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December 15, 2022

FINAL REPORT  
BASELINE STUDY

# Cacao for Development Project - C4D

## Partners of the Americas

**Solidaridad**

**muttuo**

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## Final Baseline Report

Prepared by: Fundación Solidaridad  
Latinoamericana in consortium with  
Muttuo Consultores



Prepared for: Partners of the Americas &  
The United States Agency for  
International Development



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December 2022

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## LIST OF ACRONYMS

<b>ASL</b>	Altitude above sea level
<b>C4D</b>	Colombian Cacao and Complementary Crops for Development
<b>CNCH</b>	National Chocolate Company
<b>SWOT</b>	Weaknesses, Opportunities, Strengths and Threats
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>Fedecacao</b>	National Federation of Cacao Growers
<b>GIZ</b>	German Cooperation Agency
<b>ICA</b>	Colombian Agricultural Institute
<b>IPPM</b>	Integrated Pest and Disease Management
<b>POA</b>	Partners of the Americas
<b>ODK</b>	Open Data Kit
<b>UMATA</b>	Municipal Unit of Agricultural Technical Assistance
<b>USAID</b>	United States Agency for International Development
<b>USDA</b>	United States Department of Agriculture

## Executive overview

The purpose of this study was to carry out the information gathering and analysis of the baseline of the producers of the Cacao for Development (C4D) project, funded by USDA's Food for Progress (FFPr program), as a starting point for intervention and impact strategies. The C4D project has two main pillars: (i.) increasing productivity and improving the income of cacao producers through the promotion of diversified and sustainable farming systems; (ii.) increasing trade and transaction of agricultural products through the improvement of production systems, efficiency in value chains, and increased relations between producers, associations and national and international companies. The project aims to benefit a total of 5,500 small producers.

The baseline study, conducted between April and September 2022 by Fundación Solidaridad Latinoamericana and Muttuo Consultores, allows to analyze the current state of the project beneficiaries, their productive units, and the sector in general in the target regions of the C4D project. Thus, this analysis is the starting point for directing project interventions and measuring the impact of these actions.

This study was conducted using both quantitative and qualitative methods. The main data collection tool was a survey carried out to a sample of 1,083 producers. In addition to the field survey, a qualitative information gathering process was carried out through focus groups and semi-structured interviews, to understand the current state of the cacao business, beyond the farm.

One of the main limitations in this study was in the information collection process in the field. This was mainly due to weather conditions, heavy rains caused deterioration of rural roads and this limited the access to the farms, moreover the presence of armed groups in one of the clusters also hampered the collection of information since surveyors were not able to access the farms, making it necessary to summon the producers to a common point in the village to collect the information. This prevented the collection of coordinates in some farms.

The study focused on the four clusters defined by the project, including 10 departments. The total sample of 1,083 farms was distributed as follows:

- Cluster 1, composed of the departments of Cesar, Magdalena and Guajira with 242 farms;
- Cluster 2, with the department of Santander and 198 farms;
- Cluster 3, including the departments of Antioquia and Córdoba, with 309 farms; and,
- Cluster 4, with the departments of Caldas, Huila and Tolima, and with 334 farms.

The main results obtained are as follows:

- In terms of the nature of the producers, it was found that the majority are men (69%) while women represent 31%. The average age is 56 years, and only 3% were producers in the "youth" category ( $\leq 29$  years). Regarding the level of schooling, 30% of the producers reported having no schooling at all, and 39% had only completed

primary school. On the other hand, most of the farmers reported being farm owners and having a cacao tradition of between 10 and 20 years.

- Cacao farms have an average total area of 11.05 hectares (ha). The average area under cacao cultivation is 2.37 hectares, which represents 21.44% of the farm area.
- The low level of certification processes, e.g. organic, Fairtrade or Rainforest Alliance certification, is the common denominator.
- The farms have basic electricity infrastructure, their own aqueducts, cellular telephony, but lack sewerage, natural gas and non-cellular internet. Most access their farms by dirt roads (72.8%) and use private transportation (50.6%). On average, only 32% reported having storage warehouses for supplies and/or products, and only half of the producers have areas for fermentation and drying (wooden crates). The remaining producers use polypropylene bags for fermentation processes, and sun-dried plastic for drying.
- It was found that 23.9% of the cacao hectares belong to crops between 0 and 5 years, a result marked by cluster 1 where 39% of the hectares are in that age range. In general, the bulk of cacao crops are in the age range between 11 and 20 years (31.9% of the total cacao area in the sample), followed by the range of 6 to 10 years (26.6%), with cluster 4 presenting the most advanced age crops.
- Labor for the crop is mainly provided by the producer or his family, followed by external day workers. The number of workdays used in the crop is low in most regions (52 workdays per hectare per year on average, compared to the recommended value of around 90), except for cluster 4, and especially Huila, where farmers traditionally invest more labor in harvesting and irrigation. This factor is of special attention, and should be considered by the training and technical assistance, as it could impact the correct implementation of production enabling practices, such as pruning, pest and disease control, and nutrition.
- In terms of annual productivity expressed in kilograms of dry cacao per hectare (kg/ha), the average for the entire study is 385 kg/ha per year, with a higher average productivity in cluster 3 of 436 kg/ha, and the lowest in cluster 4, around 321 kg/ha. The department with the highest productivity is Córdoba, with an average productivity of 488 kg/ha, followed by Huila with 458 kg/ha, while Tolima is the department with the lowest productivity in the sample (132 kg/ha). It is important to consider that Huila and Tolima are grouped in the same cluster (cluster 4), impacting the average productivity of this cluster.
- The predominant agricultural arrangement is "Agroforestry" for clusters 1, 3 and 4, while in cluster 2 the predominant arrangement is "cacao with associated crop"<sup>1</sup>. Most farmers have shade for their cacao crop (76.6%), however, about half of these producers do not manage this shade.

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<sup>1</sup> "Agroforestry" systems are those that have cocoa crops associated with high-stature forest trees (timber producers), that provide shade to the cocoa. On the other hand, "Cocoa with associated crops" refers to using the same area for cocoa production along with crops like banana, citrus, cassava, etc., which have a similar stature to cocoa and are either commercially exploited and/or for self-consumption. Lastly, "Monoculture" refers to systems where cocoa is the only crop grown.



- 57.4% of the producers state that they do not have soil analysis, and most of those who have it do not have a fertilization recommendation. For the cases in which there is a recommendation, the most common is that it comes from the technician of the association. The percentage of producers that fertilize four times a year is less than 1%, 44% report doing it only once a year, and 28% never fertilize. Regarding the application of amendments, there is a result close to parity between those who do apply and those who do not, and most of those who apply say they do it annually. The application of organic matter is not a common practice, and the production of organic fertilizer on the farm is even less common.
- Although 89% of growers reported doing pruning, the prevailing practice is to carry out only one maintenance pruning per year. Producers are not pruning in the correct way and with the required frequency. Proper pruning during the formation stage, tree maintenance pruning, and disease control pruning are crucial, and should be carried out in a timely manner with the right tools, according to the needs of the plant. Therefore, a single annual maintenance pruning is insufficient. Moreover, it is interesting to note that most of the producers scar pruning cuts, except for producers in cluster 1.
- The most limiting pests reported were squirrels (clusters 1 and 3), ants (cluster 2), and the black woodworm - *Carmenta foraseminis* (Busck) Eichlin - (cluster 4). Control of the most limiting pests is predominantly done manually, except for cluster 2 which does chemical control of ants.
- The most limiting disease in all the clusters was monilia - *Moniliophthora roreri* -, in first place, and phytophthora - *Pphytophthora palmivora* - (black rot), in second place. Control is predominantly occasional, although in cluster 4 it is more frequent, specifically in Huila. It is important to look into this topic with greater detail since there is a high incidence and average intensity reported by the producers, which affects in an important way their productivity and incomes.
- The portion of producers who report having irrigation is relatively low (18.71%), and occurs mainly in Huila and Córdoba.
- The analyses identified a positive relationship between productivity and tasks such as irrigation, pruning, fertilization, amendment application, organic fertilizer application, and integrated pest and disease management (IPPM). This is further elaborated by cluster throughout the report, and as a summary in Annex 1, the productivity for each of these "productivity enablers" identified by the C4D project is presented for the total sample.
- In relation to harvesting activities, it was found that harvesting pods according to the Loss of Shine criterion is not frequent in any of the clusters. Farmers are guided by their experience.
- In post-harvest, most of the producers report drying (80.7%) and on-farm fermentation (80.8%), however, as mentioned above, most of these producers do not have adequate infrastructure to carry out these processes. On average for all clusters the fermentation process takes between 5 and 6 days, and during this process most of the producers do not take or record the temperature (78.5%). In addition, most respondents also

reported that in the drying process they use a subjective method to determine if the cacao is dry (79.8%), checking the crispness of the bean from experience.

- Regarding the marketing of cacao, it is noted that cacao farmers sell almost 100% of their production, and that cacao is mostly marketed in dry form. Farmers sell cacao mainly to associations, and about half of the farmers surveyed reported that they had no commercial agreements with their buyers. No producer reports selling directly to the national industry or to exporters, in most cases they sell to producer associations or to intermediaries who ultimately sell to Luker, CNCH or foreign companies.
- Additionally, it is found as a weakness that most producers do not keep records of production and sales, which hinders a more professional administrative management of the business.
- Although the number of workdays per hectare is low, in the analysis of the operational costs of cacao production (labor costs and main supplies) it was found that the cost of workdays has the highest weight in all clusters (80%). The operational costs per hectare of cacao per year range between \$2,201,174 COP (\$588 USD)<sup>2</sup>, for cluster 1, and \$3,481,314 COP (\$930 USD), for cluster 4. The activities that represent the largest share of labor are harvest and post-harvest. It should be kept in mind that the costs for workdays are considering the workdays of the company's own labor.
- In terms of gross annual income per hectare of cacao, similar values are found in all clusters. However, when calculating the net income, cluster 4 presents a negative result (deficit), while the other clusters show positive net incomes. The possible causes of the negative result of cluster 4 are the high production costs in Huila and the low productivity of crops in Tolima.
- Of the clusters' total gross cacao income, 76% goes to cover production costs, which is an indication of low profitability. It is important to note that in all clusters most of the gross income per hectare goes to cover production costs (at least 76% of the gross income per hectare). The living income study will allow a more detailed analysis of the net income per cacao.
- Regarding other crops or livestock activities present on the farm, 64% of the producers do not have on-farm activities other than cacao that generate income, and only 25% have additional activities that represent at least 26% of the total gross income of the farm, and therefore, can be considered as complementary and/or associated, according to the project definition. For clusters 1, 2 and 4 the main crop is coffee, for cluster 3 the main crop is the banana/plantain category. This last cluster has the highest number of producers (93) with complementary and/or associated activities.
- Both for cacao and for complementary and/or associated activities, producers highlight high production costs as the major constraint.
- When the information collected is analyzed in light of the adoption standards of technologies identified by the POA project as those that promote climate risk reduction and/or natural resource management supported by USDA, it is found that on average

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<sup>2</sup> For calculations in dollars (USD), the average exchange rate for 2021 (3,743 COP/USD) was used.

only 6.7% of producers implement at least 75% of the practices. With regard to USDA-assisted improved management practices or technologies, and landscape management, this percentage decreases to about 0.2% of the sample. In addition, the study also found that the departments with the highest implementation of these technologies, such as Córdoba and Huila, are also the departments with the highest productivity. It is clear that this is an area where considerable improvements should be sought.

- The majority of farmers in all clusters do not report currently having access to technical assistance, for those farmers currently receiving technical assistance, it was found that monthly technical assistance predominates, with the exception of cluster 1 where biannual technical assistance predominates. The main provider of technical assistance varies by cluster, with associations in clusters 1 and 3, Fedecacao in cluster 2, and cooperative entities in cluster 4. As for digital agricultural extension, this is even less common in the territories.
- Regarding access to financial services, only 29% of the producers reported that they or a member of their family had had credit in 2021. Producers in general prefer not to get into debt, for fear of losing their land, being this the most mentioned justification, followed by not having the requested guarantees.

The results of the baseline study show that producers are mostly collectors and have put aside some of the fundamental agricultural tasks. There is a strong focus on “non-controllable factors” such as climate phenomena and sales prices, forgetting the “controllable factors” such as permanent and timely pruning for disease control, maintenance pruning and pruning to control tree height. This behavior has led to lower production, associated for example to the trees that become taller every day making it more difficult for producers to control diseases such as Monilia and Phytophthora, and creating physiological imbalances in the trees.

There are several practices with opportunities for improvement, and that this could be reflected not only in cacao productivity and associated income, but also in marketing opportunities for the product. On this last point, it should be noted that, although most of the stakeholders in this study identify specialty and high quality cacao as a market opportunity, poor harvesting and post-harvest practices present a limitation to realize this opportunity. In this context, the lack of support, planning and technical direction of the farms is of concern, which is also combined with a shortage of financial resources, or limited access to these resources by cacao farmers.

In addition, there is a lack of motivation in the cacao business, with producers perceiving the cacao business as a demanding activity, but with little profit. While production costs, associated for example with fertilizers and labor, continue to rise, the selling price of cacao in the last two years (2020 and 2021) has not changed, remaining in a range between COP 7,500 (\$2 USD) and COP 8,000 (\$2,14 USD) per kg<sup>3</sup>. This puts the sector at risk, showing that it is not an attractive sector for young people, who prefer to pursue other activities outside the field.

Under these conditions, it is very important to invite the producer to take charge of what he controls and to support these processes. In this sense, an agricultural extension program, which considers the specific needs of producers and their socio-demographic characteristics, is a key

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<sup>3</sup> Price paid to the producers at commercialization points in each region.

element for the improvement of economic conditions and crop sustainability in the regions analyzed. It is important that these programs help farmers understand the costs and benefits of adopting practices such as pruning, pest and disease control, nutrition and irrigation, and provide them with tools that allow them, for example, to plan their work according to the climate and the phenological development of the plantations. Finally, and as a fundamental aspect within the production process, ways must be devised to contribute to the renewal of crops so that farmers can move forward.

The strengthening and training of associations or cooperatives to which cacao farmers belong is another important element to be considered by the C4D program. Associations can be facilitators of change, and at this level they can leave installed capacities that allow for the sustainability of the improvements fostered by the project beyond its duration. Associations can facilitate producers' access to services and supplies, such as access to reliable and good quality nurseries, and can also help add value to the product in order to have better sales prices for cacao and its complementary and associated crops.

Finally, the different components of this study highlight as an essential finding the importance of cacao cultivation, and the farms where it is grown, to be seen as an integral system of income generation from the productive arrangements of cacao with associated and/or complementary species. Although currently few producers have complementary and/or associated activities that generate a significant income, in all the activities of construction of the baseline producers and actors in the sector identified the added value that this type of additional activities could provide to families, either for marketing or for self-consumption. The complementarity of the income flow of the farms, continuous in the case of cacao and seasonal in the other species of the agroforestry system, is a determining factor in weighing the expenses of the families. This holistic model allows the C4D program, with its general objectives designed to improve the overall income of cocoa-growing families, to be a valuable opportunity for the sector that begins to mark the new direction of intervention and direction of the sector in Colombia and the world.

# 1. Introduction and Purpose

This document presents the final report of the baseline study of the Cacao for Development Project (C4D). The main objective is to present the analysis of the results of the primary information that was collected during the study and that finally allowed a diagnosis of the current situation of the beneficiaries of the project and their farms before the implementation of the program. This document is divided into 5 sections, this being the first one. This section describes the context of the project and the objective of the baseline study. The second section discusses in detail the design and methodology of the study, covering the methods of sampling, data collection, data cleaning and analysis, and finally the limitations of the study. The third section presents the results of the study, the first part refers to the findings of the surveys and the second to the results of the focus groups and semi-structured interviews. The fourth section makes recommendations and finally, the fifth section presents the conclusions. Along with this document, Partners of the Americas (POA) has access to the complete and clean database, the data dictionary and a dashboard. The dashboard will present the most important descriptive statistical information of the project in an interactive manner.

## 1.1 Context of the project

The Colombian cacao and Complementary Crops for Development or Cacao for Development (C4D) project started in October 2020 and will last for 5 years, this project is being implemented by POA and is funded by the United States Department of Agriculture (USDA), through the USDA's Food for Progress (FFPr) program. The project aims to advance the cacao value chain and improve producer incomes through diversification and marketing of complementary crops.

## 1.2 Project description

The project aims to (i) increase agricultural productivity and improve the incomes of cacao producers through the promotion of diversified and sustainable farming systems, equitable marketing models, and improved collection and processing of products for the market; (ii) increase trade in agricultural products through improved systems at all levels of the value chain, increased use of financial services by producers, and the creation of more linkages between producers, associations and national and international actors within the value chain.

C4D will achieve these objectives through the following activities:

1. Special Studies (value chain analysis, carbon sequestration assessment and living income study)
2. Development and marketing of producer organizations
3. Support to agricultural production and extension
4. Post-harvest processing and aggregation
5. Access to financial services/capital for value chain actors
6. Innovation and opportunity creation through youth engagement



7. Establishment of a regional community of practice
8. Establishment of a philanthropic fund.

The C4D project aims to benefit a total of 5,500 small producers belonging to 71 organizations. The producers are distributed in four clusters of the country, defined by POA, as follows: cluster #1 includes the departments of Cesar, Guajira and Magdalena (especially in the Sierra Nevada de Santa Marta), cluster #2 includes the departments of Santander and Bolivar, cluster #3 in the departments of Antioquia and Cordoba and finally cluster #4 in the departments of Caldas, Huila and Tolima.

### 1.3 Purpose of the Baseline Study

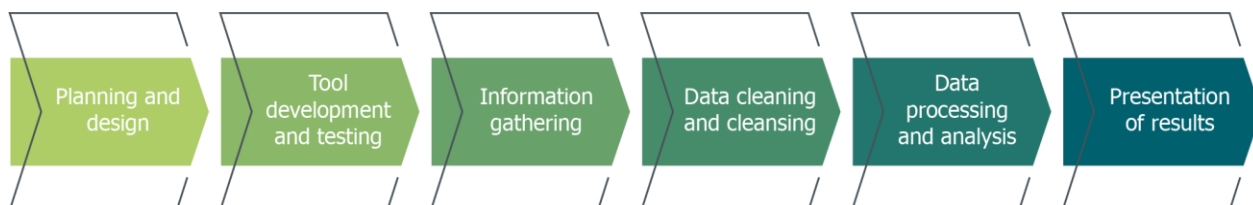
The purpose of this baseline study is to provide a characterization of the current situation of the beneficiaries (farmers and their farms) of the Cacao for Development project, prior to the implementation of the activities stipulated by the program.

Specifically, this study provides details of the characteristics, conditions, socioeconomic and cultural variables of the farmers, farms, and the development and agricultural productivity of cacao and complementary and/or associated crops, in order to: (i) refine the strategies and goals of the C4D project based on current information from the beneficiaries, (ii) inform other special studies considered in the project, and (iii) establish the basis for monitoring and evaluating the progress, effectiveness and impact of the project interventions.

## 2. Study design and methodology

### 2.1 Baseline Study Design

The baseline study was divided into 6 phases:



In the first phase, the work plan was designed and the methodologies proposed for the collection of information were reviewed. As for the surveys, the main focus was on the sample design, which is explained in the section Sampling Methods. Socialization of the project was also carried out with the producer organizations identified as relevant. In the second phase, several activities were carried out, firstly, the survey was designed in conjunction with the POA team, and guides were designed for focus groups and semi-structured interviews, for the latter strategic actors were chosen from the most important organizations of the cacao chain in Colombia. Subsequently, the survey was loaded into the Open Data Kit (ODK) application, the survey team was trained and a pilot test was conducted, and improvements to the survey were implemented.

In the third phase, information was collected through field surveys. During this process, the field coordinators were in charge of monitoring the process in situ by randomly accompanying the surveyors in each of the clusters. Additionally, data analysts conducted remote supervision of the correct uploading of completed questionnaires, and a detailed weekly review of a random sample of surveys received per cluster. In addition, four focus groups were conducted during this stage, one per cluster, mostly in a hybrid manner, and semi-structured interviews were conducted with key actors in the sector. The focus groups and the interviews were led by the technical staff of the project.

The fourth phase was carried out in multiple steps, including the evaluation of the consistency of the single records and the identification of typing errors in quantitative variables by means of outliers. Finally, the study was concluded with phases 5 and 6 corresponding to the analysis of the data and presentation of the results, which are presented in this report.

### 2.2 Sampling Methods

Following the requirements of the study, the team carried out a statistically significant sampling by cluster, with a 95% confidence level and a 5% margin of error. Since statistical significance by department was not required, it was agreed to establish the distribution of the sample within each cluster by convenience considering the organizations present in each territory, the

availability of the lists of producers by the cacao farmers' organizations, the relevance of the areas, the security in the areas for field work and the distance between the farms. Table 1 presents the distribution of the universe of the C4D project and the distribution of the sample. Annex 2 includes the list of municipalities by department in the baseline sample.

Regarding the universe, it is important to mention that due to the nature of the C4D project, the universe of producers was built from the lists of cacao associations. This has the advantages of: (i.) facilitating access to producers and information collection processes; (ii.) facilitating the overall implementation of project activities; (iii.) leaving installed capacities in these organizations that allow the sustainability of activities once the C4D project is completed. Thus, the results presented in this study reflect the current status of cacao farmers who will participate in the project, but not necessarily the Colombian cacao farmers, since there is no information on non-member producers.

**Table 1.** C4D project universe and baseline sample distribution by cluster and department

Cluster	Department	C4D Universe	# sample surveys
Cluster 1.		625	242
Cluster 1.	Cesar	500	153
Cluster 1.	Magdalena	95	69
Cluster 1.	Guajira	30	20
Cluster 2.		750	198
Cluster 2.	Bolivar	375	0 <sup>4</sup>
Cluster 2.	Santander	375	198
Cluster 3.		1,375	309
Cluster 3.	Antioquia	500	66
Cluster 3.	Cordoba	875	243
Cluster 4.		2,750	334
Cluster 4.	Caldas	570	117
Cluster 4.	Huila	750	150
Cluster 4.	Tolima	1,430	67
<b>TOTAL</b>		<b>5,500</b>	<b>1,083</b>

Table 2 shows a summary of the profile of the farmers and farms included in the baseline survey sample for the field data collection. A detailed description of these profiles by cluster is presented in the Survey Results section.

<sup>4</sup> Bolivar was added to the C4D project after the start of baseline data collection, so this department is not included in the sample.

**Table 2.** Basic profile of the producer and production unit in the sample.

Parameter	Average	Value range
Age (years)	56 (3% of young people <= 29 years)	19 - 92 years old
Men/Women (%)	31% Women (332 women) 69% Men (751 men)	N/A
Farm size (ha)	11.05 ha	0.5 - 250 ha <sup>5</sup>
Size of cacao area (ha)	2.37 ha	0.18 - 30 ha <sup>6</sup>

## 2.3 Data Collection Methods

The baseline study was conducted under a combination of quantitative and qualitative methods. Regarding quantitative methods, the main data collection tool was the survey conducted in the field to the sample of 1083 producers. This survey included components of socio-demographic characterization, profile of the production unit, work and costs of cacao cultivation, production and marketing of cacao, complementary and/or associated crops, access to technical assistance and access to financial services.

The Solidaridad and Muttuo Consultores team designed the survey in close collaboration with POA, and carried out an iterative validation process with POA, the field survey team and some farmers. In addition, together with POA, the corresponding data release form was designed for the capture and proper processing of the information. The questionnaire and data authorization were uploaded into the ODK mobile application, and instruction manuals were developed. The field survey team, made up of 19 local enumerators and 2 field coordinators, was trained in the use of the tool, the data capture requirements and the technical content of the survey. The survey was implemented in June and July 2022.

It is important to mention that not all the surveys were answered by the producers head of the productive unit, in total 10.2% of the surveys were not answered by the producer. In cases where producers were not available to answer the survey, the survey team ensured that the respondent was a person knowledgeable of the required information regarding the producer, the productive unit and the work on the farm. Of those surveys that were not answered by the producer, 60% were answered by family members of the producer and 23% were answered by farm managers.

<sup>5</sup> 95% of the respondents have a farm area of less than 40 ha, and only 1% have an area of more than 70 ha.

<sup>6</sup> 95% of respondents have an area of less than 5 ha in cacao, and only 1% have an area greater than 10 ha. In total there are 53 cacao producers with crops larger than 5 ha.

**Image 1.** Training of field surveyors



**Image 2.** Field data collection through surveys





The producer survey provided an overview of the current status of project beneficiaries and on-farm activities. However, in order to complement the understanding of the current state of the cacao business ecosystem, qualitative methods were used, including the development of focus groups with producers and leaders in each of the clusters, as well as interviews with key actors in the sector identified jointly with POA. The focus groups were conducted between August 8 and 19, 2022 and focused on conducting a SWOT analysis of the cacao business in the regions, delving into the sector's weaknesses, opportunities, strengths and threats. In addition, an identification of the most relevant actors in each cluster in relation to technical assistance, nurseries, processing plants, marketers and producer associations was also carried out.

**Image 3.** Focus groups



During the semi-structured interviews, actors from the government, cooperation, trade, finance, industry, and the guild sectors were interviewed, a complete list of the organizations that were interviewed can be found in Annex 3. These stakeholders were asked questions about their opinion of the current situation of the cacao sector in Colombia and how they see it in the future, strategies to improve the stability of the cacao value chain in terms of price, quality and productivity, areas of focus for cacao research in the coming years, and the investment pillars they would focus on if the money from the C4D project was awarded to their entities.

## 2.4 Methods of data cleaning and analysis

### 2.4.1 On-farm surveys

The cleaning and analysis process began with the structuring of the databases to suit the analysis to be carried out. Subsequently, indicators were built in Microsoft PowerBi in order to have a dynamic monitoring of the behavior of the main variables. These dashboards were used for the virtual data cleaning sessions, which were carried out between the team of data

analysts, cacao experts, field supervisors and surveyors. In parallel, database adjustment and cleaning were carried out where necessary. The data cleaning process was mainly carried out in PostgreSQL.

On the other hand, the analysis process was carried out mostly in R and Microsoft PowerBi, generating different graphs to identify trends and possible relationships. At this stage, meetings were held with the work team and POA to establish the themes and the way to represent the most important findings. Additionally, the analysis of cross-cutting variables that were created from the qualitative correlation that they had, such as productivity, number of workdays per hectare, costs per labor, volumes, etc., was done.

Similarly, the survey questions were related to the technologies supported by USDA in order to obtain a classification by cluster and identify what percentage of good practices are applied. In addition, the monthly and annual income per producer was constructed and with this information the income percentages of other non-cacao crops were recalculated, seeking to establish the activities that were analyzed in the section of complementary and/or associated activities.

As external sources, the monthly prices per kilogram (kg) of cacao<sup>7</sup> were used to calculate the monthly income of the producers, additionally the average prices of dolomite lime and fertilizer were used for the analysis of production costs.

## 2.4.2 Focus groups and semi-structured interviews

The discussions of each focus group and semi-structured interviews were audio-recorded, and notes were also taken during the activity. Using the audio recording, a transcription of the audio was made using Descript.

To analyze the information collected through focus groups, a SWOT analysis of the existing weaknesses, opportunities, strengths and threats in the cacao sector was carried out, seen from the perspective and experience of each producer in their area. To facilitate the SWOT analysis, 2x2 matrices were structured for each cluster, and then the most relevant issues were explored in more detail.

As for the semi-structured interviews, these were analyzed using coding methodology, allowing for the reduction and condensation of the information collected through the use of labels using the qualitative analysis software NVivo. In this case, codes were assigned to fragments of the transcript, either to a sentence, or to a more complex idea, identifying common themes among the responses of the strategic stakeholders who were surveyed.

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<sup>7</sup> See Annex 6. Reference prices for cacao sales (2021).

## 2.5 Limitations of the study

In relation to the way this study was designed, one limitation that stands out is that there is no counterfactual comparison group, i.e. no information was collected from farmers who will not be beneficiaries of the project. Clearly, it is not easy to identify a control group, especially considering the magnitude of the C4D project, and selecting a control group could affect the development of trust with the farmer communities. However, this decision implies that for future evaluation processes it will not be possible to establish a causal relationship between the program and its results, i.e. changes in indicators or beneficiary conditions cannot be attributed exclusively to the program intervention. By not having a control group, it is not possible to isolate the influence of other factors on the results of the intervention.

On the other hand, there were limitations regarding the collection of information through field surveys, which could also be present in the implementation of the project. One drawback was the weather conditions, especially the heavy rains that have caused deterioration of rural roads, limiting access to farms and the yield of information collection. Another problem was security in the regions due to the presence of armed groups, particularly in cluster 3 in Cáceres, Antioquia and Tierralta, Córdoba. The presence of these armed actors is largely due to the presence of coca leaf crops. In order to access some of the villages, permission must be obtained from the groups that control the area, and access is only granted for a few hours. Therefore, in these cases it was necessary to summon the producers to a common point in the village to collect the information, which prevented the collection of coordinates in some farms.

### 3. Baseline results

The main results of the baseline study, from the survey, focus groups and semi-structured interviews, are presented below. The results are presented by cluster, according to the requirements of the study.

#### 3.1 Survey results

This section first presents a description of the average farm per cluster, considering the behavior of the main variables evaluated in the survey. This description provides a summary of the most relevant results and a characterization of the type of farm per cluster. Then, a detailed analysis is made for each of the components addressed in the field survey. A joint analysis of the total production costs and income associated with cacao cultivation is also presented. Finally, an analysis is made of the technologies or practices carried out on the farms.

##### 3.1.1 Average Farm per Cluster

In order to have a characterization of the average farm in each of the clusters of the study, the technical team selected the most relevant variables to be considered. Table 3 presents the average behavior of these variables for the four clusters. In the following sections the results of each of the variables will be presented in detail.

**Table 3.** Average farm per cluster

Category	Variables	Unit of measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Producer Profile	Average age	years	51	54	55	60
Producer Profile	Percentage of women	%	32	36	25	32
Producer Profile	Percentage of men	%	68	64	75	68
Producer Profile	Predominant land tenure type	Text	Owner	Owner	Owner	Owner
Areas	Average farm area	ha	19.4	10.5	8.7	7.5
Areas	Average area of cacao on farms	ha	2.17	3.1	1.85	2.36
Age classification of the cacao crop	0 - 5	%	38.92	25.12	18.3	17.53
Age classification of the cacao crop	6 - 10	%	20.74	28.90	49.92	13.05
Age classification of the cacao crop	11 - 20	%	31.60	29.98	30.37	34.34
Age classification of the cacao crop	> 20	%	8.73	16	1.41	35.08

Category	Variables	Unit of measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	Productivity (kg/ha) <sup>8</sup>	kg/ha	396	435	436	321
	Predominant agronomic arrangement	Text	Agroforestry System	Cacao with associated crop	Agroforestry System	Agroforestry System
	Predominant complementary / associated activity	Text	Coffee <sup>9</sup>	Coffee	Banana and Plantain	Coffee
Standard of adoption of technologies and practices (% complying between 75% and 100% of technologies/practices)	Technologies that promote climate risk reduction and/or natural resource management with USDA assistance.	% ha	3	3.7	8.7	11.6
Standard of adoption of technologies and practices (% complying between 75% and 100% of technologies/practices)	USDA-assisted improved management practices or technologies	% producers	0	0.5	0	23
Standard of adoption of technologies and practices (% complying between 75% and 100% of technologies/practices)	Landscape management	% producers	0	0.5	0	0.3
Most important practices	Soil analysis	Yes/No	Yes =28% No =72%	Yes =29% No =61%	Yes =50% No =50%	Yes =48% No =52%
Most important practices	Fertilization recommendation	Yes/No	Yes =18% No =82%	Yes =19% No =81%	Yes =27% No =73%	Yes =40% No =60%
Most important practices	Who gave the recommendation?	Text	Association Technician	Association Technician	Association Technician	Association Technician
Most important practices	Fertilization	Yes/No	Yes =48% No =52%	Yes =78% No =22%	Yes =83% No =17%	Yes =75% No =25%
Most important practices	Fertilization Frequency	Text	once/year	once/year	once/year	once/year
Most important practices	Application of amendments	Yes/No	Yes =24% No =76%	Yes =70% No =30%	Yes =58% No =42%	Yes =38% No =62%

<sup>8</sup> The productivity indicator in the entire baseline study excludes the productivity of farmers who claim to have cacao crops only from 0-5 years, and those farmers who reported 0 kilograms of production in 2021.

There are variations in productivity by department that can affect the average productivity of the cluster, for example, in cluster 4 there is Huila, the department with the second highest productivity of the sample, but also Tolima, the department with the lowest productivity. As a reference, Annex 4 presents a graph with the productivity by department.

<sup>9</sup> Coffee in cluster 1 is mainly associated with the crops of Pueblo Bello, in Cesar.



Category	Variables	Unit of measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Most important practices	Frequency of amendment application	Text	Annually	Annually	Annually	Annually
Most important practices	Pruning	Yes/No	Yes =88% No =12%	Yes =84% No =16%	Yes =91% No =9%	Yes =94% No =6%
Most important practices	Type of pruning	Text	Maintenance	Maintenance	Maintenance	Maintenance
Most important practices	Pruning frequency	Text	Every Year	Every Year	Every Year	Every Year
Most important practices	Most limiting pest	Text	Squirrels	Ants	Squirrels	Black Crimson
Most important practices	How to control the most limiting pest	Text	Manual Control	Pesticide Control	Manual Control	Manual Control
Most important practices	Most limiting disease	Text	Monilia	Monilia	Monilia	Monilia
Most important practices	Predominant frequency of disease control	Text	Occasionally	Occasionally	Occasionally	Weekly <sup>10</sup>
Most important practices	Irrigation	yes/no	Yes =28% No =72%	Yes =1% No =99%	Yes =3% No =97%	Yes =43% No =57%
Most important practices	Main harvest months	Text	Mar - Apr - May <sup>11</sup>	Nov-Dec	Nov - Dec	May - Jun
Most important practices	Months of second harvest	Text	Oct - Nov - Dec <sup>12</sup>	Mar-Apr-May	Apr - Jun - Jul	Nov - Dec
Most important practices	On-farm fermentation	Yes/No	Yes =62% No =38%	Yes =96% No =4%	Yes =91% No =9%	Yes =76% No =24%
Most important practices	Drying on the farm	Yes/No	Yes =61% No =39%	Yes =95% No =5%	Yes =92% No =8%	Yes =76% No =24%
Marketing	To whom he sells the cacao	Text	Association	Intermediary	Association	Association
Marketing	To whom you sell the companion or associated crop	Text	Intermediary other than the association	Intermediary other than the association	Intermediary other than the association	Intermediary other than the association
Cacao production costs - operational	Average workdays per ha/year in cacao production	Workdays /ha	51	57	65	84
Cacao production costs - operational	Workdays per ha-year in cacao production (median)	Workdays /ha	50	50	59	70

<sup>10</sup> At the cluster level, 45% of the producers reported weekly control, mostly in Huila. The second predominant frequency was "monthly" with 37%.

<sup>11</sup> In Cesar, the main harvest occurs in Nov-Dec.

<sup>12</sup> In Cesar, the second harvest occurs in Apr-May-Jun.

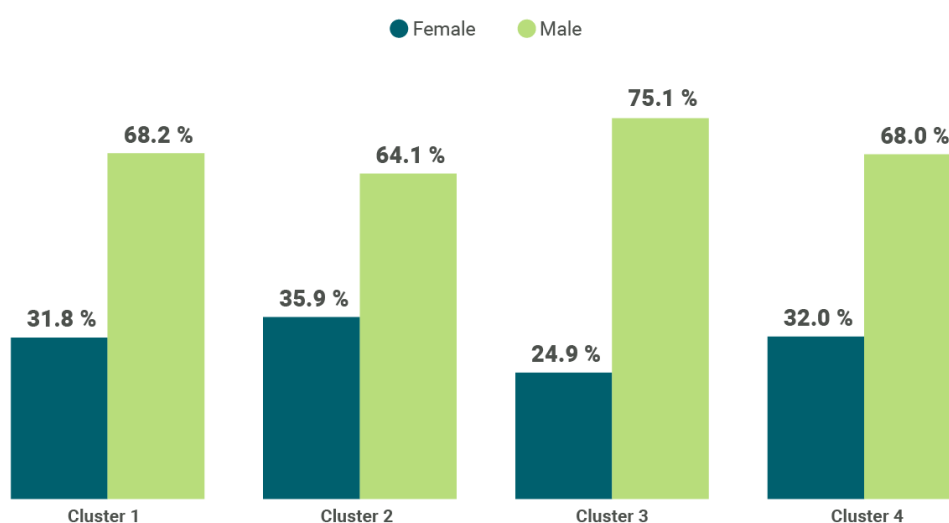
Category	Variables	Unit of measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cacao production costs - operational	Cost (truncated average) of supplies per hectare <sup>13</sup>	\$/ha	\$352,225 COP (\$94.1 USD)	\$1,012,065 COP (\$270.3 USD)	\$637,231 COP (\$170.2 USD)	\$658,057 COP (\$175.8 USD)
Cacao production costs - operational	Cost (truncated average) total cost per ha	\$/ha	\$2,201,174 COP (\$588 USD)	\$3,927,289 COP (\$1,049 USD)	\$2,766,952 COP (\$739.2 USD)	\$3,481,314 COP (\$930 USD)
Technical Assistance (TA) & Financial Services	Producers currently receiving TA	%	45	19	44	38
Technical Assistance (TA) & Financial Services	Producers and/or family members of the nucleus with credit in the last year (2021)	%	29	24	25	37

### 3.1.2 Profile of the producer and his/her family by cluster

Within the producer's profile, characterization information was analyzed, including: gender and age of the producer, last grade of schooling, nationality, belonging to ethnic groups, number of people in the family nucleus and place of residence.

For all clusters, the majority of producers surveyed were men (69% of the total sample), showing a greater presence of this gender as head of farm producers. Graph 1 shows the percentages of men and women by cluster. Cluster 2 was the cluster with the highest percentage of women (around 36%), while cluster 3 had the lowest percentage (around 25%).

**Graph 1.** Gender of the farmer head of the farm



<sup>13</sup> For all measures presented in the report as Truncated Average, also known as trimmed mean, this average is truncated to 10%. That is, discarding the 10% at the lower and upper end of the sample, correcting for outliers.

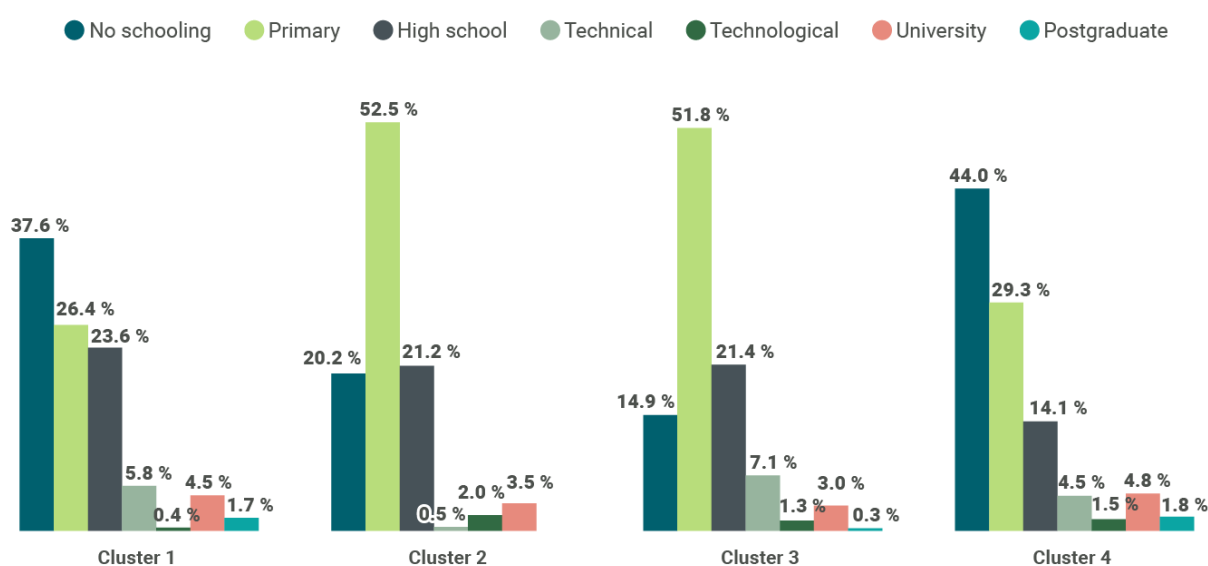
The producers surveyed are mostly in the adult category, over 29 years old. Overall, only 3% of respondents in the total sample were young producers. Table 4 shows the average age, age range and % of youth by cluster. In general, the average age in all clusters is very similar, with cluster 4 having the highest average age (60 years), and cluster 1 the lowest (51 years). The latter cluster also had the highest percentage of youth (6.2%).

**Table 4.** Age of producers by cluster

Cluster	Average producer age	Age Range	% young people (between 15 and 29 years old)
Cluster 1.	51	19 - 86	6.2%
Cluster 2.	54	25 - 83	1.5%
Cluster 3.	55	24 - 91	2.9%
Cluster 4.	60	23 - 92	1.8%

In relation to the educational level, the last grade of schooling of the producer head of the productive unit was evaluated. At a general level, it is found that around 39% of the producers have completed primary school, followed by 30% who report having no schooling. The least common degrees of schooling are "technological" with 1.3% and "Postgraduate" with 1%. Graph 2 shows the analysis by cluster, where it is highlighted that clusters 1 and 4 are the clusters with the highest percentage of producers with no schooling, while in clusters 2 and 3 producers with primary education predominate. No significant differences were found between the levels of schooling of women and men.

**Graph 2.** Last grade of schooling of the producers



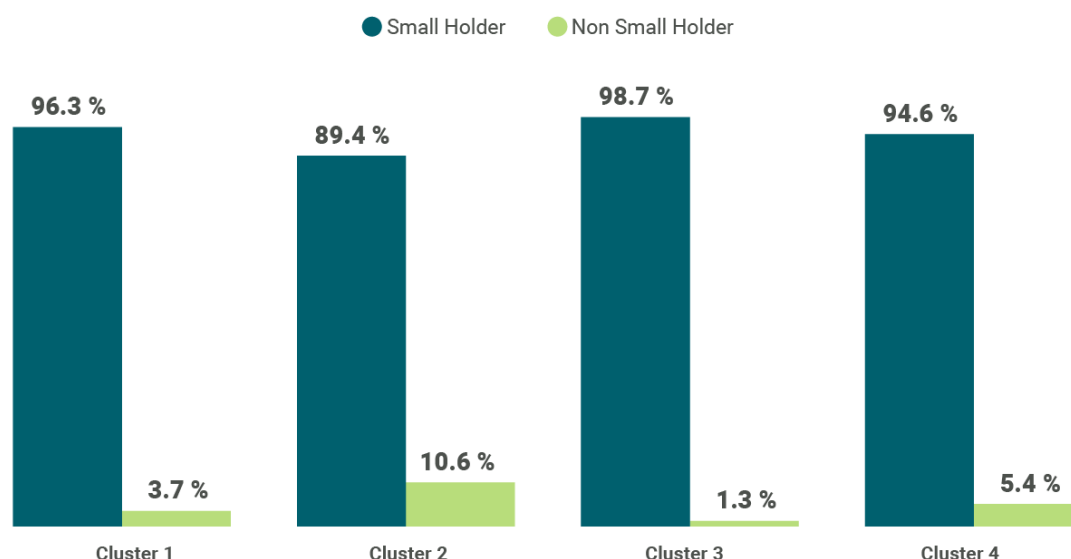
On the other hand, it was identified that most of the producers are of Colombian nationality (99.9%) and that they do not belong to any ethnic group (88%). With respect to nationality, only one record was found of a producer with Venezuelan nationality, belonging to cluster 3. On

the other hand, in cluster 1, 24% of the producers reported belonging to the ethnic group "Indigenous" and 14% to the group "Afros", and in cluster 3 there is a percentage of 3% for each of these same groups.

Regarding the family nucleus of the producers, 24% of the producers reported having 2 members in the family nucleus (including the producer), around 23% reported having 3 people, and around 19% having 4. Among the clusters, it stands out that cluster 1 presents on average the biggest family nucleus with the number of 5 people being the most common among the producers (around 21%), while cluster 4 is the cluster where more producers affirmed having families of 2 people (around 30%). The families in all clusters predominantly reside within the productive unit, which refers to the property where the agricultural activities are carried out.

Regarding the area in the farms for cacao cultivation, in the total sample it was found that 4.8% of producers have more than 5 hectares in cacao, with the highest percentage in cluster 2 and the lowest in cluster 3, as shown in graph 3.

**Graph 3.** Ranking of farmers by number of hectares in cacao (smallholder <=5ha of cacao)



### 3.1.3 Profile of the productive unit

Regarding the profile of the production unit, the survey covered the following topics: location, participation in cooperatives or associations of cacao producers, years dedicated to cacao production, certifications, and payment of property tax. In addition, the type of land tenure, the infrastructure available on the farm, and the labor force used were also inquired.<sup>14</sup>

<sup>14</sup> The interactive map with this information can be accessed through the control panel, likewise, the specific georeferencing of each of the producers can be found in the database.

## Associativity

Although the list of farmers in the universe, and hence the sample of farmers surveyed, was obtained through the cacao farmers' associations, it was desired to validate whether the farmers claimed to be members of any cacao farmers' association or cooperative, and which one.

99.4% of the sample mentioned to be associated, however, 0.4% in cluster 1 and 1.6% in cluster 3 answered not belonging to any association or cooperative. Table 5 shows the percentage of producers per cooperative or association in each of the clusters. This table does not represent the totality of the organizations present in the territories, since the sample was selected from specific lists of some associations.

**Table 5.** Associativity by cluster

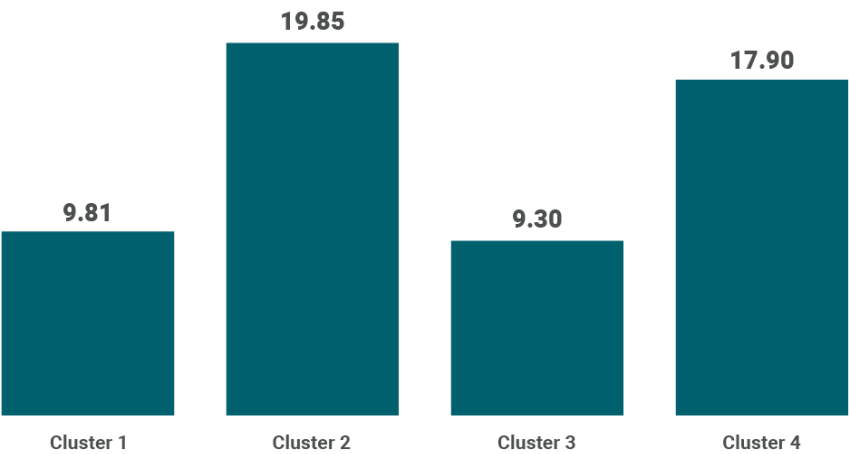
Cluster	Cooperative or association	% per cluster
Cluster 1	Asocajagua	30.58
Cluster 1	Guardabosques de la sierra	28.51
Cluster 1	Tayronaca	32.23
Cluster 1	Apomd	8.26
Cluster 1	They do not belong	0.41
Cluster 2	Asocatigra	30.30
Cluster 2	Ríos de chocolate	58.59
Cluster 2	Asocap	8.59
Cluster 2	Aroma de paz	2.53
Cluster 3	Activa G10	35.60
Cluster 3	IntegraSinú	27.18
Cluster 3	Asocaval	11.33
Cluster 3	Asoprodeama	11.00
Cluster 3	Acata	5.83
Cluster 3	Aproaca	4.21
Cluster 3	They do not belong	1.62
Cluster 3	Asoagrosinu	1.94
Cluster 3	Asodebri	1.29
Cluster 4	Aprocalg	12.57
Cluster 4	Asoprocar	20.96
Cluster 4	Asoprobrel	17.96
Cluster 4	Asopeca	11.38
Cluster 4	Asovica	9.28
Cluster 4	Aprocasurt	8.38
Cluster 4	Asocatol	8.38
Cluster 4	Acasandiego	3.59
Cluster 4	Amocal	3.29
Cluster 4	Asosemillas	2.40
Cluster 4	Asocanora	1.80



## Years dedicated to cacao production

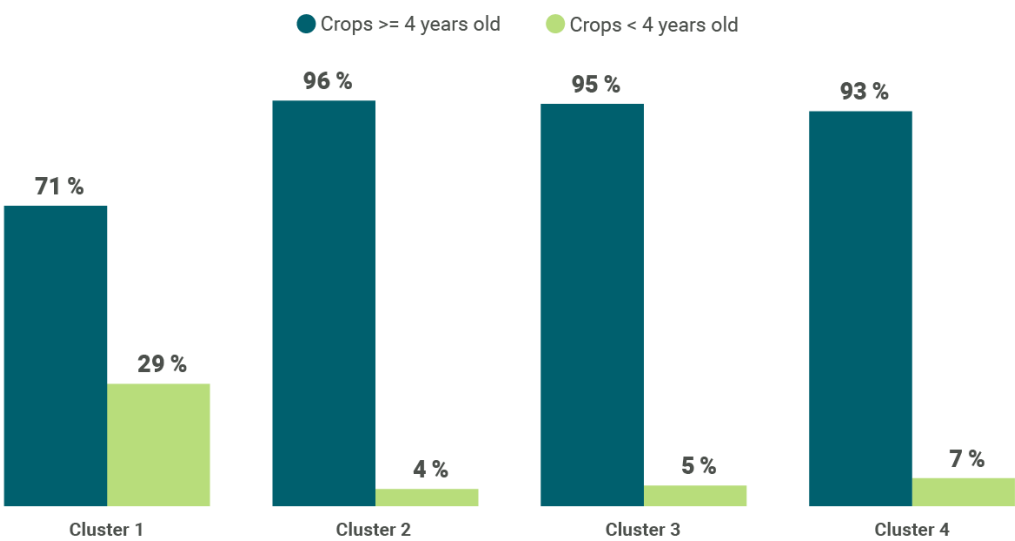
Graph 4 presents the average years spent in cacao production in the farms of each cluster. The clusters with the longest average years in cacao production are cluster 2 and cluster 4, both with experiences of approximately 20 years. On the other hand, in clusters 1 and 3, producers report that on average they have been engaged in cacao production for about 10 years.

**Graph 4.** Average years spent in cacao production



However, an additional criterion under the C4D project is to impact those producers and production units with at least 4 years dedicated to cacao production. However, when analyzing the results of the survey, it was identified that in each of the clusters there are producers who are engaged in cacao production for less than four years, particularly in cluster 1 where 29% of respondents reported so.

**Graph 5.** Farms with cacao cultivation for less than 4 years



## Certification

Regarding certification, the majority of producers, regardless of the cluster, say that the cacao crop has never been certified. Clusters 1 and 3 have very similar dynamics in terms of certification, on average, 21% of producers report that the cacao crop has been certified, in cluster 1 mostly "Organic" and in cluster 3 "Fairtrade". On the other hand, in cluster 4, 13% have had certification, mainly "Organic", and in cluster 2, only 2% report that they have had certification (Rainforest Alliance). These results are expected, considering that the level of certification in the country is low, and that so far this has only worked in some regions depending on the needs of the programs and organizations.

## Property tax and land tenure

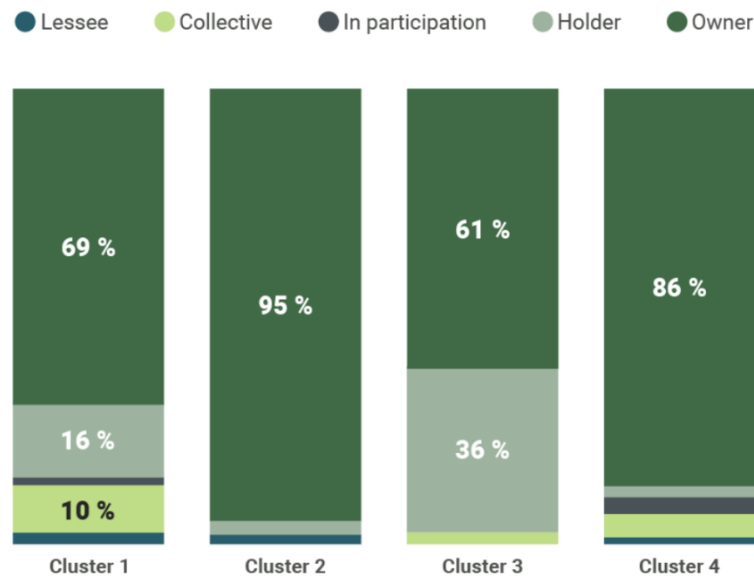
Regarding the payment of property tax in the productive unit, clusters 1 and 3 have the lowest percentage of respondents who report that the tax is paid in the productive unit, specifically for cluster 1, 33%, and for cluster 3, 12%. On the other hand, in clusters 2 and 4, on average 91% report that in their productive unit they do pay property tax.

The average value of property tax paid varies by cluster, between 135,703 COP (\$36.5 USD) on average for cluster 2 and 246,681 COP (\$65.9 USD) for cluster 3. Of all the departments within the clusters, Cesar has the highest average property tax paid with a value of approximately 300,000 COP (\$80.1 USD) per year, which could be related to the average farm size of 24 ha, the highest in the sample.

Although property tax must be paid by both owners and possessors, the lower percentage of producers paying property tax in clusters 1 and 3 could be explained by the type of land tenure in these clusters. Graph 6 shows that it is in these two clusters where the percentage of land tenure as owner is the lowest, 69% and 61% respectively.

In all clusters the least common land tenure type is "in participation" and "lessee". The majority of respondents in the sample reported owning land. In clusters 1 and 3, on average 64% own land, followed by an average of 26% who are holders. On the other hand, about 90% of producers in clusters 2 and 4 report owning the land.

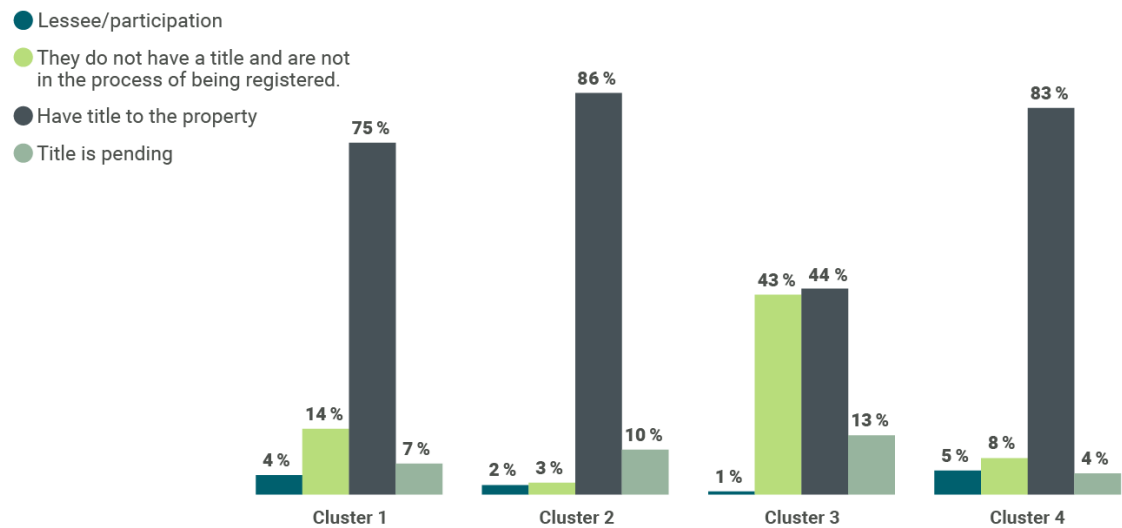
**Graph 6. Land tenure type**



For those who reported being owners, possessors or in collective tenure, the origin of land tenure is very similar across the four clusters. Specifically, on average 56% report having purchased the land. On the other hand, 27% on average of the producers report the tenure resulting from inheritance. It is worth mentioning that in cluster 1, 9% report tenure due to restitution, and in clusters 3 and 4 9% report tenure due to the adjudication of vacant land.

Regarding the status of the land title for owners, possessors or in collective tenure, in all clusters, the majority report already having the land title. In clusters 1, 2 and 4, more than 88% report that they have the land title. In cluster 3 there is a relatively high percentage, 43%, who report not having the title, nor having it in process of being registered. In general, for those who do have title, or their title is pending, more than 83% of the sample reports that this title is in the name of the head farmer, and about 15% reports that it is in the name of a relative of theirs.

**Graph 7. Title Status of Owners, Holders or Collective Tenancy**



## Infrastructure available on the farm

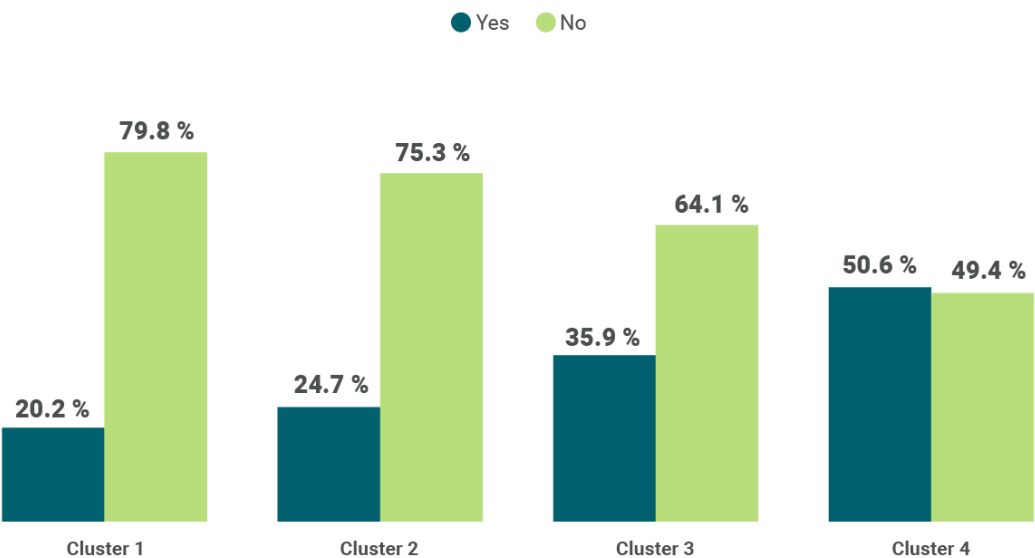
To evaluate the infrastructure available on the farm, we asked about the type of public services available on the farm, the availability of warehouses for supplies and products, the existence of fermentation areas, and the conditions of access to the farm in terms of roads and transportation.

In general, sewerage service is almost non-existent in all clusters with only about 1% of respondents claiming to have this service. Internet and household gas are the second and third most scarce services. On the other hand, the most common services in all clusters are electricity, with 80% of the sample having access, and cellular telephony, with about 75%.

Analyzing each of the clusters, in cluster 1, most of the farms do not have a local aqueduct (they use their own aqueduct with a water source or intake), nor sewage, nor internet, nor household gas. Cluster 2 is the cluster with the highest percentage of respondents who reported having cellular telephony and electricity, more than 95% of the farms. On the other hand, 52% report having their own water supply, and 42% report having a local water supply. In cluster 3, the access to any type of aqueduct is the lowest among the clusters, with only 4% reporting access to a village aqueduct, and 19% to their own aqueduct with a water source or intake. Finally, cluster 4 stands out for being the cluster with the highest number of farms reporting access to a village aqueduct, with about 62% of the farms having access.

On the other hand, most of the farms do not have warehouses for supplies and products. The cluster with the highest percentage of farms with this infrastructure is cluster 4, where about 50% of respondents claim to have a warehouse, being more common in the departments of Huila and Caldas. In cluster 1, only 20% of the farms have warehouses, being the lowest percentage among the clusters. At a general level, the department where it is more common to have warehouses is the department of Antioquia (77% of the respondents in this department have them) and Guajira is the department where this infrastructure is less common (5%).

**Graph 8.** Farms with warehouses for supplies and products



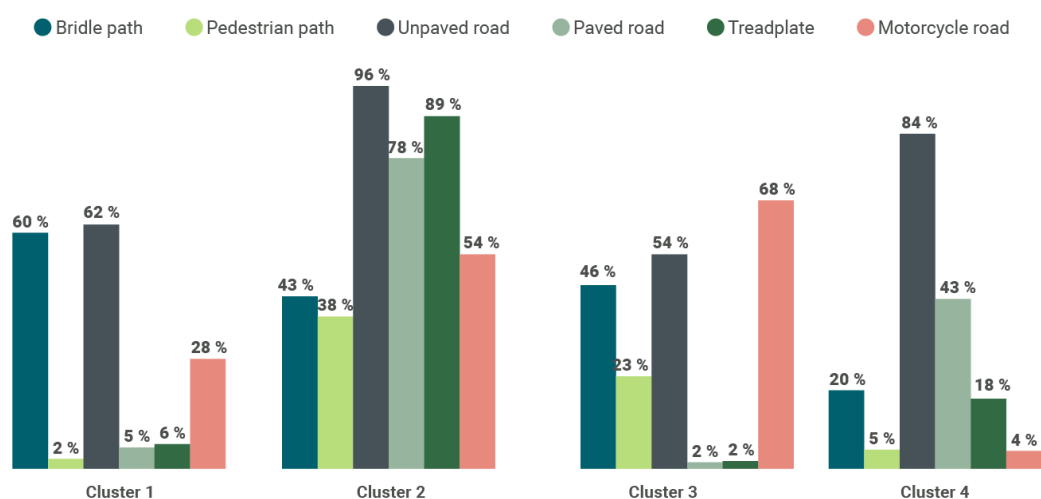
Regarding on-farm fermentation zones, table 6 shows that although the majority of respondents report fermenting on-farm, only about half of them have on-farm fermentation zones. Cluster 2 is the cluster with the highest percentage of farmers who ferment on-farm (96%) and with the highest percentage of farmers with on-farm fermentation zones (62%), while cluster 1 has the lowest percentage in these two aspects (62% and 33% respectively). How the fermentation process is carried out in each of the clusters is discussed in detail in the cacao Work and Costs - Post-harvest section of this document.

**Table 6.** Producers who ferment on-farm versus producers with a fermentation zone.

Cluster	% producers fermenting on farm	% producers who have a fermentation area	% of producers who ferment on-farm, who have fermentation area (intersection)
Cluster 1.	62%	33%	50%
Cluster 2.	96%	62%	63%
Cluster 3.	91%	47%	50%
Cluster 4.	76%	51%	59%

Finally, the main access roads to the farms are presented in graph 9. In cluster 1, the main access roads are dirt road and unpaved road, in cluster 2, the main access roads are unpaved road, dirt road and paved road, in cluster 3, motorcycle road and unpaved road and in cluster 4, unpaved road. The access to paved road and/or dirt road is particularly low in cluster 1 and 3, while it can be concluded that cluster 2 is the cluster with the best road access to the farm.

**Graph 9.** Access roads to the farms



Now, in relation to the transport services available on the farm, only in clusters 1 and 3 the use of animal transport was reported, particularly in cluster 1 where this was the transport option mentioned by more respondents. Cluster 2 has a higher number of producers reporting village transport, which may be related to access to farms with paved roads and/or paved footpaths. Similarly, in cluster 4, where 43% of producers report paved roads as an access route, village

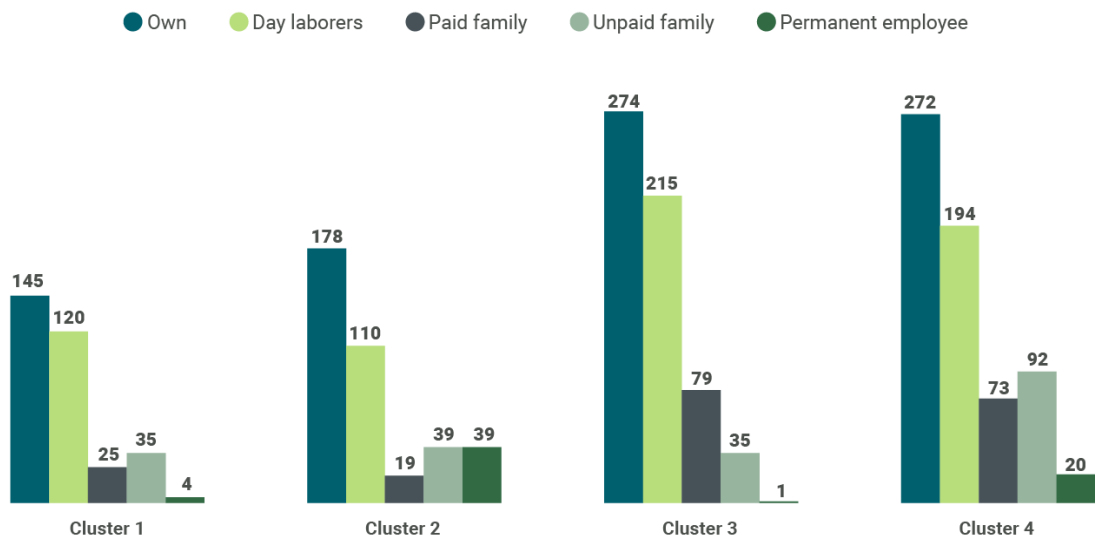
transport is a common means of transport. Finally, in cluster 3, the option most mentioned by respondents was private transport.

### Labor

For the labor used in the farm work, information was obtained regarding the type of labor used and the average value of the workday. In general, the most common type of labor in all the clusters is the labor of the producers themselves (own), followed by the labor of day laborers. Additionally, all clusters reported using family labor, although at a lower percentage compared to own labor and day laborers. The least common type of labor in all clusters is permanent employees.

The average daily wage cost varies by region, ranging from 38,084 COP (\$10.1 USD) for cluster 3 to around 46,000 COP (\$12.2 USD) for cluster 2.<sup>15</sup>

**Graph 10.** Count of producers by type of labor<sup>16</sup>



### 3.1.4 Cacao growing areas

The distribution of areas under cacao shows that, for the total surveyed, 50% of farmers have an area equal to or less than 2 hectares. The minimum value found is 0.18 ha and the maximum is 30 ha. The most common area of the farms for cacao cultivation is 1 hectare and the total hectares for cacao in the survey total 2567.2 ha, see table 7. It is noticeable that the information collected in this survey is from small cacao farmers, since 95% of them have an

<sup>15</sup> In cluster 3, in Cordoba, there is an average working day of 5 hours (7-12 noon). These workdays were adjusted/converted, managing workdays of the same hours in all regions.

<sup>16</sup> An answer count is presented, this being a multiple-choice question. This is done for all multiple-choice questions.



area less than 5 ha and only 1% have an area greater than 10 ha, in total there are only 53 cacao farmers with crops greater than 5 ha.

**Table 7.** Distribution of total area (ha) of cacao by cluster

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total sample
Average	2.15	3.10	1.84	2.58	2.37
Median <sup>17</sup>	2.00	2.50	1.50	2.00	2.00
Mode <sup>12</sup>	2.00	2.00	1.00	1.00	1.00
Total Area	520.90	614.55	569.30	862.46	2567.2
# Non Small Holders	9	21	4	19	53

Disaggregating by cluster, it is found that cluster 3 has an average of 1.84 hectares, lower values compared both at the level of the survey and among the other clusters. This result is mainly explained by Córdoba since the median is 1.5 ha while the median for Antioquia is 2.5. Cluster 4 has the largest average (3.1 ha) in the survey. With the exception of cluster 3, it is observed that 1% of the producers have an area larger than 9.56 ha.<sup>18</sup>

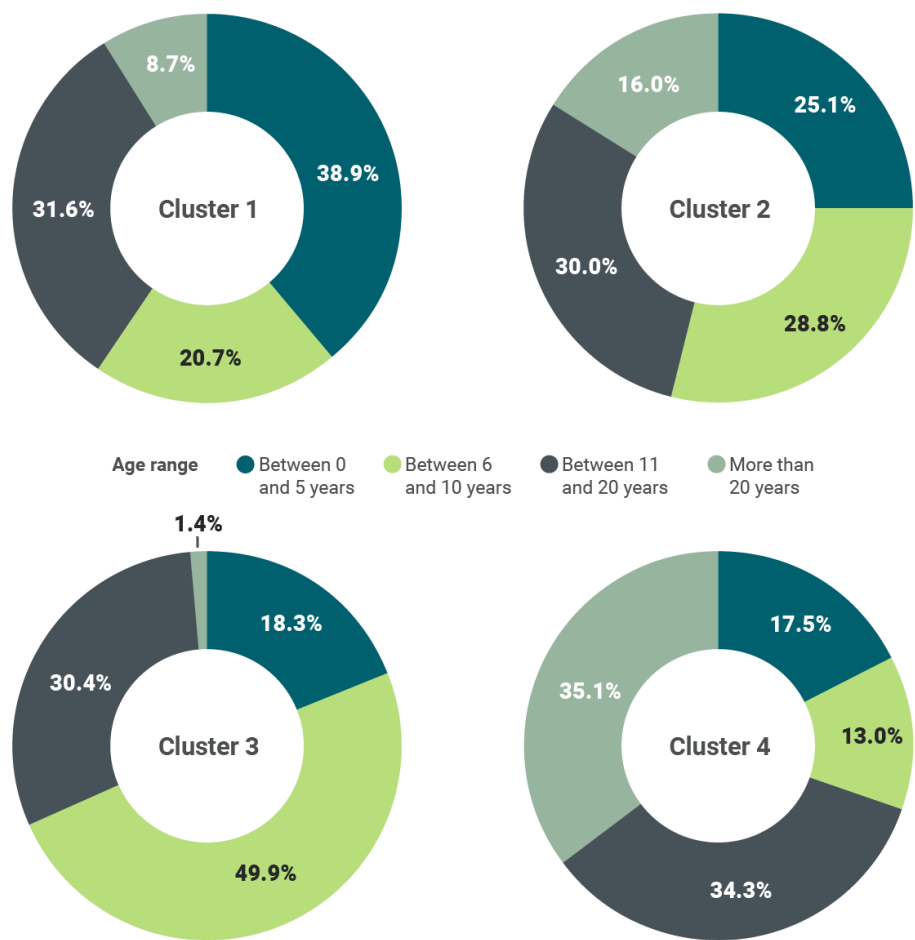
In addition, the total sample shows that the most common cacao area by age is 11 to 20 years; 817.88 ha in total, representing 31.9% of the total area. Next are the areas of 6 to 10 years with a total of 682.37 ha and with a share of 26.6%, in third place are the areas of 0 to 5 years with 612.51 ha, with a weight of 23.9%, and finally the areas of 20 years or more with 545.44 ha (17.7%).

Graph 11 shows the percentage of hectares by age range of trees per cluster. The lowest number of hectares is in the 20 years or older range, except for cluster 4 where this range represents 35.1%. In the same cluster 4, 34.3% of hectares are in the range of 11-20 years, i.e. the crops in this cluster tend to be older compared to the other clusters. On the other hand, cluster 1 presents the highest percentage of hectares of 0-5 years (38.9%). In cluster 2 there is a more equitable participation by age range where the ha of the ranges 6-10 and 11-20 stand out by little, while in cluster 3 predominates the hectareage in the range of 6-10 years (49.9%).

<sup>17</sup> Annex 5 presents a table with different measures of central tendency for different variables in the report.

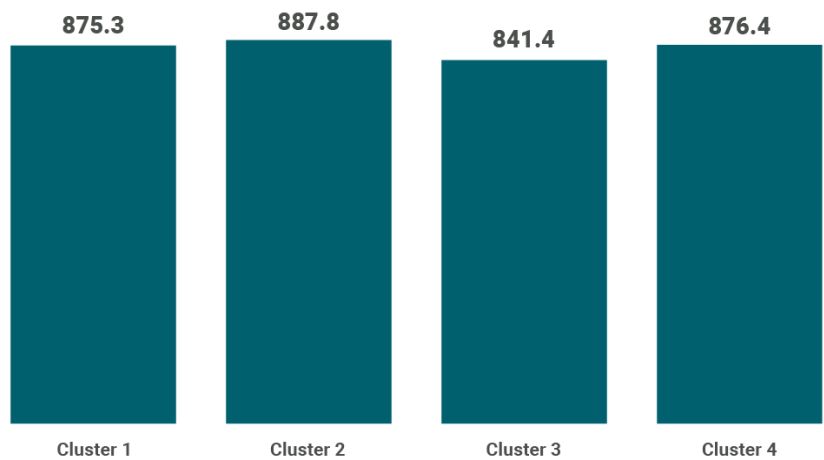
<sup>18</sup> It is important to remember that 66 surveys were conducted in Antioquia compared to 243 in Córdoba.

**Graph 11.** Share of cacao hectares by cluster and age range



Finally, the average density of trees per hectare (# trees/ha) per cluster shows similar values for each cluster, between 841 trees/ha for cluster 3 and 888 trees/ha for cluster 2 (Graph 12).

**Graph 12.** Average tree density per hectare indicator (# Trees/ha)



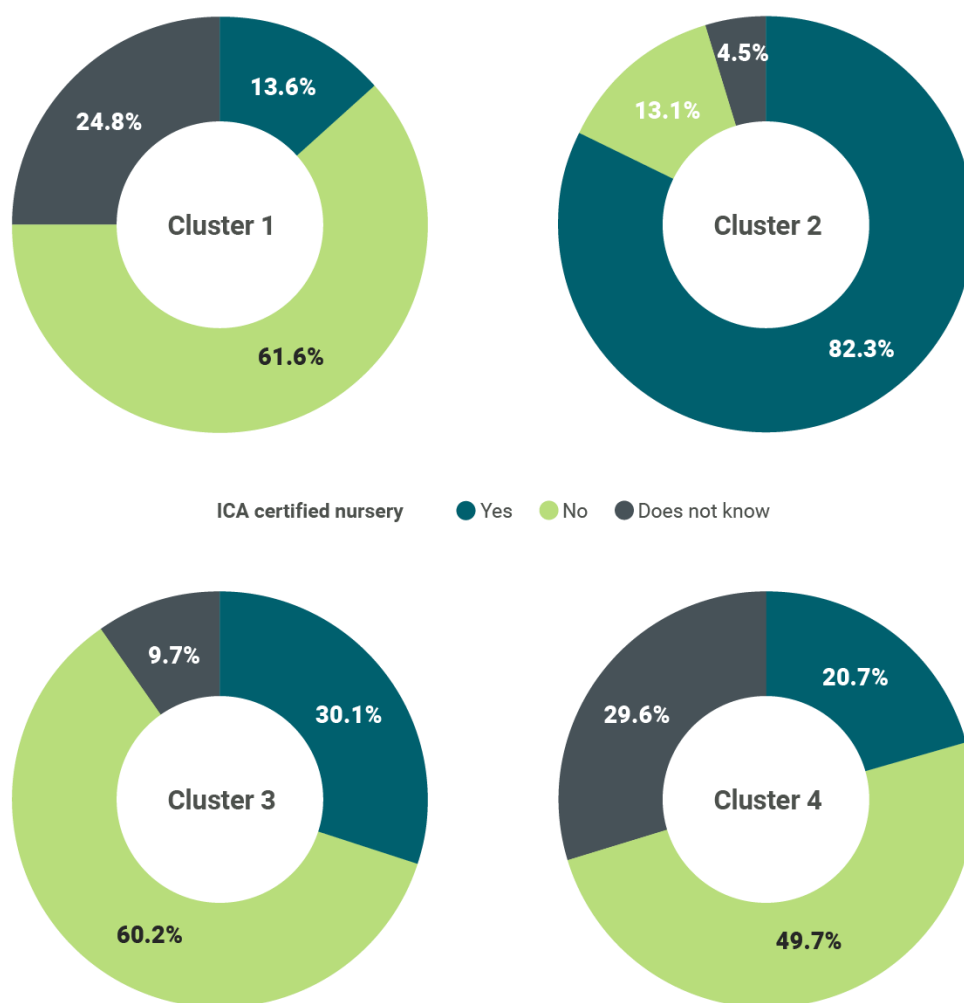
## Seeded material and renovation

Regarding the material planted, the survey inquired about the origin of the material planted in the cacao farms. Firstly, it was asked whether this material came from their own nursery or from another nursery. Of all the farmers surveyed, 57.8% said that the material planted came from another nursery, while the remaining 42% said it came from their own nursery. Segregating by cluster, in both clusters 1 and 3 it is found that the producers with material planted in their own nursery are the majority, 59% and 61% respectively. The opposite is true for clusters 2 and 4, where the second cluster stands out, since 92.4% of the producers reported having brought the material planted from other nurseries.

For those growers who claimed to have brought material from other nurseries, they were asked if they knew the location of the nursery. Of the total producers 34% do not know the location of the nursery from which they obtain the seedlings, while 23.7% affirm that they do know the location of the nursery (42.2% have their own nurseries). Regarding the department where the planted materials are obtained, when the producers knew it, for the first cluster, the seedlings come from the department of Cesar, in the second they come from the department of Santander, in the third from the department of Cordoba, and in the fourth the seedlings come from the departments of Caldas and Huila. Thus, it is common for producers to get the seedlings in their own department.

On the other hand, the producers were asked if the nurseries from which they obtained their planting material, whether their own or another, are certified by the Colombian Agricultural Institute (ICA). At the level of the survey, 48.7% of the producers answered that the nursery was not certified by the ICA, 33.1% answered that it was and 18.3% answered that they do not know. The disaggregation by cluster of this question can be seen in graph 13, observing that most of the producers in each cluster answered that the nursery was not certified, except for cluster 2 where 82.3% answered that it was certified by the ICA.

**Graph 13.** Percentage of producers who know or do not know if the nursery is certified by the ICA



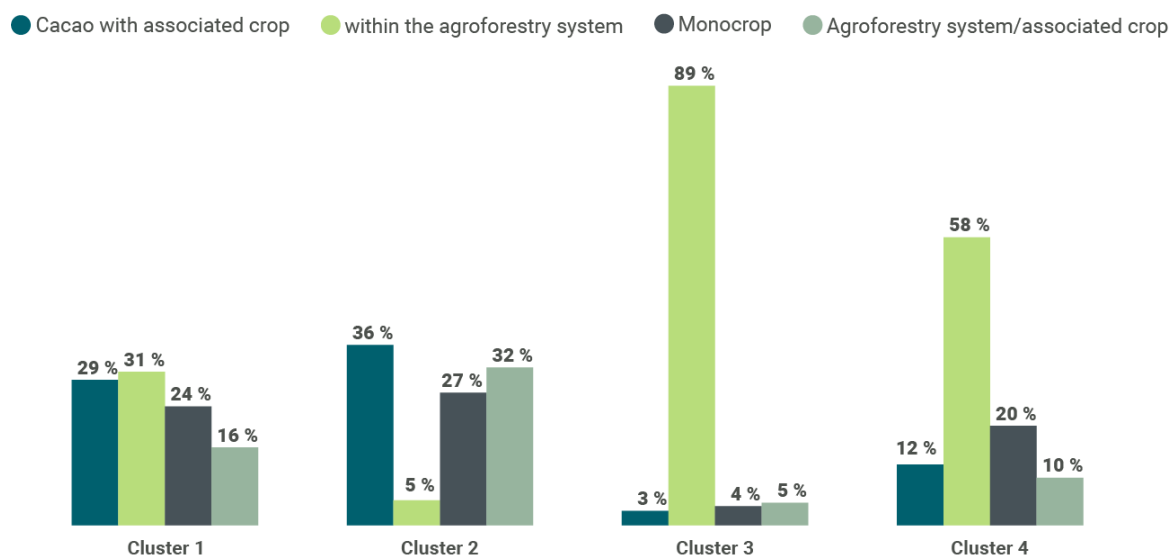
However, with regard to renewal, farmers were asked if they had made a renewal in the last two years (2020-2021). Overall, only 21.8% responded that there had been renewals in the last two years. Taken by cluster the percentages do not change significantly, only in cluster 1 and 2 the percentage of affirmative answers is the lowest, with 13.2% and 11.1% respectively. Finally, it should be noted that the departments of Antioquia and Huila have higher percentages of producers who reported having carried out renovations (50% and 44% respectively).

At the sample level, 18.1% performed renovation with cup change while 4% did it without cup change, 78.2% of the sample did not apply this question. At the cluster level, for clusters 1 and 2 around 9% of the sample had a cup change, while for clusters 3 and 4 this percentage was 23% and 25%, respectively. Finally, when asked about the type of material used for canopy renewal, 18% of the producers stated that it was clones, while 82% of the sample did not apply this question.

## Agronomic arrangement

In terms of agronomic arrangement, farmers were asked how they had established their cacao crop. In general, 51% of respondents stated that cacao cultivation is established within an agroforestry system, and the categories of "cacao with associated crop", "monoculture" and "agroforestry system and cacao with associated crop"<sup>19</sup> have a weight of 17.8%, 17.5% and 14% respectively (Graph 14). When analyzing the results by cluster, it is noted that in cluster 1, the four categories have a more equitable participation, although cacao establishment within the agroforestry system continues to predominate. For cluster 2, the category "within an agroforestry system" has the lowest weight (5.1%) and the others have a similar weight with the highest weight being the option of "cacao with associated crop". For cluster 3, the category "within the agroforestry system" predominates with 88.7% and for cluster 4 a similar relationship to the results of the overall sample is maintained.

**Graph 14.** Percentage of producers by type of establishment of cacao cultivation

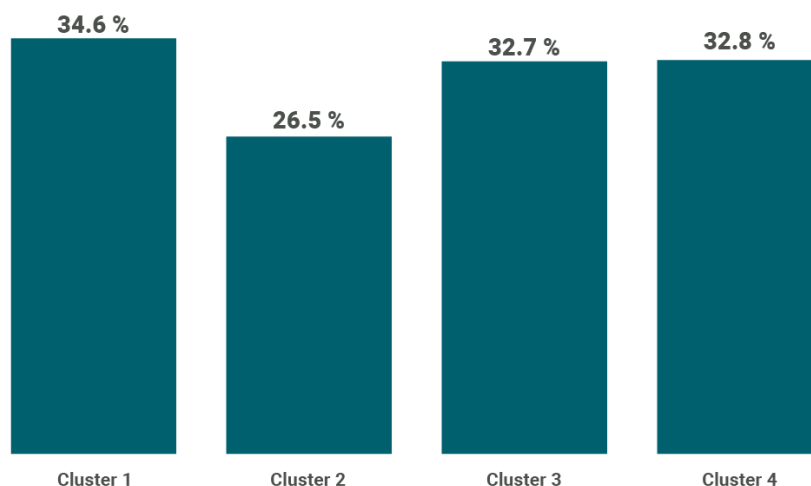


For those farmers who answered that they had their cacao crop established with an associated crop, they were asked if their cacao crop had shade. Twelve percent of the farmers did have shade in their associated crops while 6% did not, 82% did not provide this information. Now, including those producers with an agroforestry system and those who have an associated crop with shade, at the sample level we have that 77% of producers have shade. Cluster 3 stands out with the highest percentage of producers with shade (96%), followed by cluster 1 and 4 both with 75% and cluster 2 with 53%.

<sup>19</sup> "Agroforestry" systems are those that have cocoa crops associated with high-stature forest trees (timber producers), that provide shade to the cocoa. On the other hand, "Cocoa with associated crops" refers to using the same area for cocoa production along with crops like banana, citrus, cassava, etc., which have a similar stature to cocoa and are either commercially exploited and/or for self-consumption. Lastly, "Monoculture" refers to systems where cocoa is the only crop grown.

On the other hand, they were asked about the estimated level of shade of their cacao crops, finding an average shade level of 32.4%<sup>20</sup>. At the cluster level, similar percentages are obtained, as shown in Graph 15. The first cluster has the highest average (34.6%) followed by clusters 4, 3 and 2 (32.8%, 32.7% and 26.5% respectively).

**Graph 15.** Average shade level of the cacao crop



Finally, those who have shade were asked about the average age of shade. The survey found that the average age in years of the shade is 13.7 years. Only 5% of the growers have shade that is older than 30 years. By cluster there is an important difference in the average age of the shade. Cluster 4 has the highest average with 20.6 years, followed by cluster 2, with an average of 16.9 years. The lowest average shade age is found in clusters 1 and 3, with an average of 10 and 9 years respectively.

## Cacao production

Regarding cacao production, we asked about the kilograms produced in 2020 and 2021. For 2020, it was first asked if it was known how much this production was. Overall, it was found that only 29.4% of farmers were aware of the production for that year. Of those who knew the production, some producers reported that it was zero for reasons such as forced displacement and abandonment of the farm (which they are resuming this year), or because they have had the crop since 2021. Thus, the percentage of producers with knowledge of production in 2020, and with a production different from zero, was 27.7%. Observing by cluster, it is found that in cluster 3 and 4 there is a higher proportion of producers who know the 2020 production (32.7% and 43.4% respectively).<sup>21</sup>

<sup>20</sup> The level of shade refers to the percentage of shading provided by the agroforestry system or associated crop arrangement over the cocoa trees. Depending on the environmental conditions of a particular region, such as the amount of sunlight, precipitation, and relative humidity, varying levels of shade can have either positive or negative effects on cocoa production.

<sup>21</sup> There is no analysis of productivity (kg produced/ha) for 2020 because there are very few records of producers who report knowing this value.

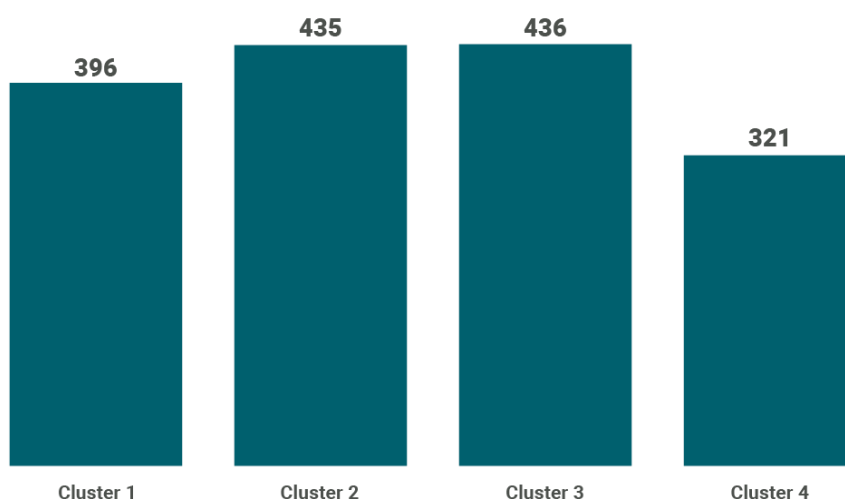


Regarding the production for 2021, it was found that 107 respondents reported a production of 0 kilograms, explained by the reasons given above. These records have been removed from the 2021 production calculation considering that they do not reflect the performance of the farm, but are a consequence of exogenous effects or shocks.

Using the information of months of the main and second harvest, their respective percentages of production and production in kg per year for 2021, a monthly proportion of production in kg per person was constructed. At the general level, there is an average of 900 kg of dry cacao produced per person. By cluster, the production in cluster 2 stands out with an average of 1393.5 kg per person. The other three clusters have a similar production of about 815 kg of dry cacao.

Making an analysis of productivity (kg/ha) for the year 2021 it is found that for the sample the average is 385 kg/ha. At cluster level the averages are similar, being cluster 3 the most representative with 436 kg/ha on average, followed by cluster 2 with 435 kg/ha, and finally cluster 1 with an average of 396 kg/ha and 4 with an average of 321 kg/ha.<sup>22</sup>

**Graph 16.** Average productivity Kg/ha of cacao (converted to dry) in 2021



### 3.1.5 Labor and operational costs of cacao production

In the section on cacao work and costs, information was collected for the following activities: pruning, irrigation and shading; fertilization and organic matter; pest and disease control; harvesting; post-harvest. Understanding that most farmers do not have records of activities and costs, in conjunction with POA, it was decided to calculate the cost of each of these tasks based on the number of workdays per activity and the cost of supplies, where applicable. The analysis of these operational costs of cacao production is presented at the end of this section.

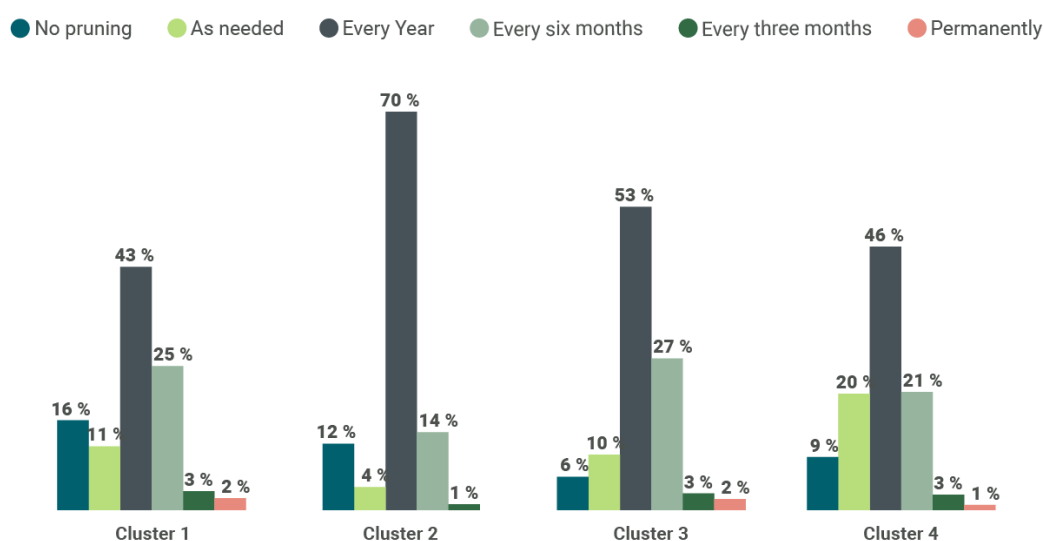
<sup>22</sup> In cluster 4 are Huila, Caldas and Tolima. While Huila is the department with the highest productivity in the sample, Tolima is the department with the lowest productivity in the sample.

## Pruning, irrigation and shade management

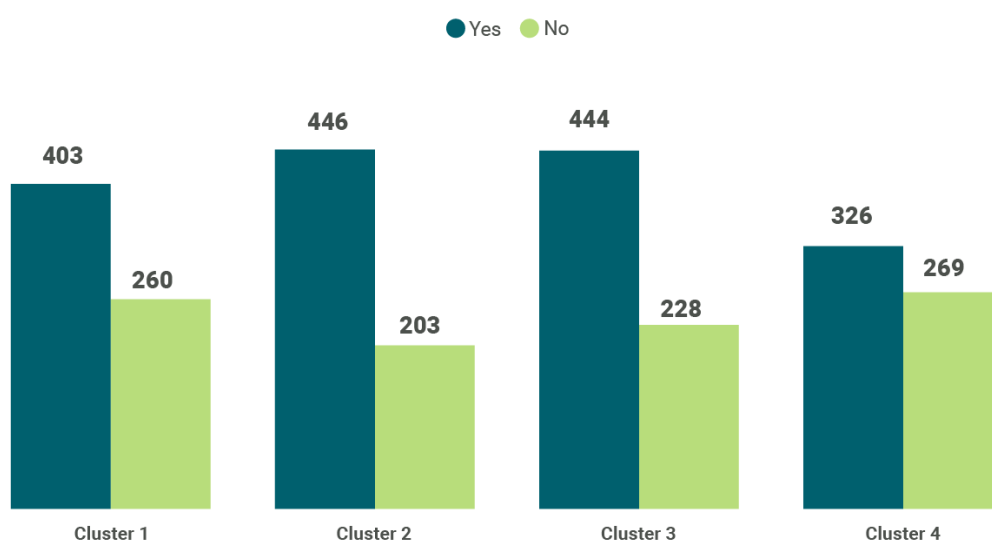
Analyzing the data for pruning, it is identified that the percentage of producers that prune in all clusters is higher than the percentage that do not prune. In general, only 10.16% of the respondents in the whole sample reported not pruning. Cluster 1, is the cluster with the highest number of respondents reporting no pruning (16%), followed by cluster 2 (with 12%), cluster 4 (9%) and cluster 3 (6%). On average, more than 50% of growers in the entire sample pruned once every year, with the frequency being more common in all four clusters. The second most common pruning frequency across all clusters is every six months, with approximately 21% of all respondents. The least common in all clusters is to prune permanently or continuously. Regarding the tools used, most producers have several tools to carry out pruning work in the four clusters, with scissors being the most common tool in all clusters, and chainsaw the least common.

However, the most common type of pruning in the four clusters is maintenance pruning, followed by plucking pruning in clusters 1 and 4, and training pruning in cluster 2. As for the use of healing agents, in clusters 2, 3 and 4 most producers apply healing agents in the cuts after pruning. On the contrary, in cluster 1 it is more common not to do this practice.

**Graph 17. Frequency of pruning**



Comparing the productivity of those farms that prune versus those that do not prune, graph 18 shows that for all clusters, the producers who claimed to prune are those producers with higher productivity levels. In cluster 1, producers who prune show an improvement in productivity of around 60%, cluster 2 and 3 of more than 100% and cluster 4, an improvement of around 20%.

**Graph 18.** Productivity (kg/ha) with and without pruning

On the other hand, the data collected show that in the four clusters there is a predominance of farmers who do not irrigate. In cluster 1 about 72% of farms do not have irrigation for cacao cultivation, in cluster 2 96%, in cluster 3 97% and 57% in cluster 4. It is worth mentioning that cluster 4 is the most irrigated, but this is only in Huila, which may be related to droughts and high temperatures in this department. On the other hand, cluster 4 is also the cluster with the highest reported access to the service of village aqueduct.

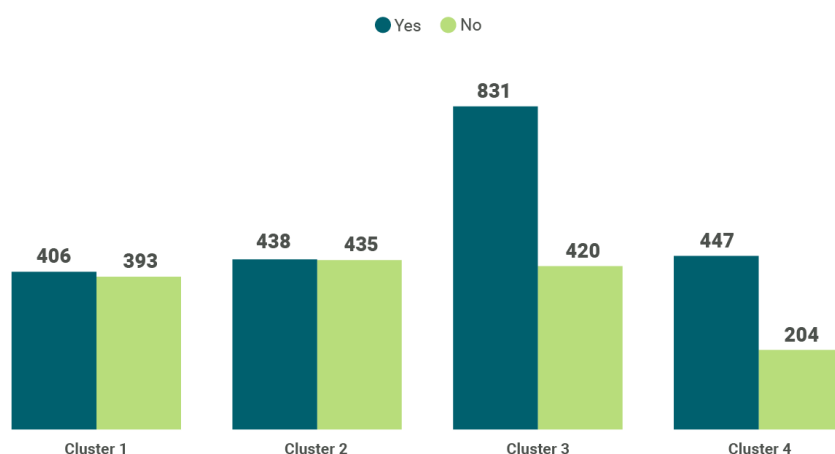
For growers who reported having irrigation, Table 8. shows the most common types of irrigation.

**Table 8.** Irrigation and most common types of irrigation by cluster

Cluster	% irrigated producers	1st type of irrigation	2nd type of irrigation
Cluster 1.	28%	Drip	Sprinkling
Cluster 2.	1%	Sprinkling & Drip <sup>23</sup>	
Cluster 3.	3%	Drip	Microaspiration
Cluster 4.	43%	Channels	Flooding

As with pruning, when comparing the productivity of cacao in those farms with irrigation versus those without, it can be seen that farmers who do have irrigation have higher productivity for the four clusters, with a greater difference in cluster 3.

<sup>23</sup> Only two respondents in this cluster reported having irrigation, one reported sprinkling and the other drip.

**Graph 19.** Productivity (kg/ha) with and without irrigation<sup>24</sup>

Regarding the work of shade management, activity that only applied to those producers with shade (about 77%), 57% of these producers claimed not to do shade management. Table 9 shows the percentages of producers per cluster that have shade, and the percentage of these producers with shade that claim not to do any kind of management, with a very similar behavior between clusters.<sup>25</sup>

For those who manage, the most common type of management is: in cluster 1 shade tree removal, and in clusters 2, 3 and 4 pruning of shade trees. Planting shade trees is the least common type of management in all clusters. In addition, it is important to mention that shade management is not carried out with a certain frequency, as the main frequency reported for shade management is "occasionally" in all four clusters.

**Table 9.** Shade management

Cluster	% producers with shade	% of producers who DO manage	% of producers who do NOT manage
Cluster 1.	75%	35%	40%
Cluster 2.	53%	20%	33%
Cluster 3.	96%	40%	56%
Cluster 4.	75%	34%	41%
<b>Total</b>	<b>77%</b>	<b>33%</b>	<b>44%</b>

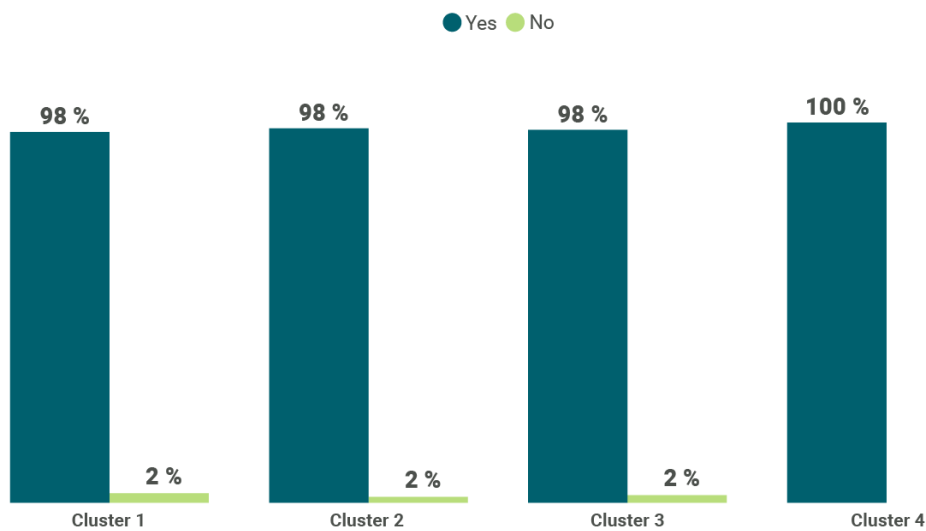
<sup>24</sup>Consider that for cluster 4, all producers who reported to have irrigation, belong to the department of Huila.

<sup>25</sup> Corresponds to respondents who reported having cacao cultivation established as an agroforestry system, or agroforestry system and cacao with associated crop (in the same area cacao, forestry and associated crop), or cacao with associated crop and who subsequently claimed to have shade.

## Weed control

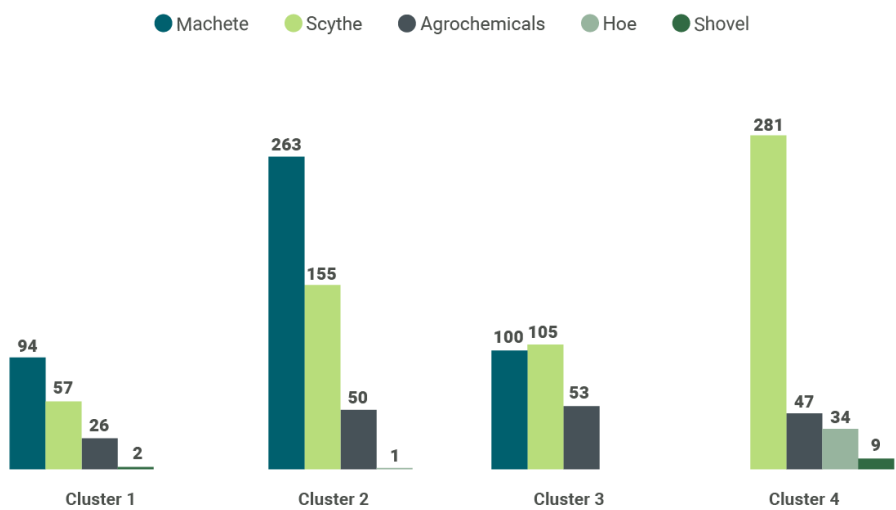
Weed control is a fundamental activity in the cacao growing process, and this is evident in the data collected, where 99% of respondents reported doing this activity. In clusters 1 and 2 the main weed control frequency is every three months, while in clusters 3 and 4 weed control is done mainly when needed.

**Graph 20.** Weed control



On the other hand, graph 21 shows the count of producers by type of weed control. In clusters 1 and 3, machete is the most used method for this control. On the other hand, in cluster 2 and 4 they report scythe as the main method. The use of agrochemicals (herbicides for weed control) is the third most common type of weed control in all clusters, while hoeing is the least used tool. Regarding the use of agrochemicals, cluster 2 is the cluster with the highest number of liters used per year.

**Graph 21.** Survey Count by Type of Weed Control

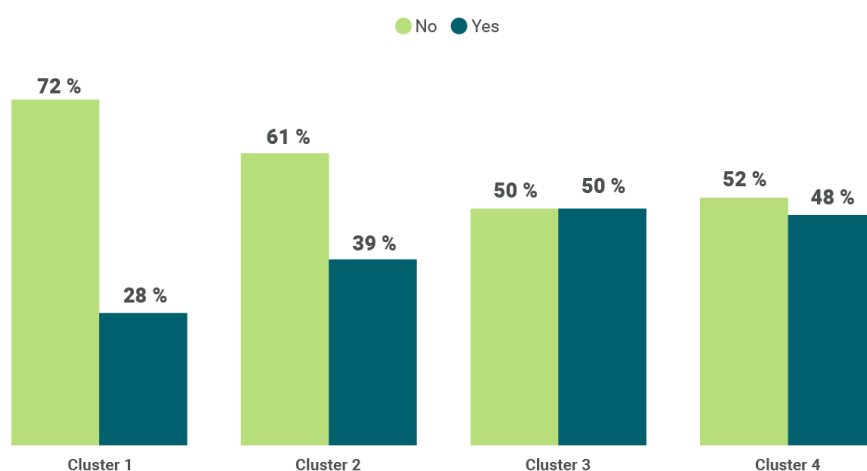


## Fertilization and organic matter

This component analyzed the availability of soil analysis, the way in which fertilization activities are carried out, the use of amendments and limes, and the use and production of organic matter on the farm.

In the first place, regarding soil analysis, in general, most of the producers report not having soil analysis. Graph 22 shows that cluster 3 presents the highest percentage of producers with soil analysis (50%), and cluster 1 the lowest percentage (28%). For those who reported having soil analysis, the last analysis was mainly done more than two years ago in all four clusters.

**Graph 22.** Producers with soil analysis

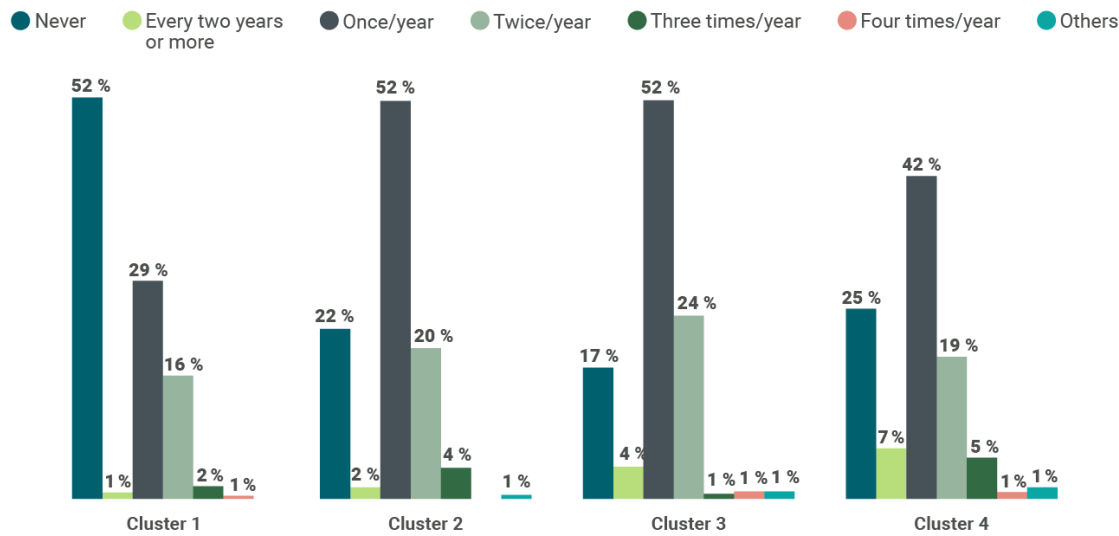


Secondly, it was found that most of the producers in all clusters do fertilization, except for cluster 1 where a higher number of producers never fertilize (52%), while in clusters 2, 3 and 4 there is an average of 24% of producers that never fertilize. Among those who fertilize, the most common frequency in all clusters is once a year, followed by twice a year, as shown in Graph 23.

Fertilizations in all clusters are mostly done without fertilization recommendations, with an average of 26% of farmers in the four clusters reporting having fertilization recommendation and 74% without such recommendation. Those with a recommendation stated that this recommendation was mainly given by association technicians and Fedecacao technicians.

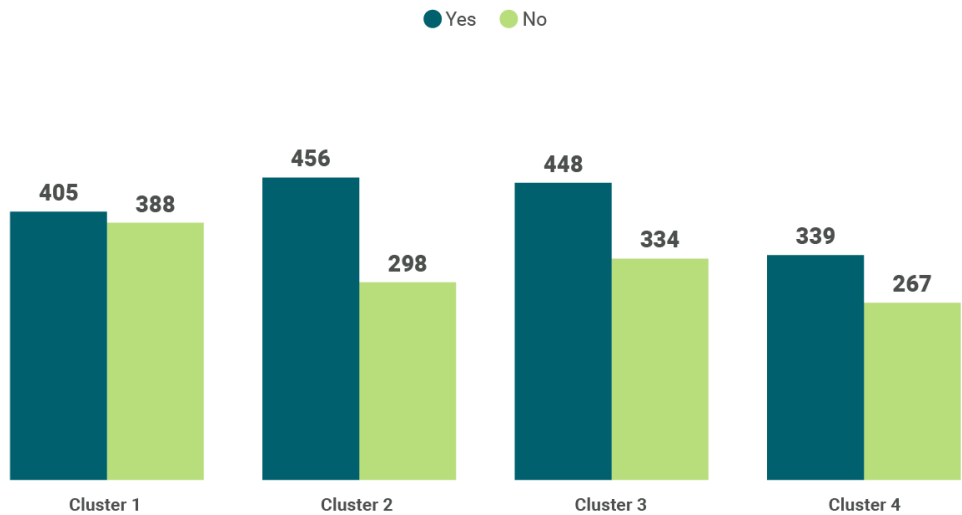


**Graph 23.** Producers by fertilization frequency



However, comparing the productivity of those farms that report doing fertilization versus those that never do it, it was determined that, as for the previous activities, the productivity is higher for those that do this activity independently of the frequency (graph 24). When analyzing productivity by frequency, it was not possible to determine a pattern.

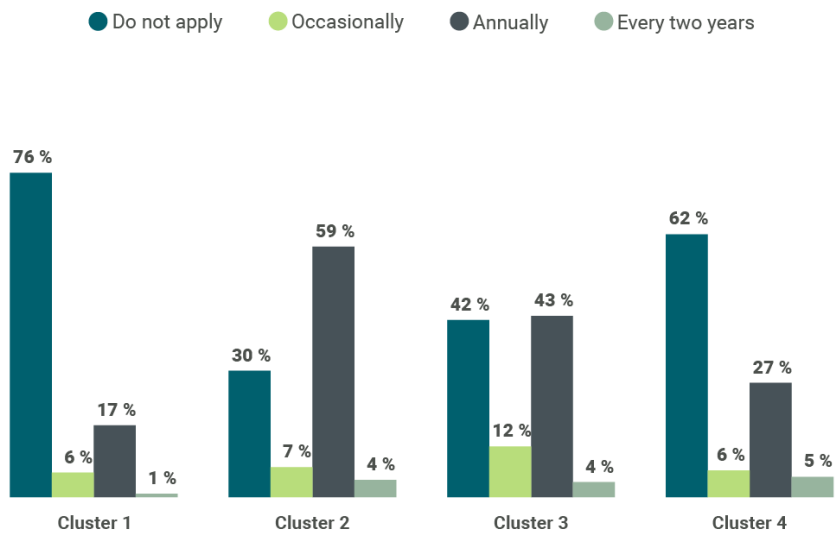
**Graph 24.** Productivity (kg/ha) with and without fertilization



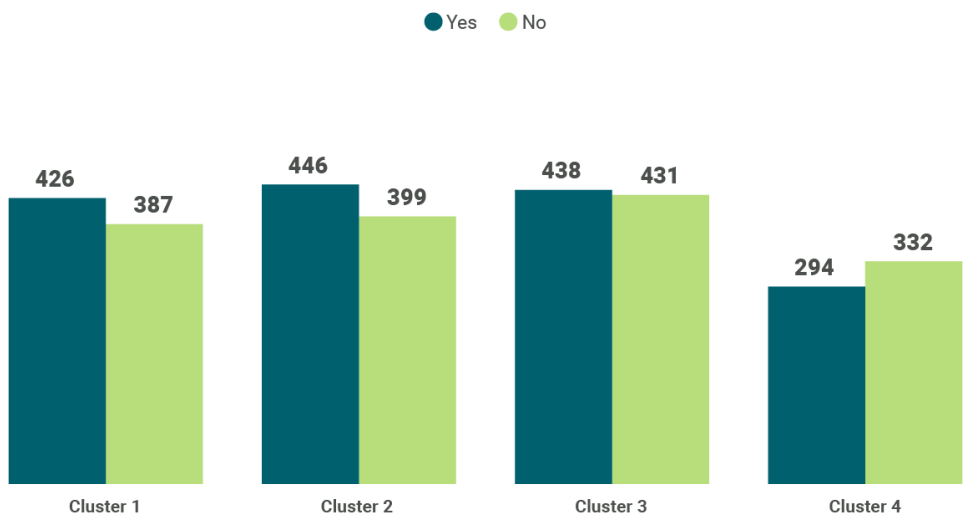
Regarding the use of amendments or which, this varies by cluster. In clusters 1 and 4 it is found that approximately 30% of the producers apply amendments or limes, while in clusters 2 and 3 the use is higher with a percentage of 64% of producers. Now, reviewing this component by department, it is highlighted that in cluster 1, the department of Cesar is the one that mostly applies amendments or limes, none of the producers in Guajira reported using amendments or limes, while in Magdalena only about 1.5% does. On the other hand, in cluster 3, more than 96% of the producers in Antioquia apply amendments or limes, being the department with the highest percentage of producers who carry out this activity.

For the four clusters the type of lime that is most used is dolomite lime, presenting a considerable difference compared to the other types of amendments or limes. Regarding the frequency, the most common in all clusters is to make the applications annually. Finally, graph 26 shows that, in general, the productivity is higher for those producers who reported applying amendments or limes, especially in cluster 1 and 2, while in cluster 3 and 4 there is no major difference.

**Graph 25.** Application of amendments or limes



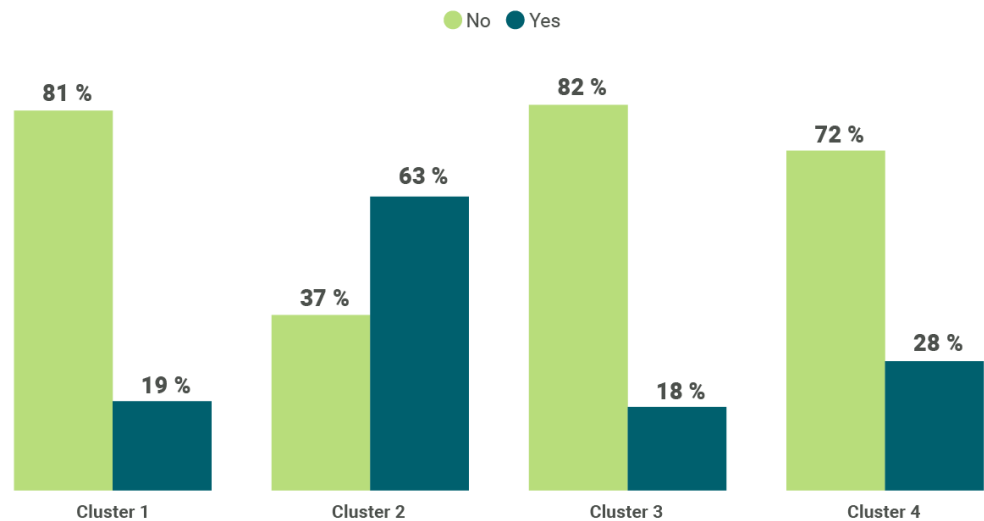
**Graph 26.** Productivity (kg/ha) with and without application of amendments or limes.



Finally, the application of organic matter is also different for each cluster. Cluster 2 is the cluster with the highest percentage of producers reporting applying organic matter (63%), while cluster 3 has the lowest percentage (18%). In cluster 1, 19% of producers apply organic matter, and in cluster 4, this percentage is 28%. The two most used types of organic matter are poultry manure and compost.

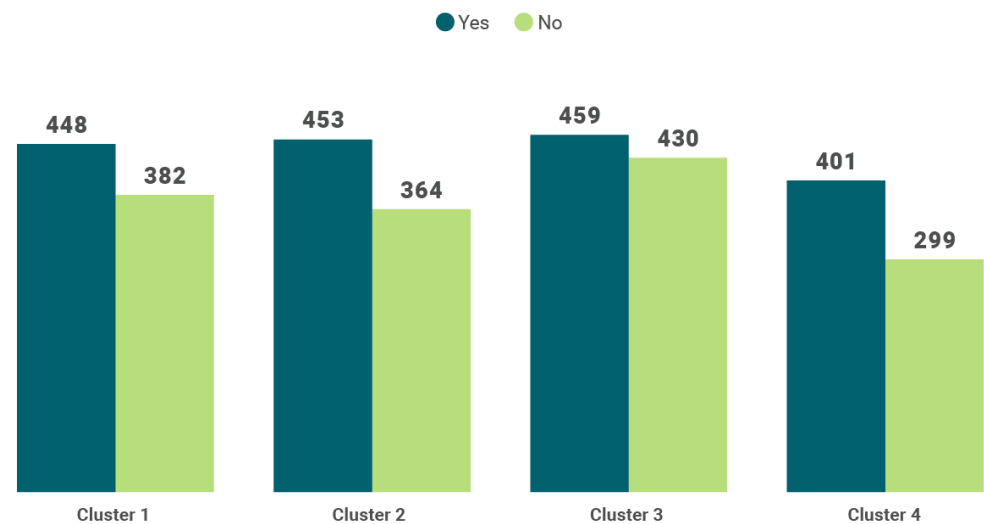
Thus, in general, for all clusters, except for cluster 2, most of the producers do not apply organic matter. This finding is complemented by the identification of a low percentage of producers that produce organic manure on the farm, with an average of 13% of producers reporting this type of production. This shows a low level of utilization of organic residues from the farm.

**Graph 27.** Application of organic matter



When comparing the productivity between producers who apply organic matter and those who do not apply organic matter, it is identified that producers who apply organic matter have a higher productivity in all clusters, as can be seen in graph 28.

**Graph 28.** Productivity (kg/ha) with and without the application of organic matter.



## Pest and disease control

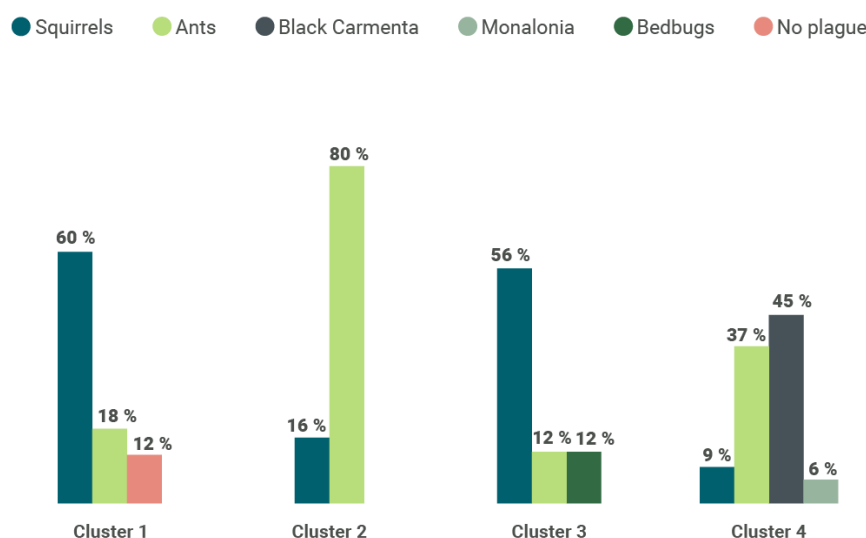
### • Pest control:

In this component we inquired in general about the different pests present in the crop, and in more detail about the type of control that is done to the most limiting pest.

For the total sample, it was identified that only about 4% of the producers stated that they had no pests. Due to the particular conditions in each of the clusters, there are different pests in each region, however, the most predominant are ants (Formicidae) and squirrels (*Sciurus vulgaris*) being the most mentioned in cluster 1, 2 and 3, while in cluster 4 the most predominant were the ants, followed by the Black Carmenta (*Carmenta foraseminis* spp) and the Monalonia (*Monaloniom dissimulatum* and *M. annulipes*), the latter two with similar relevance.

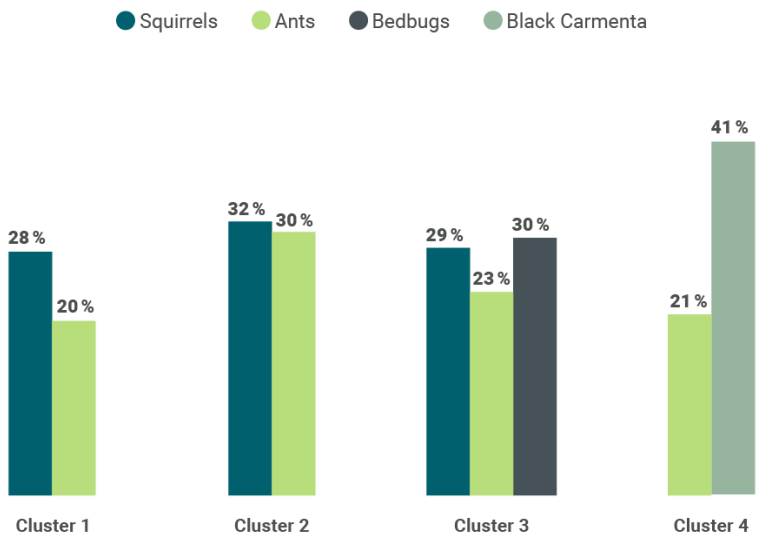
Now, the most limiting pest, in relation not only to the predominance but also to the impact, is different for each cluster: in cluster 1 60% of producers report squirrels as the most limiting pest, followed by 18% of producers for ants; in cluster 2, 80% of producers report ants as the most limiting pest, and 16% squirrels; in cluster 3, 56% of producers report squirrels as the most limiting pest, 12% report ants, and another 12% report bed bugs; in cluster 4, 45% of producers report black carp as the most limiting pest, and 37% report ants.

**Graph 29. Most limiting pest**



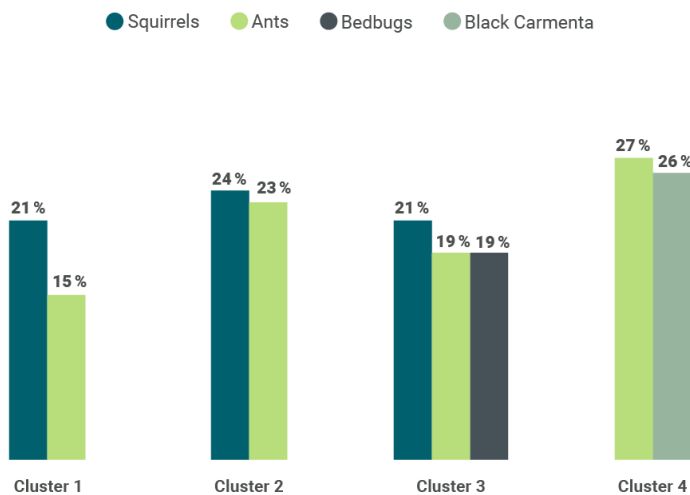
The incidence of these most limiting pests in the trees was also evaluated, as well as the intensity with which the pods and leaves are attacked. Graph 30 shows the percentage of incidence of the two most limiting pests by cluster in the trees, for cluster 3 the graph presents three pests since ants and bugs are equally relevant. In cluster 1, squirrels have 28% incidence in trees and ants have 20% incidence in trees; in cluster 2, squirrels have 32% incidence in trees and ants have 30% incidence; in cluster 3, squirrels have 28% incidence in trees, bedbugs have 31% and ants have 23% incidence; in cluster 4, black carmenta has 41% incidence in trees, ants have 21% incidence. It is emphasized that the black carmenta attacks a higher percentage of trees compared to the other pests.

**Graph 30.** Incidence of the most limiting pests in trees.



Graph 31 shows the percentage of pods or leaves affected by the most limiting pests in each cluster. In cluster 1, squirrels have 21% intensity on the pods or leaves and ants have 15%; in cluster 2, squirrels have 24% intensity on the pods or leaves and ants have 23%; in cluster 3, squirrels have 21% intensity, bugs have 19% intensity and ants have 18%; and in cluster 4, black bug has 26% intensity and ants have 27%. In general, the percentage of affected pods or leaves is very similar for all pests, with an average of about 22% intensity.

**Graph 31.** Intensity of the most limiting pests in pods and leaves.



Regarding the type of control carried out for the most limiting pest, in all clusters, except cluster 2, manual control is the most common type of control for the most limiting pest. Cluster 2, mainly controls with pesticides, related to the presence of ants as the most limiting pest.

Finally, for the specific indicators of the project, it was particularly inquired about the management of the fruits affected by black or yellow leafmint, finding that 58% of the

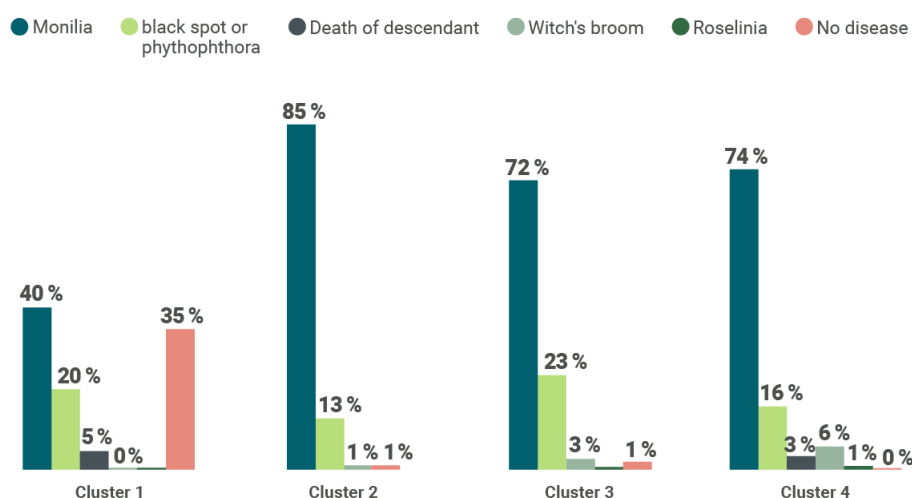
producers that report some kind of leafmint as a pest, also report that they identify, cut and bury the fruits affected by this pest.<sup>26</sup>

- **Disease control:**

As with the pests, in this component the different diseases present in the crop are investigated in general, and in more detail by the type of control that is done to the most limiting disease.

In a similar way as it was explained in pests, in the crops there are different diseases, although this does not mean that all of them are the most limiting ones. Diseases such as black spot (Phytophthora spp), monilia (Moniliophthora roreri), downy dieback (caused by various endophytic microorganisms), witches' broom (Moniliophthora perniciosa), and rosellinia (Rosellinia pepo) were found in all clusters, with only about 9% of the total sample reporting no diseases. Overall, the top three diseases reported were monilia, followed by black spot or Phytophthora, and witches' broom. On the other hand, considering the lethality of Rosellinia, it is important to highlight that this disease is the fourth most mentioned disease in the totality of the sample, mostly explained by 37% of the producers in cluster 4 that reported having it. However, as will be shown below, few reported it as the most limiting disease.

**Graph 32. Most limiting disease**



In the analysis of the most limiting diseases, in all clusters monilia is the disease with the highest percentage, followed by black spot (graph 32). Cluster 1 has the highest percentage of producers reporting no diseases (35%). Also, in this cluster Monilia is less reported as the most limiting disease compared to the other clusters, this is related to the high relative humidity in Magdalena that makes the black spot (Phytophthora) have higher incidence, while cacao crops

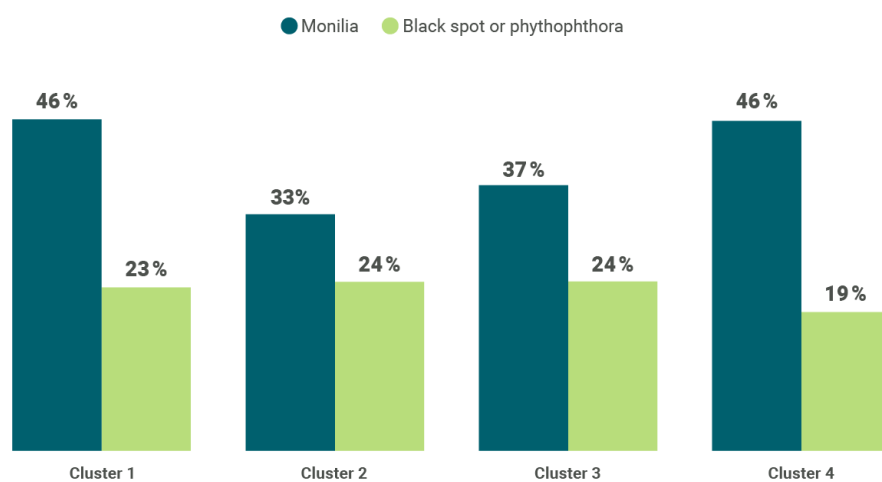
<sup>26</sup> It is important to mention that in clusters 1, 2 and 3, on average, only 7% of the producers report black seed beetle as a pest, although not as the most limiting one. On the other hand, in cluster 4, 60% of the producers mention that they have the black stem weed as a pest, and 35% report the yellow stem weed as a pest in their crops, however, only 45% report the black stem weed as the most limiting pest.



in Cesar are located in low marginal coffee zone, where the relationship between the height above sea level (a.s.l) makes Monilia less aggressive.

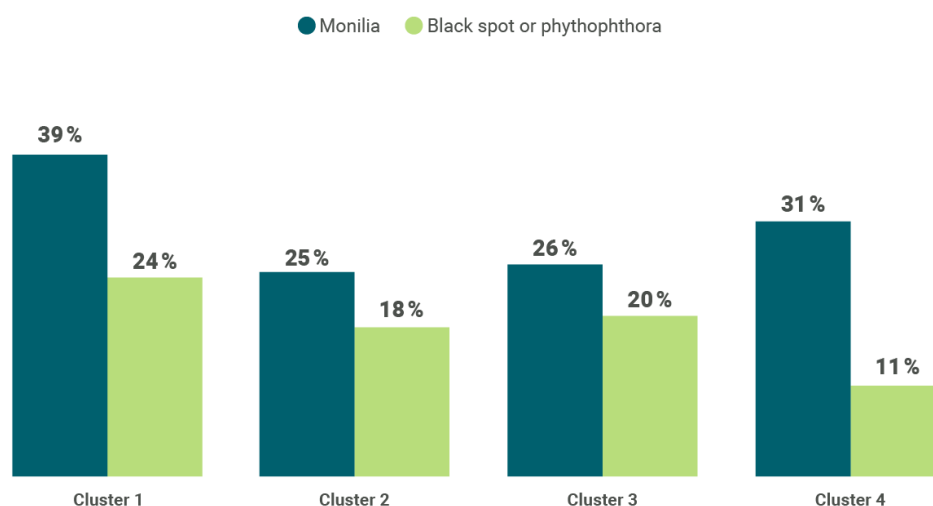
Graph 33 shows the percentage of incidence in trees of the most limiting diseases: in cluster 1, the percentage of incidence of monilia is 46% of the trees, and 23% for black spot; in cluster 2, for monilia it is 33% and for black spot it is 24%; in cluster 3, the percentage of incidence of monilia is 37%, and of black spot it is 24%; and in cluster 4, the percentage of incidence of monilia is 46% and of black spot it is 19%. For all clusters, the percentage of trees affected by monilia is higher than the percentage of trees affected by black spot.

**Graph 33.** Incidence of the most limiting tree diseases



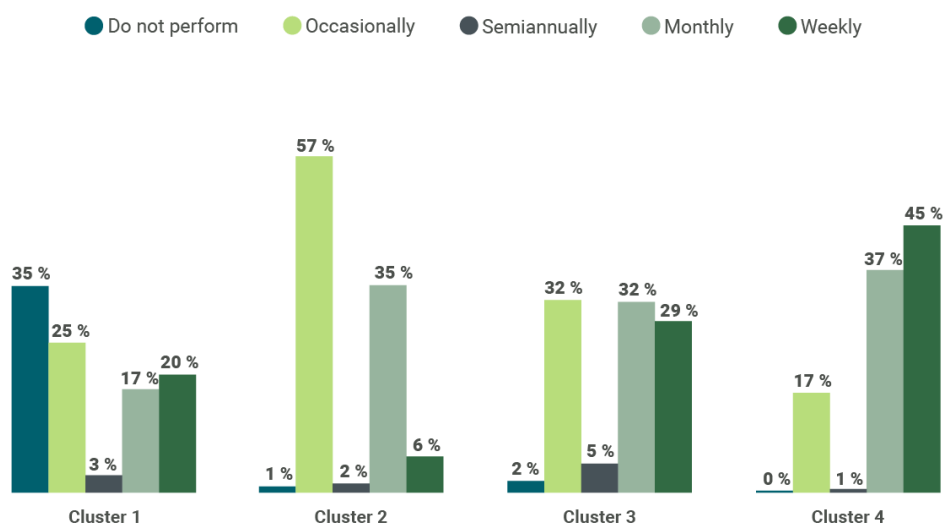
Similarly, graph 34 shows the percentage of pods affected by the most limiting diseases in each cluster. The results of the percentage of pods lost by the most limiting diseases, also called percentage of intensity, are similar to those of incidence, since the disease with the highest intensity in all clusters is monilia with an average percentage of 30%, and an average percentage of 18% for black spot. In addition, it was also found that a high percentage of producers harvest diseased pods: in cluster 1, 61%, in cluster 2, 59% in cluster 3, 81%, and in cluster 4, 85%.

**Graph 34.** Intensity of the most limiting diseases in pods



The frequency of disease control is different for each cluster. In cluster 1 and 2 the most common frequency of disease control is "occasionally", in cluster 3 similar percentages are found for "occasionally" and "monthly", and in cluster 4 there is a higher frequency of control with the highest percentage for "weekly" followed by "monthly". <sup>27</sup>

**Graph 35.** Frequency of disease control



Finally, for the specific indicators of the project, it was asked about the control of the Witches' Broom disease, and if the diseased fruits were buried or placed under the leaf litter for monilia or black spot. Regarding the control of witches' broom, it was found that most of the producers with presence of this disease perform control. In the same way, the producers that control witches' broom also reported that they identify and eliminate branches and fruits affected by this disease. It is important to mention that the presence of this disease is almost null in cluster 1. Regarding the management of diseased fruits by monilia or black spot, it was found that most of the producers in cluster 1, 3 and 4 bury or place under the leaf litter diseased fruits, while in cluster 2 the percentage of those who do it is very similar to the percentage of those who do not do it.

## Harvest

In harvesting, information is available on the collection of cacao pods, the separation and disposal of bad pods and beans, and the dehusking of cacao.

First, we inquired about the months in which the main and the main crop was harvested by cluster. Table 10 presents this information at the departmental level, considering that there are marked climatic differences between departments in the same cluster.

<sup>27</sup> The weekly frequency in cluster 4 is mostly in the department of Huila.

**Table 10.** Months of the year by type of harvest

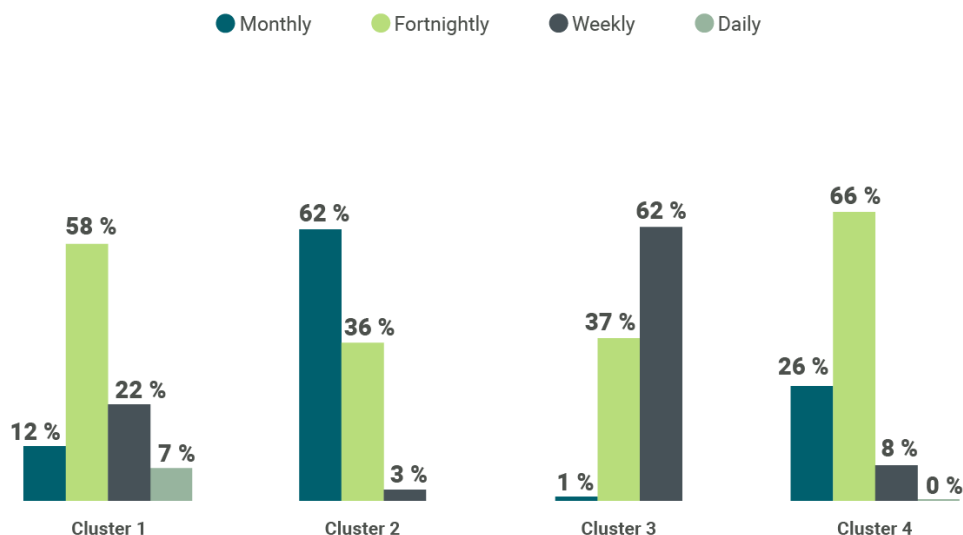
Cluster	Department	Months Main Harvest	Months Second Harvest
Cluster 1	Cesar	November December	April May June July
Cluster 1	La Guajira	March April May	October November December
Cluster 1	Magdalena	March April May	October November December
Cluster 2	Santander	November December	March April May
Cluster 3	Antioquia	November December January February	July August September
Cluster 3	Cordoba	October November December January	March April May June
Cluster 4	Caldas	April May June	November December
Cluster 4	Huila	May June July	November December
Cluster 4	Tolima	March April May June	October November December

In relation to the frequency of harvesting for each of the harvests, graphs 36 and 37 show that the frequency of harvesting is equal in cluster 2 and 4 for both periods. Particularly, in cluster 2, the most common harvesting frequency in both periods is monthly harvesting, followed by biweekly harvesting, and in cluster 4, the most common harvesting frequency in both periods is biweekly, followed by monthly.

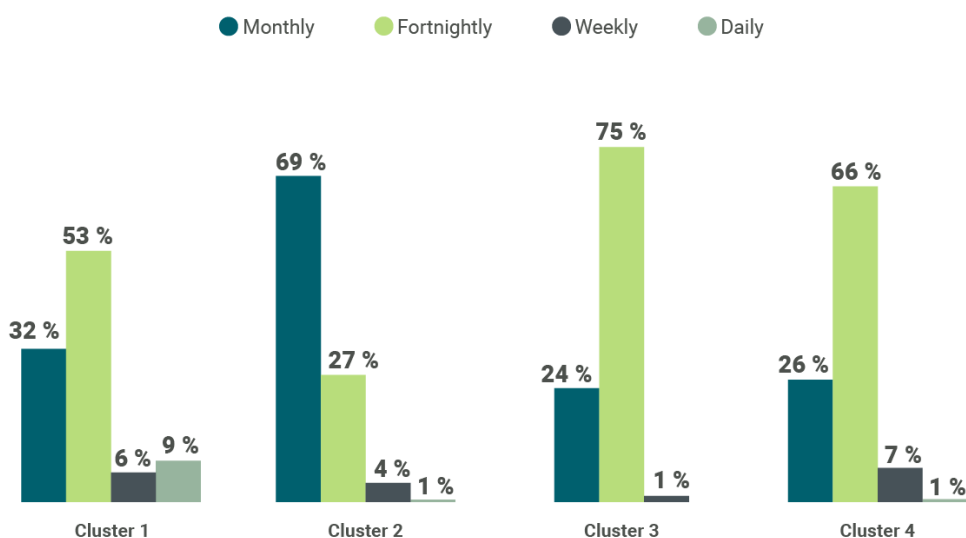
For clusters 1 and 3 the most common harvest frequencies are different in each harvest period. Specifically, cluster 1 presents a mostly biweekly harvest followed by weekly in the main harvest, while in the second harvest the second most common frequency is monthly and not weekly. On the other hand, in cluster 3, the main harvest is most commonly done weekly followed by a fortnightly frequency, while in the second harvest it is most commonly done fortnightly followed by monthly. For both main and second harvest periods, daily harvesting frequency is uncommon, and occurs more in cluster 1.

Regarding harvesting criteria, producers in general in all four clusters use pod color as the main criterion for harvesting, the next most common criterion is experience. Harvesting pods according to the criterion "Loss of gloss" is not frequent in any of the clusters.

**Graph 36.** Frequency of harvesting in main harvest



**Graph 37.** Frequency of harvesting in the second harvest

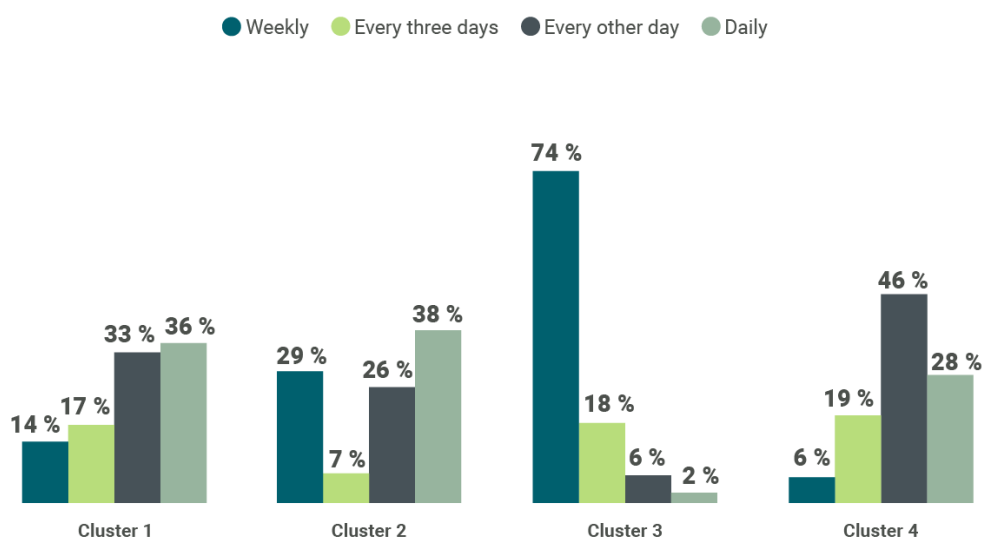


In general, most farmers separate and discard diseased pods, and separate and discard bad kernels. Table 11 shows the percentages of farmers who do not perform these activities for each of the clusters. These percentages are very similar for both activities, with cluster 2 having the highest percentage of producers that do not perform these activities and cluster 4 having the lowest percentage. The table also shows that it is more common among producers to separate and discard diseased pods than to separate and discard bad kernels.

**Table 11.** Producers who do not separate and dispose of diseased pods and bad grains

Cluster	% producers do NOT separate and discard diseased pods.	% producers do NOT separate and discard bad grains
Cluster 1.	29%	30%
Cluster 2.	51%	54%
Cluster 3.	23%	40%
Cluster 4.	10%	13%
<b>Total Average</b>	<b>28%</b>	<b>34%</b>

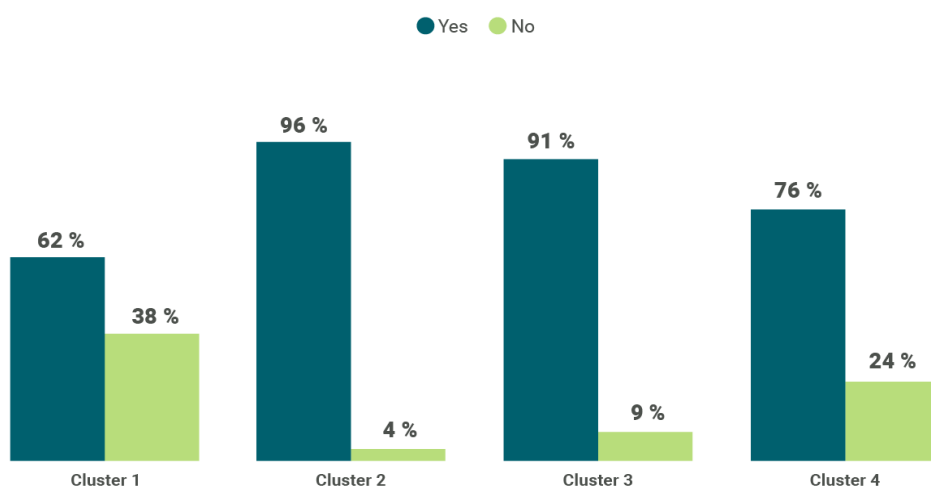
Finally, analyzing the data collected on dehusking, it is identified that the most common frequency of dehusking in cluster 1 and 2 is daily, followed by every two days in cluster 1 and weekly in cluster 2. In cluster 3 there is a prevalent weekly frequency, while in cluster 4 the most common frequency is every two days followed by daily (graph 38). This process is generally done manually in all clusters, with an average of about 92% of respondents doing it this way. Finally, in the four clusters there is a small percentage of producers that make use of the cacao, specifically in clusters 1, 3 and 4 on average 32% make use of it, and in cluster 2, 14% make use of it.

**Graph 38.** Frequency of ear shucking or pod splitting

## Post-harvest

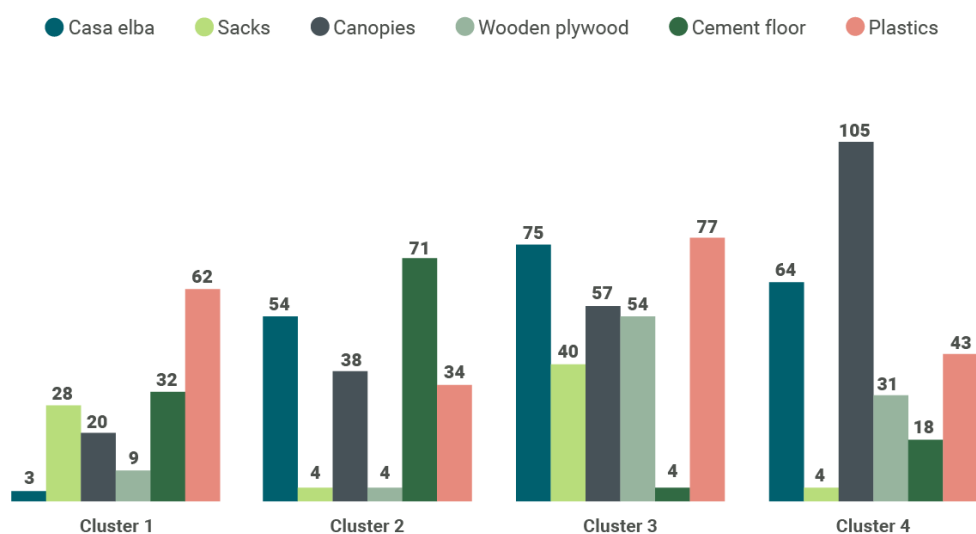
In the post-harvest stage, the fermentation and drying processes were investigated.

In clusters 2 and 3, on average 93% of the producers surveyed report that they do ferment on the farm. On the other hand, in clusters 1 and 4, the percentage of farmers reporting fermentation is lower (68.5% on average). This is related to the way in which cacao is marketed, a detailed analysis of the marketing processes is presented in the section cacao Marketing.

**Graph 39. On-farm fermentation**

The fermentation process is done in the four clusters in a similar way. Cacao farmers mainly ferment in wooden crates, followed by sacks. Plastic bins are less used in all clusters. In addition, as mentioned in the farm infrastructure section, although most respondents report fermenting on the farm, few have fermentation areas. On the other hand, on average for all clusters the fermentation process takes between 5 and 6 days, and during this process most producers in all clusters do not take or record the temperature.

As for the fermentation process, in general, in all clusters, the majority of farmers report drying on the farm (61% in cluster 1, 95% in cluster 2, 92% in cluster 3, and 76% in cluster 4; percentages almost identical to those farmers who report fermenting on the farm). On the other hand, as can be seen in graph 40, in each cluster the cacao is dried in different places: in cluster 1, mainly in plastic, in cluster 2 in cement floors, in cluster 3 in plastic and elba house, and in cluster 4 in canopies.

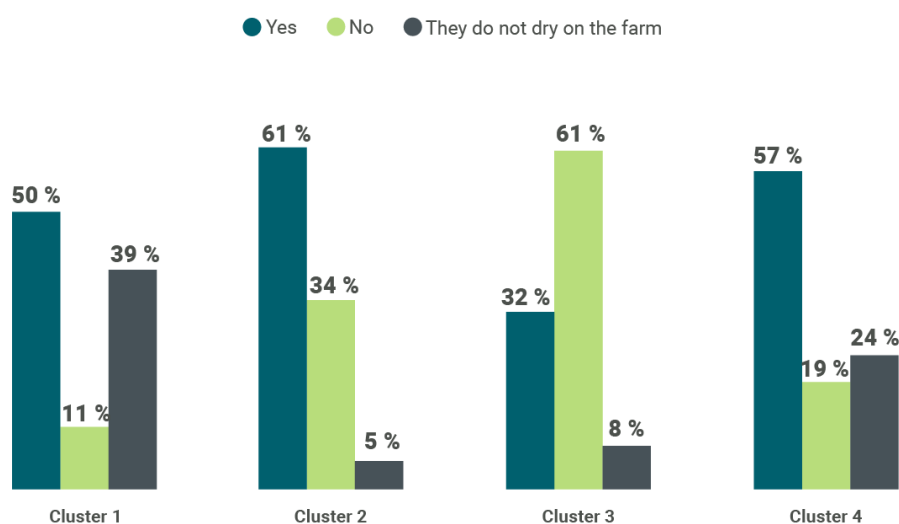
**Graph 40. Place of cacao drying, for those who dry on the farm<sup>28</sup>**

<sup>28</sup> A count of producers is presented, this being a multiple-choice question.

Regarding the average number of days that the drying process takes, in winter producers in clusters 2, 3 and 4 report approximately 7 and a half days for drying, and in cluster 1, an average of 9 days for drying. In summer, the average is lower for all clusters, with similar behavior in all, reporting approximately 4 days on average. In addition, most respondents reported that they use a subjective method to determine if the cacao is dry, checking the crispiness of the bean based on the experience of the farmer. In the total sample, only 0.83% of the 1,083 farmers reported measuring moisture percentage.

Finally, graph 41 shows that in all clusters, except for cluster 3, the percentage of farmers who select cacao free of impurities and pasilla when drying on the farm is higher than those who do not. However, there is a considerable percentage of producers who do not do this practice (11% in cluster 1, 34% in cluster 2, 61% in cluster 3, and 19% in cluster 4).

**Graph 41.** Selection of cacao free of impurities and pasilla



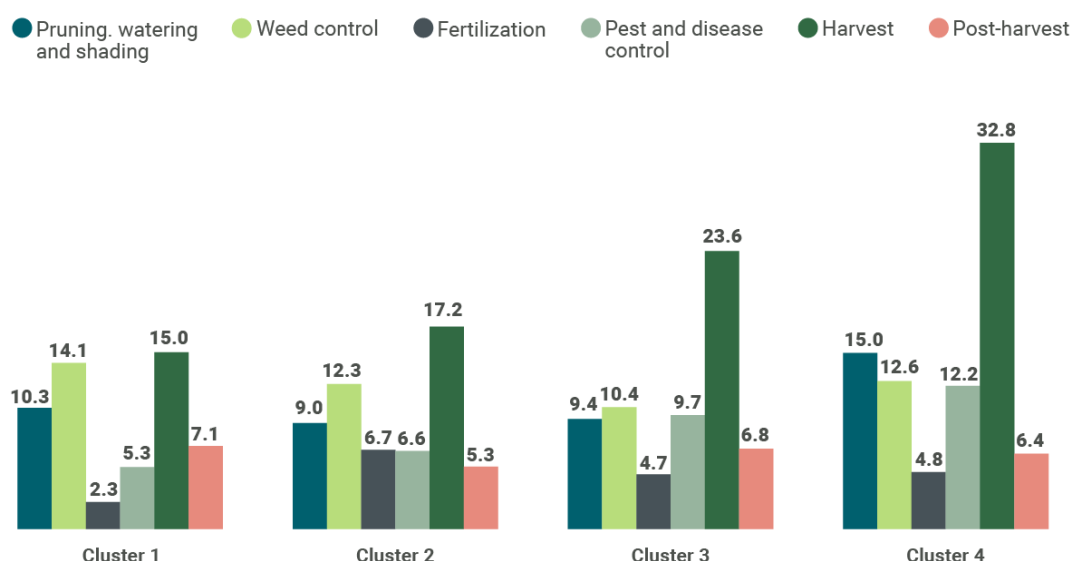
## Workdays per hectare per labor

For each of the tasks described above, information was collected on the number of workdays used per year, and considering the hectares in cacao, an analysis of workdays per hectare per cluster was made.

The number of workdays per year per hectare of cacao depends on several aspects, among which are: the area distribution by age of the trees, productivity, and the work they do, and how they do it. From Graph 42, it can be concluded that for the four clusters, the number of workdays per hectare is higher in the harvest stage, weed control and pruning, irrigation and shade activities.<sup>29</sup>

<sup>29</sup> Only one question was asked for the number of workdays in pruning, irrigation and shading, i.e., they are not discriminated.



**Graph 42.** Number of workdays per hectare, per activity

Analyzing each of the tasks in the different clusters, we find:

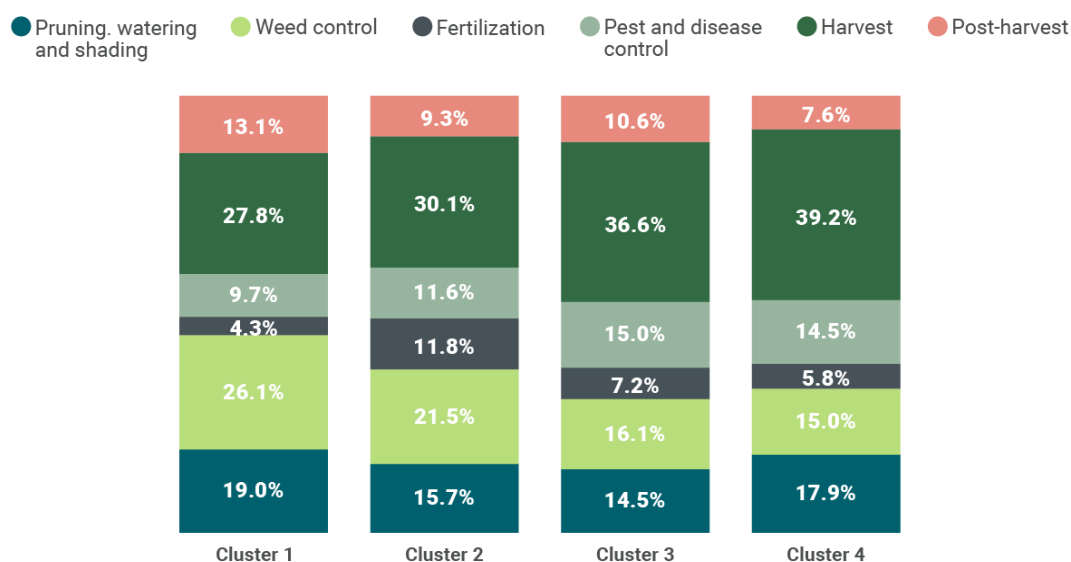
- Workdays for pruning, irrigation and shading: cluster 4 has on average a higher percentage of producers who perform these three activities, especially in cluster 4 is the cluster with more irrigation. Thus, it is logical that in this cluster there is a higher number of workdays invested per hectare for this activity.
- Workdays for Weed control: this activity is commonly performed by all clusters. The clusters that have more workdays per hectare in this activity are cluster 1 and 4. In cluster 1 this could be explained by the use of machete to carry out this activity. For cluster 4 this could be explained by the use of scythes. The analysis did not identify a correlation between the frequency of weed control and the number of workdays for this activity.
- Workdays for fertilization: clusters 2, 3 and 4 have similar number of workdays per hectare for this activity, while cluster 1 stands out for having the lowest number of workdays, this cluster is also the cluster with the highest percentage of producers who report never fertilizing and the lowest percentage of producers applying amendments or limes. Cluster 2 is the cluster that needs more workdays per hectare for this activity, which could be related to the higher percentage of producers that apply amendments, in addition, 70% of the producers in this cluster fertilize between 1 and 2 times per year.
- Workdays for pest and disease control: Cluster 4 and 3 report the highest number of workdays per hectare for IPPM. This may be related to the fact that these clusters have the highest percentage of producers that claim to harvest diseased pods, 85% and 81% respectively, and that they carry out disease control with a higher frequency: in cluster 4 they do it mostly on a weekly basis, result pulled by Huila, and in cluster 3 the weekly frequency and the occasional frequency have similar percentages. On the other hand, cluster 1 presents the lowest number of workdays per hectare, and it is also the cluster in which less producers affirmed to harvest diseased pods (61%), the cluster

with the highest percentage reporting not having diseases (35%), and where an occasional frequency of occasional disease control predominates.

- **Harvest workdays:** In cluster 4 there is a higher number of workdays per hectare for the harvest work compared to the other clusters. Analyzing the departments of this cluster, it is found that the department that mainly drags the number of workdays in harvest is Huila, which is the department with the highest productivity of the sample, it is the third with the highest percentage of producers that in harvest separate and discard the diseased pods, and it is the department with the highest percentage of producers that separate and discard the bad grains. There is no clear relationship between the frequency of harvesting in main and second harvest, and the number of workdays in this activity, nor in relation to the frequency of shelling.
- **Post-harvest workdays:** The number of post-harvest workdays is very similar between clusters, which could be explained by a similar average productivity per cluster, and because in all clusters, most producers report doing drying and fermentation processes on the farm.

Now, graph 43 shows the distribution of workdays per hectare in the different labors, for each cluster, reflecting also that the harvest activity has greater representativeness in the workdays per hectare in all clusters, while the second most representative activity is the weed control in cluster 1, 2 and 3, and the pruning, irrigation and shading in cluster 4.

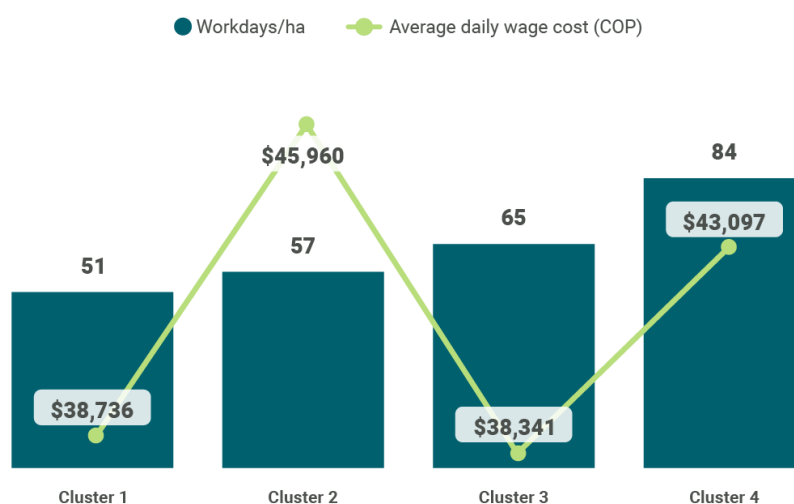
**Graph 43.** Distribution of workdays/ha by cluster



Finally, graph 44 shows the average number of total workdays per hectare per cluster, and the average cost of the daily wage, already analyzed in the section Profile of the productive unit - Labor. In this graph it is highlighted that cluster 4 is the cluster with the highest number of workdays per hectare. As explained above, this cluster is the cluster with the highest number of workdays for pruning, irrigation and shading, IPPM and harvesting, the second highest number of workdays for weed control and fertilization, and the third highest number of workdays for post-harvest. In addition, as will be seen below, in the section on Complementary and/or

associated costs, the costs of cluster 4 could be related to the fact that this is the cluster in which more farmers reported that the costs of their other crops or livestock activities were covered within the costs of cacao. On the other hand, cluster 1 has the lowest costs, related to the lowest number of daily wages per hectare and one of the lowest costs per day in the sample (about 38,000 COP or 10.1 USD). As seen above, this cluster has the lowest number of workdays in fertilization, in IPPM, and in harvesting. It is also one of the clusters with the lowest productivity in the sample.

**Graph 44.** Average workdays/ha and daily wage cost per cluster (COP)

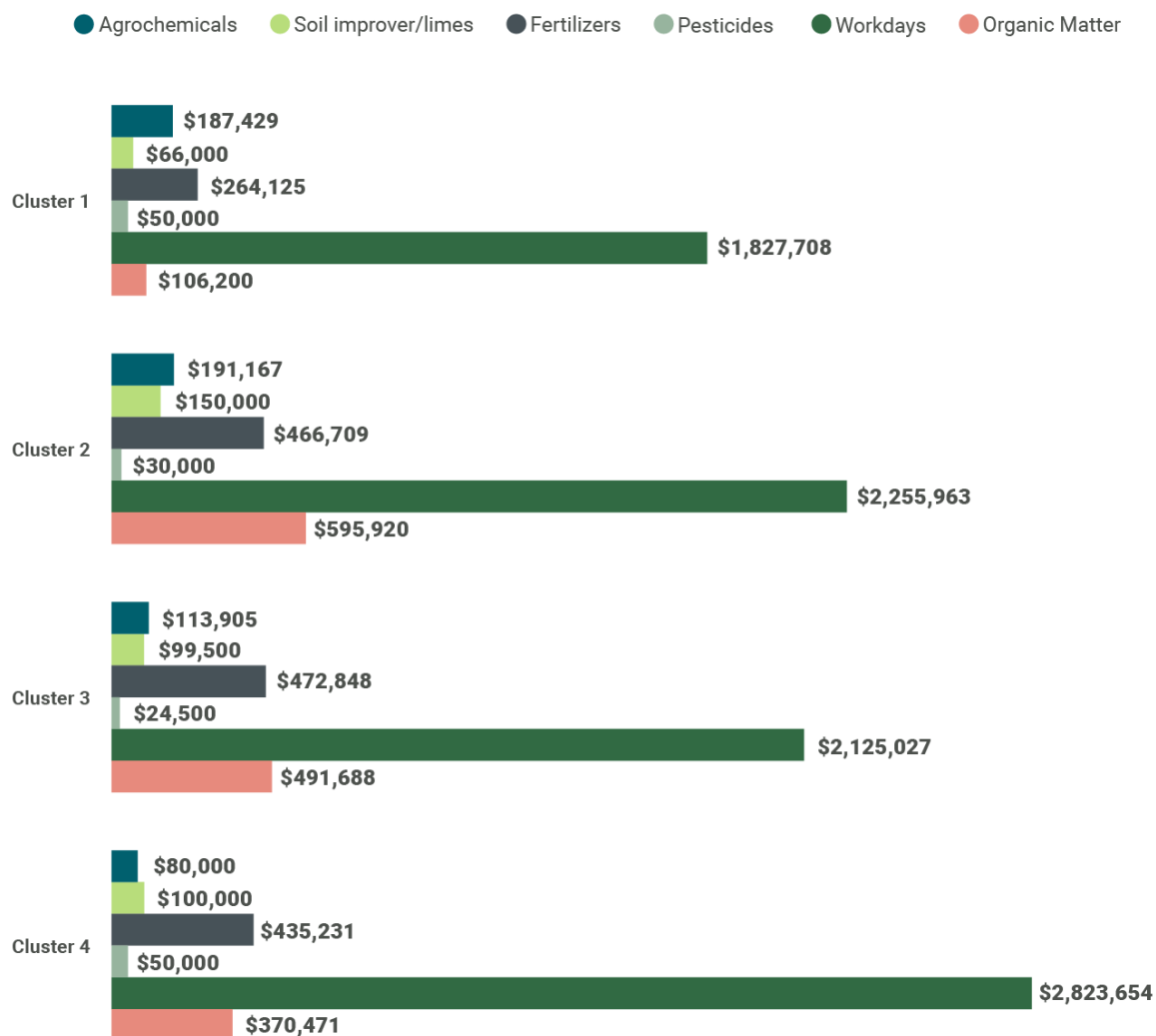


## Total operational costs of production

In addition to the number of workdays per hectare and the cost of these, information was collected on the use and cost of the main supplies (agrochemicals, organic matter, amendments or limes, pesticides and fertilizers). This information allows an analysis of the total operational costs of cacao production.

Graph 45 shows the average costs (truncated average) that a producer has in each of the clusters for the year 2021, based on what was reported in the survey. It is important to clarify that the costs were averaged for producers who responded that they did do the work, i.e. producers who do not perform the respective activity were not considered within the average.

**Graph 45.** Truncated average operational costs (daily wages and supplies) per hectare of cacao (year 2021) - COP



The following is an explanation of each of the cost sources:

- **Daily Wages:** The costs for daily wages are higher in clusters 2 and 4 due to the fact that this is where the average value of daily wages is the highest, approximately 46,000 and 43,000 COP respectively (\$12.2 USD and \$11.4 USD). Cluster 4 also has the highest number of workdays per hectare.
- **Agrochemicals:** The costs for agrochemicals can be justified from what was explained in previous sections. In cluster 2 there are higher values for agrochemicals since it is in this cluster where there is a higher average of liters of agrochemicals used per year (20 L average per year), followed by cluster 1 with 12 L average per year.
- **Organic Matter:** For the calculation of these costs, the amount of organic matter applied per tree per year was considered, multiplied by the number of trees, and finally multiplied by the cost of each kilogram of this organic matter. As for the other costs, this value is divided by the number of hectares of cacao. It is important to mention that only people who apply organic matter were considered, and that people who produce organic manure were given a cost of 0 COP. Those who produce organic fertilizer were not removed from the average, in order to show cost reductions if the same production unit produces its own organic fertilizer. In the cost of organic matter there is a

considerable difference in cluster 1, which could be explained by the fact that it is the cluster that produces the most organic matter.

- Amendments or limes: In this case, and from the information given above, the most used amendment or lime is dolomite lime. The survey collected information on the amount of amendments or lime applied per tree, a value that was multiplied by the number of trees and by an average cost of 500 COP (\$0.13 USD) per kilogram. From the graph it can be identified that cluster 2 has a higher cost per application of amendments or limes. This cluster reports the highest amount of amendments or limes applied per tree, with approximately 379 grams per tree per year. In the data there is no clear relationship between the cost of amendments or limes and the number of trees per hectare.<sup>30</sup>
- Pesticides: To obtain the cost of pesticides, the questionnaire question "In pesos, how much do you spend per year on pesticides" was taken directly and the average was calculated. It is found that in clusters 1 and 4, it is where most is paid for pesticides per hectare. In cluster 4, this could be related to the presence of black carmenta and ants, reporting that 41% of its trees are attacked by black carmenta and 21% by ants. Additionally, cluster 4 was the only cluster in which some producers reported monalonium as the most limiting pest. It should be noted that, in this cluster, the use of pesticides is reported for both carmenta and monalonium.
- Fertilizers: For the case of fertilizers, the information given by the experts and technicians of the zones was taken. For this an average amount of 200 g of fertilizer per tree per year was taken, multiplied by the number of trees reported by the producers and multiplied by an average price per kg of fertilizer in 2021 of approximately \$3,600 COP (\$0.96 USD). This calculation was made for all farmers who did not answer "never" as the frequency of fertilization, for farmers who reported that they never fertilize no value was given to the cost. The values are very similar between clusters due to the standardized prices given, which only depends on the number of trees in each productive unit. Finally, it is important to mention that the cost of fertilizer is the second main cost in cacao production, with labor costs being the first.<sup>31</sup>

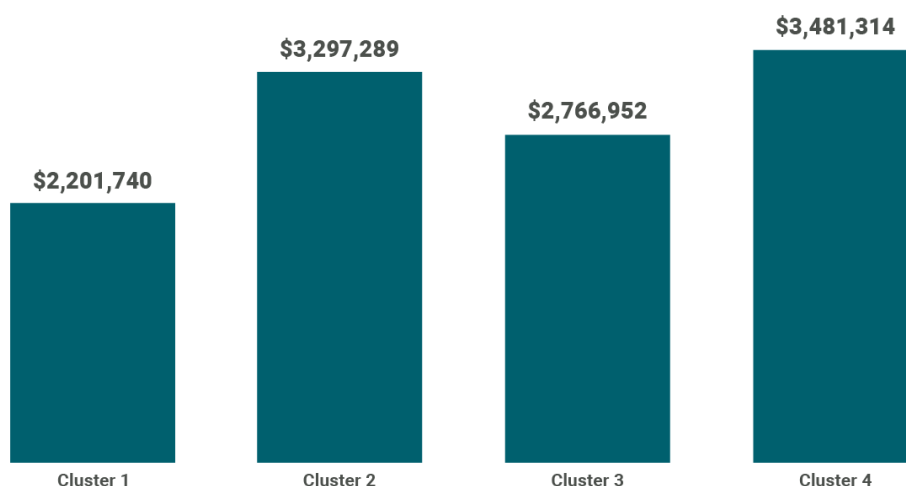
Having analyzed the costs per hectare for each of the activities, all costs were summed and the total cost value for each producer per hectare was obtained, these total cost values were averaged to calculate the average total costs per hectare for each of the clusters, presented in graph 46. Aligned with the results presented above, the graph shows that the total cost per hectare per year was highest in cluster 4, while cluster 1 had the lowest cost.

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<sup>30</sup> Price indicated by cacao cultivation experts and validated by technicians in the areas.

<sup>31</sup> The frequency of fertilization is not taken into account, since the average amount per tree per year is always the same, regardless of whether it is spread over one or more applications.

**Graph 46.** Total cost of production (COP) per hectare of cacao (2021) - truncated average

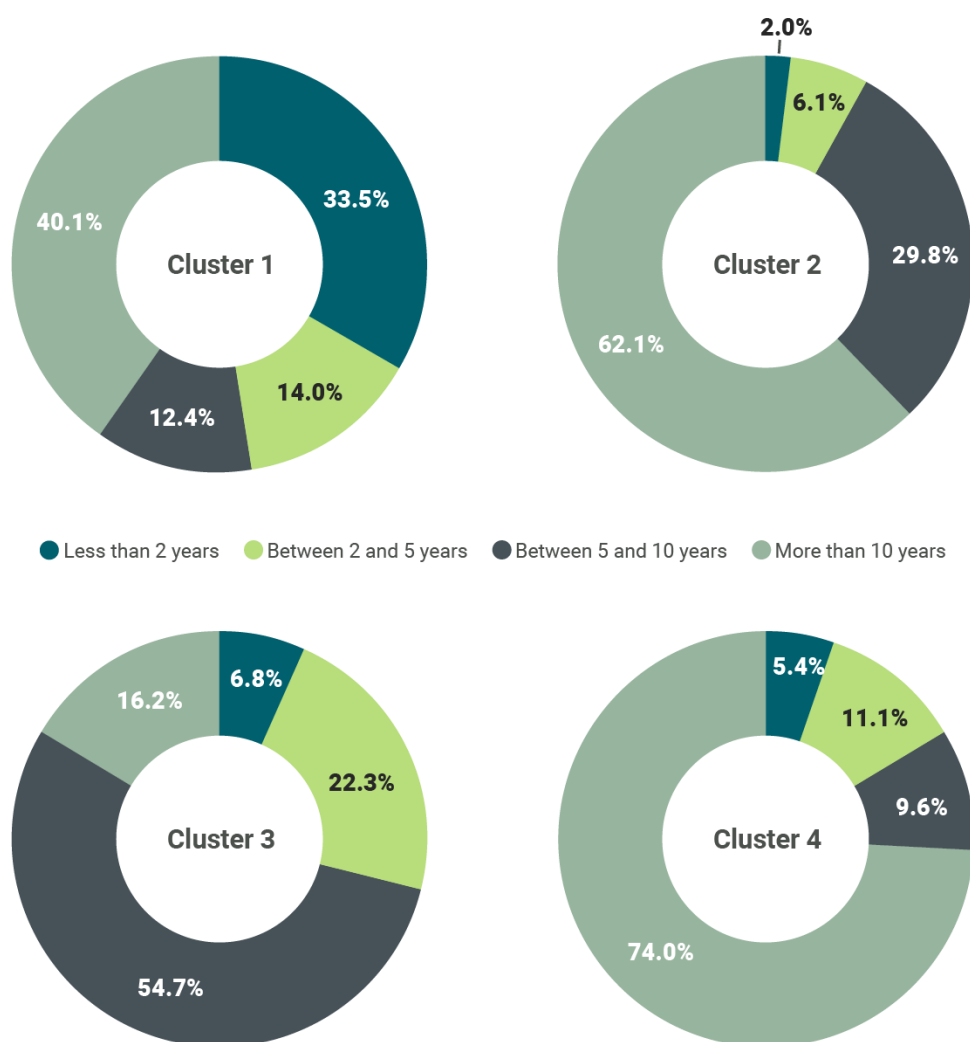


### 3.1.6 Cacao Marketing

The cacao marketing component addressed issues of production and sales records, years dedicated to cacao marketing, sales for 2020 and 2021, sales conditions (stakeholders to whom they were sold, trade agreements, transport for delivery), and the general limitations that producers have in relation to their cacao crop.

Overall, only 20.5% responded that they do keep records of production and annual sales of cacao. Analyzing by cluster, in cluster 3 are most producers who keep records of production and annual sales (29.1%), and the lowest number is cluster 2 (8.6%). It should be noted that, at the departmental level, Cordoba has the highest number of positive responses (47% of producers in this department) and in La Guajira none of the producers reported keeping records.

On the other hand, in relation to the years of marketing of cacao, it is evident that 47.7% of producers market cacao for more than 10 years, 26.8% between 5 and 10 years, 15% between 2 and 5 years and to a lesser extent, 11.5% indicate that they market less than 2 years ago. Graph 47 shows that in cluster 3 most producers (54.7%) are between 5 and 10 years (both in Antioquia and Cordoba this group is the majority), and cluster 1 is where there is a large portion of producers with less than 2 years of cacao marketing (33.5%).

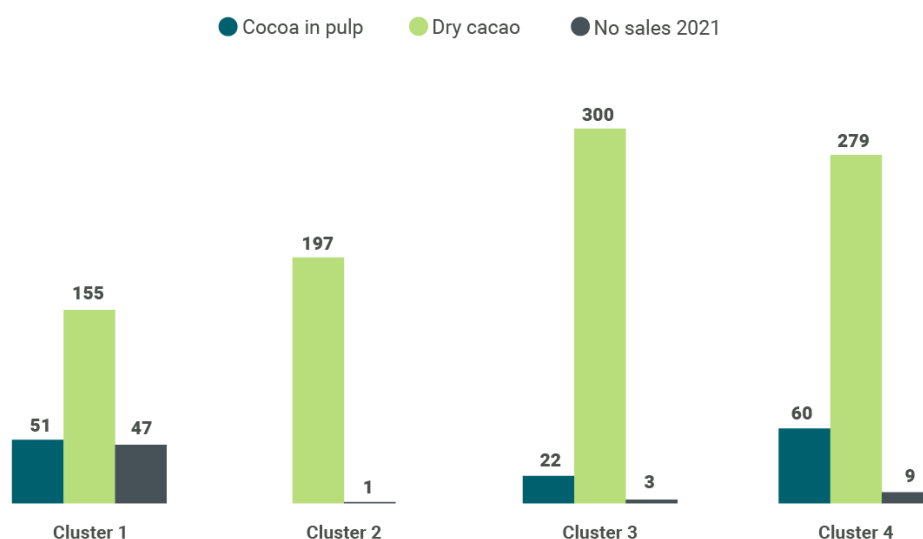
**Graph 47. Years marketing cacao**

Regarding the marketing of cacao, we also inquired about the type of cacao sold in 2020 and 2021. Only 304 producers (28%) in the total sample reported knowing the volume sold in 2020, of which 48% belong to cluster 4, 33.6% to cluster 3, 10.7% to cluster 1 and 7.5% to cluster 2. The total kilograms sold in that year for these people is 305820.4 kg, which would be an average of 1005.9 kg per person per year.<sup>32</sup>

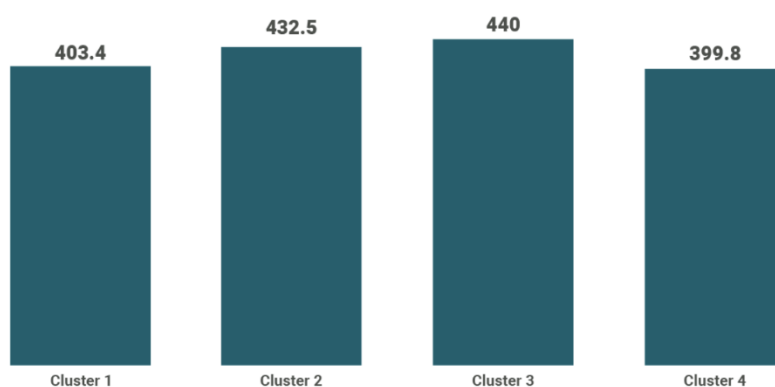
An analysis of 2021 shows that for 2021, 931 farmers reported selling dry cacao and 133 farmers sold cacao in slurry, while 60 farmers did not sell cacao in 2021 (Graph 48). This was a multiple-choice response, so a producer could choose both categories, if applicable. Thus, analyzing each category separately, 92 producers sold only in slurry, 890 only in dry, 82 sold both types. Cluster 2 stands out, where all producers sold dry cacao in 2021. On the other hand, most of those who said they did not sell cacao in 2021 are in cluster 1.<sup>33</sup>

<sup>32</sup> For this calculation, the kg sold in slime was converted to dry; considering that 1kg slime is equal to 0.333 kg dry.

<sup>33</sup> This is the cluster with the highest number of producers with only 0-5 year old crops.

**Graph 48.** Count of producers by type of cacao for sale in 2021: in beans and dry cacao

Of the total number of farmers, 968 reported the kg of dry cacao or cacao beans sold in 2021, 33.5% are from cluster 4, 31.6% from cluster 3, 20% from cluster 1 and 14.8% from cluster 2. Among them, the total amount of kg sold in that year was 683782, which would give an average of 821.85 kg per person per year. Analyzing the kg/ha sold per cluster, it is found that the average of kg/ha among the clusters is similar: 403.4 kg/ha in cluster 1, 432.5 kg/ha in cluster 2, 440 kg/ha in cluster 3, and 399.8 kg/ha in cluster 4. When comparing these kg/ha sold with the kg/ha produced (graph 16) the values are very similar, which evidences that the production is mostly sold, except in cluster 4 where the production sold per hectare is 225 kg/ha. <sup>34</sup>

**Graph 49.** Kg/ha sold in 2021

Linked to the question of cacao sales in 2021, producers were also asked about the type of stakeholders they sold cacao to in that year. At the level of the total sample, producers most frequently sold cacao to associations (on average 68.5%, across the entire sample), then to intermediaries (on average 28.1%, across the entire sample), Fedecacao (on average 2.4%, across the entire sample) and to artisanal processors and cooperatives less than 1% across the entire sample. Table 12 shows the two main buyers, by cluster. At the cluster level, it is

<sup>34</sup> Farmers with a single crop age of 0-5 years, and those who reported not selling cacao in 2021 are excluded.



highlighted that in cluster 2 the intermediaries appear with a proportion of 82% while the associations weigh only 5%. On the other hand, intermediaries have less presence in cluster 3, representing only 6.2%. None of the respondents reported selling directly to the national industry or to exporters.

**Table 12.** Top 2 cacao buyers, by cluster

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Top 1 buyer	Association (74.8%)	Intermediary (82%)	Association (93.5%)	Association (80%)
Top 2 buyer	Intermediary (24.8%)	Fedecacao (12%)	Intermediary (6.2%)	Intermediary (17.6%)

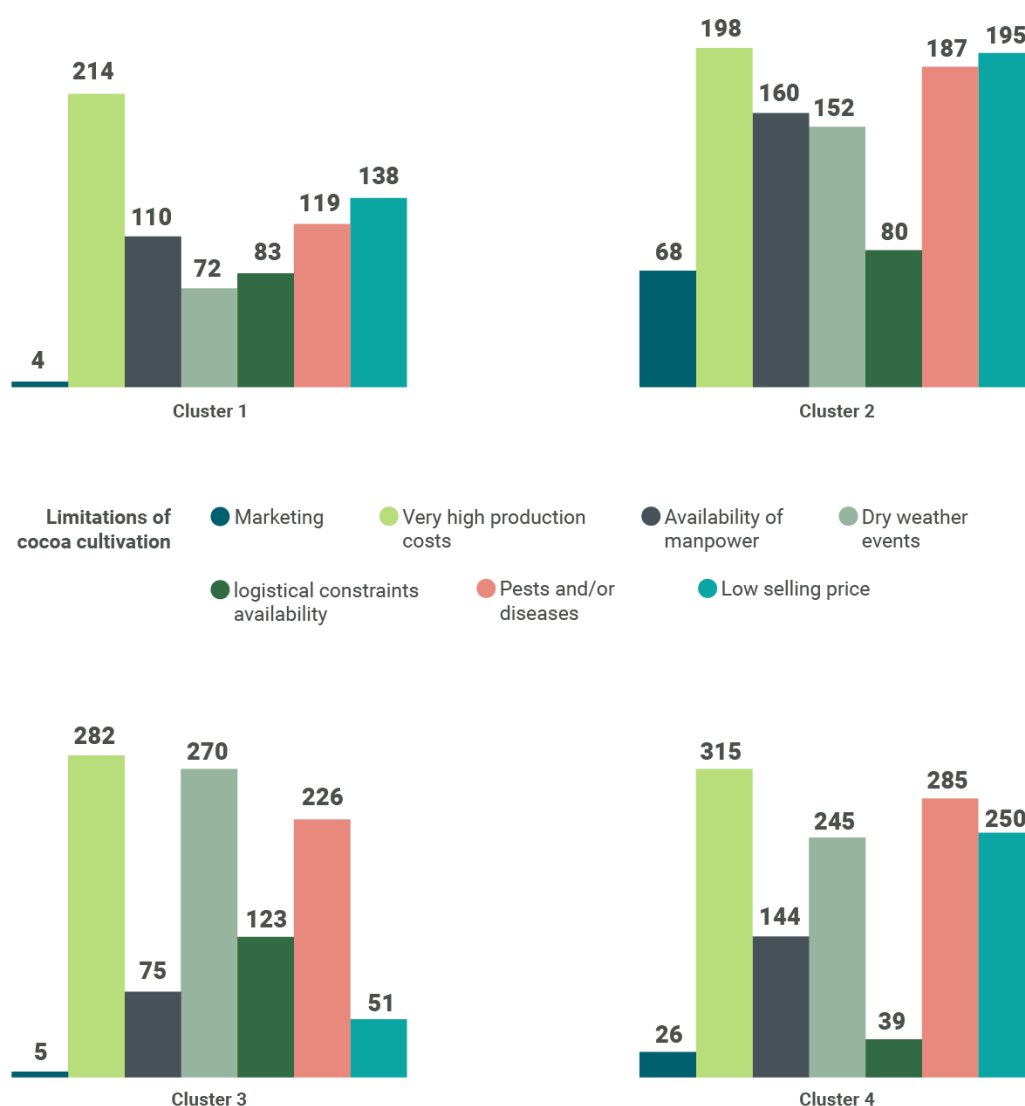
Regarding the type of packaging used for the sale of cacao, it was found that in the four clusters mainly two types of packaging are used for the sale of cacao: polypropylene bags and fique bags. The first packaging is the most used in clusters 1, 2 and 4, while in cluster 3, the majority use fique bags as the main packaging.

Now, when analyzing the type of commercial agreement that producers have with their main buyer, it is found that at the level of the sample 53.9% of the producers affirm that they do not have any type of agreement with their buyer. 35.5% affirm that they have a verbal agreement and 11.1% that they have a written agreement. At the cluster level, written agreements have more weight in cluster 1 and 3 (18.6% and 22.3%, respectively). On the other hand, of the total producers surveyed 81.3% say that they deliver cacao in the village, this large proportion is maintained at the cluster level. Only in cluster 2 and 3 there are producers who deliver in town and in a very low proportion also in cluster 4 (0.3%), for cluster 1 is found that 21.1% of producers deliver cacao in the village.

On the other hand, we inquired about the means of transport used to deliver the cacao sold when it is not delivered to the farm. In general, private transport was found to be the most common means of transport used to move cacao, followed by motorcycle taxis and rural transport. By cluster, private transport is more common in clusters 1 and 4, while the most common in cluster 2 and motorcycle taxi in cluster 3. With regard to transport costs per kilogram of dry cacao for sale, the sample found that the average cost of transport for sale is 140.1 COP (\$0.037 USD) per kg of dry cacao. Cluster 1 has an average transport cost of 100.1 COP (\$0.026 USD) per kg, cluster 2 of 149.7 COP (\$0.039 USD), cluster 3 of 170.6 COP (\$0.045 USD) and cluster 4 of 132.49 COP (\$0.035 USD).

Finally, in this component, farmers were asked what they considered to be the main constraints on their cacao crop. At the sample level, practically all farmers highlighted high production costs as one of the most important constraints (mentioned by 1,009 farmers), on the other hand, 817 farmers mentioned pests and/or diseases, while climatic events and a low selling price were other important constraints for 739 and 634 farmers, respectively. Graph 50 shows the information by cluster, highlighting that high production costs are considered the most important constraint in all clusters, and marketing the least important.

**Graph 50.** Constraints to cacao cultivation (producer count)

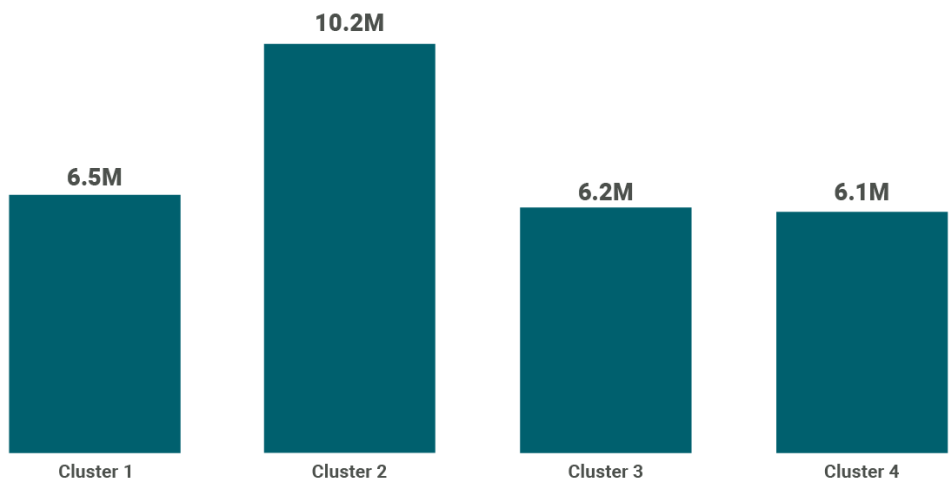


### 3.1.7 Income from cacao cultivation

In order to determine the gross income of producers related to cacao cultivation, a monthly production per farmer was calculated by relating the information of the months and the percentages of main and transverse harvest, and the total produced in the year 2021. This monthly exercise allows to capture the seasonality of income through monthly reference prices, versus an exercise of annual averages. The reference prices used are presented in Annex 6.

In general, it is found that the average gross annual income per producer is around 6,800,000 COP (\$1,816 USD). However, Graph 51 shows the result of the gross income per cacao for each cluster. At the cluster level, cluster 2 stands out with an average of 10,292,000 COP (\$2,749 USD). The other clusters have a similar income of around 6,200,000 COP (\$1,656 USD).

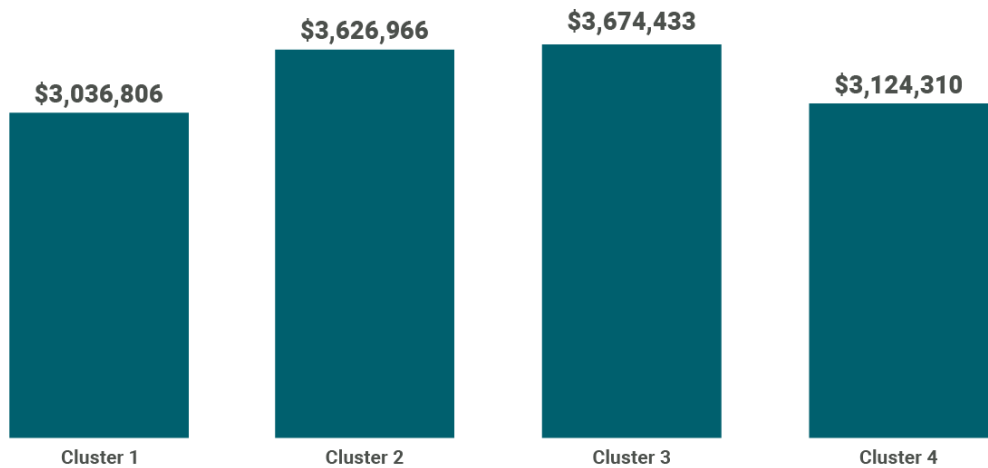
**Graph 51.** Average gross annual cacao income (2021) - COP



### Gross income per hectare - 2021

Firstly, it is important to mention that for this analysis of gross income per hectare, producers with no cacao sales in 2021 are not considered. A comparison between the gross revenue per hectare of two groups in particular will be presented: (i.) group 1: composed of all farmers with sales in 2021, (ii.) group 2: excluding farmers who only have crops aged between 0 and 5 years.<sup>35</sup>

**Graph 52.** Annual gross income per hectare for group 1 (2021) - COP, truncated average



In Graph 52 it can be seen that the gross income per hectare is higher for cluster 3, surpassing cluster 1 by approximately 21%, cluster 1 with the lowest gross income per hectare. It is worth mentioning that, in the age distribution of cacao trees, cluster 1 has a higher percentage of trees aged between 0 and 5 years, age range, where there is little production. Graph 53 shows

<sup>35</sup> Productivity at this age is almost zero, contributing little to income, while hectares further affect the gross income/ha indicator.

the gross income per hectare for cluster 2, i.e. excluding producers who have only trees aged between 0 and 5 years.

**Graph 53.** Gross annual income per hectare for group 2 (2021) - truncated average

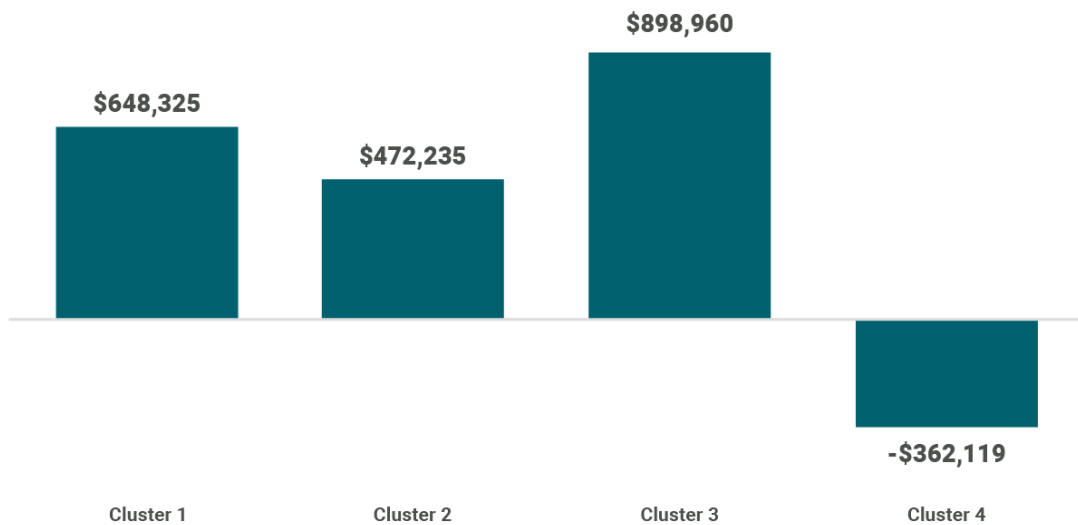


From the above graph it is possible to identify a growth in gross income per hectare for all clusters because unproductive areas are not being considered within the relationship. The gross income per hectare is similar between clusters. It is worth mentioning that in cluster 1 there is a change of approximately 9%, due to its high percentage of trees aged between 0 and 5 years, becoming the cluster with the second lowest gross income per hectare.

### Net income per hectare - 2021

Analogous to gross income, this section shows a comparison between net income per hectare (gross income/ha, minus operational cost/ha) between group 1, which includes all producers, and group 2, excluding those who only grow crops between 0 and 5 years old. This comparison is even more relevant in an analysis of net income, because when considering farmers with crops between 0 and 5 years old, we are considering a population with high costs, but with low remuneration due to the low cacao production at these ages.

**Graph 54.** Net income per hectare per year for group 1 (2021) - COP, truncated average



Graph 54 shows the net income per hectare for the year 2021 of the four clusters; in a relevant way it is identified that there are positive net incomes per hectare for the first three clusters, mainly cluster 3, where its net income per hectare is around 900,000 COP (\$240.4 USD) per hectare per year. It is worth mentioning that cluster 3 has the highest sales per hectare (440 kg/ha). On the other hand, cluster 4 has a negative net income per hectare for the year 2021, which shows on the one hand the high operational costs that are presented there, explained above.<sup>36, 37</sup>

Graph 55 shows the net income per hectare for the year 2021 for cluster 2. Similar to the analysis of gross income, there is an improvement in the net income per hectare, due to the fact that the trees in the 0 to 5 year old age groups are not very productive, but with a high production cost. Similarly, there is an improvement of approximately 27% in net income per hectare for cluster 1, which has a higher percentage of trees under 5 years of age. Cluster 3 continues to show the highest net income, and cluster 4 continues to show a deficit.

<sup>36</sup>In this cluster is Córdoba, the second department with the highest productivity in the sample.

<sup>37</sup>Although Huila, the department with the second highest productivity in the sample, is in cluster 4, this cluster also includes Tolima, the department with the lowest productivity.

**Graph 55.** Annual net income per hectare for group 2 (2021) - COP, truncated average

Table 13 presents an analysis for this cluster 2, of the percentage of the gross income per hectare that is converted into profit (remains as net income), and the percentage of the gross income per hectare that goes to cover production costs. The table shows that most of the gross income per hectare goes to cover operational production costs, with values ranging from 74% for clusters 1 and 3, to 107% for cluster 4.

**Table 13.** Percentage of gross income per hectare allocated to cover operational costs of production per hectare

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
% of gross income/ha free after covering operational production costs / ha	26%	16%	26%	-7%
% of gross income/ha allocated to cover operational costs of production / ha	74%	84%	74%	107%

Finally, it is important to mention that this is a first analysis of net income per cacao, considering the income and operational costs presented in this report. However, the Living Income study, under the C4D project, will present a more in-depth analysis, considering non-operational costs such as the payment of utilities, transport and property tax. In addition, this study will be able to understand the impact of one's own workdays, which for this baseline analysis have been counted as a cost.

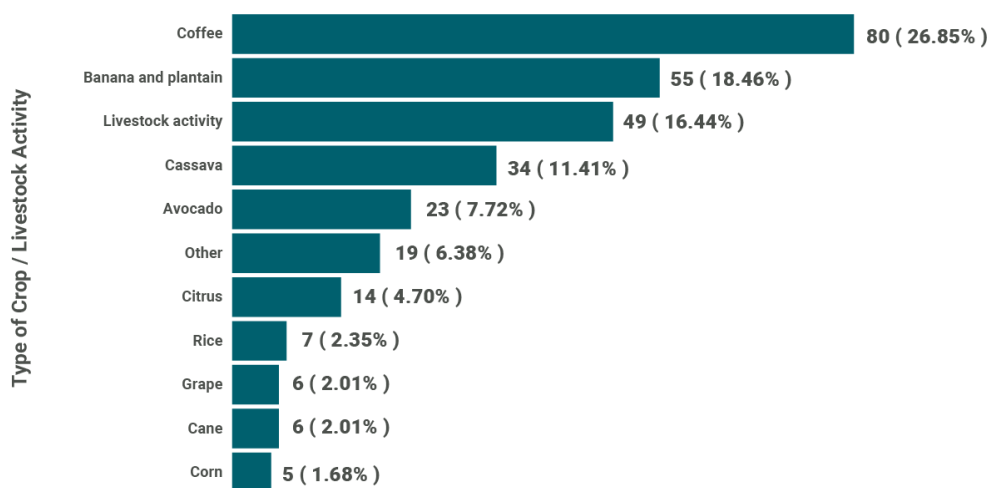
### 3.1.8 Associated and/or complementary crops / livestock activities

The C4D project defined as a complementary and/or associated crop those crops that will represent at least 26% of the gross income of the farm. In the survey, farmers were asked to identify these crops, with the support of the enumerator. However, in the data cleaning process it was identified that these values were distorted. Therefore, an internal analysis was carried out in which the total income of the farm was calculated by taking the income from cacao and the

income from all the crops or livestock activities reported by the respondents, and from this, the representativeness of each of the activities was calculated.<sup>38</sup>

As a result, 397 producers (36% of the respondents) were identified with at least one crop / livestock activity that generated an income, regardless of the value of this income. Filtering out those with an income representativeness of at least 26%, 270 producers (25%) were found with activities that could be considered as complementary and/or associated in the project. The complete list of these complementary/associated crops is presented in annex 7. Graph 56 presents the most predominant complementary and/or associated activities, where coffee is the most relevant category, followed by banana and plantain (mainly plantain), livestock activities (mainly livestock), cassava and avocado.

**Graph 56.** Number of producers by complementary and/or associated activity, and share of these crops/livestock activities <sup>39</sup>



On the other hand, graph 57 presents the proportion that each crop has in each of the clusters. For clusters 1, 2 and 4 the main crop is coffee with a share of 52.2%, 30.3% and 37.4%, respectively, while for cluster 3 the main crops are banana and plantain, and cassava with 32.4% and 28.6%, respectively.

<sup>38</sup> To do this, we also took into account the crops/livestock activities reported in the living income section, which was applied to a sub-sample of farms.

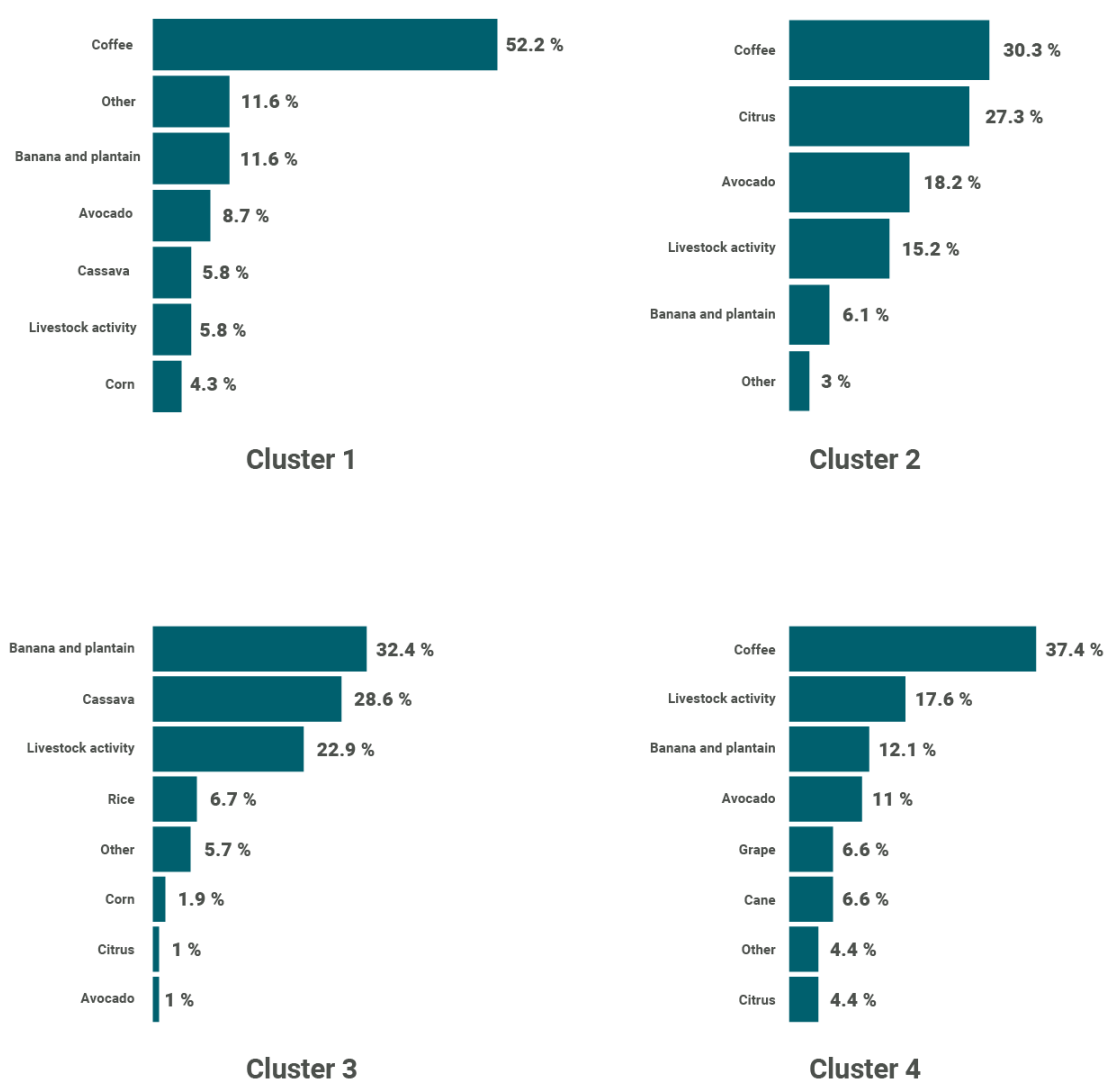
<sup>39</sup> The "Banana and plantain" category includes: banana, plantain and popocho.

The category "Livestock activities" includes livestock, fish farming, poultry farming, pig farming and beekeeping.

The category "Other" includes: papaya, malanga, coconut, yam, passion fruit, coriander, soursop, watermelon, pineapple, tomato, sapote, arazá, eggplant, borojó, exotic flowers, beans, mango, and bijao.

The "Citrus" category includes: mandarin, lemon, orange and grapefruit.

Details of the number of producers by crop/activity are presented in Annex 5.

**Graph 57.** Participation of complementary and/or associated activities by cluster

Analyzing whether the activities were complementary or associated with cacao<sup>40</sup>, it is found that 75.2% are characterized as complementary, while 15.8% are associated, the remaining comes from the section of living income of the survey so it is not possible to categorize them. Livestock and cassava are categorized as complementary, coffee 69% is categorized as complementary and 25% as associated. In the case of banana and plantain, 67% are complementary and 22% associated. On the other hand, at the cluster level, it is found that the greatest amount of associated activities is found in clusters 2 and 4, with a participation of 21.2% and 30.8% with respect to the total of each cluster, respectively, while for clusters 1 and 3, the weight of associated crops is only 13% and 2.9%, respectively.

<sup>40</sup> An associated activity is an agricultural or livestock activity carried out within the same area where cocoa is grown, whereas a complementary activity takes place on the same farm but in different areas.

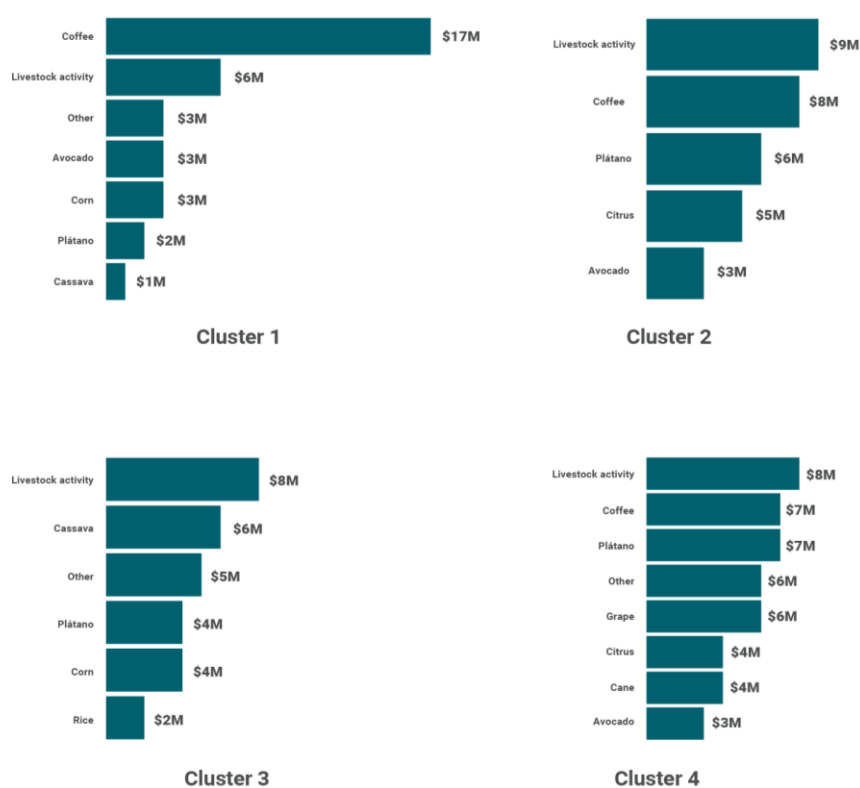


Finally, calculating the annual gross income by complementary and/or associated, it is found that the highest income in each cluster is generated by the following activities (Graph 58):<sup>41</sup>

- Cluster 1: coffee, with almost 17 million COP (\$4,541 USD).
- Cluster 2: livestock activities (mainly livestock), with an average of 8.5 million COP (\$2,270 USD), closely followed by coffee with an average income of 8.3 million COP (\$2,217 USD).
- Cluster 3: livestock activity, with an average of around 8.5 million COP (\$2,270 USD), followed by cassava with an average of 5.9 million COP (\$1,576 USD), however, there are few records for cassava. Although in terms of income, bananas and plantains only have an average of 3.9 million COP (\$1,041 USD), it must be considered that, as shown in the previous graph, this activity is the one that has the most weight in this cluster (in terms of quantity of crops) with respect to the other crops.
- Cluster 4: livestock activity with a value of 7.5 million COP (\$2,003 USD), followed by coffee and the banana/plantain category, both with an average of 7.2 million COP (\$1,923 USD).

The activities with the most records in this analysis, and therefore the most reliable results, are: coffee, banana/plantain, livestock and avocado.

**Graph 58.** Average gross annual income by associated/complementary activity (2021) - COP



<sup>41</sup> The analysis focuses on the highest income earners, and it is not recommended to draw conclusions from those that generate the lowest incomes, since the activities that generate the lowest incomes are also those that have few records in the sample.

Finally, it was asked whether the production costs of the complementary and/or associated activities were covered by the cacao costs. For 32.7% of the records of complementary and/or associated activities (97 records), the costs were included in the cacao costs. These percentages varied at the cluster level between 18.1% in cluster 1, and 51.6% in cluster 4. When respondents stated that the production costs of the activities were not covered by the cacao costs, they were asked about the percentage of the income generated by each of these activities that should be used to cover the production costs of these activities. By type of crop, 79.5% of the records of complementary crops do not have their costs included in the costs of cacao while 80.9% of the associated crops do. For activities with costs not covered by cacao, it is found that in the category of banana/plantain an average of 63% of income is used to cover costs, in cassava 60%, in coffee 56% and in livestock activities 48%.<sup>42</sup>

Now, analyzing the interest of the producers with complementary and/or associated activities to continue with these in the next 5 years; both at survey level and for each one of the clusters, more than 95% affirmed that they are interested in continuing: in cluster 1 98.4%, in cluster 2 96.6%, in cluster 3 97.9% and in cluster 4 95.4%.

Finally, about the limitations that producers present with these activities, table 14 shows that the main limitation presented by all the clusters are the high production costs, the same result in the case of cacao. Climatic events are also important for cluster 3 and 4, low selling price is an important problem for cluster 2 and 3 as well as pests and diseases for cluster 2 and 4. Finally, in cluster 1 the low availability of labor and logistic constraints are in the top 3 constraints.

**Table 14.** Main constraints for associated / complementary activities

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
<b>Top 1</b>	Very high production costs (31.7%)	Very high production costs (19.4%)	Very high production costs (24.6%)	Very high production costs (33.2%)
<b>Top 2</b>	Availability of manpower work (20.1%)	Low selling price (17.6%)	Weather events (23.9%)	Weather events (25.1%)
<b>Top 3</b>	Logistical constraints (access roads, transport) (14.6%)	Pests and/or diseases (16.2%)	Low selling price (17.2%)	Pests and/or diseases (20.3%)

<sup>42</sup> There is no net income analysis for complementary crops, considering the few records that are kept on this subject, especially in relation to production costs.

### 3.1.9 Technical assistance

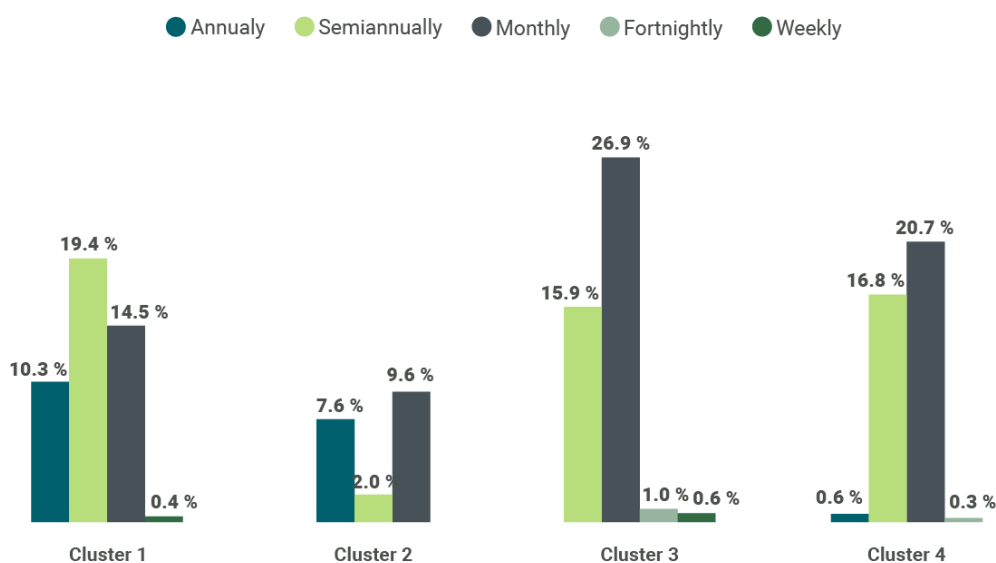
Technical assistance enables farmers to improve in the different processes of the crop. Most of the farmers surveyed have had some technical assistance either currently or in the past. In particular, and as can be seen in Graph 59, cluster 1 and 3 have the highest percentage of farmers who report currently receiving technical assistance (those who did not receive technical assistance before, but do now, and those who received before and still receive) with a percentage of about 44% of farmers for both clusters, while cluster 2 has the lowest number of farmers receiving technical assistance currently (19%). On the other hand, cluster 2 is also the cluster with the highest percentage of producers reporting never having received technical assistance (32%) while cluster 3 reports the lowest percentage (4%) in this category.

**Graph 59. Access to technical assistance**



Analyzing the frequency (graph 60) and the providers of technical assistance, for the group of producers who currently receive assistance, it is found that: (i.) in cluster 1 the frequency of semi-annual assistance predominates. This assistance is mainly given by the associations; (ii.) In cluster 2 monthly assistance predominates, followed closely by annual assistance. Attendance is mainly given by Fedecacao; (iii.) In cluster 3 monthly attendance is predominant, with associations as the main suppliers; (iv.) In cluster 4, monthly attendance predominates, followed very closely by semi-annual attendance. The main provider is currently the cooperative sector.

However, it is important to keep in mind that, with respect to technical assistance, we did not inquire about the quality of this assistance or its duration. Therefore, it is not advisable to make conclusions regarding variables such as productivity or income, based on access to this service.

**Graph 60.** Frequency of technical assistance for those producers who currently receive it

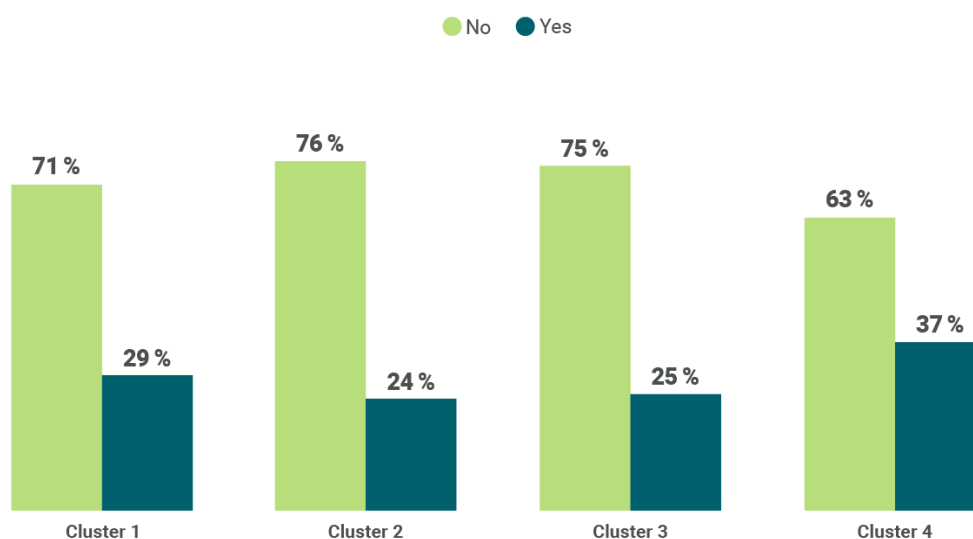
On the other hand, with respect to digital agricultural extension, on average, only about 5% of farmers in clusters 1, 3 and 4 have received agricultural extension, and the format in which they have received it has been mainly links and text messages. In cluster 2, no respondents reported receiving digital agricultural extension. Of the farmers who have received digital agricultural extension, the majority rate this extension with a value of 5, equivalent to "excellent".

Finally, when evaluating the participation of producers in USDA funded projects, other than C4D, in all clusters the majority of respondents reported that the productive unit has never been linked to USDA funded projects. Particularly in clusters 1 and 3, 63% of producers on average report that they have never been linked, 27% report that they do not know if they have been linked and 8% report that they have been linked in the past. On the other hand, in cluster 2, 80% of producers report that they have never been linked, 19% report that they do not know and 1% report that they are currently linked. Finally, in cluster 4, 96% of producers report that they have never been linked, 2% report that they do not know and 2% report that they have been linked in the past.

### 3.1.10 Access to financial services

Analyzing access to financial services, the majority of respondents report not having had credit in their household in the last year 2021. On average, 29% of producers report that they or a member of their household has had credit. Cluster 4 reports the highest percentage of producers and/or family members with credit in the last year, with 37% (Graph 61).

**Graph 61.** Producers and/or household members with credit in the last year, 2021



Of the producers who report direct or indirect financial links, more than 80% report that the entity that granted them the most significant amount has been financial entities. In cluster 1, some credits were granted by the cooperative or producers' association, this was not the case in any of the other clusters. It is worth noting that of those few that reported having had credits, 78% approximately, report that this has been a credit of agricultural type, which implies investment for the productive unit.

Finally, of the large percentage of respondents who reported not having had credit in the last year, the main argument is that they prefer not to get into debt, mainly for fear of losing their land. The next most important reason is not having the collateral requested for the credit; however, this reason is much less common than the preference of not getting into debt.

### 3.1.11 Landscape technologies and management

#### Hectares under technologies that promote improvements in climate risk reduction and/or natural resource management (Standard #2)

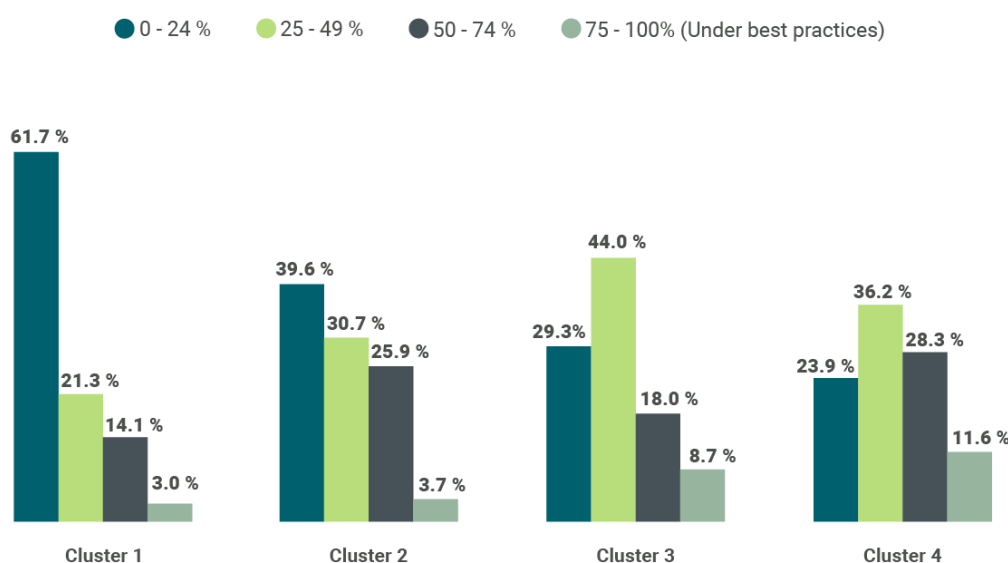
The analysis of technologies that promote improvements in climate risk reduction and/or natural resource management takes into account the hectares of producers that meet the following conditions:

- Cacao is packed for sale in sacks of fique (a kind of straw).
- Produce organic fertilizer on the farm
- Apply organic matter on the farm
- They bury or place the diseased fruits under the leaf litter.
- Fruit affected by Carmenta are identified, cut and buried.

These practices, as well as those presented in the following sections, were suggested by the C4D project.

For the analysis, a count of responses was made, giving a score depending on the number of correct answers, in order to categorize the percentage of hectares and identify how much is or is not complied with these technologies. If a farmer complies with all 5 questions, it means that his cacao crop is 100% compliant with the technologies of this standard. To aggregate the results, producers who apply more than 75% of the technologies were considered as those producers or hectares under improved management practices or technologies that promote climate risk reduction and/or natural resource management.

**Graph 62.** Categorization of hectares under technologies that promote improvements in climate risk reduction and/or natural resource management



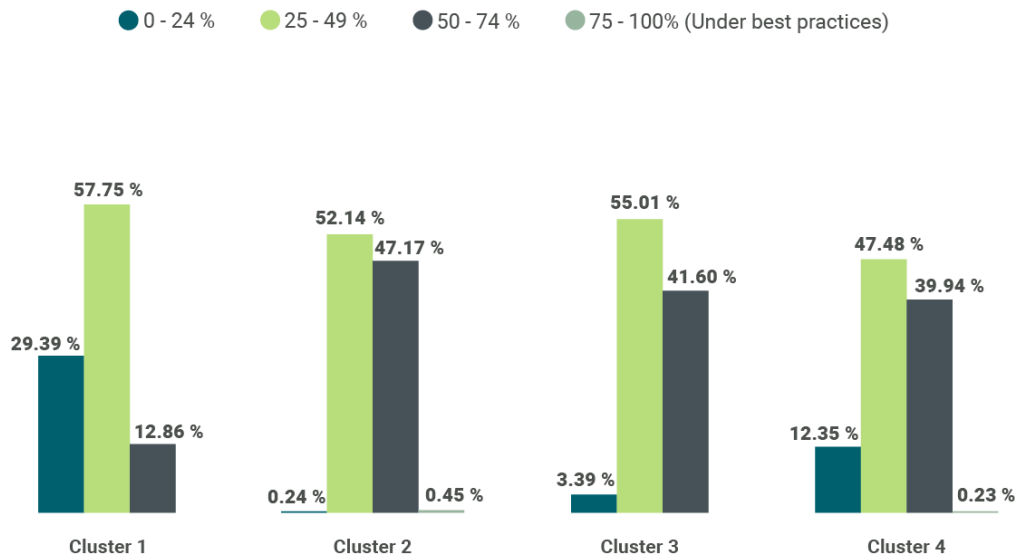
Graph 62 shows that in clusters 1 and 2 mainly between 0 - 24% of the technologies in this standard are applied, on the other hand, in clusters 3 and 4 mainly between 25 - 49% of these technologies are applied. In general, only 188.1 hectares apply between 75 - 100 % of these technologies, being the hectares of the department of Huila the one with the best practices. This is evident in cluster 4, which has the highest percentage of producers applying between 75 and 100% of the practices (11.6% of producers). In general, the most applied technology for all the departments is the one related to bury or place under the leaf litter the diseased fruits, on the other hand, the one that is less applied is the one related to identifying the hectares where organic fertilizer is produced. Annex 8 shows the percentage of hectares that comply with each of these technologies, and of the technologies of the following sections, per department

### Hectares under USDA supported technologies (Standard #3)

In order to count this standard, 19 questions of the questionnaire were used, whose answers point to different technologies, in annex 8 the questions and answers that were considered are shown. Similar to the previous standard, graph 63 shows the hectares per cluster categorized, depending on the number of practices fulfilled, highlighting the category of between 75 - 100%

of the technologies (between 15 and 19 questions) as the category of hectares under good practices.

**Graph 63.** Categorization of hectares under technologies supported by USDA

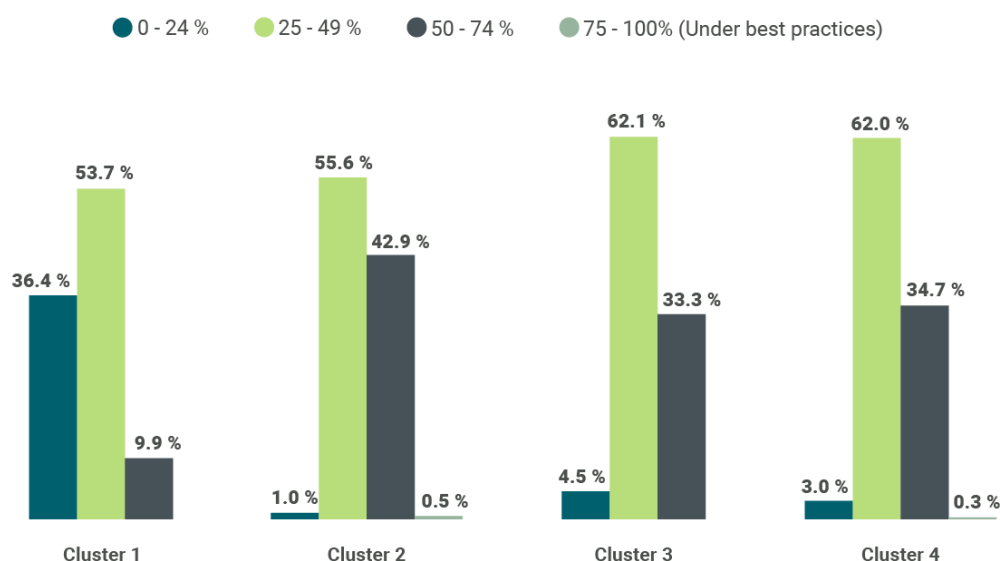


We identify that the main category is 25-49% of the technologies applied, additionally, it shows that no cluster has areas that meet more than 75% of the technologies, except 0.45% of the area of cluster 2 and 0.23% of cluster 4. The technology that is least applied (less than 10%) in all departments is related to how they determine that cacao is dry, on the other hand the technology that is most applied (more than 90%) is weed control. Finally, the department that applies less technologies of this standard is Magdalena, where only 23.64% of the technologies are applied on average in cacao crops.

### Number of producers under USDA-supported technologies (Standard #4)

Equivalent to the hectares under USDA-supported technologies, the analysis of the number of farmers under USDA-supported technologies is presented. This analysis follows the same criteria as above, but in terms of the number of farmers. Graph 64 shows that the majority of farmers (between 50 and 62%) apply between 25-49% of the technologies in their cacao crops. Similarly, it is important to mention that in cluster 1 is where more percentage of producers are in the category of 0-25%, which implies that it is where more percentage of producers apply fewer technologies. The department of Magdalena (in cluster 1) is the department with the lowest percentage of producers applying USDA-supported technologies, followed by Cesar.

**Graph 64.** Categorization of producers under technologies supported by USDA



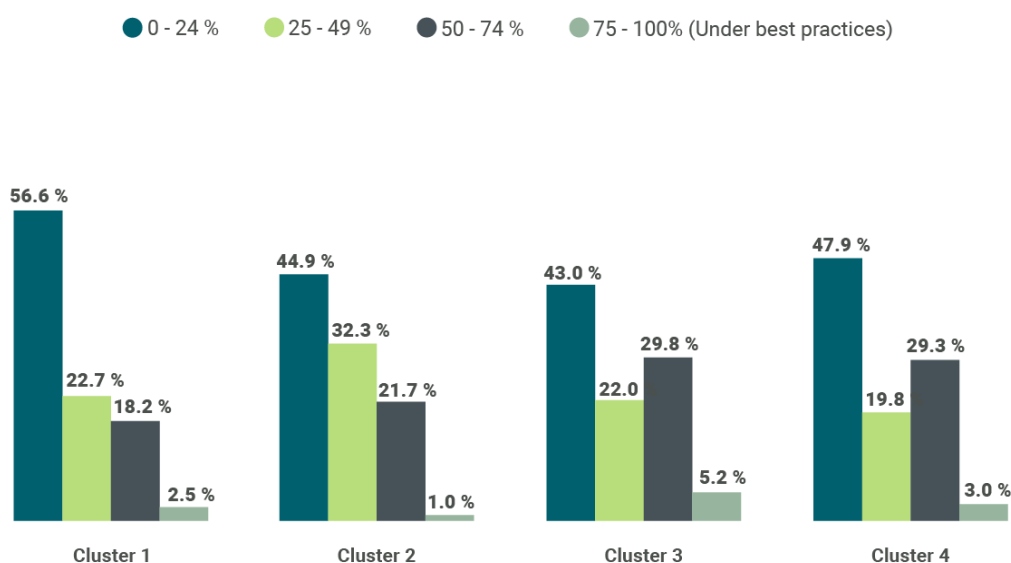
### Farms that apply landscape management (Custom #3)

For the analysis of the farms that currently apply landscape management, farms that comply with the following conditions were considered:

- Produce organic fertilizer on the farm
- Apply organic matter on the farm
- They did renovation in the last 2 years
- They made a cup change at the renovation
- They have not established cacao as a monoculture crop.
- They have a crop or livestock farm in addition to cacao cultivation, which generates a representative income of at least 26% (complementary or associated).

Analogous to what was described in the previous technologies, a count was made and from this a categorization of the farms was made. Graph 65 shows how all the clusters apply landscape management mostly between 0 and 24%, being the weakest practice, the one referring to the production of organic fertilizer. On the other hand, the practice that is most applied for landscape management is the way in which they have established the cultivation of cacao, not having the cacao crop established as a monoculture. Cluster 3, has the highest percentage of producers with a compliance of between 75% and 100% of the practices (5.2%), and cluster 2 the lowest percentage (1%).



**Graph 65.** Categorization of farms currently implementing landscape management

## 3.2 Results qualitative methodologies: focus groups and semi-structured interviews

The findings of the focus groups and semi-structured interviews are presented below, also relating the quantitative results, in cases where the issues addressed in the field survey were also widely discussed in the focus groups and/or interviews. In addition, Annex 9 presents a summary table with the findings of those issues addressed in both the quantitative and qualitative analyses.

### 3.2.1 Results of focus groups

A total of four focus groups were conducted, one in each cluster, with a participation of 9 to 12 producers per focus group. In most cases, hybrid focus groups were conducted with some producers participating in person and others virtually. In the focus groups, a SWOT analysis and an identification of the relevant stakeholders in the cacao business, from the producer's perspective, were carried out.

### SWOT Analysis

In the focus groups, information was mainly collected on the weaknesses, opportunities, strengths and threats in the cacao sector, as seen from the perspective and experience of each producer in their area. To facilitate the analysis, a 2x2 matrix is presented for each cluster and based on the matrix, the most relevant points in each focus group are discussed.

It is important to note that the cacao business was the object of study of these focus groups, and not the cacao farmer. Thus, weaknesses refer to the negative aspects that currently characterize the cacao business of each cluster, but that can nevertheless be seen as

possibilities for improvement, while threats are those factors that can make the cacao business disappear, likewise, when weaknesses are not worked on, they can also become threats. When talking about strengths, we refer to those special capacities, available resources and activities developed positively in the cacao business in each cluster. On the other hand, opportunities refer to those favorable and exploitable factors of the environment, which can be exploited for the future growth and sustainability of the cacao business.

**Table 15.** SWOT Matrix, Cluster 1: Cesar, Magdalena and Guajira

<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Lack of irrigation systems</li> <li>• Labor shortage (focus on technical assistance)</li> <li>• Increase in supply costs (fertilizers, fertilizers)</li> <li>• Young people do not see cacao business as profitable</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Low cacao sales price</li> <li>• New European standards for organic production and zero deforestation are set without considering the context or the opinion of producers.</li> <li>• Recession in Europe by the war between Russia and Ukraine could affect the purchase of cacao from the Sierra Nevada</li> <li>• Little support from the State to strengthen cacao farmers' associations</li> <li>• Climate change (impact of La Niña phenomenon)</li> <li>• Diseases (Monilia)</li> <li>• Long summer periods that cause water stress to the cacao tree (Santa Marta and Pueblo Bello).</li> <li>• Roads in poor condition</li> </ul>
<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Land low in Cadmium</li> <li>• All the cacao produced is sold</li> <li>• Production of fine cacao flavor and aroma</li> <li>• Tayronaca collection center offers good prices, encourages the production of good quality cacao and the purchase of cacao beans.</li> <li>• Resilient producer associations: (Asocajagua, Tayronaca and Guardabosques de la Sierra)</li> <li>• Support and donations from international institutions (Embassy of Japan and Canada).</li> </ul>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Increase productivity</li> <li>• To have a stronger identity as a cacao farmer and not to accept any price from middlemen.</li> <li>• Establish organic fertilizer plants</li> <li>• Produce other cacao derivatives and offer them to tourists in the Sierra Nevada.</li> <li>• Sell good quality cacao, cacao of origin, on the international market.</li> <li>• Increased international recognition of Colombia as a cacao-producing country</li> </ul>

The focal group of cluster 1 was carried out in hybrid modality, 5 producers participated in person in Pueblo Bello (Cesar), and 2 producers from La Jagua de Ibirico (Cesar) and 2 producers from Santa Marta (Magdalena) participated virtually.

One of the main weaknesses mentioned in this cluster is the shortage of labor, a common weakness in all the focus groups. It was noted that although it is difficult to find people to do the cacao work, there is also a lack of personnel to provide technical assistance to producers. In this cluster there are producers from the Wiwa, Kogui and Arhuaco indigenous peoples who live

in reservations in the Sierra Nevada, which take time to reach because they are difficult to access, and with few technicians they cannot be given proper assistance. Also mentioned is the lack of human talent to carry out administrative work related to accounting and customer relations management within the cacao farmer associations.

One of the threats identified by producers of Pueblo Bello and Santa Marta is related to climate, especially because the summer seasons are very long in this region, with up to 9 or 10 months without rain. During the summer cacao tends to suffer from water stress, and the plant prioritizes its survival over production, also in general the farms do not have irrigation systems to help mitigate this problem, in fact, in the quantitative results reported above it was found that about 72% of producers in this cluster do not have irrigation for the crop. This makes their production lower compared to other areas of the country where there are higher levels of rainfall, according to producers.<sup>43</sup>

Another issue mentioned as a threat and which is common in all clusters, is the poor state of roads and high transport costs, in general producers are charged quite a lot of money to collect cacao from their farms and take it to the urban area. On the other hand, there is a perceived threat and that is the imposition of new European standards on cacao farmers in relation to organic production and zero deforestation, which could limit access to international markets. The producers argue that these standards are imposed from a European vision where there is a lack of knowledge of the context of farmers and where their voice is not considered. As expressed by a producer from Santa Marta:

"We believe that they still can't get it through their heads what we are, the diversity of peoples in Latin America, the diversity of cultures, the biological and natural diversity, the diversity of our types of cacao, even within the same regions ... to come and impose rules from a desk in Europe, to us, that seems very complicated".

According to this producer, the problem with this imposition of standards is that compliance falls mostly on the producers. However, producers will continue to receive a very small percentage of the net profits from the business.

In terms of strengths, producers consider that there is a good national market, which always sells all the cacao produced, this was also reflected in the quantitative analysis. The participants also highlight the work of the Tayronaca association in Pueblo Bello as a strength, since it is a collection center that supports producers, offers a fair price, trains producers in planting, drying and fermentation necessary to obtain a good quality cacao and also encourages the purchase of cacao in slime.

In addition, mention is made of the support of international entities, which have had more projects and positive impact in the region than national entities, and the donation of a collection center in La Jagua de Ibirico by the Embassy of Japan is given as an example. In addition,

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<sup>43</sup> The same is not the case for the municipality of La Jagua de Ibirico, although it is also located in the department of Cesar, it has a different climate than Pueblo Bello. On the other hand, it is important to mention that the municipality of La Jagua de Ibirico has been hit by violence and so far the producers who were displaced are returning to their land, this information was provided by the producers themselves during the focus group.

mention is made of a project in La Jagua where between 160 and 180 hectares of cacao were planted, financed by the Canadian Embassy.

Finally, with respect to opportunities, the producers mentioned the possibility of increasing the volume of cacao produced, planting new cacao crops and making their existing crops more productive, since they perceive a growing demand for cacao and therefore see the opportunity for expansion. Similarly, they see the opportunity to produce other cacao derivatives, not only chocolate, taking advantage of the fact that the Sierra Nevada area is quite touristic and could offer these new products to tourists.

On the other hand, there is an opportunity to produce and export good quality cacao, a cacao of origin that has a history, and that is of higher quality than cacao produced in African countries. According to one of the producers of Pueblo Bello, cacao has the potential to be a "flagship" product of Colombia, considering that due to global warming there are more areas suitable for growing cacao than before.

**Table 16.** SWOT Matrix, Cluster 2: Santander

<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Shortage of labor (farm work)</li> <li>• Types of genetic materials planted most vulnerable to disease</li> <li>• Increased supply costs (fertilizers)</li> <li>• Young people do not see cacao business as profitable</li> <li>• Producing better quality cacao sometimes does not represent a higher profit for producers.</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Climate change</li> <li>• Low cacao sales price</li> <li>• Competition from countries that produce more cacao than Colombia or produce it more cheaply</li> <li>• Lack of agricultural focus in schools</li> <li>• Roads in poor condition</li> <li>• Diseases (Monilia)</li> <li>• Pests (monkeys, squirrels, woodpeckers)</li> </ul>
<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Land low in Cadmium</li> <li>• Good land to work</li> <li>• It is a crop that can be grown as a family</li> <li>• High female participation in the work of cultivation</li> <li>• Coca and tobacco crop substitution in Santander</li> <li>• Because of rising temperatures, sites that were once good for growing coffee are now good for growing cacao.</li> <li>• Environmental strength, established crops in agroforestry systems</li> </ul>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• International trade in higher value specialty cacao derived from the region's environmental offerings</li> <li>• Use of all that cacao produces (especially the mucilage).</li> <li>• To produce and export fine cacao beans of flavor and aroma.</li> <li>• Linking young people to business from other areas such as technology management and international trade.</li> <li>• Have cacao certification of origin</li> </ul>

The focus group of cluster 2 was completely face-to-face, with the participation of 10 producers from Rionegro and 2 producers from El Playón.

As in cluster 1, one of the major weaknesses identified by producers is the shortage of labor. In the case of Santander, the weakness focuses on the shortage of labor for the work on the farm. The producers state that on the one hand there is no labor because people, especially young

people, prefer to dedicate themselves to the motorcycle taxi business, as this work seems easier to them than the work in the fields. The producers also say that when labor is available, the workers do not like to work long hours and are not committed to the crop, nor to the owners of the farms.

On the other hand, the types of genetic materials planted were identified as a weakness, since they are more susceptible to diseases such as monilia. One of the producers commented that sometimes it is the same state institutions that bring these clones to the regions, they promise them that they are good quality clones, but in the end they do not work, then bring another type of clone to change it, but that generates a setback for cacao farmers. This is how this cacao farmer expressed himself on the subject:

"We were first told to sow this plant, that this plant is the maximum ... we sow it, then no this is not ... it is this one and then we have to change again, so when are we going to prosper? "

It was also indicated as a weakness, the fact that there are no incentives to produce higher quality cacao, some producers strive to carry out processes of good fermentation, good drying to produce good quality cacao, but there is no economic return for that effort. In fact, as there are no requirements for sanitary standards, some producers dry cacao in their yards or on the terraces when they do not have adequate infrastructure and, although this practice contaminates the product, there is no entity that supervises this process. In the end, regardless of the processes used or the sensory quality of the cacao, cacao farmers are generally paid equally.

In terms of threats, competition in international markets is mentioned, there are African countries and countries such as Ecuador and Peru that produce more cacao than Colombia or produce it cheaper, and this puts the country at a disadvantage. Another important point that was mentioned, and which is connected to the shortage of labor, is the lack of an agricultural approach in schools, as children are not taught the importance of the countryside and are not provided with agriculture-related lessons.

In terms of strengths, participants identified that their land is low in cadmium and is good for cacao production. Although climate change is considered a threat, it can also be a strength and this is because, due to rising temperatures, sites that were once good for growing coffee are now good for growing cacao.

The focus group participants agreed that one of the strengths is the high female participation in cacao work, some said that this is because cacao work is simple, including harvest and post-harvest work; they also believe that women are better at managing the fermentation and drying times of cacao. The quantitative results show that, although the participation of women in general is low, cluster 2 has the highest percentage of women producers (36%). One of the producers in Rionegro, commented that there are several women who are heads of households and that they themselves plant, cultivate and process cacao, also teach their children the work of cacao and love of the field. In relation to this last point, it was also mentioned as a strength that the cultivation of cacao is a crop that can be done as a family, they can manage it together and teamwork can be done by dividing the tasks.

Finally, when talking about opportunities, the opportunity for cacao farmers to continue training in cacao processing was mentioned, so that they can learn to take advantage of everything that cacao produces and not just produce chocolate. This has already been working in Rionegro, where some producers mentioned the use of cacao mucilage to make sweets, jams and produce beers.

The producers of this cluster also identified an opportunity to export cacao and access the international market, especially European markets, considering that their land is low in cadmium. Similarly, the opportunity to produce and export fine cacao flavor and aroma is recognized, one of the producers recognized that this may be possible because institutions such as Fedecacao and Agrosavia have studied what are the fine clones and those that are best suited to the soil types of that department. Finally, the opportunity to link young people to the cacao business was mentioned, not only as producers, but also from other areas of knowledge that can enhance the business, such as the use and management of technologies to improve production and knowledge of international trade to sell cacao products to other countries.

**Table 17.** SWOT Matrix, Cluster 3: Córdoba and Antioquia

<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Labor shortage (only part-time availability)</li> <li>• Increased supply costs (fertilizers)</li> <li>• National industrial monopoly</li> <li>• Crop ageing</li> <li>• Lack of discipline on the part of the producer</li> <li>• There is not a good supply of export-ready materials adapted to the region.</li> <li>• Little research on cultivation in different agro-ecological zones.</li> <li>• Young people do not see cacao business as profitable</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Climate change (impact of La Niña phenomenon and landslides)</li> <li>• Low cacao sales price</li> <li>• Presence of armed actors, illicit activities</li> <li>• Illicit crop laborers earn a much higher daily wage and there is no opportunity to compete.</li> <li>• Diseases (Monilia, Phytophthora)</li> <li>• Roads in poor condition</li> </ul>
<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Good land to work</li> <li>• Availability of irrigation water for most crops</li> <li>• Ability to produce fine flavor and aroma cacao</li> <li>• Resilience of producers</li> <li>• Attitude of producers to work from legality</li> <li>• Accompaniment and support from international entities</li> <li>• All the cacao produced is sold</li> </ul>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• International trade of higher value specialty cacaos for fine chocolates</li> <li>• Selling more differentiated cacao than conventional cacao</li> <li>• Study clones that are productive in that region, other than CCN-51.</li> <li>• Incentivizing producers to have quality clones</li> <li>• Female participation in cacao transformation processes</li> </ul>

This focus group was done in hybrid modality, 9 producers participated in person in Tierralta, one of them came from the municipality of Valencia (Córdoba), and 2 producers from Valdivia (Antioquia) participated virtually.

One of the weaknesses identified by the participants of this cluster is the lack of discipline of some producers to manage their cacao crops. Several do not have a work plan and got used to work only until half a day, so there is no success in the work of cacao because they do not work



in due time. In addition to this, the farmers also mentioned that the workers on the farms are paid full daily wages, but work only in the morning hours, this increases their production costs and with the low price of cacao this does not compensate their earnings. This was also found in the quantitative analysis, identifying average working hours of 5 hours (7-12 noon).

Another weakness is the genetic material that was initially planted in the region, due to ignorance genetic materials were planted that are not suitable for export because they are not sufficiently productive. Producers expressed their concern about this because it will take time to change these materials and achieve higher productivity, necessary to be able to export their cacao.

One of the major threats mentioned in this cluster, by the producers of Tierralta and Valdivia, is the presence of armed groups and illicit activities related especially to coca leaf cultivation. As mentioned above, this was a limitation that was also identified at the time of the field surveys. Because of this situation, some producers have abandoned their productive units and then have many difficulties to recover them. In addition, there is competition between this illicit crop and other crops, since the labor force is better paid for those who work growing coca, and this puts the farmers at a disadvantage. This was expressed by a farmer from Tierralta who commented that day laborers of illicit crops can earn between \$100,000 (\$26.7 USD) and \$120,000 COP (\$32 USD) per day, while cacao farmers are paying a daily wage of around \$25,000 COP (\$6.6 USD).

Another threat is climate change, this threat was also identified in the other clusters, this is because in the last year it has rained constantly and this leads to crop diseases such as monilia, and limit production. However, something particular to this cluster, is that the rains have also generated landslides that have completely destroyed cacao crops and also worsen the condition of the access roads to the farms. Sometimes mules are used to remove the product and then are removed by motorcycle, because there is no other way to access the production unit.

In terms of strengths, the producers highlighted the resilience of the cacao farmers, who despite the difficulties of the sector continue with their business, and who also decide to continue working legally, even when illicit crops represent higher profits. They also highlight the fertility of their soils and the ease of access to water sources on the farms that could be useful in the future to install irrigation systems in the crops. As in cluster 1, it is identified as a strength the fact that all the cacao produced is sold, and the accompaniment of cooperation agencies that have projects to support farmers and have always had a presence, as expressed by a producer of Valencia:

"Despite everything there has always been the helping hand that has contributed to the field, especially on the issue of cacao, there have always been entities that have been ready to provide assistance to the farmer, small, medium, large producer of cacao ... and thank these entities that have helped us within the range of their powers".

Finally, with regard to opportunities, there is a growing demand for fine cacao flavor and aroma in the international market, so producers see the possibility of producing more differentiated cacao instead of conventional cacao so that it can be exported and used to make fine chocolate. It is hoped that, through this, cacao farmers can also receive better prices for their product. Another opportunity that producers visualize is that studies are made on clones that are suitable

for the soils of this region and that can also be productive, this would help increase the volume of cacao produced and its quality. However, they also mention that national or international entities should be in charge of these studies and should share this information with producers.

**Table 18.** SWOT Matrix, Cluster 4: Huila, Tolima and Caldas

<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Labor shortages</li> <li>• Lack of technical assistance</li> <li>• Increase in supply costs (fertilizers, fertilizers)</li> <li>• National industrial monopoly (prices)</li> <li>• Young people do not see cacao business as profitable</li> <li>• Decrease in cacao quality due to the proliferation of diseases.</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Low cacao sales price</li> <li>• Tourism encroachment in cacao-growing areas</li> <li>• Climate change (impact of La Niña phenomenon)</li> <li>• Roads in poor condition</li> <li>• Pests (African Snail and Black Snail)</li> <li>• Diseases (Monilia)</li> </ul>
<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Good land to work</li> <li>• Availability of irrigation water for most crops</li> <li>• Ability to produce fine flavor and aroma cacao</li> <li>• Resilience of producers</li> <li>• Attitude of producers to work from legality</li> <li>• Accompaniment and support from international entities</li> <li>• All the cacao produced is sold</li> </ul>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• International trade in higher value specialty cacao derived from the region's environmental offerings</li> <li>• To have a stronger identity as a cacao farmer</li> <li>• Strengthening of profit centers</li> <li>• Strengthening associativity</li> <li>• Produce and sell cacao of origin</li> <li>• Producing cacao derivatives</li> <li>• Generational Inclusion</li> </ul>

A total of 10 producers participated in the cluster 4 focus group. In a virtual way, 4 producers from the municipalities of Victoria and Belalcázar (Caldas), 2 producers from the municipality of Chaparral (Tolima), and 4 producers from Huila, 2 of them from Rivera, 1 from Campoalegre and 1 from Algeciras participated in person.

In the field of weaknesses, several participants talked about the low generational replacement, this is a concern that was also expressed in the other focus groups conducted. One of the producers from Rivera (Huila) expressed:

"Young people are told that a pencil weighs less than a shovel, so young people are going to university, we're going to work behind a desk and over there in the field, nothing.

Also mentioned as a weakness is the increase in the cost of supplies, especially fertilizers and manure, which in turn raises the production costs of cacao farmers. This coupled with the low price of cacao, makes the business unprofitable for cacao farmers because their production costs are higher than their profits.

For most of the producers, one of the most relevant threats are pests and diseases, which was widely discussed in this focus group. Regarding diseases, special mention is made to monilia, the most limiting disease in this cluster according to the quantitative findings. This disease has become a problem for the sector because some producers do not want to lose the harvested pods and mix the pods affected by monilia with the good pods, causing a decrease in the quality



of cacao produced. As for pests, the black carmenta and the African snail were mentioned, about the latter, producers consider that this foreign species that affects their crops arrived through the trafficking of material from non-certified nurseries.

Among the most important threats mentioned by producers is the low selling price of cacao, this is a threat that was also found in the other clusters. One of the participants said that this is partly due to the existence of an industrial monopoly in Colombia on the issue of prices. According to him, despite the recent rise in the price of the dollar and the commodity, Colombian companies have not yet raised the price at which they buy cacao.

On the other hand, in terms of strengths, producers agreed that in their regions there are good lands to work, the lands are low in cadmium and have abundant water sources. Another strength identified is that some producers produce cacao organically and have the proper certification, which is aligned with the quantitative results, which identifies that this is the cluster with the highest percentage of producers reporting having had a certification (13%). Having this certification represents an added value to their product when they sell it. In addition, they mentioned the ability to produce fine cacao flavor and aroma for export and also the possibility of producing and selling different cacao derivatives.

Finally, one of the greatest opportunities identified is access to a higher value specialty cacao market thanks to the environmental offer of the departments, especially because of the low cadmium soils. It was also discussed the possibility of selling cacao of origin, for this one of the participants suggested that you can create an identity around the production of cacao knowing what are the flavors of each region.

Despite the fact that there is a low generational replacement in these departments, the producers consider that there is an opportunity to change this situation. One of the producers proposed to continue carrying out activities that include the new generations, such as those made by SENA. This institution has done training with young people in which they are taught to taste cacao in order to fall in love with the business and that this can be sustainable in the long term. Finally, an opportunity is seen in the strengthening of the central benefit where you can sell cacao in slime, this would help to improve the quality of cacao, and therefore its price.

## Identification of stakeholders in the cacao sector

During the focus groups, a brief exercise was also carried out to collect information to identify the most relevant stakeholders currently involved in technical assistance, nurseries, processing plants, traders and cacao farmer associations within each cluster. The most important points are highlighted below, while the specific stakeholders identified by cluster for each of these topics are listed in Annex 10.

### Cluster 1.

Producers in cluster 1 mentioned that they receive technical assistance from Fedecacao, however, technicians visit them only 1-2 times a year. Producers said that Fedecacao's assistance is infrequent because a single technician is assigned too many producers who are spread over a large territory, this hinders the possibility of more frequent visits; it is important to

note that this situation occurs in all clusters. In the case of La Jagua de Ibirico there is a greater presence of Fedecacao and this is due to the fact that there is a specific program that is being executed in this municipality. On the other hand, the Tayronaca Association provides technical assistance to its producers in Pueblo Bello, and the Guardabosques de la Sierra provides technical assistance especially to indigenous producers in the Sierra Nevada. This is aligned with the survey results presented above, as the associations represent the largest provider of assistance for this cluster, with a biannual frequency.

In this cluster 3 very important producer associations were identified, the Tayronaca Association that has a branch in Pueblo Bello and another in Chimila (Cesar), Asocajagua in La Jagua de Ibirico and Guardabosques de la Sierra in Santa Marta, these associations buy cacao from producers and also have processing plants. In the case of Tayronaca, this association sells cacao mainly to European countries and the United States, and are exclusive suppliers of certified organic cacao. The Guardabosques de la Sierra association sells mainly to CACAO HUNTERS, D'ORIGENN, Maki Cacao, Compañía Nacional de Chocolates and Legast, while Asocajagua sells to Compañía Nacional de Chocolates (CNCH). According to the focus group participants, very few producers sell to intermediaries and this is because producers receive better prices and have more confidence in the associations. Considering the findings of the quantitative analysis, in this cluster it was found that 80% sell to the associations and only 17.6% of the producers sell to intermediaries.

## **Cluster 2.**

According to the focus group participants, in this cluster some producers also receive technical assistance from Fedecacao, and they receive it at least 3 times a year, although, there are producers from Rionegro who do not receive it. Other producers receive technical assistance from UMATA, when they request it and also receive monthly technical assistance from the Productive Alliance, which is part of a project of the Colombian Ministry of Agriculture. From the survey results, Fedecacao was identified as the entity that currently provides the most technical assistance, and monthly technical assistance predominated (9.6%), followed by annual technical assistance (6.57%).

Regarding nurseries, producers mentioned that there are certified nurseries in Rionegro. This is in line with the findings of the surveys, where 82.3% of the producers responded that the nursery where they obtained their planted material was certified by the ICA. However, during the focus groups it was mentioned that although the nurseries are certified, they are not reliable, since they deliver genetic materials different from the ones they promise to sell, except for a certified nursery of Fedecacao, which is reliable.

Regarding the processing plants, in Rionegro there are 3 but they are not working. However, two of the producers have within their farm a central processing plant in conjunction with an association, those producers who use these plants of the farms agree to deliver cacao once a week.

Producers in Rionegro and El Playón sell their cacao to Fedecacao, to intermediaries who eventually sell to Luker and CNCH, and some producers also reported selling to Zurronas de Santander. Indeed, the survey found that in this cluster 82% of producers sell to intermediaries

and only 12% to Fedecacao. With respect to the associations, 3 stand out mainly: Aromas of peace, Zurrónas de Santander and Ríos de Chocolate, producers commented that the first two associations have received training to make fine chocolate.

### **Cluster 3.**

In this cluster it was mentioned that producers receive technical assistance primarily from Fedecacao every 2 months, and others receive it every 4 months. Some also receive technical assistance from other organizations, but this depends on whether they are part of the project they are implementing, for example, some receive technical assistance from the Food and Agriculture Organization of the United Nations (FAO) every 4 months and also from a project of the German Cooperation Agency (GIZ) on a monthly basis. In Valencia (Córdoba) the association Asoprodema provides technical assistance to its producers. However, the survey found slightly different results for this cluster, identifying that technical assistance from associations predominates (64.4%) and that monthly assistance predominates.

Regarding nurseries, the producers commented that there are no nurseries in Tierralta, in the past there were 4 certified nurseries, but nowadays none of them are working. According to the participants of the focus group, this was due to unfair competition from non-certified nurseries that sold material at lower prices. In Valencia, there is one nursery that belongs to the municipal government, but it is not certified. This is in line with the results of the quantitative analysis which showed that most of the producers in this cluster obtain their planting material from their own nurseries (61%).

In Tierralta there are two important associations which are IntegraSinú and Activa G10, IntegraSinú has 6 micro processing plants and Activa G10 has one. These two associations also buy cacao from their producers and sell it to Luker, CNCH, Chocolates El Triunfo and also export to European countries. On the other hand, the associations of Asoprodema (Valencia) and Asocaval (Valdivia) also buy cacao from their producers, but do not have processing plants, are the same producers who ferment and dry on the farm. This information corroborates the quantitative findings, where 93.5% of the producers reported that they sell to associations and only 6.2% to intermediaries.

### **Cluster 4.**

Finally, in cluster 4 some producers in Huila receive technical assistance from Fedecacao and those who are beneficiaries of the Efecto Cacao program receive assistance from the Luker Foundation. Producers in Chaparral (Tolima) receive technical assistance from Fedecacao, but they do not receive it directly on their farms, Fedecacao conducts field schools every 6 months or every year where it convenes producers and trains them in crop management issues. In the department of Caldas, producers in Belalcázar receive technical assistance from Fedecacao but this is scarce, and they also receive from Finanzfuturo once a month, while in Victoria there is no technical assistance from Fedecacao, this organization is only operating a renovation program according to the focus group participants. This is consistent with the quantitative results, which showed that of the producers who receive technical assistance, only 11.4% receive it from Fedecacao.

Regarding nurseries there are also several problems in this cluster, because although there are some certified nurseries, they are not reliable. One of the Belalcázar producers commented that the nurseries claim to sell different clones such as FEAR-5, LUKER-40 and TCS-01, but in the end they end up selling CCN-51 and the producers only realize it when the tree starts to produce.<sup>44</sup>

In relation to the processing plants, in Chaparral there is one, but it is not communal, in the department of Huila, in Rivera there is the Asoprocar plant, in Campoalegre there are two processing plants that are currently being improved through a project of GIZ and Colombia Más Productiva, and in Algeciras there is also a processing plant. In the department of Caldas, in Belalcázar, the processing plant is still under construction, and in Victoria there is no processing plant.

Finally, producers in Caldas sell their cacao through the associations to Luker and CNCH. In the department of Huila, the Asoprocar association sells to Luker and also to D'ORIGENN, in Algeciras the Aprocalg association buys cacao to sell to Equiori and sells certified cacao, and in the municipality of Chaparral (Tolima) they sell to CNCH through the associations. This is in line with the survey, where 80% of producers reported selling cacao to the associations.

### 3.2.2 Results of semi-structured interviews

Between August and September 2022, a total of 10 interviews were conducted with actors from the government, cooperation, trade, finance, industry, and trade union sectors. The interviews were analyzed using the coding method, through the Nvivo software. The analyses of the main themes are presented below.

#### Present vision and future projection of the cacao sector

One of the first questions asked to key stakeholders was about the present vision of the cacao sector in Colombia and the future projection. In the first aspect, the most mentioned issue was the low productivity, and how this affects the low income of producers. On the one hand, some of the stakeholders spoke of how this productivity has not increased over the years, and the concern that for some families the sale of cacao is the main source of income, since the perception is that there are not many producers with enough complementary crops that can allow them to have an income to live in dignity. In fact, from the quantitative results, it was also found that only 270 producers (25% of the sample) have complementary and/or associated crops.

From the point of view of Participant 11, the low productivity in some regions of the country has been related to acts of violence and displacement of producers, and lately it has had to do with the phenomenon of La Niña, which has worsened the situation of monilia in crops, this is in line with the analysis of the survey that showed that in all clusters monilia is the most reported disease and is also reported as the most limiting. Despite everything, he considers that

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<sup>44</sup> The results of the survey showed that in this cluster, according to producers, the percentage of non-certified nurseries is higher than those certified by the ICA (49.7% compared to 20.7%, respectively).

productivity has increased and will continue to increase in the coming years thanks to the work that has been done in tree renewal and with the planting of new high quality and productive materials from his organization.

Another issue that stands out in terms of the current vision of the sector is the importance of cacao at the national level, especially for the high local consumption in Colombia and its contribution to the country's economy as a crop that is in production throughout the year. However, although some recognize this national importance, they also consider that producers may have the possibility to not only depend on the domestic market but also to sell in international markets special cacao thanks to the good reputation of Colombian cacao as fine flavor and aroma, this was also mentioned during the focus groups, and represents an opportunity for producers to grow their business.

Finally, an important issue mentioned by some stakeholders in terms of future projection is a living income. According to some stakeholders, ensuring that producers begin to have a living income is relevant for two reasons, the first is that producers are part of the first link in the cacao chain and if this link is not solid this can threaten the sustainability of the business. The second is that cacao must become a profitable business, which encourages young people to stay in the field, as expressed by Participant 14:

"The one who is 15 years old, 18 years old, what he has to have is an attraction for him to choose this and not to go to work for Ecopetrol or that he is going to drive a taxi. That's the competition".

The fact that young people do not perceive the cacao business as profitable was also a topic discussed in the focus groups, so it is very important to address this issue in order to ensure that the chain will continue to be maintained in the future.

Additionally, the need to improve cacao quality and increase productivity in the future was discussed, however, these are issues that will be discussed in the next section as they are also related to the sustainability of the sector.

## Sustainability of the sector

Stakeholders were asked about how to improve the image and sustainability of the cacao business, from the point of view of quality, price and productivity, considering the low price of cacao in recent years and its loss of value compared to other commodities.

Most of the stakeholders interviewed agree that for the business to be sustainable it is necessary to improve the quality of cacao. For the government sector this is the most important point, since now both national and international buyers see cacao as a differentiated product, in which traceability has increased, allowing the final consumer to know who grew it and how it was grown. To achieve this, the processing plants are very important, ensuring that the cacao does not lose the special fine connotations of flavor and aroma. In addition, the sale of specialty cacao can enable cacao farmers to earn more income and be more competitive. On the other hand, according to Participant 11, Colombia has already developed high quality and productive

clones that have international recognition, so there is an opportunity to work with these clones to improve the quality of cacao.

The price of cacao was not discussed in detail during the interviews as several stakeholders consider that they have no influence on this, since prices are determined by the international market, however, the importance of quality premiums was discussed. According to Participant 12, in order to stimulate an increase in quality, premiums should be given to producers. From his point of view, the premium should be sufficient to encourage producers to carry out better harvest and post-harvest processes in their crops, for example, for him, a premium of 100 pesos (\$0.026 USD) per kilo is not enough, considering that the price per kilo of cacao is already low, the premium should be at least \$3,000 or \$4,000 COP per kilo (\$0.80 or \$1.06 USD).

One of the interviewees from the industrial sector, agreed with this point and commented that in his company since last year have been given bonuses for good quality (up to 11%) and also bonuses for cacao origin, if the cacao is of good quality and additionally is of origin the producer can get a maximum bonus of 20% per kilo, finally, poor quality is discouraged by paying 5% less than the normal price per kilo of cacao.

Finally, in terms of increasing productivity, several stakeholders agree that this is essential for the business to be sustainable over time, but opinions on how to improve productivity vary. Participant 14 sees this increase in productivity as paramount in order to achieve a living income, which requires at least a doubling of current productivity. For this participant, an important factor to achieve this productivity is the care of the crop, especially focused on pruning and monilia control. On the other hand, for Participant 11, the increase in productivity should be focused on the issue of renewal and the density of productive trees per hectare, where trees that are not productive should be replaced by good quality clones that have been developed in the country.

## Impact of cadmium

Regarding cadmium, some stakeholders were asked about their perspective on this issue and the impact on the future supply of cacao in Colombia. From the point of view of Participant 1, cadmium is a very big threat to the cacao sector. However, he commented that several mitigation measures have been worked on. It was mentioned for example that the Ministry of Agriculture and the Ministry of Health have worked on a food safety document where maximum cadmium limits are established. This participant also commented that there has been a preparation making a study of cadmium resistant clones, field evaluations to reduce the cadmium content of soils and to see the ways in which cadmium remains in the leaves and branches, but does not pass to the grain, in addition to studies that have been conducted in conjunction with the European Union to map the high cadmium zones in Colombia.

Other stakeholders agreed that the issue of cadmium is a negotiating factor that aims to curb the export of Colombian cacao, but that this issue is not really so serious in the country. On the one hand, Participant 13 considers that these regulations on cadmium are of recent years but that cadmium has existed for several years and also exists in other crops, this stakeholder believes that these rules are an excuse for buyers not to buy Colombian cacao. On the other hand, Participant 11 and Participant 14 agreed that Colombian cacao gained a bad reputation



internationally because of a few areas where there are high concentrations of cadmium. Finally, these stakeholders generally agreed that cacao production should be encouraged in those regions low in cadmium, which have possibilities to export their product.

## Crop cultivation and productivity

The stakeholders interviewed were asked a question about the main agricultural tasks or factors that should be considered to achieve better productivity. The most mentioned task by the interviewees was the control of pests and diseases, especially the control of monilia. According to Participant 15, in order for producers to be more efficient in disease control, they should acquire more knowledge about the ways of early detection to attack them in a timely manner. On the other hand, Participant 11 considers that the most important work is renovation, however, for him pest control should be considered in the renovation because this should be done with trees that have greater tolerance to monilia. Pruning is also mentioned as an important task because it is part of the activities to control diseases.

Another point mentioned is related to shade management. For Participant 12 one of the factors that decreases productivity is the large amount of shade that some cacao crops have, and gives the example of the department of Santander. For him, much more sunshine should be allowed in cacao trees, to achieve this, agroforestry systems should be designed for each region to allow much more light to the crop and thus be more productive. From the quantitative findings it was found that 53% of producers in Santander have shade in their crops and, in fact, is the cluster with the lowest percentage of producers who reported having shade.

Finally, post-harvest work was widely discussed. For Participant 2, this is one of the major bottlenecks in cacao production in the country, stressing the importance of the cacao going through a good fermentation and drying process, in order to obtain quality. However, one of the biggest problems of small producers is that they cannot produce quality cacao on the farm, sometimes because they do not have the necessary infrastructure, and sometimes because they produce very low volumes of cacao that are not sufficient to obtain a good fermentation process, so they must perform the processes of processing as a whole to achieve good quality.

## Technical assistance and rural extension

On this topic, some of the stakeholders were asked about their perspective on technical assistance or rural extension in the cacao sector. Participant 5, commented that, for him in Colombia, there is no rural extension but there is technical assistance, and that one of the biggest problems is the few visits to farmers. This interviewee also stated that his organization makes visits to their areas of interest but that they have a very small team to meet the needs of many producers. In addition, he expresses dissatisfaction with the producers because they do not follow the recommendations of the technicians and this is reflected in their low productivity.

On the other hand, Participant 15 considers that beyond the technical advice, the capacity of the producer to implement the recommendations given in relation to the different tasks in the crop should be considered. As an example, he specifies the case of soil analysis:

"A specific example is to give a producer a soil analysis, we can even get to the interpretation of the soil analysis. But if the producer does not have the economic capacity to acquire these supplies, we are not doing anything.

Ultimately, from his point of view, the fundamental aspect of technical advice is to identify the needs of the producer and to be able to provide producers with the means to implement the recommendations.

Finally, for Participant 3 and Participant 14 technical assistance or agricultural extension should be a business rather than an altruistic activity, representing economic gains for the extension company. In this way it can be guaranteed that the service provided by the technicians is of good quality and the producers could be in a position to demand improvements in the service, if necessary. Participant 3 considers that this could help to materialize the objective of increasing productivity, and Participant 14 considers that this would help to value the advice received, recognizing it as a transaction where knowledge is "sold" to the farmer.

## Future Research

Regarding the topic of future research, the stakeholders interviewed were asked which were the most important topics on which research in the cacao chain should focus in the next 5 years. It is important to note that there was very little consensus in the answers to this question. Some believe that there should be a focus on the genetic issue in two directions: (i.) study the genetic materials best adapted to the climatic conditions of each region, since the same varieties have different yields and behaviors depending on the region; (ii.) study which are the genetic materials that absorb less cadmium and self-compatible genetic materials, i.e. those that are self-pollinated and do not depend on insects or cross-pollination and also have more fruits.

Other stakeholders mentioned that research should be done on the physiology of the cacao plant in relation to leaf area, the amount of light the plant should receive, and the flow of the fruits of the plant, helping to improve pruning practices. Another issue related to the physiology of the plant is the phenomenon of "Cherelle Wilt" that causes premature death of the pods, with a negative impact on productivity, and about which there is much ignorance.

One point to keep in mind is that, beyond doing more research, it is important to implement it and transfer knowledge to producers. There are several studies on the ways in which quality can be improved and productivity increased, however, it is necessary to find ways in which these can be understood and applied by farmers. In relation to implementation, it is also mentioned that research should be done on how to encourage the adoption by producers of harvest and post-harvest protocols that can be used to standardize qualities and produce cacao with good organoleptic conditions.

## Financial indicators

The question on this topic only applied in the interview with a financial entity for the agricultural sector, who was asked about credit indicators for the cacao sector in the last two years in his organization. Participant 10, commented that between January and December 2021 for the cacao sector they granted \$496 billion Colombian pesos (\$132.51 million dollars) in credits for a



total of 14,000 operations, and so far in 2022, they have granted credits for 6,000 operations for a total of approximately \$207 billion pesos (\$55.30 million dollars). Of this last amount, \$62 billion pesos (\$16.56 million dollars) were granted in loans to small producers, of which \$35 billion (\$9.35 million dollars) were used to invest in planting. The medium-sized producer was granted loans for approximately \$19.5 billion pesos (\$5.20 million dollars) and the large producer for \$126 billion pesos (33.6 million dollars). Of the \$207,000 million, \$100 billion (\$26.71 million dollars) have been used for the transformation of cacao into chocolate, and of this amount \$98.4 billion pesos (\$26.28 million dollars) have been used by the industry.

On the other hand, in terms of special lines of credit last year in this financial entity \$61.2 billion pesos (\$16.35 million dollars) were granted for the cacao sector and this year (2022) \$28 billion pesos have been granted, of the latter amount, \$12.4 billion pesos (\$3.31 million dollars) have been used in strategic issues of sustaining cacao for perennial crops in 1,023 operations of which 996 operations correspond to small producers, equivalent to \$11.3 billion pesos (\$3.01 million dollars). So far in 2022, credits for machinery have been granted for approximately \$1.7 billion pesos (\$467,539 USD) in 115 operations. Finally, for cacao renovation credits have been granted for \$1.8 billion (\$480,897 USD) pesos, for 136 operations. However, the results of the survey identified that there is a very low percentage of producers who accessed credit in 2021, mainly for fear of losing their land.

## C4D Investment Pillars

Another relevant question asked to most of the stakeholders interviewed was about the investment pillars they would focus on if money from a project like C4D had been awarded to their organizations.

The most frequently mentioned investment pillar was rural extension. For example, Participant 1 believes that rural extension is important to be able to work hand in hand with producers, and offer them solutions, goods or services based on their needs. Participant 13 said that the importance of investing in rural extension is that it is something transversal, it is a common thread that encompasses other issues such as fertilization, soil analysis and pollination, which will ultimately allow to increase production and quality.

There are other investment pillars that were mentioned less frequently, but are also relevant. For example, Participants 10 and 12 spoke of the importance of promoting the use of credit. From the point of view of Participant 10, one of the reasons why producers do not ask for credit or are not granted credit is because there is no understanding between the bank analyst and the producer, in his words: "analysts talk about "internal rates of return", while producers talk about "tons per hectare" and neither of them understand each other". Therefore, to solve this he proposes that there should be a third party between the bank analyst and the producer, for example, an extensionist, to help the conversation flow more smoothly and finally provide a financial model that is understandable to the bank, but also reflects the needs of the producer.

Finally, the other pillars that were mentioned are complementary crops and commercial anchors. Regarding complementary crops, it is considered that these can "lend a hand" in terms of income when cacao is not being so profitable, and on the other hand can mean savings for cacao farming families by producing food for self-consumption on their farms. However,

Participant 3 was of the opinion that a comprehensive rural extension model should be used that includes cacao, but also other crops. In relation to commercial anchors, some stakeholders spoke of the importance of having a commercial stakeholder who is willing to pay a high and stable price to producers who sell quality, and that these stakeholders continue to be part of the value chain even after the project ends, to ensure that the results of an intervention such as C4D are sustainable over time.

## Perception of the cooperation sector

In the framework of this project, interviews were also conducted with donor organizations, one with USDA, the organization that funds the C4D program, and another with the United States Agency for International Development (USAID), which, although it does not fund this project, has been a donor in other Colombian cacao projects in conjunction with USDA, such as the cacao for Peace project. Given that these organizations are not specifically in the cacao business, and the role they play in the project, it was decided to analyze these interviews separately.

- Interview with USDA

The main objective of this interview was to learn from the donor's perspective what is the expected impact of the program in terms of technical assistance, research and the problem of low cacao prices. First, in general terms, participant 17 commented that USDA expects the program to generate reliable information that can be used for decision making in the social, political and economic spheres, high quality information that shows the institutional capacity in extension, marketing and youth support, which demonstrates that USDA bases its work on data and evidence. On the other hand, in terms of technical assistance, the program is expected to set up a scheme whereby assistance will continue to be provided to producers even when C4D comes to an end. From the point of view of participant 17, this can be achieved through income: as the program is expected to increase the productivity and thus the income of cacao farmers, it is also expected that this increase in income can help to pay for technical assistance in the future.

Regarding research, Participant 17 considers that the attention of C4D should be focused on issues of genetic materials, but with an organization of the use of these genetic resources where it is known what is to be produced (what type of material) and what it is to be produced for. Additionally, in line with what the stakeholders mentioned in the other interviews, beyond continuing to do research, the conventional tools that have already been researched in relation to pruning, cacao processing and sanitary management should begin to be applied in the sector; and when these tools have already been applied, more research should begin to be done on cutting-edge technologies.

Finally, regarding what can be done in C4D as a contribution to solving the problem of low cacao prices, Participant 17, first mentioned cadmium, stating that it should work on migrating to areas low in cadmium so that there is greater opportunity for export, this is especially relevant to promote the sale of cacao originating in these areas. As a second point he mentioned that they should work on applying technical standards to buy cacao, i.e. create a

special cacao standards, and when cacao does not pass these standards should continue to be purchased as a raw material, but when it passes it should be purchased as a differentiated product, recognizing in the price the good post-harvest processes carried out by the producer.

- **Interview with USAID**

The main objective of this interview was to know the opinion of the organization on issues such as the present vision and future projection of the sector, the work with producer associations, and the articulation of the cooperation sector with the government sector in terms of projects or plans for the development of cacao.

Regarding the present vision, Participant 18 highlighted the good results of the Commercial Alliances program carried out with 12,000 producers, a significant increase in productivity due to good crop management, disease control and the implementation of irrigation equipment. The good results of the program were largely due to the technical assistance provided to producers. However, Participant 18 believes that in the future technical assistance should be managed from the union and government sectors, and should not depend so much on the cooperation sector.

Regarding the work with producer associations within the projects, there is no positive opinion, because some associations are "facades" and are only created to receive resources from the government or cooperation. Participant 18 considers that the associativity in the sector is important, but that the associations should be restructured so that they can fulfill their true function.

Finally, regarding institutional cooperation, Participant 19 commented that USAID's work in cacao is aligned with Colombia's national strategies, especially on peace issues, as the focus is on areas with illicit crops and areas affected by the conflict. In addition, Participant 18 noted that for USAID it is very important that there is communication between the various institutions that have development projects in the cacao sector, and that this has already been working under the Business Partnerships program where interventions and workshops have been conducted together to increase productivity and net income especially in areas such as Tumaco, Bajo Cauca and Catatumbo.

## 4. Conclusions

The main conclusions for each of the issues addressed in the baseline study are presented below. These conclusions reflect the current status of the future beneficiaries of the C4D project and their productive units, i.e. the status of those producers belonging to cacao farmers' associations in the regions of interest of the project.

### Characterization of producers

The farmers are mostly adult men, with an average age of 56 years, and report owning the land. The percentage of female producers is 30%, while the percentage of young people under or equal to 29 years of age is only 3%. The sector presents as a common weakness in all clusters the low generational replacement, with few incentives for new generations to work in the field, being cacao cultivation an activity perceived as demanding, but with few profits.

On the other hand, farmers mostly have low levels of schooling with 30% of the sample reporting no schooling, and 39% reporting only having completed primary school. On the other hand, farmers report mostly owning the land, and mostly live on the farms, which may be a positive factor, in relation to the willingness of farmers to make investments in the farm and the possibility of them taking care of the crops.

Both the age and schooling level findings are key to the implementation of C4D project activities, for example, in the development of technical assistance methodologies and training. Likewise, these results highlight the importance of all those activities that promote the participation of women and youth in the development of the sector and in the generation of income for the household, an opportunity that has been identified by the different stakeholders participating in this study.

### Characterization of the productive units

The farms are mostly small farms with an average of 11.05 hectares total, and 2.37 hectares in cacao. These farms have basic infrastructure such as electricity, their own aqueducts, and cellular telephony. They often lack sewage, natural gas, non-cellular internet, and good access roads, predominantly dirt and dirt roads. Likewise, they do not have storage warehouses for supplies and/or products, and only half of the producers in the sample have areas for fermentation.

Regarding cacao hectares, crops are commonly between 11 and 20 years old, with cluster 4 having the oldest crops in the sample. In addition, most farmers do not report having made crop renewal in the last 2 years (only 29% have done so). The material planted by the producers comes mostly from their own nurseries in cluster 1 and 3 and from other nurseries in cluster 2 and 4. In both cases, both for their own nursery and for other nurseries, it is common that these do not have ICA certification, except for cluster 2 where it was highlighted that most of the nurseries are certified. Additionally, a problem of trust was identified on the part of the producers, who claim that the nurseries deliver genetic materials different from those agreed upon, except for one nursery of Fedecacao.

Analyzing the predominant agronomic arrangement in cacao cultivation, it was found that most farmers have an agroforestry system, or an associated crop that provides shade to the cacao crop. The presence of agroforestry systems on the farms is a point that could be exploited, considering the benefits that this can bring both for the cultivation of cacao, as well as for the diversification of income of producers, considering for example participation in the carbon market.

Finally, only 36% of the sample has crops or livestock activities on the farm, in addition to cacao and with a marketing purpose. This percentage decreases to 25% when considering that these additional activities generate at least 26% of the gross income of the farm, and therefore can be categorized as complementary and/or associated in the definition of the C4D project. The most common complementary and/or associated activities in the sample are the banana/plantain category, coffee and agricultural activities. Likewise, these are the ones that report the highest average gross income, especially coffee and agriculture. For clusters 1, 2 and 4 the main crop is coffee, for cluster 3 the main crops are banana and plantain. These activities are mostly activities that are presented as complementary to the cultivation of cacao.

Considering the conditions of cacao cultivation and cacao-growing families, it is important to generate income diversification by promoting associated or complementary crops on the farms, either for marketing or for self-consumption. This was also a point highlighted by several of the stakeholders interviewed, stating that the production unit should be seen as an integral system in which different activities are carried out beyond the cultivation of cacao, even beyond the agricultural activity. In this sense, the study of living income that is being carried out under the C4D project is key to making an in-depth analysis of how to diversify the income of cacao farming families, under a holistic profile that seeks to ensure that a decent standard of living is achieved and resilient to possible shocks or unexpected events.

## Cacao growing practices and their relationship to productivity

The results show that pruning is a common practice for farmers, with few respondents reporting that they do not prune. By cluster, cluster 1 has the highest number of respondents reporting not pruning (16%), followed by cluster 2 (12%), cluster 4 (9%) and cluster 3 (6%). On average, more than 50% of growers in the entire sample pruned every year, with the frequency being more common in all four clusters. Regarding the use of cicatrizants, in clusters 2, 3 and 4 most of the producers apply cicatrizants in the cuts after pruning. On the contrary, in cluster 1 it is more common not to do this practice. Weed control is also a common practice among cacao farmers, with 99% of respondents reporting doing it, with machete predominantly in clusters 1 and 3, and scythe in clusters 2 and 4.

With regard to irrigation, it can be concluded that in the four clusters there is a predominance of producers who do not perform this activity. In cluster 1 about 72% of farms do not have irrigation for cacao cultivation, in cluster 2 96%, in cluster 3 97% and 57% in cluster 4. It is worth mentioning that cluster 4 is the most irrigated, but this is only in Huila. However, despite the fact that the majority of the producers in all the clusters stated that they had shade trees, 57% of these producers stated that they did not manage them. Planting shade trees is the least common type of management in all clusters, and those that do manage it do so predominantly on an occasional basis in all four clusters.

On the other hand, most of the farmers report not having soil analysis, and those who have it, most of them do not have a fertilization recommendation (74% of the farmers). Although the majority of farmers in all clusters fertilize, except for cluster 1 where 52% report never fertilizing, fertilization is commonly done once a year. Less than 1% of the sample reported fertilizing 4 times a year. Regarding the use of amendments or limes, in clusters 1 and 4 approximately 30% of the producers apply amendments or limes, while in clusters 2 and 3 the use is higher (64% of the producers). On the other hand, the application of organic matter is not a common practice, and the production of organic fertilizer on the farm is even less common, showing a low level of use of organic residues from the farm.

Regarding pest and disease control, in general, a low percentage of producers reported no pests and diseases. The most limiting pests reported were Squirrels (cluster 1 and 3), Ants (cluster 2), and Black Mottles (cluster 4), while the most limiting disease for all clusters was Monilia. Black spot or Phythophthora and Witches' Broom were also predominant diseases, but not categorized as the most limiting. Control of the most limiting pests is predominantly done manually, with the exception of cluster 2 which does chemical control of ants. However, the frequency of disease control varies by cluster, in cluster 1 and 2 the most common frequency is "occasionally", in cluster 3 there are similar percentages for "occasionally" and "monthly", and in cluster 4 there is a higher frequency of control with the highest percentage for "weekly", particularly in Huila. Finally, it was also found that a high percentage of producers harvest diseased pods: in cluster 1, 61%, in cluster 2 59%, in cluster 3 81%, and in cluster 4 85%.

At the harvesting stage, the frequency varies by cluster and depending on the type of harvesting, main or second harvest. However, it was found as a common factor that the frequency of daily harvesting is uncommon in either period, and that, and harvesting pods according to the "Loss of Shine" criteria is not frequent in any of the clusters. In general, most producers reported separating and discarding diseased pods, and separating and discarding bad kernels, with cluster 2 having the highest percentage of producers who do not perform these activities and cluster 4 having the lowest percentage. As for dehusking, this activity is done manually in all the clusters; in clusters 1 and 2, farmers do it daily, in cluster 3 weekly, and in cluster 4 every two days. Finally, in the four clusters there is a small percentage of producers who make use of the cacota, specifically in clusters 1, 3 and 4 on average 32% do it, and in cluster 2 only 14%.

Finally, in the post-harvest stage, it is evident that, although the majority of respondents report fermenting on the farm, mainly in clusters 2 and 3, few have fermentation areas, as mentioned above. On average for all clusters, the fermentation process takes between 5 and 6 days, and during this process most producers do not take or record the temperature. Regarding the drying process, in general, most of the producers report drying on the farm (61% in cluster 1, 95% in cluster 2, 92% in cluster 3, and 76% in cluster 4; percentages almost identical to those producers who report fermenting on the farm). In addition, the majority of respondents reported using a subjective method to determine if the cacao was dry, by checking the crispiness of the bean based on the experience of the farmer. Finally, in all clusters, with the exception of cluster 3, the percentage of farmers who select cacao free of impurities and pasilla when drying on the farm is higher than those who do not. However, there is a considerable percentage of farmers who do not do this practice (11% in cluster 1, 34% in cluster 2, 61% in cluster 3 and 19% in cluster 4).



In general, it was found that the implementation of practices varies by cluster, and that it often depends on particular conditions at the departmental and even municipal level. Many of the practices are carried out at the discretion of the producers, based on their experience, without relying on or following specific recommendations from experts. This is an important finding, since it was also found, both at the level of the general sample and at the cluster level, that the implementation of practices such as irrigation, pruning, fertilization, application of amendments, application of organic fertilizer, and integrated pest and disease management (IPPM) has a positive relationship with productivity. The case of the departments of Córdoba and Huila supports these findings, being the two departments with the best implementation of practices, and the two departments with the best productivity in the sample.

The results of the baseline study show that there are several practices with opportunities for improvement, and that this will be reflected not only in cacao productivity and associated income, but also in marketing opportunities for the product. On this last point, it should be noted that, although most of the stakeholders participating in this study identify specialty and high quality cacao as a market opportunity, poor harvesting and post-harvest practices present a limitation to realize this opportunity.

## Operational costs of production and revenues associated with cacao

In the analysis of the operational costs of cacao production, it was found that the total cost per hectare per year was highest in cluster 4 for the year 2021, while cluster 1 had the lowest cost. In cluster 4, in addition to being one of the clusters with the highest percentage of implementation of practices, and with the highest number of workdays per hectare per year, it was also found that it is the cluster in which more farmers reported that the costs of their other crops or livestock activities were covered within the costs of cacao. On the other hand, cluster 1 has the lowest costs, related to the lowest number of daily wages per hectare and one of the lowest daily wages per day in the sample (about 38,000 COP or \$10.1 USD). However, the cost per daily wage has the highest weight in all clusters, and for the four clusters, the number of daily wages per hectare is higher in the harvest stage, weed control and pruning, irrigation and shading activities.

The gross income analysis indicates that income is similar in all clusters. However, when analyzing the net income, we find low profits per hectare for clusters 1, 2 and 3, and a deficit in cluster 4. This deficit in cluster 4 is explained by the higher production costs, and the low productivity of Tolima, the department with the lowest productivity in the sample, which cannot be compensated by the productivity of Huila.

However, the low net income of cacao farmers is not associated with marketing problems, since almost 90% of the production is sold, except in cluster 4, where the production sold per hectare is approximately 70% of what is produced per hectare. Thus, it could be related to stable sales prices in recent years, which do not compensate for the considerable increase in production costs. This is in line with the finding that for producers the high production costs are the biggest constraint of the crop, also showing that most of the gross income per hectare is destined to cover production costs (at least 76% of the gross income per hectare). Finally, it cannot be ignored that there are other variables that may be playing a determining role in net income,

such as productivity and farm area. In this sense, the study of living income will allow for a more detailed analysis.

Thus, a general lack of motivation in the cacao activity is identified, with producers who perceive the cacao business as a demanding activity, but with little profit. This puts the sector at risk, showing that it is not an attractive sector for young people, who prefer to pursue other activities outside the field. However, the farmers themselves also identify different opportunities in the sector, including the marketing of special and high quality cacao. In this sense, it is important to develop strategies along the chain that promote and facilitate the production of this type of cacao, but also reward it through, for example, premiums or bonuses.

## Access to technical assistance and financial services

Although approximately 80% of the farmers reported having ever had technical assistance, when analyzing the percentage of farmers who currently receive it, we find that it is less than 50% in all clusters: 44% in cluster 1, 19% in cluster 2, 43% in cluster 3, and 38% in cluster 4. Regarding access to financial services, only 29% of the farmers reported that they or a member of their family had had credit in 2021. Producers in general prefer not to get into debt, for fear of losing their land, being the most mentioned justification, followed by not having the requested guarantees.

Considering the conclusions presented above regarding the work carried out by producers, the low productivity of the sector, and the low income generated by the crop, this deficit of support, planning and technical direction of the farms, combined with a shortage of financial resources, or limited access to them by cacao farmers, is a cause for concern. Under these conditions, an agricultural extension program is crucial, considering the specific needs of producers and their socio-demographic characteristics, helping the farmer to understand the costs and benefits of adopting practices, and providing tools for planning work according to the climate and phenological development of plantations. It is also vital for farmers to have access to better supplies and services. In this sense, the strengthening and business-oriented training of the associations or cooperatives to which the farmers belong is an important component of the C4D project. Associations can be facilitators of change, and at this level they can leave installed capacities that allow for the sustainability of the improvements fostered by the project beyond its duration.



## 5. Recommendations

Methodological, practical, and research recommendations derived from the development of this baseline study are presented below.

### 5.1 Methodological recommendations

- Reconsider the definition of clusters for the project, understanding that this concept implies homogeneity. The results of this study showed that the departments grouped in the current clusters have different conditions and therefore require different interventions. Different ways of grouping beneficiaries at the departmental and even municipal level should be considered, depending on the specific interests of the project, for example, by geographical proximity, market conditions or similarity of conditions related to the crop.
- Revise the target of young producers and women producers as the results show low participation of these groups as the head of cacao cultivation. The study found only 3% of young people in the total sample, a low percentage compared to the project target of 10%. Regarding the percentage of women, a percentage of 30% was found in the study, which is exactly the same as the project target. Therefore, there is a risk that the project goals in this regard may not be achieved.
- Review the lists of producers provided by the cacao farmers' associations, under which the project universe has been built. From the sample of the baseline study, it was identified that the information provided by the organizations on the producers in some cases is outdated, for example, some producers have already died, others were displaced and have not yet returned to their farms, others are no longer engaged in cacao cultivation, or there are several producers registered with the same farm.
- Validate that the producers in the universe meet the criteria established for participation in the project: small producers older than 14 years, with cacao crop has at least 4 years of planting or is in the process of renovation / rehabilitation, and located outside forest reserve areas. In the sample there were no producers younger than 14 years old, but there were producers with more than 5 hectares of cacao and with crops less than 4 years old. The geographic location criterion can be reviewed by the project using the georeferencing of the producers in the sample.

### 5.2 Practical recommendations

- Include the family members of the producers in the interventions. It was found that in many cases the cacao business is a family business, but technical assistance, training and other activities of national and international entities only include the producer and not their families.
- In technical assistance or digital extension services it is important to consider that the internet service in the productive units is almost nonexistent, while most report having cellular telephony. A deeper analysis is recommended in relation to the availability of

access to online digital content and the digital skills of producers in the case of digital extension services.

- Based on the results of the semi-structured interviews, it is recommended to promote active communication between the different institutions that have implemented or are currently implementing development projects in the cacao sector, ensuring exchange of experiences and alignment of efforts.
- In case you want to implement irrigation practices, it is important to consider limitations of access to utilities on the farm.

### 5.3 Research recommendations

- If possible, include in the analysis of living income: (i.) an analysis of the income implications of selling cacao in slurry or dry form; (ii.) a segmentation of cacao hectares in the smallholder category (<5 ha in cacao); (iii.) an analysis of variables such as planting density, age of farmers and family composition.
- It is recommended to deepen the understanding of the effect of climatic phenomena, such as the La Niña phenomenon, on the behavior of productivity and costs in each of the regions of interest of the project. Although climate change is mentioned as a possible strength, by converting land previously unsuitable for cacao, producers also highlighted the effect of heavy rains on crops in 2021, not only by the increase of diseases such as Monilia, but also by floods that wiped out crops, for example, in Rionegro, Santander.
- An in-depth analysis of the production costs of cacao cultivation is recommended, since the study found that a large part of the farmers' income is used to cover production costs. A specific analysis should be made of the costs associated with labor, and the effect of own and family labor. Although this study found that the number of daily wages per hectare in all clusters is lower than the ideal of 90-120 daily wages per hectare per year, these costs are the most important in the total cost of production.
- It is recommended to analyze the effects of rising supply prices, such as fertilizers, on production costs and the appropriate use of these supplies in cacao cultivation, and to identify options to mitigate the negative impact of these increases.

## Annexes

### Annex 1: Productivity of the sample for each of the "productivity enablers" in the C4D project

Productivity enablers	Cacao productivity (kg/ha)	Cacao productivity (kg/ha)	% difference between YES and NO
<b>Pruning</b>	<b>YES</b>	<b>NO</b>	
Do you prune?	393	251	57%
Pruning at least twice a year (every six months and every three months)?	407	378	7.7%
Do you prune in dry weather?	365	391	-6.65%
<b>Integrated Pest and Disease Management (IPPM)</b>	<b>YES</b>	<b>NO</b>	
Do you bury or place diseased fruits under the leaf litter?	412	285	45%
Do you do weekly disease checks?	500	337	48%
Do you harvest diseased pods?	400	325	23%
<b>Fertilization</b>	<b>YES</b>	<b>NO</b>	
Do you have a fertilization recommendation?	453	351	29%
Do you do fertilization?	404	323	25%
Do you fertilize four times a year?	520 <sup>45</sup>	384	35%
Do you fertilize at least three times a year?	581 <sup>46</sup>	379	53%
Do you fertilize at least two times a year?	509 <sup>47</sup>	351	45%
<b>Irrigation</b>	<b>YES</b>	<b>NO</b>	
Do you have irrigation systems?	452	363	25%

<sup>45</sup>This corresponds to less than 0.5% in the total sample that fertilizes four times a year, and also has cacao crop ages other than 0-5 years.

<sup>46</sup>This figure corresponds to 2.88% in the total sample that fertilize at least three times a year, and also have cacao cultivation ages other than 0-5 years.

<sup>47</sup> This figure corresponds to 22.12% in the total sample that fertilize at least two times a year, and also have cacao cultivation ages other than 0-5 years.

## Annex 2: List of municipalities per department included in the sample

Cluster	Departament	Municipality
Cluster 1.	Cesar	Chiriguana Curumaní La Jagua De Ibirico Pueblo Bello
Cluster 1.	Magdalena	Santa Marta
Cluster 1.	Guajira	Dibulla
Cluster 2.	Santander	El Playón Rionegro
Cluster 3.	Antioquia	Cáceres Tarazá Valdivia
Cluster 3.	Córdoba	Tierralta Valencia
Cluster 4.	Caldas	Belalcázar Norcasia Samaná San José Victoria Viterbo
Cluster 4.	Huila	Algeciras Campoalegre Rivera
Cluster 4.	Tolima	Chaparral San Antonio

## Annex 3: Key stakeholders interviewed

Sector	Organization
Government	Ministry of Agriculture and Rural Development
Industry	CACAO HUNTERS
Industry	Luker
Industry	Luker
Industry	Compañía Nacional de Chocolates
Industry	Compañía Nacional de Chocolates
Industry	Compañía Nacional de Chocolates
Cooperation	Swisscontact
Cooperation	Swisscontact
Cooperation	USDA
Cooperation	USAID
Cooperation	USAID
Finance and Credit	Financial entity of the agricultural sector
Guild	Fedecacao
Guild	Consejo Nacional Cacaotero
Marketers	Red Cacaotera
Marketers	Colcocoa
Marketers	Colcocoa
Marketers	Colcocoa

## Annex 4. Productivity by department (kg/ha)

Departament	Productivity (Kg/ha)
Córdoba	488
Huila	458
Santander	435
Cesar	430
Magdalena	349
Antioquia	341
La guajira	298
Caldas	219
Tolima	132

## Annex 5. Additional Measures of Central Trends

	Cluster	Average	Median	Standard deviation	Max	Min	Asymmetry	Kurtosis	Mode
Cocoa area (ha)	Cluster 1	2.17	2.00	1.54	11.00	0.50	0.32	3.21	1/2
Cocoa area (ha)	Cluster 2	3.10	2.50	2.02	12.00	0.50	0.90	1.31	2
Cocoa area (ha)	Cluster 3	1.85	1.50	1.20	12.00	0.30	0.87	5.66	1
Cocoa area (ha)	Cluster 4	2.36	2.00	2.24	30.00	0.18	0.48	22.56	1
Daily wage cost (COP)	Cluster 1	\$1,988,441.90 (\$531 USD)	\$1,950,000.00 (\$520 USD)	\$906,371.97 (\$242 USD)	\$5,040,000.00 (\$1,346 USD)	\$165,666.67 (\$44 USD)	0.13	0.60	\$1,260,000.00 (\$336 USD)
Daily wage cost (COP)	Cluster 2	\$2,605,387.88 (\$696 USD)	\$2,300,000.00 (\$614 USD)	\$1,447,330.86 (\$386 USD)	\$10,400,000.00 (\$2,778 USD)	\$683,333.33 (\$182 USD)	0.63	1.30	\$2,400,000/2,160,000/3,420,000/2,300,000/1,440,000
Daily wage cost (COP)	Cluster 3	\$2,450,916.20 (\$654 USD)	\$2,200,000.00 (\$587 USD)	\$1,494,281.12 (\$399 USD)	\$17,800,000.00 (\$4,755 USD)	\$2,125.00 (0.56 USD)	0.50	10.80	\$2,500,000.00 (\$667 USD)
Daily wage cost (COP)	Cluster 4	\$3,342,125.08 (\$892 USD)	\$2,800,000.00 (\$748 USD)	\$2,185,292.55 (\$583 USD)	\$15,875,000.00 (\$4,241 USD)	\$3,176.00 (\$0.84 USD)	0.74	2.89	\$4,500,000.00 (\$1,202 USD)
Agrochemical costs (COP)	Cluster 1	\$234,750.92 (\$62 USD)	\$187,428.57 (\$50 USD)	\$137,209.37 (\$36 USD)	\$640,000.00 (\$170 USD)	\$50,000.00 (\$13 USD)	1.03	0.00	\$180,000/\$200,000 (\$48/\$53 USD)
Agrochemical costs (COP)	Cluster 2	\$216,343.89 (\$57 USD)	\$191,166.67 (\$51 USD)	\$136,012.26 (\$36 USD)	\$600,000.00 (\$160 USD)	\$12,500.00 (\$3.3 USD)	0.56	0.00	\$148,000 (\$39.5 USD)
Agrochemical costs (COP)	Cluster 3	\$136,173.67 (\$36 USD)	\$113,142.86 (\$30 USD)	\$151,020.00 (\$40 USD)	\$1,080,000.00 (\$288 USD)	\$25,000.00 (\$6 USD)	0.46	1.00	\$140,000 (\$37 USD)
Agrochemical costs (COP)	Cluster 4	\$148,145.26 (\$39 USD)	\$80,000.00 (\$21 USD)	\$157,677.94 (\$42 USD)	\$700,000.00 (\$187 USD)	\$5,142.86 (\$1.3 USD)	1.30	0.00	\$60,000 (\$16 USD)
Organic matter costs (COP)	Cluster 1	\$104,117.41 (\$27 USD)	\$0.00	\$315,631.74 (\$84 USD)	\$1,600,000.00 (\$427 USD)	\$0.00	0.99	0.78	\$1,600,000/\$180,000/\$1,440,000/\$200,000
Organic matter costs (COP)	Cluster 2	\$595,919.67 (\$159 USD)	\$400,000.00 (\$106 USD)	\$828,025.98 (\$221 USD)	\$8,137,500.00 (\$2,174 USD)	\$0.00	0.71	6.41	\$400,000 (\$106 USD)
Organic matter costs (COP)	Cluster 3	\$484,005.52 (\$129 USD)	\$0.00	\$1,059,510.26 (\$283 USD)	\$6,400,000.00 (\$1,709 USD)	\$0.00	1.37	1.02	\$3,266,666.667 (\$872 USD)
Organic matter costs (COP)	Cluster 4	\$374,769.28 (\$100 USD)	\$230,384.62 (\$61 USD)	\$599,842.27 (\$160 USD)	\$5,000,000.00 (\$1,335 USD)	\$0.00	0.72	3.36	\$300,000/\$1,000,000 (\$80 / \$267 USD)
Soil improver/ lime costs (COP)	Cluster 1	\$94,330.93 (\$25 USD)	\$66,000.00 (\$17 USD)	\$64,897.42 (\$17 USD)	\$250,000.00 (\$66 USD)	\$16,250.00 (\$4 USD)	1.00	1.00	\$50,000 (\$13 USD)
Soil improver/ lime costs (COP)	Cluster 2	\$166,773.64 (\$44 USD)	\$150,000.00 (\$40 USD)	\$89,502.65 (\$23 USD)	\$500,000.00 (\$133 USD)	\$5,333.33 (\$1.4 USD)	1.00	1.00	\$150,000 (\$40 USD)
Soil improver/ lime costs (COP)	Cluster 3	\$104,994.05 (\$28 USD)	\$90,180.00 (\$24 USD)	\$70,784.02 (\$18 USD)	\$496,650.00 (\$132 USD)	\$80.00 (\$0.02 USD)	1.00	2.00	\$50,000 (\$13 USD)
Soil improver/ lime costs (COP)	Cluster 4	\$105,590.17 (\$28.2 USD)	\$100,000.00 (\$26 USD)	\$60,786.00 (\$16 USD)	\$250,000.00 (\$66 USD)	\$12,000.00 (\$3 USD)	0.00	2.00	\$100,000 (\$26 USD)

Insecticide costs (COP)	Cluster 1	\$63,501.59 (\$16.9 USD)	\$50,000.00 (\$13 USD)	\$48,320.74 (\$12 USD)	\$200,000.00 (\$53 USD)	\$4,000.00 (\$1.06 USD)	1.00	1.00	\$100,000 (\$26 USD)
Insecticide costs (COP)	Cluster 2	\$42,466.05 (\$11.3 USD)	\$30,000.00 (\$8 USD)	\$42,741.07 (\$11.4 USD)	\$342,857.14 (\$91 USD)	\$5,882.35 (\$1.5 USD)	1.00	3.00	\$30,000 (\$8 USD)
Insecticide costs (COP)	Cluster 3	\$43,554.49 (\$11.6 USD)	\$24,500.00 (\$6.5 USD)	\$43,645.11 (\$11.6 USD)	\$180,000.00 (\$48 USD)	\$5,000.00 (\$1.3 USD)	1.00	0.00	\$24,000/\$20,000 (\$6 / \$5 USD)
Insecticide costs (COP)	Cluster 4	\$80,004.68 (\$21.3 USD)	\$50,000.00 (\$13 USD)	\$78,115.37 (20 USD)	\$400,000.00 (\$106 USD)	\$555.56 (\$0.14 USD)	1.00	1.00	\$50,000 (\$13 USD)
Fertilizers costs (COP)	Cluster 1	\$670,343.94 (\$179 USD)	\$684,000.00 (\$182 USD)	\$101,915.96 (\$27 USD)	\$900,000.00 (\$240 USD)	\$360,000.00 (\$96 USD)	-0.40	216.00	\$720,000 (\$192 USD)
Fertilizers costs (COP)	Cluster 2	\$637,610.11 (\$170.3 USD)	\$691,200.00 (\$184 USD)	\$131,699.48 (\$35 USD)	\$822,857.14 (\$219 USD)	\$132,000.00 (\$35 USD)	-1.22	23.00	\$720,000 (\$192 USD)
Fertilizers costs (COP)	Cluster 3	\$612,743.53 (\$163.7 USD)	\$624,000.00 (\$166 USD)	\$135,739.84 (\$36 USD)	\$1,191,960.00 (\$ 318 USD)	\$720.00 (\$0.19 USD)	-0.25	22.00	\$720,000 (\$192 USD)
Fertilizers costs (COP)	Cluster 4	\$626,699.04 (\$167.4 USD)	\$658,285.71 (\$175 USD)	\$140,862.89 (\$37 USD)	\$1,080,000.00 (\$ 288 USD)	\$26,666.67 (\$7 USD)	-0.67	31.00	\$720,000 (\$192 USD)
Total costs (COP)	Cluster 1	\$2,391,514.82 (\$638 USD)	\$2,486,833.33 (\$664 USD)	\$1,030,461.74 (\$275 USD)	\$5,688,000.00 (\$ 1,519 USD)	\$180,000.00 (\$48 USD)	-0.28	1.00	\$2,700,000 (\$721 USD)
Total costs (COP)	Cluster 2	\$3,685,254.27 (\$984 USD)	\$3,523,666.67 (\$941 USD)	\$1,685,732.82 (450 USD)	\$11,342,700.00 (\$3,030 USD)	\$842,500.00 (\$225 USD)	0.29	1.00	\$975,000 (\$260 USD)
Total costs (COP)	Cluster 3	\$3,147,808.41 (\$840 USD)	\$2,795,250.00 (\$746 USD)	\$1,707,276.05 (\$456 USD)	\$18,640,000.00 (\$ 4,979 USD)	\$300,000.00 (\$80 USD)	0.62	7.00	\$2,360,000 (\$630 USD)
Total costs (COP)	Cluster 4	\$4,037,129.51 (\$1078 USD)	\$3,643,333.33 (\$973 USD)	\$2,358,882.48 (\$630 USD)	\$17,233,333.33 (\$ 4,604 USD)	\$95,123.46 (\$25 USD)	0.50	3.00	\$5,172,000 (\$1,381 USD)
Cocoa sold 2020 (Kg)	Cluster 1	848.85	540.00	780.43	3600.00	100.00	1.19	0.44	2000/500
Cocoa sold 2020 (Kg)	Cluster 2	2826.86	2000.00	2062.01	6500.00	200.00	1.20	0.61	6000
Cocoa sold 2020 (Kg)	Cluster 3	1098.97	781.00	1013.94	6000.00	80.00	0.94	1.07	500/400
Cocoa sold 2020 (Kg)	Cluster 4	715.99	500.00	696.05	3500.00	15.00	0.93	1.01	200
Cocoa sold 2021 (Kg)	Cluster 1	848.12	552.50	880.31	5000.00	15.00	1.01	1.53	500
Cocoa sold 2021 (Kg)	Cluster 2	1338.99	800.00	1335.83	6500.00	120.00	1.21	0.96	800
Cocoa sold 2021 (Kg)	Cluster 3	799.80	500.00	883.58	5000.00	50.00	1.02	3.14	300
Cocoa sold 2021 (Kg)	Cluster 4	808.34	600.00	828.79	4800.00	12.00	0.75	2.50	400/500/600
Cocoa income 2021 (COP)	Cluster 1	\$6,493,254.92(\$1,734 USD)	\$4,211,155.00 (\$1,125 USD)	\$6,743,211.59 (\$1,801 USD)	\$38,019,400.00 (\$ 10,157 USD)	\$194,285.00 (\$51 USD)	1.02	1.58	\$1,504,706.667 (\$402 USD)
Cocoa income 2021 (COP)	Cluster 2	\$10,292,001.85 (\$2,749 USD)	\$6,232,386.67 (\$1,665 USD)	\$10,240,523.66 (\$2,735 USD)	\$49,842,365.63 (\$13,316 USD)	\$931,646.25 (\$248 USD)	1.19	0.96	\$6,123,320/\$5843,688/\$3,120,053/\$46,146,150
Cocoa income 2021 (COP)	Cluster 3	\$6,175,282.32 (\$1,649 USD)	\$3,920,500.31 (\$1,047 USD)	\$6,824,844.82 (\$1,823 USD)	\$40,227,258.33 (\$10,747 USD)	\$386,831.25 (\$103 USD)	0.99	3.15	\$3,028,400 (\$809 USD)
Cocoa income 2021 (COP)	Cluster 4	\$6,065,720.35 (\$1,620 USD)	\$4,532,202.40 (\$1,210 USD)	\$6,203,153.89 (\$1,657 USD)	\$35,503,680.00 (\$9,485 USD)	\$89,514.00 (\$23 USD)	0.74	2.49	\$6,656,940 (\$1,778 USD)

## Annex 6. Reference prices for cacao sales (2021)

Month	Monthly prices (COP) /Kg - analysis	Colombian Ministry of agriculture (COP)
January	\$7,624 (\$2.04 USD)	\$7,874.625 (\$2.10 USD)
February	\$7,458 (\$1.99 USD)	\$7,708.375 (\$2.06 USD)
March	\$7,447 (\$1.99 USD)	\$7,697.525 (\$2.05 USD)
April	\$7,254 (\$1.94 USD)	\$7,504.4 (\$2.00 USD)
May	\$7,300 (\$1.95 USD)	\$7,550.4 (\$2.01 USD)
June	\$7,317 (\$1.95 USD)	\$7,267.3 (\$1.94 USD)
July	\$6,699 (\$1.79 USD)	\$6,949.28 (\$1.85 USD)
August	\$7,506 (\$2.00 USD)	\$7,756.7 (\$2.07 USD)
September	\$8,014 (\$2.14 USD)	\$8,264.325 (\$2.20 USD)
October	\$8,274 (\$2.21 USD)	\$8,524.425 (\$2.27 USD)
November	\$7,940 (\$2.12 USD)	\$8,190.55 (\$2.18 USD)
December	\$8,019 (\$2.14 USD)	\$8,269.04 (\$2.21 USD)

This table presents the monthly cacao sales prices for the year 2021, used for the cacao revenue analysis. The prices used are the prices in the column "Monthly prices/kg - analysis", which were determined with the support of the expert team and the technical team in the field, taking as a reference the prices in the column "Prices Ministry of Agriculture", but adjusting them for the intermediation margins in the areas of interest. <sup>48</sup>

## Annex 7. Complementary and/or associated activities

Activity	# Records <sup>49</sup>	Proportion %	Category
Coffee	80	26.9%	Coffee
Plantain	54	18.1%	Banana AND Plantain
Cassava	34	11.4%	Cassava
Cattle farming	34	11.4%	Livestock activity
Avocado	23	7.7%	Avocado
Rice	7	2.4%	Rice
Grapes	6	2%	Grapes
Sugar cane	6	2%	Sugar cane
Mandarine	5	1.7%	Citrus
Corn	5	1.7%	Corn
Lemon	5	1.7%	Citrus
Fish farming	4	1.3%	Livestock activity

<sup>48</sup> Prices of kg of cacao from the Ministry of Agriculture " [Agronet: Information and communication network of the Colombian agricultural sector](#)".

<sup>49</sup> Number of surveys for which the activity represented at least 26% of farm income.



Activity	# Records <sup>49</sup>	Proportion %	Category
Papaya	4	1.3%	Others
Beekeeping	3	1%	Livestock activity
Orange	3	1%	Cítrus
Taro	3	1%	Others
Poultry farming	3	1%	Livestock activity
Pig farming	3	1%	Livestock activity
Soursop	2	0.7%	Others
Coriander	2	0.7%	Others
Bijao	1	0.34%	Others
Tomato	1	0.34%	Others
Small plantain	1	0.34%	Others
Pineapple	1	0.34%	Others
Watermelon	1	0.34%	Others
Passion Fruit	1	0.34%	Others
Red beans	1	0.34%	Others
Exotic flowers	1	0.34%	Others
Coconut	1	0.34%	Others

## Annex 8. Practices or technologies of the C4D project

List of practices or technologies identified by POA as relevant to the C4D project to identify number of acres under improved management practices or technologies that promote improved climate risk reduction and/or natural resource management with USDA assistance:

Questions for standard 2 (Hectares that comply with at least 75% of the following questions):

1. What do you pack the cacao for sale in? R/ Fique Sacks
2. Do you produce organic fertilizer on the farm? R/ Yes
3. Do you apply organic matter? R/ Yes
4. Do you bury or place diseased fruits under the leaf litter? R/ Yes
5. Fruit affected by Carmenta are identified, cut and buried. R/ Yes

	Cluster 1	Cluster 1	Cluster 1	Cluster 2	Cluster 3	Cluster 3	Cluster 4	Cluster 4	Cluster 4
Question	CESAR	GUAJIRA	MAGDALENA	SANTANDER	CÓRDOBA	ANTIOQUIA	CALDAS	TOLIMA	HUILA
Producers	153.00	20.00	69.00	198.00	66.00	243.00	117.00	150.00	67.00
Total area cocoa	359.60	45.70	115.60	614.55	189.70	379.60	288.96	406.20	167.30
1	50.54%	41.58%	30.54%	50.40%	90.93%	81.61%	44.64%	46.31%	3.77%
2	24.68%	0.00%	3.03%	8.18%	2.64%	20.28%	11.59%	11.77%	0.00%
3	28.99%	13.13%	4.76%	66.71%	17.40%	21.27%	36.77%	25.58%	0.00%
4	40.00%	97.81%	60.81%	46.16%	59.41%	85.16%	84.67%	89.78%	48.00%
5	2.92%	6.56%	1.30%	3.50%	3.43%	11.09%	55.88%	99.14%	7.83%

List of practices or technologies identified by POA as relevant to the C4D project to identify the number of acres or producers under improved management practices or technologies with USDA assistance:

Questions for standard 3 and 4 (Hectares /producers that comply with at least 75% of the following questions):

1. How do you perform weed control? A/ Agrochemicals
2. Do you perform weed control? R/ Yes
3. How many days on average does fermentation take? R/ More than 5 days
4. What does it ferment? R/ Objects made of materials other than wood
5. Do you separate and discard diseased pods? R/ Yes
6. How many days on average does it take to dry cacao in winter? R/ More than 4 days
7. How many days on average does it take to dry cacao in summer? R/ More than 4 days
8. How do you determine that a cacao is dry? R/ The percentage of humidity is measured
9. What do they dry it on? (Multiple Choice) R/ Wooden fish tanks, elba house and canopies
10. What do you pack the cacao for sale in? R/ Figue Sacks
11. Do you select cacao free of impurities and pasilla? R/ Yes
12. Do you apply amendments or limes to your cacao crop? R/ Yes
13. Do you apply organic matter? R/ Yes
14. Do you keep records of annual cacao production and sales? R/ Yes
15. Does it identify and remove branches and fruits affected by Witches' Broom? R/ Yes
16. Fruit affected by Carmenta are identified, cut and buried. R/ Yes
17. In this renovation(s), was there a cup change? R/ Yes
18. Do you prune? R/ Yes
19. When do you prune? R/ Dry weather

Technology Standard #3 Number of acres under improved management practices or technologies with USDA assistance.

	Cluster 1	Cluster 1	Cluster 1	Cluster 2	Cluster 3	Cluster 3	Cluster 4	Cluster 4	Cluster 4
Question	CESAR	GUAJIRA	MAGDALENA	SANTANDER	CÓRDOBA	ANTIOQUIA	CALDAS	TOLIMA	HUILA
Producers	153.00	20.00	69.00	198.00	66.00	243.00	117.00	150.00	67.00
Total area cocoa	359.60	45.70	115.60	614.55	189.70	379.60	288.96	406.20	167.30
1	15.02%	0.00%	3.89%	25.34%	34.53%	12.10%	19.84%	13.79%	3.59%
2	97.78%	100.00%	100.00%	97.64%	98.68%	98.34%	100.00%	100.00%	100.00%
3	47.62%	39.39%	29.41%	69.12%	65.89%	15.17%	40.51%	53.03%	78.24%
4	33.30%	51.86%	10.38%	37.06%	25.57%	44.86%	23.47%	0.49%	27.02%
5	79.00%	100.00%	51.12%	51.42%	93.94%	76.51%	93.53%	92.49%	83.14%
6	75.78%	82.49%	34.60%	93.17%	91.57%	91.17%	64.60%	61.03%	98.21%
7	9.32%	33.92%	34.60%	21.93%	54.03%	17.20%	18.45%	35.45%	1.79%
8	0.00%	0.00%	0.00%	0.45%	3.16%	0.66%	0.00%	1.38%	0.00%
9	16.13%	45.95%	10.38%	57.41%	87.88%	57.65%	47.48%	73.95%	69.10%
10	50.54%	41.58%	30.54%	50.40%	90.93%	81.61%	44.64%	46.31%	3.77%
11	66.95%	64.99%	27.68%	62.05%	86.82%	17.58%	46.08%	42.07%	97.01%
12	36.94%	0.00%	0.87%	74.40%	97.36%	51.99%	29.10%	19.84%	63.54%
13	28.99%	13.13%	4.76%	66.71%	17.40%	21.27%	36.77%	25.58%	0.00%
14	23.53%	0.00%	5.88%	9.07%	23.46%	33.50%	14.06%	30.87%	17.51%
15	0.28%	0.00%	0.00%	71.96%	15.29%	37.18%	14.32%	40.72%	100.00%
16	2.92%	6.56%	1.30%	3.50%	3.43%	11.09%	55.88%	99.14%	7.83%
17	10.57%	28.45%	4.33%	11.30%	51.40%	21.65%	12.33%	35.45%	13.93%
18	89.99%	90.15%	81.40%	89.21%	95.52%	95.71%	91.42%	91.38%	94.92%
19	19.95%	0.00%	17.99%	37.82%	3.16%	16.46%	19.80%	2.58%	48.77%

Technology Standard #4 Number of producers in the farming system who have implemented improved management practices or technologies with USDA assistance.

	Cluster 1	Cluster 1	Cluster 1	Cluster 2	Cluster 3	Cluster 3	Cluster 4	Cluster 4	Cluster 4
Question	CESAR	GUAJIRA	MAGDALENA	SANTANDER	CÓRDOBA	ANTIOQUIA	CALDAS	TOLIMA	HUILA
Producers	153.00	20.00	69.00	198.00	66.00	243.00	117.00	150.00	67.00
Total area cocoa	359.60	45.70	115.60	614.55	189.70	379.60	288.96	406.20	167.30
1	16.00%	0.00%	3.00%	25.00%	35.00%	12.00%	21.00%	14.00%	1.00%
2	96.08%	100.00%	100.00%	98.48%	98.48%	97.94%	100.00%	100.00%	100.00%
3	41.83%	40.00%	20.29%	67.17%	60.61%	12.35%	51.28%	43.33%	79.10%
4	35.95%	70.00%	10.14%	42.42%	21.21%	51.03%	42.74%	0.67%	31.34%
5	75.16%	100.00%	53.62%	48.99%	93.94%	72.43%	88.89%	93.33%	83.58%
6	71.90%	85.00%	26.09%	93.43%	92.42%	92.18%	88.89%	55.33%	95.52%
7	11.11%	35.00%	26.09%	24.24%	57.58%	13.99%	27.35%	26.00%	1.49%
8	0.00%	0.00%	0.00%	0.51%	3.03%	0.82%	0.00%	2.67%	0.00%

	Cluster 1	Cluster 1	Cluster 1	Cluster 2	Cluster 3	Cluster 3	Cluster 4	Cluster 4	Cluster 4
Question	CESAR	GUAJIRA	MAGDALENA	SANTANDER	CÓRDOBA	ANTIOQUIA	CALDAS	TOLIMA	HUILA
9	14.38%	40.00%	2.90%	48.48%	86.36%	53.09%	58.12%	58.00%	67.16%
10	47.06%	25.00%	20.29%	46.97%	86.36%	80.66%	47.01%	34.67%	4.48%
11	61.44%	60.00%	20.29%	61.11%	84.85%	17.28%	63.25%	34.00%	97.01%
12	36.60%	0.00%	1.45%	70.20%	96.97%	47.74%	41.88%	25.33%	59.70%
13	27.45%	5.00%	4.35%	62.63%	16.67%	18.11%	46.15%	25.33%	0.00%
14	20.92%	0.00%	5.80%	8.59%	21.21%	31.28%	11.11%	38.67%	11.94%
15	0.65%	0.00%	0.00%	71.72%	15.15%	37.04%	20.51%	44.00%	100.00%
16	1.96%	5.00%	2.90%	2.02%	3.03%	13.99%	35.90%	98.67%	7.46%
17	9.80%	30.00%	2.90%	8.59%	50.00%	18.52%	11.97%	39.33%	7.46%
18	86.93%	90.00%	76.81%	88.38%	95.45%	93.83%	87.18%	92.00%	94.03%
19	18.30%	0.00%	7.25%	34.85%	4.55%	17.28%	26.50%	2.67%	43.28%

### Custom # 3 - Number of farms currently implementing landscape management

List of practices or technologies identified by POA as relevant to defining farms that apply landscape management:

1. Do you produce organic fertilizer on the farm? R/ Yes
2. Do you apply organic matter? R/ Yes
3. In this renovation(s) was there a cup change? R/ Yes
4. Was there a renewal(s) in the last 2 years, 2020 - 2021? R/ Yes
5. How is cacao cultivation established? R/ <Other than monoculture>
6. Presents complementary/associated crops (C/A) that represent 26% of the farm's income or more.

	Cluster 1	Cluster 1	Cluster 1	Custer 2	Cluster 3	Cluster 3	Cluster 4	Cluster 4	Cluster 4
Questions	CESAR	GUAJIRA	MAGDALENA	SANTANDER	CÓRDOBA	ANTIOQUIA	CALDAS	TOLIMA	HUILA
Producers	153.00	20.00	69.00	198.00	66.00	243.00	117.00	150.00	67.00
Total area cocoa	359.60	45.70	115.60	614.55	189.70	379.60	288.96	406.20	167.30
1	25.49%	0.00%	2.90%	8.59%	3.03%	16.46%	14.53%	10.67%	0.00%
2	27.45%	5.00%	4.35%	62.63%	16.67%	18.11%	46.15%	25.33%	0.00%
3	9.80%	30.00%	2.90%	8.59%	50.00%	18.52%	11.97%	39.33%	7.46%
4	12.42%	35.00%	8.70%	11.11%	50.00%	21.81%	17.95%	44.00%	13.43%
5	64.05%	100.00%	95.65%	73.23%	96.97%	95.88%	48.72%	96.67%	97.01%
6	32.00%	20.00%	23.00%	17.00%	23.00%	37.00%	49.00%	11.00%	27.00%

## Annex 9: Matrix of quantitative vs. qualitative results

Subject	Cluster 1 Quantitative findings	Cluster 1 Qualitative findings	Cluster 2 Quantitative findings	Cluster 2 Qualitative findings
Technical support	<p>44% of producers currently receive technical assistance. Semi-annual technical assistance predominates.</p> <p>The largest provider of assistance is the associations.</p>	<p>Technical assistance providers: Fedecacao, Tayronaca Association (Pueblo Bello), Guardabosques de la Sierra (Santa Marta).</p> <p>Fedecacao provides technical assistance every 6 months or every year.</p>	<p>Approximately 19% of producers currently receive technical assistance, with monthly assistance predominating.</p> <p>The largest provider of assistance is Fedecacao.</p>	<p>Technical assistance providers: Fedecacao, Municipal Agricultural Technical Assistance Units (UMATA), Productive Alliance.</p> <p>Those who receive technical assistance from Fedecacao receive it at least 3 times a year.</p>
Certified planting material and nurseries	<p>The majority of growers in this cluster obtain planting material from their own nurseries (59%).</p>	<p>The producers obtain the materials from their own nurseries.</p>	<p>92.4% of the producers bring the planted material from other nurseries.</p> <p>82.3% responded that the nurseries from which they bring the material was certified by the ICA.</p>	<p>There are certified nurseries, but they are not reliable.</p> <p>Fedecacao has a nursery, and this one is reliable.</p>
Cacao marketing	<p>In this cluster, 74.8% of producers sell to associations and only 24.8% of producers sell to intermediaries.</p>	<p>In general, the producers sell their cacao to the associations and very little to the intermediaries because the associations give them better prices.</p>	<p>In this cluster 82% of producers sell to intermediaries and only 12% to Fedecacao.</p>	<p>Producers sell their cacao to intermediaries who eventually sell to Luker and CNCH, they also sell to Fedecacao.</p>
Pests and diseases	<p>40% of producers reported monilia as the most limiting disease.</p>	<p>One of the most common diseases is Monilia.</p>	<p>85% of producers reported monilia as the most limiting disease.</p> <p>80% of producers considered ants to be the most limiting pest.</p>	<p>Diseases with greater presence: Monilia</p> <p>Pests that most affect crops: mice, squirrels and woodpeckers.</p>

Subject	Cluster 3 Quantitative findings	Cluster 3 Qualitative findings	Cluster 3 Quantitative findings	Cluster 3 Qualitative findings
Technical support	<p>Approximately 43% of producers currently receive technical assistance, with monthly assistance predominating.</p> <p>The largest provider of assistance is the associations.</p>	<p>Technical assistance providers: Fedecacao, FAO, GIZ and Asoprodema.</p> <p>Those who receive technical assistance from Fedecacao receive it every 2 months and others receive it every 4 months. Those who receive assistance from FAO receive it every 4 months and from GIZ it is monthly.</p>	<p>Approximately 38% of producers currently receive technical assistance, with monthly assistance predominating.</p> <p>The largest provider of assistance is from the cooperative sector.</p>	<p>In Huila, producers receive assistance from Fedecacao and the Cacao Effect Program.</p> <p>In Caldas and Tolima, Fedecacao's technical assistance is deficient or non-existent.</p> <p>In Caldas, technical assistance is provided by Finanzfuturo once a month.</p>
Certified planting material and nurseries	<p>The majority of growers in this cluster obtain planting material from their own nurseries (61%).</p>	<p>There are no nurseries operating in Tierralta (Córdoba).</p> <p>In Valencia (Córdoba) there is only one nursery of the mayor's office and it is not certified.</p>	<p>The percentage of non-certified nurseries is higher than those certified by the ICA. (49.7% compared to 20.7%, respectively).</p>	<p>There are certified nurseries, but they are not reliable.</p>
cacao marketing	<p>93.5% of producers reported that they sell to associations and only 6.2% to intermediaries.</p>	<p>The producers sell their cacao to the associations. The associations sell to Luker, CNCH and Chocolates El Triunfo, they also export cacao.</p>	<p>80% of producers reported that they sell to associations and 17.6% to intermediaries.</p>	<p>The producers sell the cacao to the associations.</p>
Pests and diseases	<p>72% of growers reported monilia as the most limiting disease and 23% reported black spot as the most limiting disease.</p>	<p>Diseases with greater presence: monilia and black spot.</p>	<p>74% of growers reported monilia as the most limiting disease.</p> <p>45% of the producers reported black woodworm as the most limiting pest.</p>	<p>One of the most common diseases is monilia.</p> <p>Pests that most affect crops black and African snails</p>

## Annex 10: Identification of cacao sector stakeholders by cluster (focus groups)

Stakeholders	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Technical support	Fedecacao. Tayronaca Association (Pueblo Bello). Guardabosques de la Sierra (Santa Marta).	Fedecacao Municipal Agricultural Technical Assistance Units (UMATA). Alianza productiva.	Fedecacao Food and Agriculture Organization of the United Nations (FAO). GIZ. Asoprodeema.	Fedecacao. Efecto cacao (Fundación Luker). Finanfuturo.
Nurseries	Nurseries are made on the farm.	Fedecacao. Unreliable certified nurseries.	Nurseries are inactive (Tierralta). Nursery of the mayor's office (Valencia)	Unreliable certified nurseries.
Profit centers	Tayronaca Association. Asocajagua (La Jagua de Ibirico). Guardabosques de la sierra	There are 3 in Rionegro, but they are not functioning.  There are none at El Playón.	IntegraSinú (Tierralta). ActivaG10 (Tierralta).	There is no milling center (Victoria). Under construction (Belalcázar). Asoprocar (Rivera).
Marketers	Tayronaca Association. Asocajagua Guardabosques de la sierra Intermediaries who sell to CNCH.	Fedecacao. Intermediaries who sell to Luker and CNCH. Zurronas de Santander.	IntegraSinú. Activa G10 Asoprodeema (Valencia). Asocaval (Valdivia). Intermediaries.	Luker. CNCH. Asoprocar (Rivera). Asovica (Victoria). Aprocalg (Algeciras).
Producer associations	Tayronaca Association. Asocajagua Guardabosques de la sierra	Aromas de paz. Ríos de chocolate Zurronas de Santander.	IntegraSinú. Activa G10 Asoprodeema . Asocaval	Asoprocar Aprocalg Asopeca (Campoalegre). Asocatol (Chaparral). Asovica.

## Annex 11. Indicators Matrix

An independent Excel document provides a detailed presentation of the indicator matrix. Additionally, the primary tables are also presented here. It is important to note that, for all the information provided below sample weights are not used.

No.	Indicator Title	Type	Total Production (kg)	Unit of Production (ha)	Baseline (kg/ha)	Number of Participants
SI-1	Yield of targeted agricultural commodities among project participants with USDA assistance	Outcome				
Commodity (level 1)	Cacao		805,140	2,091.28	385.00	832
Commodity (level 1)	Avocado		8,800	8.80	1,000.00	8
Commodity (level 1)	Rice		2,822	1.00	2,822.00	2
Commodity (level 1)	Banana and plantain		30,307	8.24	3,678.03	12
Commodity (level 1)	Coffee		54,562	84.88	642.81	46
Commodity (level 1)	Citrus (mandarine, lemon and orange)		36,650	12.66	2,894.94	7
Commodity (level 1)	Corn		4,100	3.20	1,281.25	4
Commodity (level 1)	Grapes		8,800	1.50	5,866.67	2
Commodity (level 1)	Cassava		84,249	7.50	11,233.2	8

No.	Indicator Title	Type	Number of hectares (ha)
SI - 2	Technology Standard #2. Number of hectares under improved management practices or technologies that promote improved climate risk reduction and/or natural resources management with USDA assistance ( $\geq 75\%$ )	Outcome	
Total (level 1)			188.10



No.	Indicator Title	Type	Number of hectares (ha)
SI - 3	Technology Standard #3. Number of hectares under improved management practices or technologies with USDA assistance (>=75%)	Outcome	
Total (level 1)			4.75

No.	Indicator Title	Type	Number of producers
SI - 4	Technology Standard #4. Number of individuals in the agriculture system who have applied improved management practices or technologies with USDA assistance (>=75%)	Outcome	
Total (level 1)			2.00

No.	Indicator Title	Type	Number of Participants
SI - 5	Number of individuals accessing agriculture-related financing as a result of USDA assistance	Outcome	
Total (level 1)			259

No.	Indicator Title	Type	Baseline (COP)	Baseline (USD)	Baseline (kg)	Number of Participants
SI - 18 & 19		Outcome	Value of annual sales of farms and firms receiving USDA assistance (COP)	Value of annual sales of farms and firms receiving USDA assistance (USD)	Volume of commodities sold by farms and firms receiving USDA assistance	
Commodity (level 1)	Cacao		\$5,994,209,901 COP	\$ 1,601,445 USD	786,092	832

No.	Indicator Title	Type	Number of Participants
SI - 21	Number of individuals who have received short-term agricultural sector productivity or food security training as a result of USDA assistance	Outcome	
Total (level 1)			866

No.	Indicator Title	Type	Number of Participants
SI - 22	Number of individuals participating in USDA food security programs	Outcome	
Total (level 1)			253

No.	Indicator Title	Type	Number of producers	Average household members
SI - 23	Number of individuals benefiting indirectly as a result of USDA assistance	Outcome		
Total (level 1)			49.00	4.00

No.	Indicator Title	Type	Number of farms
CU - 3	Number of farms demonstrating improved landscape management	Outcome	
Total (level 1)			34

No.	Indicator Title	Type	Number of producers
CU - 8	Number of youth with increased capacity in agribusiness	Outcome	
Total (level 1)			24