Impact of coffee crop renewal program on small producers in department Cundinamarca (Colombia)

Impacto del programa de renovación de cafetales en pequeños productores en Cundinamarca (Colombia)

Carlos Andrés Guarín N.[1] and Fabio Alberto Pachón A.[2, 3]

ABSTRACT

The modernization of crops through renewal is a vital option for the restoration of the productivity and competitiveness of the coffee crop. The Federación Nacional de Cafeteros (National Federation of Coffee) is banking on a strategy that promotes renewal by providing resources to stimulate growers. As a result of the implementation of the program, it is hoped that it will reverse the aging process of coffee crops, consolidate a productive and competitive market, provide appropriate ages and densities and promote the use of coffee rust resistant varieties. Similarly, it is expected that small producers, who constitute the majority of farmers and who presumably suffer major limitations to independent renewal, will be the main beneficiaries.

Key words: technification, competitiveness, productivity, coffee varieties.

RESUMEN

La tecnificación de los cultivos a través de la renovación, constituye una decisión crucial para el restablecimiento de la productividad y de la competitividad de la caficultura. La Federación Nacional de Cafeteros le apuesta a una estrategia que promueve la renovación mediante la entrega de recursos para estimular la decisión del caficultor. Se espera, como resultado de la implementación del programa, revertir el proceso de envejecimiento de la caficultura, consolidando un parque productivo y competitivo, en edades apropiadas, con densidades adecuadas y con el uso de variedades resistentes a la roya. De igual manera, se espera que los pequeños productores, que son la mayoría de caficultores y de quienes se presume adolecen de mayores limitaciones para renovar autónomamente, sean los más beneficiados.

Palabras clave: tecnificación, competitividad, productividad, variedades de café.

Introduction

In response to the difficulties faced by the coffee sector in the nineties characterized by a sharp drop in international coffee prices and its subsequent effects on regions where coffee represents an important economic sector (e.g. reduction of income for farming families, impossibility of renewal or modernization of crops, reduced quality of life, among others), the National Federation of Coffee Growers intervened with the implementation of a strategy called "Program for Colombian coffee competitiveness through modernization" with the goal of restoring the income of producers and restitution of the competitiveness of the national coffee crop through renewal of aged coffee farms.

The nineties represented a critical juncture for the coffee industry. The elimination of market management instruments that producing countries maintained for 30 years led to a price war by industry players and disruption of production policies in countries, whose effects were reflected in the steep fall in international prices in subsequent years.

Disorderly and excessive growth in crops and coffee production, especially in countries like Brazil and Vietnam, had destabilizing effects on the market equilibrium. In reviewing the statistics of the International Coffee Organization (ICO), the lack of coordination and policy manifested itself in an increase of 21% in global production during the nineties, while global demand only grew 10% in the same period.

The decrease in revenue due to low coffee prices impacted Colombian coffee through a profound process of crop aging. Of course, lower incomes limit investment decisions, which affects the productivity of the farms.

Received for publication: 23 August, 2010. Accepted for publication: 1 March, 2012.

[1] Comité de Cafeteros de Cundinamarca, Federación Nacional de Cafeteros de Colombia. Bogota (Colombia).
[2] Department of Agronomy, Faculty de Agronomy, Universidad Nacional de Colombia. Bogota (Colombia).
[3] Corresponding author. fapachona@unal.edu.co

In fact, the behavior of coffee production throughout the nineties showed a downward trend, going from 14.1 million 60 kg bags at harvest in 89/90 to 10.6 million in 99/00 (Pizano, 2001), attributed to, among other reasons, the existence of aged coffee farms.

To address this problem, the institution decided to implement an intervention policy for aged crops as a tool to restore income and coffee production. The strategy, launched in 1998 by the National Federation of Coffee Growers, was called "Program for Colombian coffee competitiveness through modernization" and was aimed at encouraging the renewal of aged coffee farms through the introduction of resources. The resources devoted to the program amount to 25 billion Colombian pesos per year for the whole country.

The farmers have access to the program with the following requirements: possess aged cultivars (aged past their optimal output level: 9 years in the case of coffee produced in the sun and 12 years for shaded coffee production), located in an optimal area (between 1,200 and 1,800 m), and renew at least 400 plants (for farms under five hectares the renewed coffee may be up to one hectare, and for farms larger than five hectares, 20% of the total area is the maximum). After completion of these requirements, and after verification of the work, the incentive is given until depletion of the resources, as provided in the respective operating regulations.

The program seeks to consolidate a competitive coffee industry through renewal, a concept associated with "the ability of a producer to differentiate himself from other products, regions or countries; the differentiation may be due among other factors to the quality of the product, the amount thereof, the convenience of delivery, production or harvest periods, the ability to produce coffee under certain conditions (regional, organic, environmentally friendly, etc.), the exchange rate in the country, the infrastructure of roads and ports, among others" (Duque, 2002).

A crucial aspect of differentiation corresponds to the levels of production and productivity, since they determine cost. "Productivity" is defined as production levels (kg of dry coffee beans) obtained per unit of resources used (Arcila, 2007a). However, productivity levels are associated with the level of "modernization" of the crop, conceived as a set of practices and existing technologies, connected or associated with crop management during its production cycle.

In an effort to carry out the analysis, since the decision to renew encompasses a wide range of concepts related to modernization, three aspects that are considered crucial in perennial crops such as coffee, according to Duque (2002), were referenced:

First, the "age" of the coffee. Establishing renewal cycles is one of the most important decisions. Renewal stimulates the production capacity of the plant, which can be affected by aging, unnecessarily extending production cycles. Due to the growth of the coffee tree, production increases to a certain age, and then decreases (point of inflexion or slope change of the yield curve). Modernization unquestionably includes periodic renewal to establish high and constant production, since with free growth the plants present strong fluctuations in yields (Mestre and Arboleda, 1999).

Second, the use of resistant "varieties". The development of the Colombia variety, (and later the Regional Castle varieties) as a result of years of research, allowed the introduction of plants resistant to coffee rust (*Hemileia vastatrix*). The benefits to the farmer are manifold: eliminates the costs associated with disease management (Sierra and Montoya, 1993); avoids economic losses ensuring higher productivity (Farfán, 1998; Alvarado, 2002), and finally, increases grain quality, which has been sufficiently tested (Alvarado and Puerta, 2002).

Finally, maintaining "high density" brings undeniable advantages: high productivity, reduced erosion by full terrain coverage, low weeding costs, better use of resources and increased labor efficiency, to name a few (Arcila, 2007b). Duque and Bustamante (2002) demonstrated, in a study of the determinants of productivity, that sowing density, compared with other variables, had the highest partial elasticity, indicating that the largest changes in productivity depended on sowing density variations, or in other words, the percentage of increased sowing density will have the greatest effect on the percentage of increased productivity compared to the other variables studied by the model.

The model includes seven variables that were significant in productivity outcomes: availability of working capital, hectares of coffee, average lot age, average sowing density, labor (wages per hectare), kilograms of fertilizer applied per hectare, and the percentage of the property used for coffee. Although all showed positive relationships with respect to the response variable (productivity), the greatest response came from sowing density.

Consequently, this paper aims to determine the benefits of the implementation of the program during the years 2005 to 2008, in two ways: first, because small farmers account for

the largest proportion of farmers, it seeks to establish their participation in the overall resources for the program, and secondly, determine the impact on their crops in terms of strategic indicators of modernization (densities, varieties and age).

Methodology

To accomplish the proposed objectives, a detailed exploration of the SICA (Coffee Information System) platform was used as an official source of information on coffee production, with the aim of establishing and consolidating all comparative indicators for the study periods (area, farmers, densities, age, varieties), and in addition, we performed a thorough analysis of the files for the renewal program in the department of Cundinamarca. Finally, to analysis the impact the program implementation has had on small farms, we worked with aggregated results (averages) of the characteristics of the crops of the farmers that were found in both sources.

We chose the study period 2005 to 2008 because the information from previous years to 2005 does not possess the needed conditions and quality to establish the necessary comparison. Of course, the established period is short taking into account the perennial condition of the coffee crop which influences decisions about renewal and technological adoption; however, it can be a reference for further analysis.

Finally, although the classification of producers has many differences, this paper sets the size of the plantation for categorization as: small farmers (up to 5 ha of coffee), medium (greater than 5 and up to 10 ha) and large (greater than 10 ha).

As a supplement to the considerations, staff from the Servicio de Extensión y de la División Técnica del Comité de Cafeteros de Cundinamarca (Extension and Technical Division Service of the Committee of Coffee Growers of Cundinamarca) was informally interviewed.

Results and discussion

The impact of coffee renewal is considered in two aspects. First, the Cundinamarca department spent about $ 1.5 billion pesos annually during the four years of study. Since coffee growing in Cundinamarca is supported by small farms, as will be shown later, and since the conferred benefit is not exclusive, the involvement of these structures in total renewed area and resources has not been quantified. The emphasis is on small farmers not only because they represent most producers, but also because they suffer from a reduced ability to undertake the renewal processes. If the above is true, it must be assumed that they have been, or should be, the most benefited.

Secondly, the impact can be measured under the conditions of cultivation. Renewal processes of modernization bring determinant decisions for farms and farmers' incomes, such as the use of suitable varieties, optimum densities and timely renewal cycles (age). For this reason, the intention is to establish what changes benefit small farmers for these specific indicators.

Participation of small farmers in the renewal program

To establish the participation of small farmers in the program, for a first step, their participation in the productive structure of the department was defined.

TABLE 1. General indicators of coffee in Cundinamarca.

Year	Coffee total area (ha)	Producers	Farm size (ha, average)
2005	58,958.3	50,414	1.17
2006	51,022.3	40,931	1.25
2007	48,195.7	40,284	1.20
2008	48,989.1	41,593	1.18

Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC). Authors' calculation.

Cundinamarca has, on average, 50,000 ha, as seen in Tab. 1. During the years 2005 to 2008, changes in area and in the number of farmers were very low, another reason for the very short period of analysis. Initially, the average size demonstrates the conformity of a market sustained by small producers.

Crop participation by size, in total area and number of reported farmers (Fig. 1), shows that small farms (up to 5 ha) compose 98.2% of producers and contribute 86.6% to the planted area in the department, confirming their significant contribution to the market.

This evidence must affect the access that the distinct structures of the programs designed by the institutions can have.

In the case of the renewal program, of the 6 billion pesos for the program from 2005 to 2008 (Tab. 2), 87% actually reached small coffee farms. Participation included 95% of the registered farmers and 86% of the renewed area. Generally speaking, the program has clearly focused on small producers, but probably due to their majority position and not exactly due to an institutional decision.

When comparing the percentage of area of land intervened on by the program in each structure with respect to the

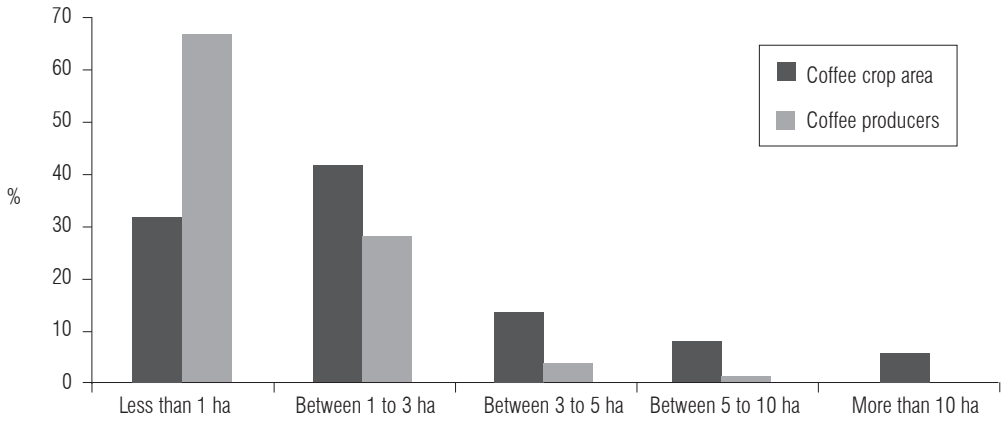

FIGURE 1. Distribution of area and farmers by size (average 2005/08). Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC). Authors' calculation.

TABLE 2. Program Participation by size (cumulative 2005/2008).

Crop size (ha)	Benefit producers (a)	Total coffee area (ha)	Coffee renewed area (ha)	Incentive total cost (millons Colombian pesos) (b)	Value for coffee producers (Colombian pesos) (b/a)
Less than 1 ha	9,009	5,170	2,756	2,213	245,665
Between 1 to 3 ha	7,239	12,618	3,194	2,452	338,693
Between 3 to 5 ha	1,433	5,446	822	619	432,240
Between 5 to 10 ha	665	4,523	506	381	572,782
More than 10 ha	288	6,457	571	421	1,463,542
Total	18,634	34,214	7,849	6,087	326,650

Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC) Years 2005, 2006, 2007 and 2008. Authors' calculation.

total area of coffee held, the result shows that of the 23,000 ha of benefited small farmers (those with up to 5 ha in coffee), 30% (6772 ha) has been renewed, while for the other structures the percentage was lower (11% for medium-sized producers, and 9% for large).

However, the average large farmer received 5 times more than a small one. These differences may arise from the area restrictions of the regulation, and may correspond to the renew decision of small producers to not contemplate the possibility of intervening on the entire crop, since this would decrease their ability to generate revenue.

While it is true that under the initial analysis small coffee farmers benefited the most by concentrating a greater share of resources and renewed area, the participation rate of those farmers with respect to their total registered number in each year reflects a different situation (Tab. 3).

As noted, the program was used by an average of 10% of total registered small farmers in the study years. For the same period, about 30% of medium and nearly half of large (44%) farmers participated in the program annually. The reality is that, with the small producers representing such a significant proportion, it is expected that the program's coverage will not reach the desired values. As an interim conclusion, it can be established that small producers represent a majority of users of the resources for the program, but since it is a world of big farmers, the coverage of the program is tiny.

TABLE 3. Ratio of total number of producers to beneficiaries by size.

Crop size	Total producers per year				Benefit producers per year				Participation average (05/08)
	2005	2006	2007	2008	2005	2006	2007	2008	
Less than 5 ha	49,488	40,106	39,602	40,961	4,521	5,251	3,840	4069	10.4%
Between 5 to10 ha	728	646	542	501	228	165	131	141	27.5%
More than 10 ha	198	179	140	131	108	72	45	63	44.4%
Total	50,414	40,931	40,284	41,593	4,857	5,488	4,016	4,273	10.8%

Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC) Years 2005, 2006, 2007 and 2008. Authors' calculation.

It is also relevant to frame the above results in the global scope of the coffee sector and the possible repercussion of the consolidation of a modernized and competitive production market.

Renewal processes are not determined exclusively by the implementation of the program. Some farmers renew their crops themselves without relying on the resources allocated in the program. The possibility and the ability of the farmers to make this decision independently has been the subject of many discussions within the coffee institution.

For many analysts, renovation is part (or should be) of the technology package developed by Cenicafé, reason enough to prevent farmers from depending on resources, which could create a culture of welfarism for crucial decisions. One of the recommendations of the Comisión de Ajuste de la Institucionalidad Cafetera on this topic was: "regarding the renewal program that provides subsidies, there are questions as to its nature as a public good. The Commission considers that these programs should be integrated with technical assistance to the extent they are part of the technology transfer package that seeks greater competitiveness for the coffee crop and not through the provision of direct incentives. In the past, to the extent that these programs encouraged and subsidized, there was a distortion of market signals and direct interference in the private decision making of producers... In that vein, the Commission recommends suspending the incentive for coffee renewal..." (Silva *et al*., 2002).

On the other hand, renewal involves investments that are not available to the small farmer, and in that sense, removing the incentive could mean a stagnation of renewal and a probable loss of competitiveness for coffee.

The incidence of the departmental renewal program, as shown in Tab. 4, is not negligible. On the contrary, it can be assumed that the program determines a good percentage of annual renewals (70%). While it is true that the percentage of areas renewed under the program has decreased slightly, it can be concluded that the decision is not being made independently as hoped.

The consequences of such a close relationship can be detrimental to the competitiveness of coffee: prompting a welfare culture that has not internalized the benefits of renewal, and, as explained above, eliminating help can generate unexpected difficulties in productivity and competitiveness.

It is noteworthy that there is a greater propensity for small producers to decide to renew independently (Tab. 5): as the size of the crop grows, increasing the ratio of renewal by the program. This result counters the argument that small farmers, due to their income, face greater difficulties in renewing.

TABLE 5. Renewal ratio by size (cumulative 2005/08).

Crop size	Cumulative renewed (ha)		
	Total (a)	By programm (b)	Ratio (b/a)
Less than 1 ha	4,180	2,756	65.9%
Between 1 to 3 ha	4,684	3,194	68.2%
Between 3 to 5 ha	1,092	821,7	75.2%
Between 5 to 10 ha	569,1	506,0	88.9%
More than 10 ha	589,8	571,1	96.8%
Total	11,114	7,849	70.6%

Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC). Authors' calculation.

TABLE 4. Ratio of annual renewals and program participation.

Producers	**2005**	**2006**	**2007**	**2008**	**Average**
Total renewed (ha)	2,349	3,008	2,837	2,912	2,779
Renovation by programm (ha)	2,067	2,225	1,701	1,856	1,962
Total producers who renewed	5,423	6,920	6,199	5,720	6,066
Total producers who renewed by programm	4,857	5,488	4,016	4,273	4,659
Percentage renewed by programm (ha)	88.0	74.0	60.0	63.7	70.6
Percentage producers who renewed by programm	89.6	79.3	64.8	74.7	76.8
Small producers	**2005**	**2006**	**2007**	**2008**	**Average**
Total renewed (ha)	2,093	2,725	2,595	2,678	2,523
Renovation by programm (ha)	1,691	1,950	1,517	1,615	1,693
Total producers who renewed	5,240	6,729	6,016	5,565	5,888
Total producers who renewed by programm	4,521	5,251	3,840	4,069	4,420
Percentage renewed by programm (ha)	80.8	71.5	58.5	60.3	67.1
Percentage producers who renewed by programm	86.3	78.0	63.8	73.1	75.1

Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC) Years 2005, 2006, 2007 and 2008. Authors' calculation.

One reason for the above trend could be the area restriction established by the program. However, it is not clear that the regulation is linked to this behavior. What is clear is that small farmers, in the light of these figures, have understood the need to make better decisions without exclusive attachment to renewal incentives, contrary to what happens with the larger farmers, where the level of dependence is greater.

Impact of the program on crop modernization of small farmers

After verifying that indeed small farmers constitute the largest percentage of participation for total approved resources, renewed area and producers who have agreed to the renewal program for the years 2005-2008; it is essential to analyze what impact this participation has had on characteristics of the crop in terms of age, density and variety; criteria related to modernization and the pursuit of competitiveness for coffee.

To avoid distorting the findings detailed here, the analysis was performed only with small-scale farmers who have accessed the program at least once during those years and renewed part of their crops.

The deductions from the figures are only a partial reference for the real impact access to this program has had for farmers, since the period of analysis is short. However, some trends can be identified that will serve as reference for future studies.

The testing procedure was to review the information given by the SICA platform and compare it with the files of small growers who participated in the renovation program. Subsequently, SICA information was screened for 2005 and 2008 to determine which farmers had complete information (specifically age, variety and density indicators) for comparison as to the variation that may occur in these indicators. Finally, we worked with aggregated results (averages) of the characteristics of the crops of the farmers that were found in both time periods.

Because SICA was still perfecting the platform in 2005, many farmers who renewed in subsequent years (2006-2008), did not have complete information for that year, preventing the comparative performance of the entire scope of registered farmers as beneficiaries of the program (17,681 cumulative 2005/2008). Only 44% of these growers had complete indicator crop structures. That is, the results shown below correspond to data collected from 7,770 small producers.

According to Tab. 6, the increase in area under cultivation can be considered a primary benefit. Although this variation is minimal (2%), changes presented in the use of varieties within farms is significant: 23% reduction in typical variety area, representing an increase in variety Caturra (5%) and a significant increase in 'variety Colombia' area (12%).

TABLE 6. Consolidated variety area*.

Coffee crop (ha)	2005	2008	Change (%)
Total area	12,594	12,850	2.0%
Tipica area	2,701	2,083	-22.9%
Caturra area	4,889	5,147	5.3%
Colombia area	5,004	5,620	12.3%

* For 7,770 small producers.
Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC). Authors' calculation.

It is worth noting that the use of variety Caturra, susceptible to attack by coffee rust and prone to difficulties arising from the disease (cost, volume and quality), still represents a valid option to many. The Servicio de Extensión del Comité Departamental considers that this trend may be due to cultural conditions of fear of risk until other farmers blaze the path and demonstrate the benefits of adopting new technology.

Another way to establish the benefits can be checking the "level of adoption" (Tab. 6), a concept related to the percentage of area for the variety. In this case, 44% of the study area is planted with 'Variety Colombia', with a variation of 10% in four years. Having almost half the area for this variety and with such growth rates in such short periods is a good indication of adoption. But it would be interesting to analyze the rate of adoption of the farmers, which would depend on statistical analysis over longer periods of time, at least 20 years.

TABLE 7. Participation by variety in the total study area*.

Variety use (%)	2005	2008	Change (%)
Típica	21.4	16.2	-24.3
Caturra	38.8	40.1	3.4
Colombia	39.7	43.7	10.1

* For 7,770 small producers.
Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC). Authors' calculation.

As for the status of the other two variables, average density and age, the results of the coffee renewal program (Tab. 7) show a change in their representative structures.

While it is true that the average density increased slightly (5%), the variation in the average age is significant for all varieties.

The process of modernization is especially reflected in indicators such as age (timely renewal cycles) due to its relationship with the productive capacity of the plant, and the population of trees per unit area (density) since this variable is especially related to farm productivity (Duque and Bustamante, 2002).

TABLE 8. Average age and density of the total study area*.

Average ages variety (years)	2005	2008	Change (%)
Típica	28.8	22.6	-21.5
Caturra	10.4	6.5	-37.5
Colombia	9.9	6.1	-38.4
Average density area**	**2005**	**2008**	**Change (%)**
Plants/ha	4,233	4,460	5.4

* For 7,770 small producers; ** Density is related with total area.
Source: Coffee Information System (SICA). Committee of Coffee Growers of Cundinamarca (FNC). Authors' calculation.

Overall, it can be argued that the strategy of modernization through the Coffee Farm Renewal Program has brought many benefits to small farmers who have accessed it, at least, concerning the indicators studied here. On one hand, the mean area of their farms for use with Variety Colombia has grown significantly, demonstrating a significant level of adoption, which can be strengthened in the coming years.

In addition, the improvement of the indicators of average age and average crop density demonstrates the positive impact that the presence of the program has had, stimulating modernization of the coffee crop.

Conclusions

By way of conclusion we can say that the timely renewal of crops is a crucial decision that restores the productive capacity of the plant and can maintain long-term stable production.

Although the "Program for Colombian coffee growing competitiveness through modernization" has contributed substantially to the reversal of the aging process of coffee production, it has also generated undisputed reliance on a decision that hopefully will be made independently by the producers (about 70% of the total area renewed in Cundinamarca is done this way). Removal of the program would likely be detrimental to the sustainability of the sector in the long term, and paradoxically, while increasing the size of the crop, would increase reliance on incentives for the renewal: in the total renewed area by small producers each year, 30% is done independently, meanwhile, for medium and large producer 11% and 3% are renewed without incentive, respectively.

This allows us to infer that small producers have internalized the benefits of the renovation, consolidating a positive culture at the time the help is discontinued. On the other hand, medium and large producers use the program for renewal decisions, with a high degree of dependency.

It can be argued, in general terms, that small farmers are the main beneficiaries of the program: 87% of the resources are appropriated for them, and they make up 95% of registered growers and 86% of the total renewed area. However, if these numbers are transferred to the coverage of the program with the total number of reported farmers for this activity, the results are not very encouraging: on average, the program serves 10% of all small farmers, 30% of medium and 44% of those considered large.

Finally, it is unquestionable that the program has brought benefits to farmers who have participated. Despite the short period of analysis, production systems have improved in conditions of modernization, at least for the studied variables (age, variety and density).

The benefits are summarized as follows: increase of 2% of the total planted area; significant increase in the use of coffee rust resistant varieties (12% increase in the area cultivated with Variety Colombia); increase in average sowing densities (5%), and decreased average age of the coffee (about 35%).

It is interesting that despite the introduction of coffee rust-resistant varieties (Colombia and Regional Castillo), variety Caturra still has a place with farmers (up to 5% of the area for this variety). The Servicio de Extensión del Comité Departamental considers this to be due to risk aversion of the producers. Somehow, the Caturra variety has generated confidence with them (relatively good production levels), and they assume that it is a variety better suited to the topographical conditions that occur in the growing areas.

Acknowledgements

The authors thank the following persons who contributed substantial guidance, reviews and information for the development of the document: Dr. Anyul del Pilar Mora, manager at (SICA) in the Department of Cundinamarca; Dr. Alejandro Vacca, statistician at Gerencia Técnica de la Federación Nacional de Cafeteros, and the team at División Técnica del Comité de Cafeteros de Cundinamarca, headed by Dr. Luis Francisco Useche.

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