villamar
57	García Holguín Teófilo Jarmen
58	García Sellan Fredy Aurelio
59	García Sellan Rosendo Amador
60	García Soledispa Betty Bartola
61	Gonzáles Muguerza Ariel Naicer
62	Guamán Almagro Marco Rodrigo
63	Guerrero Alvarado José Alvarado
64	Guerrero Alvarado José Antonio
65	Guerrero Salazar Luz María
66	Guim Burgos Jorge Eduardo
67	Heredero Banchón Girson José
68	Heredero Barzola Genoveva del Carmen
69	Heredero Barzola Jacinto Darío
70	Jama Rubio Homero Lizandro
71	Jama Rubio Julio José
72	Jaramillo Arriaga Etiel Ivan Victor
No	**Encuestados**
73	Jaramillo Arriaga Miguel Iván
74	Javier Isidro Olmedo Cabrera

75	Javier López
76	Jeferson Israel Abad Burgos
77	López Villamar Fulgencio Bacilio
78	Jessenia Selena Macías López
79	Jonathan Castellano
80	Juan Avilés jama
81	Junior Castro
82	Junior López
83	Kelvin Stalin Sánchez Mayea
84	Laz Majojo Idelfonso Máximo
85	Lizbeth Stefania Bohórquez Ochoa
86	López Burgos Kléber Sebastián
87	López Burgos Miguel Angel
88	López Espinoza Carlos Alberto
89	López Espinoza Freddy Orlando
90	López Espinoza Victor Javier
91	López López Miguel Angel
92	López Párraga Silvia Tiostista
93	López Parrales Félix Javier
94	López Rosado Junior Ramón
95	López Rosado Kléber Abad
96	López Rosado Luis Enrique
97	López Villamar Fulgencio Bacilio
98	Luis Palacios
99	Luz Haydee Castro Sanchez
100	Macias Alay Aladino
101	Macias Alay Hermogenes Henrry
102	Macias Chichanda Verónica Aurelina

103	Macias López Felicita Griceida
104	Macias López Jessenia Selena
105	Macías Obregón Antolin Teodoro
106	Macías Pluas Luciano Otilio
107	Macías Vargas Esteban Bartolo
108	Mantuano Manzana Miguel Leonardo
109	Mantuano Pluas Carlos Alberto
110	Manzana Ochoa Richard Francisco
111	Manzano Sellan Fausto Andrés
No	**Encuestados**
112	Maquilon Rosendo Antonio
113	Maquilon Villamar Mario Roberto
114	Maria Elena Arruaga Arriaga
115	Mayea Santillan Teresa De Jesus
116	Mendez Castillo Mercedes
117	Mendieta Almeida Darwin Bolivar
118	Mendieta Almeida Hellyn Abel
119	Mendoza Guerrero Carlos Javier
120	Mendoza Obregón Jackeline Verónica
121	Mendoza Obregón Jacqueline Verónica
122	Mendoza Zambrano Joffre Humberto
123	Mieles Giler Flora Asunción
124	Miguel Ángel López Burgos
125	Miguel López
126	Molina Mora Andrés Elias
127	Mora Arteaga Carlos Ernesto
128	Mora Espinoza Alcides Jacinto

129	Mora Espinoza Leonardo Eduardo
130	Mora García Pedro Victricio
131	Mora Moreira Moisés Merquiares
132	Mora Silva Franklin Niceno
133	Morales abad jenifer aracely
134	Moran garcia jose tomas
135	Moreira Obregón Rosa Del Pilar
136	Muguerza Mieles Teresa de Jesús
137	Muñoz Aviles Wilson Dagoberto
138	Muñoz Mora Bárbara Isidora
139	Muñoz Triviño Fidel Euclides
140	Narcisa Arriaga Alvarado
141	Navarrete Burgos Felix Anantalon
142	Nelson Burgos Zambrano
143	Nelson Jonanthan zambrano Villamar
144	Noemi Casquete
145	Obregon Burgos Andres Lino
146	Obregón Macías Alejandro René
147	Obregón Mantuano Carlos Javier
148	Obregón Mantuano Diógenes Noel
149	Obregón Mantuano Maricela Janina
150	Ochoa Olvera Carlos Luis
No	**Encuestados**
151	Ochoa Olvera Diana Del Pilar
152	Ochoa Olvera Gabriel Agustín
153	Ochoa Sellan Maryuri Elizabeth
154	Oliver Sergio Burgos Ochoa

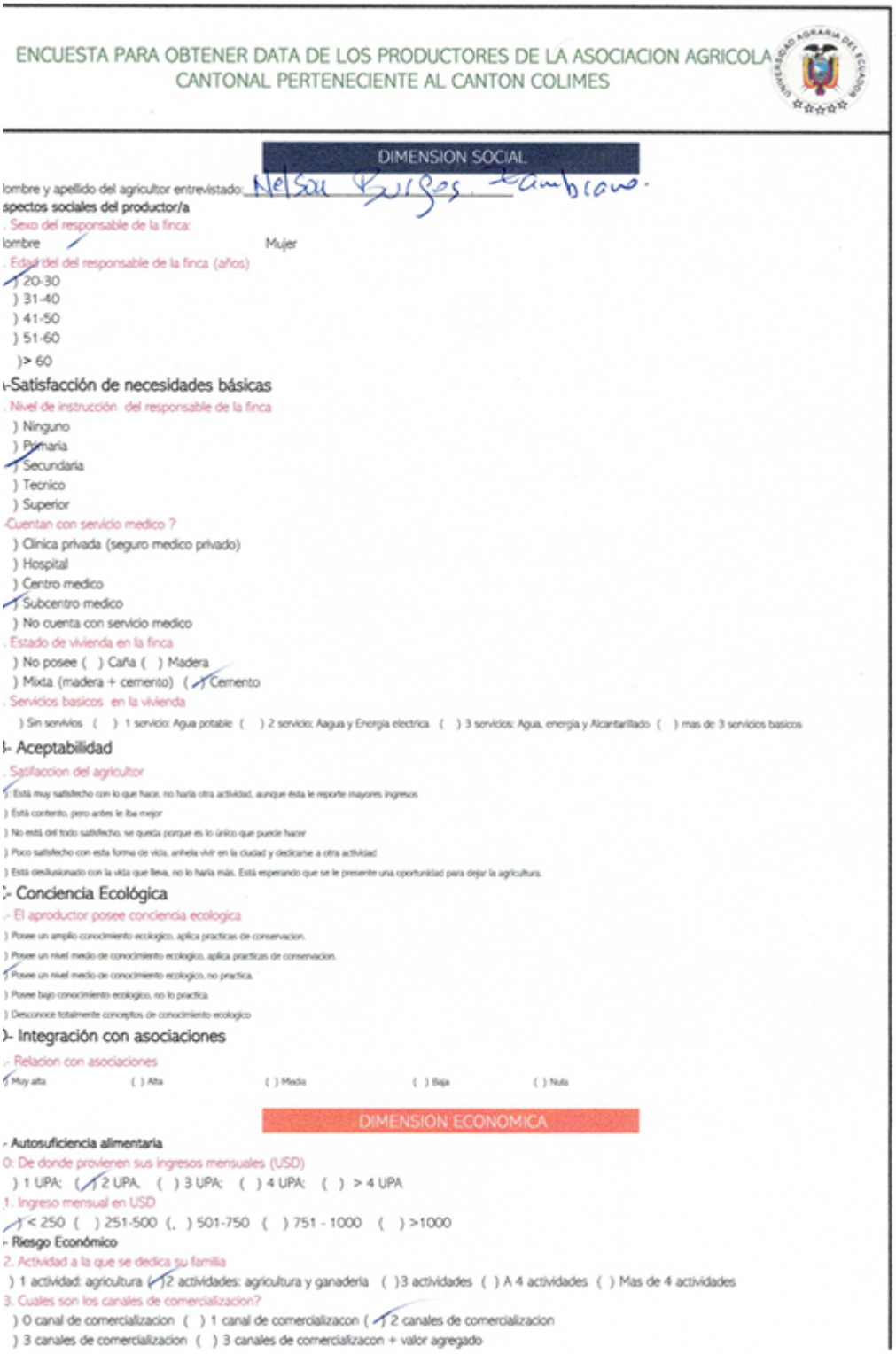
155	Olmedo Cabrera Isidro Javier
156	Olvera Castillo Marcos Aurelio
157	Palacios Rosado Luis Alberto
158	Palacios Troncoso Francisco Vicente
159	Parrales Manzano Juan Bautista
160	Parrales Mendoza Elena Yissela
161	Parrales Santana Mercy Miriam
162	Piloso Párraga Néstor Alejandro
163	Pin Mendoza Augusto Agrigildo
164	Pino Martillo Thomas
165	Plazarte Loor Rosa Monserrate
166	Plua Castro Stalin David
167	Plúa Chilan Cesar Augusto
168	Plua Chilan Fredy Edén
169	Pluas Benalcázar Rosendo Benjamin
170	Plúas Segura Nixon Gerónimo
171	Plúas Zambrano Danilo Alberto
172	Plúas Zambrano Geovanny Ivan
173	Plumas Romero Zobeida Lucia
174	Ramírez Aviles Gabriela Janeth
175	Rendón Burgos Jacinto Diomedes
176	Reyes Herederos Fausto Agapito
177	Reyes Pionce Rubertina Haydee
178	Rivas Burgos Antonio De Jesus
179	Rivas Burgos Christian
180	Rivas Villegas Brayan Daniel
181	Rodriguez Baque Cruz Floresmila

182	Rodríguez Peñafiel Josué David
183	Romero Burgos Orly Geovanny
184	Ronquillo Soledispa Eduardo Lautaro
185	Rosado araujo ladislao carlos
186	Rosado Burgos Cristhiam Alberto
187	Rosado Burgos Juan Alberto
188	Rosado Espinoza Luis Adalberto
189	Rosado Paulina María escribe
No	**Encuestados**
190	Rosado Rosado Luis Abraham
191	Rubio Pluas Sandra Antonela
192	Ruiz Cabrera Medardo
193	Tomás Morán
194	Verónica Macias cChichanda
195	Villegas Piguades Juana Arcadia
196	Walter Alvarado Briones
197	Wilson Muñoz
198	Yuri Rodríguez Garabi
199	Yury Avilés
200	Zambrano Castro Luis Alfredo

Photo 1. Interviews with members of the agricultural center

Photo 2. Interviews with members of the agricultural center

Image 3. Realized Surveys



ENCUESTA PARA OBTENER DATA DE LOS PRODUCTORES DE LA ASOCIACION AGRICOLA CANTONAL PERTENECIENTE AL CANTON COLIMES

DIMENSION SOCIAL

lombre y apellido del agricultor entrevistado: Nelson Burgos Zambrano.

spectos sociales del productor/a

. Sexo del responsable de la finca:

lombre ✓ Mujer

. Edad del responsable de la finca (años)

✓) 20-30
) 31-40
) 41-50
) 51-60
)> 60

-Satisfacción de necesidades básicas

. Nivel de instrucción del responsable de la finca

) Ninguno
) Primaria
✓) Secundaria
) Tecnico
) Superior

-Cuentan con servicio medico ?

) Clinica privada (seguro medico privado)
) Hospital
) Centro medico
✓) Subcentro medico
) No cuenta con servicio medico

. Estado de vivienda en la finca

) No posee ( ) Caña ( ) Madera
) Mixta (madera + cemento) (✓) Cemento

. Servicios basicos en la vivienda

) Sin servivios ( ) 1 servicio: Agua potable ( ) 2 servicio: Aagua y Energia electrica ( ) 3 servicios: Agua, energia y Alcantarillado ( ) mas de 3 servicios basicos

)- Aceptabilidad

. Satifaccion del agricultor

✓) Está muy satisfecho con lo que hace, no haría otra actividad, aunque ésta le reporte mayores ingresos
) Está contento, pero antes le iba mejor
) No está del todo satisfecho, se queda porque es lo único que puede hacer
) Poco satisfecho con esta forma de vida, anhela vivir en la ciudad y dedicarse a otra actividad
) Está desilusionado con la vida que lleva, no lo haría más. Está esperando que se le presente una oportunidad para dejar la agricultura.

:- Conciencia Ecológica

.- El aproductor posee conciencia ecologica

) Posee un amplio conocimiento ecologico, aplica practicas de conservacion.
) Posee un nivel medio de conocimiento ecologico, aplica practicas de conservacion.
✓) Posee un nivel medio de conocimiento ecologico, no practica.
) Posee bajo conocimiento ecologico, no lo practica.
) Desconoce totalmente conceptos de conocimiento ecologico

)- Integración con asociaciones

.- Relacion con asociaciones

✓) Muy alta ( ) Alta ( ) Media ( ) Baja ( ) Nula

DIMENSION ECONOMICA

- Autosuficiencia alimentaria

0: De donde provienen sus ingresos mensuales (USD)

) 1 UPA; (✓) 2 UPA. ( ) 3 UPA; ( ) 4 UPA; ( ) > 4 UPA

1. Ingreso mensual en USD

✓) < 250 ( ) 251-500 (.) 501-750 ( ) 751 - 1000 ( ) >1000

- Riesgo Económico

2. Actividad a la que se dedica su familia

) 1 actividad: agricultura (✓) 2 actividades: agricultura y ganaderia ( )3 actividades ( ) A 4 actividades ( ) Mas de 4 actividades

3. Cuales son los canales de comercializacion?

) 0 canal de comercializacion ( ) 1 canal de comercializacon (✓) 2 canales de comercializacion
) 3 canales de comercializacion ( ) 3 canales de comercializacon + valor agregado

( ) 3 canales de comercializacion ( ) 3 canales de comercializacon + valor agregado

14. Dependencia de insumos agrícolas

(✓) 100% de dependencia ( ) 75% de dependencia ( ) 50% de dependencia ( ) 25% de dependencia ( ) 0% de dependencia

15. Numero de hectareas cultivadas

(✓) < 5 ( ) 6 a 15 ( ) 16 a 25 ( ) 26 a 35 ( ) > 35

DIMENSION ECOLOGICA

A- Riesgo de erosion

16. Topografía de la finca

( ) Alto grado de inclinacion ( ) Mediano grado de inclinacion ( ) Bajo grado de inclinacion

( ) Ondulado (✓) Plano

17. Fuente de abastecimiento de agua

( ) No posee agua de riego ( ) Lluvia ( ) Pozo (✓) Rio ( ) Canal de riego

B -Conservación de la vida de suelo

18. Tipo de coberturas empleadas

(✓) No emplea ( ) Malezas ( ) Leguminosas ( ) Residuos de cosechas ( ) Mas de una

19. Con que frecuencia realiza la rotacion de cultivos?

( ) Semestrales ( ) Anuales ( ) Bianuales ( ) > 2 años (✓) No rota

20. Fertilizantes empleados en los sistemas productivos

(✓) 100 Fertilizante de sintesis química ( )75% Fertilizante de sintesis química 25% organicos ( ) 50% Fertilizante de sintesis química 50% organicos

( ) 25% Fertilizante de sintesis química 75% organicos ( ) 100% organicos

21. Criterios de fertilizacion del agricultor

( ) Recomendación técnica en base a análisis de suelo y foliar

( ) Recomendación técnica en base analisis de suelo

( ) Recomendación sin analisis de suelo y foliar

(✓) Según presupuesto

( ) Por tradicion

22. Diversificacion de cultivos

(4) Muy alta diversificación 5 especies de cultivos diferentes

(3) Alta diversificación 4 especies de cultivos diferentes

(2) Media diversificación 3 especies de cultivos diferentes

(1) Baja diversificación 2 especies de cultivos diferentes

(0) Monocultivo

C. Manejo de la Biodiversidad

23. Biodiversidad temporal.

(4) Rota todos los años, deja descansar un año el potrero o incorpora leguminosas o abonos verdes

(3) Rota todos los años, no deja descansar el suelo

(2) Rota cada 2 ó 3 años

(1) Realiza rotaciones eventualmente

(0) No rotaciones.

24. Biodiversidad espacial.

4) Establecimiento totalmente diversificado, con asociaciones entre ellos y con vegetación natural

(3) Alta diversificación de cultivos, con asociacion media entre ellos.

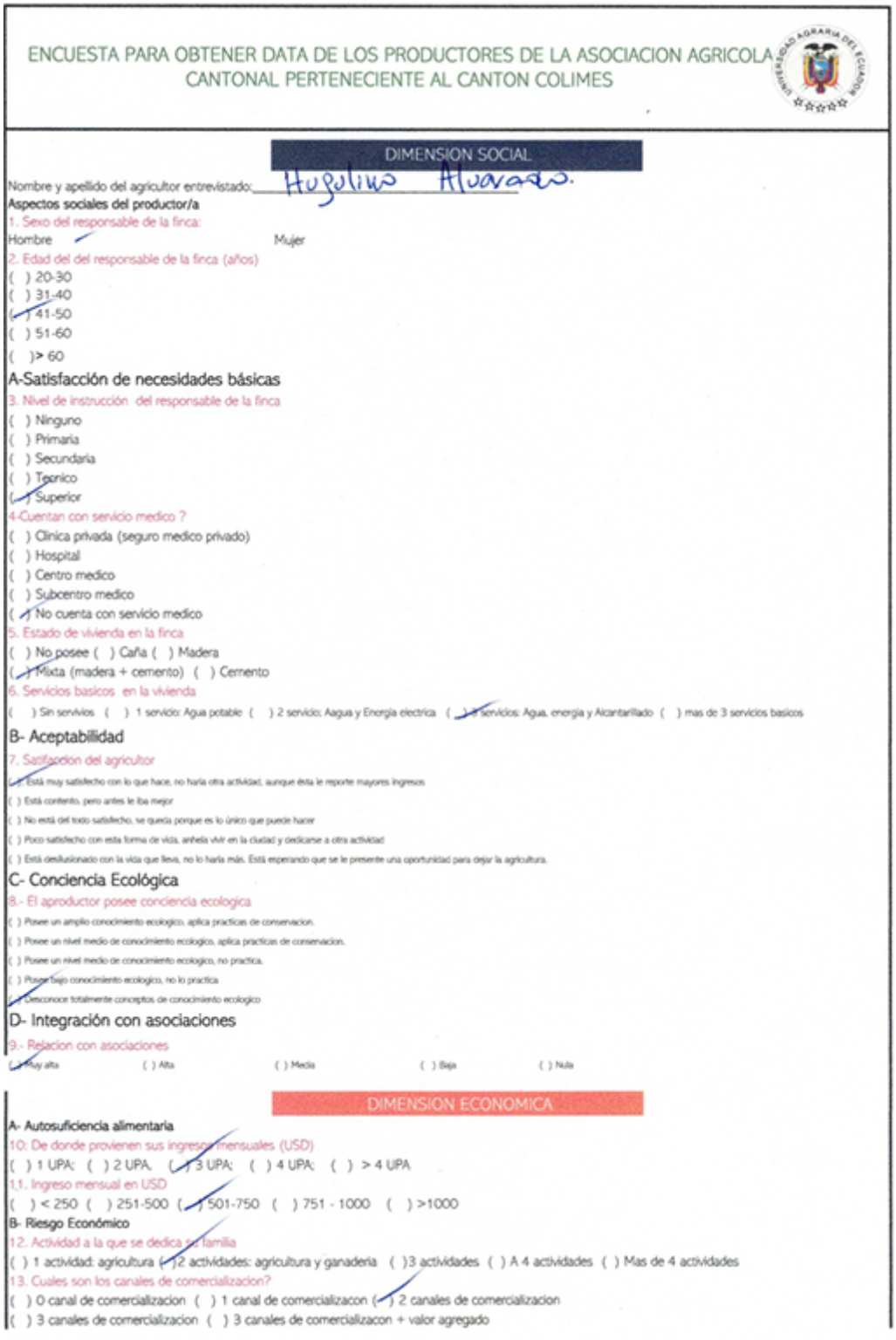
(2) Diversificación media, con muy bajo nivel de asociación entre ellos

(1) Poca diversificación de cultivos, sin asociaciones

(0) Monocultivo.

eh

Image 4. Surveys conducted



ENCUESTA PARA OBTENER DATA DE LOS PRODUCTORES DE LA ASOCIACION AGRICOLA CANTONAL PERTENECIENTE AL CANTON COLIMES

DIMENSION SOCIAL

Nombre y apellido del agricultor entrevistado: Hugolino Alvarado.

Aspectos sociales del productor/a

1. Sexo del responsable de la finca:

Hombre ✓ Mujer

2. Edad del del responsable de la finca (años)

( ) 20-30
( ) 31-40
(✓) 41-50
( ) 51-60
( )> 60

A-Satisfacción de necesidades básicas

3. Nivel de instrucción del responsable de la finca

( ) Ninguno
( ) Primaria
( ) Secundaria
( ) Tecnico
(✓) Superior

4-Cuentan con servicio medico ?

( ) Clinica privada (seguro medico privado)
( ) Hospital
( ) Centro medico
( ) Subcentro medico
(✓) No cuenta con servicio medico

5. Estado de vivienda en la finca

( ) No posee ( ) Caña ( ) Madera
(✓) Mixta (madera + cemento) ( ) Cemento

6. Servicios basicos en la vivienda

( ) Sin servivios ( ) 1 servicio: Agua potable ( ) 2 servicio: Aagua y Energia electrica (✓) 3 servicios: Agua, energia y Alcantarillado ( ) mas de 3 servicios basicos

B- Aceptabilidad

7. Satisfaccion del agricultor

(✓) Está muy satisfecho con lo que hace, no haría otra actividad, aunque ésta le reporte mayores ingresos
( ) Está contento, pero antes le iba mejor
( ) No está del todo satisfecho, se queda porque es lo único que puede hacer
( ) Poco satisfecho con esta forma de vida, anhela vivir en la ciudad y dedicarse a otra actividad
( ) Está desilusionado con la vida que lleva, no lo haría más. Está esperando que se le presente una oportunidad para dejar la agricultura.

C- Conciencia Ecológica

8.- El aproductor posee conciencia ecologica

( ) Posee un amplio conocimiento ecologico, aplica practicas de conservacion.
( ) Posee un nivel medio de conocimiento ecologico, aplica practicas de conservacion.
( ) Posee un nivel medio de conocimiento ecologico, no practica.
( ) Posee bajo conocimiento ecologico, no lo practica
(✓) Desconoce totalmente conceptos de conocimiento ecologico

D- Integración con asociaciones

9.- Relacion con asociaciones

(✓) Muy alta ( ) Alta ( ) Media ( ) Baja ( ) Nula

DIMENSION ECONOMICA

A- Autosuficiencia alimentaria

10: De donde provienen sus ingresos mensuales (USD)

( ) 1 UPA; ( ) 2 UPA; (✓) 3 UPA; ( ) 4 UPA; ( ) > 4 UPA

11. Ingreso mensual en USD

( ) < 250 ( ) 251-500 (✓) 501-750 ( ) 751 - 1000 ( ) >1000

B- Riesgo Económico

12. Actividad a la que se dedica su familia

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DIMENSION ECOLOGICA

A. Riesgo de erosion

16. Topografia de la finca

( ) Alto grado de inclinacion ( ) Mediano grado de inclinacion ( ) Bajo grado de inclinacion

( ) Ondulado ( ) Plano

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( ) No posee agua de riego ( ) Lluvia ( ) Pozo ( ) Rio ( ) Canal de riego

B. Conservación de la vida de suelo

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( ) 100 Fertilizante de sintesis quimica ( )75% Fertilizante de sintesis quimica 25% organicos ( ) 50% Fertilizante de sintesis quimica 50% organicos

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( ) Recomendación técnica en base a análisis de suelo y foliar

( ) Recomendación técnica en base analisis de suelo

( ) Recomendación sin analisis de suelo y foliar

( ) Según presupuesto

( ) Por tradicion

22. Diversificacion de cultivos

(4) Muy alta diversificación 5 especies de cultivos diferentes

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(2) Media diversificación 3 especies de cultivos diferentes

(1) Baja diversificación 2 especies de cultivos diferentes

(0): Monocultivo

C. Manejo de la Biodiversidad

23. Biodiversidad temporal.

(4) Rota todos los años, deja descansar un año el potrero o incorpora leguminosas o abonos verdes

(3) Rota todos los años, no deja descansar el suelo

(2) Rota cada 2 ó 3 años

(1) Realiza rotaciones eventualmente

(0) No rotaciones.

24. Biodiversidad espacial.

4) Establecimiento totalmente diversificado, con asociaciones entre ellos y con vegetación natural

(3) Alta diversificación de cultivos, con asociacion media entre ellos.

(2) Diversificación media, con muy bajo nivel de asociación entre ellos

(1) Poca diversificación de cultivos, sin asociaciones

(0) Monocultivo.

eh

Image 5. Review letter of the improvement plan by members of the agricultural center

CENTRO AGRÍCOLA CANTONAL DE
"COLIMES"
RUC:0992561904001

Colimes, 09 de enero del 2025

Ing. Jorge Coronel Quevedo, MSc.,
Director de la Escuela de Posgrado Dr. Jacobo Bucaram Ortíz
Universidad Agraria del Ecuador.
En su despecho

De mi consideración:

Yo, Nelson Abraham Burgos Zambrano, con CI: 094222058-3, me permito CERTIFICAR, que se ha revisado el Plan de desarrollo sostenible en la tesis presentada por la Ing. Dioselina Clemencia Navarrete Chevez y estamos seguros que una vez implementado, los socios del centro agrícola cantonal de Colimes, nos beneficiaríamos, debido a que dentro de las medidas propuestas, se propone incrementar prácticas que no sean perjudiciales para el medio ambiente, ya que actualmente dependemos al 100% de productos de síntesis química, tenemos monocultivo, no protegemos el suelo, entre otras causas que afectan a nuestra salud, el suelo, el agua y a los animales.

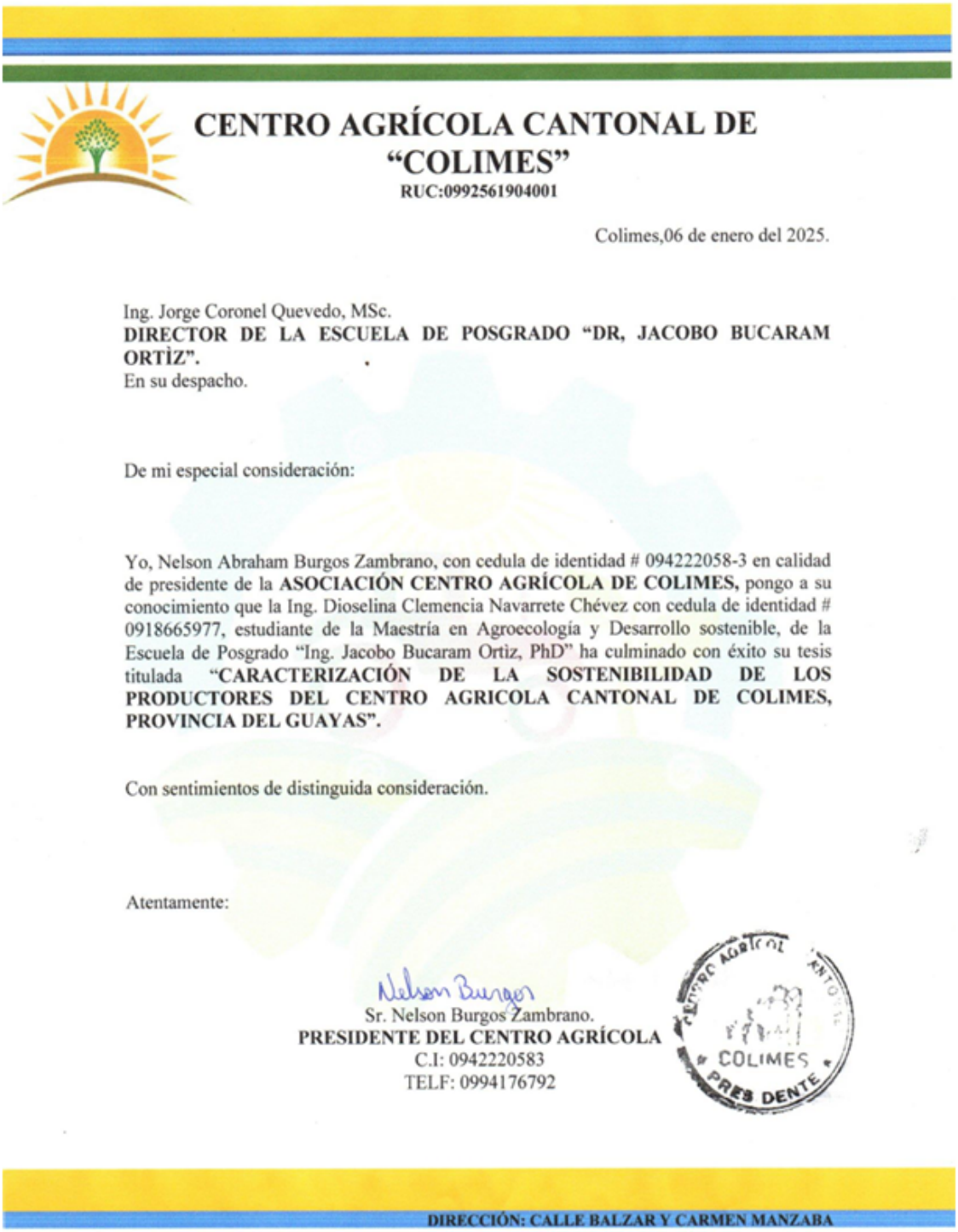
Con sentimientos de estima y consideración

Atentamente,

Nelson Burgos
Sr. Nelson Abraham Burgos Zambrano.
PRESIDENTE DEL CENTRO AGRICOLA
CI: 094222058-3

COLIMES
PRESIDENTE

Image 6. Thesis completion letter



CENTRO AGRÍCOLA CANTONAL DE "COLIMES"
RUC:0992561904001

Colimes,06 de enero del 2025.

Ing. Jorge Coronel Quevedo, MSc.
DIRECTOR DE LA ESCUELA DE POSGRADO "DR, JACOBO BUCARAM ORTÌZ".
En su despacho.

De mi especial consideración:

Yo, Nelson Abraham Burgos Zambrano, con cedula de identidad # 094222058-3 en calidad de presidente de la **ASOCIACIÓN CENTRO AGRÍCOLA DE COLIMES,** pongo a su conocimiento que la Ing. Dioselina Clemencia Navarrete Chévez con cedula de identidad # 0918665977, estudiante de la Maestría en Agroecología y Desarrollo sostenible, de la Escuela de Posgrado "Ing. Jacobo Bucaram Ortiz, PhD" ha culminado con éxito su tesis titulada **"CARACTERIZACIÓN DE LA SOSTENIBILIDAD DE LOS PRODUCTORES DEL CENTRO AGRICOLA CANTONAL DE COLIMES, PROVINCIA DEL GUAYAS".**

Con sentimientos de distinguida consideración.

Atentamente:

Nelson Burgos
Sr. Nelson Burgos Zambrano.
PRESIDENTE DEL CENTRO AGRÍCOLA
C.I: 0942220583
TELF: 0994176792

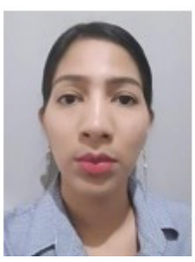
COLIMES
PRES DENTE

DIRECCIÓN: CALLE BALZAR Y CARMEN MANZABA

About the Authors

Dioselina Clemencia Navarrete Chevez is an Agricultural Engineer, Food Technologist, and holds a master's degree in environmental management, and Agroecology and Sustainable Development. Institutional email: dnavarrete@uagraria.edu.ec; Cell phone: 0993890768. Dioselina Clemencia Navarrete Chevez (0009-0005-1011-8357) - ORCID. She has 13 years of teaching experience in Agroindustry, Environment, and Agronomy at the Universidad Agraria del Ecuador. Her areas of expertise include environmental management, food safety, microbiology, biosecurity, solid waste, environmental auditing, and sustainability assessment. She has a technical and managerial track record in environmental impact assessments, occupational safety, quality control, and public environmental management. She has published three books with ISBNs on environmental management, flood risks, and wastewater treatment. Additionally, she has authored scientific articles on leachates, water quality, biocontrol, sustainable agriculture, and agricultural producer sustainability.

Dayanara Nicolle Tapia Quintana is an Agronomist and holds a master's degree in Agronomy, with a concentration in Sustainable Agricultural Production. Institutional email: dtapia@uagraria.edu.ec; Cell phone: 0978947188. Dayanara Nicolle Tapia Quintana (0009-0004-0370-7893) - ORCID. Her professional profile specializes in agricultural microbiology, plant pathology, edaphology, plant nutrition, agroecology, and agrochemistry. She is a researcher accredited by SENESCYT as an Assistant Researcher 1 and has experience working with Trichoderma, Pseudomonas, Bacillus, and other beneficial microorganisms. She has developed applied research focused on the biocontrol of pathogens and the sustainable management of cocoa, banana, corn, and agricultural soils. She has teaching experience in Plant Nutrition, Edaphology, Agrochemistry, Biosecurity, and Agricultural Ecology. She has a record of publications in indexed journals such as TerraLatinoamericana, Agronomía Mesoamericana, Manglar, and Ciencia y Tecnología, including articles indexed in Scopus and Latindex.



Juana Estefanía Cisneros Fariño is a Commercial Engineer, holds a master's degree in business administration, and a master's degree in education with a concentration in Mathematics Teaching. Email: jcisneros@uagraria.edu.ec. Cell phone: 0991317484. Juana Estefania Cisneros Fariño (0009-0005-2142-3533) - ORCID. Her profile integrates mathematics, physics, statistics, administration, research methodology, office automation, and entrepreneurship. She has teaching experience at the Universidad Agraria del Ecuador, teaching Mathematics, Physics, Office Automation, Calculus in Statistics, and Research Methodology. She has pursued continuing education in educational innovation, artificial intelligence for teaching, scientific writing, project design, and indexed publications. She has experience as a speaker on topics related to agro-business transformation and innovative strategies for teaching mathematics.

David Jesús Macías Hernández is an Agronomist and holds a master's degree in Agroecology and Sustainable Agriculture. Institutional email: dmacias@uagraria.edu.ec; personal email: davidmaciashernandez@yahoo.es. Cell phone: 09990855697. David jesus Macias Hernandez (0000-0001-9404-0908) - ORCID. He has 20 years of teaching experience in Agronomy at the Universidad Agraria del Ecuador. His areas of expertise include oilseed and tropical crops, agricultural machinery, chemistry, agroecology, and agrochemistry. He has received training in agricultural experimentation, irrigation and drainage, biosecurity, precision agriculture, ICTs, and scientific writing. He also has training in digital tools, virtual learning, and data science techniques applied to the agricultural sector.

Miguel Antonio Aragundi Demera is an Agricultural Engineer and holds a master's degree in Agronomy, with a concentration in Agricultural Mechanization. Institutional email: maragundi@uagraria.edu.ec; Cell phone: 0980945346. His profile focuses on general agriculture, agroforestry, short-cycle crops, agroecology, topography, and agricultural mechanization. He has 15 years of technical experience as an agricultural machinery operator and four years as a field supervisor in seed multiplication. He also has university teaching experience in Topography, Physics I, Agricultural Mechanization, and Agricultural Constructions. He has strengthened his training through courses on agroecological production, sustainable agriculture, rural business, and pest management. He has a record of published scientific articles on agricultural mechanization in Crucita and the management of Ralstonia solanacearum in Musaceae.

Roy Emanuel León Palma is an Agronomist and holds a master's degree in Agroecology and Sustainable Agriculture. Email: rleon@uagraria.edu.ec. Cell phone: 0993212439 alternative contact: 0993915215. ING. ROY LEON, MSc. (0009-0000-5679-7213) - ORCID. His experience is directly linked to the production of rice, soy, corn, cocoa, and mango. He has worked as a technical supervisor and technical-administrative assistant in logistical services for short- and long-cycle crops. He also has experience as a rice crop technician, supervising germination, transplanting, fertilization, spraying, and harvesting. He has completed training in the production of organic matter, ecological fertilizers, and agricultural system design.

Luis Alfredo Figueroa Quintana is an Agronomist. Email: luisalfre2009@outlook.com. Cell phone: 0986583160. He completed his Agronomy degree at the Universidad Agraria del Ecuador and holds a Master's degree in Agroecology and Sustainable Development. His thesis addressed planting spacing and the number of plants per hill in rice cultivation in Naranjal, Guayas. He served as a teacher at the Unidad Educativa Particular Benemérita Sociedad Filantrópica del Guayas. He has experience since 2021 in rice crop planning at Hacienda "Adeline" and also serves as the general manager of RESOSFI S.A.S., strengthening his technical and management profile. He has completed training in organic production, soils, plant nutrition, irrigation, fertigation, automation, and biological pest control.

Juan Abel Ríos Moreno is a Chemical Engineer and Commercial Engineer specializing in Human Resources, with a master's degree in environmental management. Email: j.riosm@hotmail.com. Phone: 0939024612. He has complementary training in occupational risk prevention for high-risk activities in construction and civil engineering works. He has received training in computer applications, English, human relations, project management, and administration. His technical background includes food microbiology, industrial safety, chemical processes, and production management. He specializes in the treatment of drinking water, wastewater, sludge, and hazardous waste. He is also knowledgeable in environmental legislation, environmental impact assessment, emissions control, and environmental auditing. He has worked as an administrator, technical advisor, manager, and supplier for various companies. He has experience in environmental consulting and has participated in environmental licensing processes. He has designed, supervised, and commissioned industrial wastewater treatment plants for multiple companies throughout Ecuador. His professional profile combines technical, environmental, administrative, and industrial project management experience.

Leontes Leónidas Zambrano Barcos is an Agronomist and holds a master's degree in Agricultural Engineering, with a consolidated academic and technical background. Institutional email: lzambrano@uagraria.edu.ec; cell phone: 0982935592; Leontes Leonidas Zambrano Barcos (0009-0003-2774-5635) - ORCID. His profile specializes in agronomy, soil and water management, sprinkler irrigation, drainage, and agricultural sustainability. He has eight years of teaching experience at the Universidad Agraria del Ecuador, having taught subjects such as General Agriculture, Edaphology, Soil Conservation, Plant Taxonomy, and Crop Production. His professional experience includes twelve years as an agency manager in the agricultural sector as well as academic coordination work. He has a record of recent scientific publications on water quality, fertilization, sustainability, cocoa, corn, tomato, and agroecological management, participating as an author and co-author in national and international indexed journals between 2024 and 2026. His research lines focus on: Agroecology and sustainable agriculture; Plant and forest diversity; Water resource management and environmental treatment; Bioprotection and plant pathology.

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