

Socio-Environmental Impacts of *Certifica Minas Café* Program on Coffee Plantations in Southern Minas Gerais

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Abstract

The *Certifica Minas Café* (Minas Coffee Certification) is the only public program in Brazil for coffee plantation certification. Therefore, this study aimed to evaluate the environmental and social impacts, as well as the best production practices on the properties that adopted the *Certifica Minas Café* certification program. The research sampled 46 certified properties, which were evaluated in the years 2013 and 2015, based on the same criteria used in the official audits of the program. The results demonstrate that certified properties tend to show significant improvements in the criteria for property management and capacity building of rural workers. On the other hand, certification adoption did not show significant changes in traceability and environmental responsibility despite the reduction of agrochemical pollution found on certified farms. The research also pointed out the challenges faced by program managers. However, we affirm that the Minas Gerais certification program is helpful, but adjustments are necessary to meet the objectives of sustainable coffee production.

Keywords: agricultural certification, coffee farms, sustainable agriculture

1. Introduction

Coffee certification has been considered the main strategy to reverse undesirable trends in the sector associated with adverse environmental impacts. The pressure on coffee farmers to adopt sustainable initiatives has led them to acquire environmental certification. This strategy has reached the major producing regions in the world, including developing countries (Ochieng, Hughey & Bigsby, 2013).

In Brazil, there are different certification standards: Rainforest Alliance, Organic, Nespresso AAA, 4C (Common Code of the Coffee Community), UTZ Certified, Fair Trade, Global gap, Starbucks C.A.F.E. Practices, *Certifica Minas Café*, Certification of Origin and Brazilian Specialty Coffee Association – BSCA. The plurality of certifications and seals has been identified as an obstacle to producers regarding the system to be adopted. This makes it difficult for consumers to choose the brands and seals available on the market (Pinto & Prada, 2008).

Coffee cultivation in Brazil is characterized by smallholder farming, with numerous and geographically dispersed producers, as it occurs in several countries such as Nicaragua and Costa Rica (Blackman & Naranjo, 2012). Thus, for small producers, auditing-based certifications, in addition to being considered bureaucratic and without technical assistance, are often not feasible due to the high cost (Flaten, Lien, Koesling & Løes, 2010; Vriesman, Okuyama, Rocha & Neto, 2012).

This research aimed to study one of the coffee certifications directed to cultivation, the *Certifica Minas Café* - CMC. It is the only agricultural certification in Brazil managed by the state public authority. Unlike other certifications, CMC has a significantly lower cost and prepare producers to apply certification requirements, which may explain the accelerated spread of CMC and the accession of small farmers.

In 2007, the first year of the program, there were 40 certified properties, and in December 2014, it reached the mark of 1,487 certified farms. In 2015, there was a decrease in the number of certifications; currently it has 1,378 certifications (Instituto Mineiro de Agropecuária [IMA], 2015). Due to these data, some questions arise: Does CMC bring improvements in the management of socio-environmental aspects and good production practices for the rural properties that adopt it? What viability of its continuity as a public policy and its dissemination to other regions and products considered strategic for development? Coffee farms in the South of Minas Gerais were

evaluated, a region with the highest number of certificates (56.5%). The sample analysed consisted of farms certified for the first time in 2013. It compared the situation of these properties in 2015 based on the criteria used in the certification audits.

The approach of this research was social-environmental, including the requirements of the standard and aspects related to soil conservation, water resources and waste disposal, working conditions, training, and capacity building. In addition, it was concerned with assessing the impacts of certification on good production practices, involving care in soil preparation, planting maintenance, harvesting, and post-harvesting.

This paper is structured in four sections in addition to this introduction. In the first section, relevant data are presented for the understanding of the CMC structure, the procedures, and the criteria adopted for the certification of coffee properties. Then, the adopted methodology is presented. In the third section, the results are presented. Finally, in the fourth section, the results are discussed, followed by the conclusions.

2. Literature Review

2.1 Coffee Production in Brazil

Data for 2016 point to Brazil as the world's largest producer of *Coffea arabica*, with 30.2% of production, followed by Vietnam (19.2%) and Colombia (9.4%). Brazilian production reached 43.2 million bags in the 2015 harvest, in a production area of 1.92 million hectares. It is the fifth product of Brazilian agribusiness, reaching revenues of 6.158 billion dollars in exports in 2015 (Ministério da Agricultura e Pecuária [MAPA], 2016). In 2016, the *C. arabica* harvest grew by 18.4%, jumping from 1,993,444 tons in 2015 to 2,359,937 tons that year. There was also a 16.8% increase in the average production yield, which in the current harvest is estimated at 1,579 kilos per hectare (Instituto Brasileiro de Geografia e Estatística [IBGE], 2016).

It is worth mentioning that the state of Minas Gerais is the largest producer of *C. arabica* in Brazil, a position that it has assumed since 1980. The current production is estimated at 28 million and 181 thousand bags of coffee in the 2016 harvest, which corresponds to 69.98 percent of the national production. The south of Minas Gerais is the largest producing region of the State, with 37.1% of the national production (MAPA, 2016). In addition, Minas Gerais has the largest planted area with 1,000,000 hectares and the largest production with 30,000,000 bags.

2.2 Certifica Minas Café

The objective of the *Certifica Minas Café* program is to certify the coffee farms in the State of Minas Gerais, expanding its insertion in the national and international market (Dutra, 2009). CMC is coordinated by SEAPA - Secretariat of State for Agriculture, Livestock and Supply. The operational part is developed by EMATER – Technical Assistance and Rural Extension Company of the State of Minas Gerais (which promotes guidance to producers in adjusting the properties to the program requirements) and by IMA – Agriculture Institute of Minas Gerais - (which accounts for the audits of the program).

One of the advantages of the program is to be low cost to the producer. This aspect may justify the profile of producers joining the program, where most certified plantations have up to 16 hectares (Silveira, Dias, Carli & Melo, 2013). Federal Law 8629 (Brazil, 1993) classifies properties as smallholding, small, medium, or large, based on the number of fiscal modules. The fiscal module, in turn, is defined by Special Instruction no. 20, dated 05/28/1980 (*Instituto Nacional de Colonização e Reforma Agrária* [INCRA], 1980), varying the fiscal module for each Brazilian municipality. Smallholdings and small properties correspond to 73.8% of the total certifications, thus confirming the profile of the producers identified in the study by Silveira et al. (2013). Although the program reached 1,487 properties in 2014, it is still little disclosed among producers of the State of Minas Gerais. Silveira et al. (2013) reported that 78.9% of the producers associated with a cooperative did not know any certification program, while only 12.7% knew the *Certifica Minas Café* program.

The involvement of independent audit companies is crucial for the reliability and effectiveness of certification (Blackman & Naranjo, 2012; Palmieri, 2008). However, certification and maintenance audits in CMC, carried out by independent conformity assessment bodies, started to be carried out by IMA only as of 2014, putting in question the reliability of the certification. To solve this problem, the certification developed specific procedure to ensure impartiality through the internal and external evaluation of the auditors involved, implementation of confidentiality terms, training sessions and auditor casters in each region. Auditors are admitted into the program through extensive recruitment public tendering. They are prohibited from performing private consultancies to clients of the program and having family, commercial, employment, administrative or any other link with the producers audited, among other aspects (Minas, 2015).

In addition to being unprecedented by the governmental initiative, the CMC raises positive considerations. Among them, affordable costs, improved property management, more efficient use of available resources, improved

working conditions for farmers, improved market prices, and a consequent improvement in farmers' income (Dutra, 2009; Silveira et al., 2013; Sousa, 2011). On the other hand, some criticisms are also presented as for example: questioning about the acceptability of certified coffee in the foreign market, considering the references of the certifying body (Dutra, 2009). The most severe criticism refers to the use of inputs on properties certified by the CMC. Research conducted by Sousa (2011), comparing certified and uncertified properties in the *Montanha de Minas* region, concluded that certified properties spend more inputs than similar, uncertified properties (Sousa, 2011).

2.3 Certification Procedure

The certification is structured through procedures and forms, some of which are available for public consultation by IMA. For this Section, other applicable documents provided by the managing body were used.

The path to be taken for certification is simple: the interested property must fill out an application to be delivered to the local EMATER office. The request is analysed and when there is viability of service, the property is included in the program. Each admitted property signs an accession contract and begins to receive technical assistance to know and apply the CMC requirements. After a year, on average, the property qualifies for the certification audit (Empresa de Assistência Técnica e Extensão Rural do Estado de Minas Gerais [EMATER], 2011).

In the certification audit, the property must meet a minimum of 80% of the program requirements. All properties are evaluated. The audit uses a specific form for the work, identified by the acronym F.GEC.055 (Minas, 2016). Ninety-five items are verified, 16 are considered recommendable, 52 items are considered restrictive and 27 mandatory items, receiving relative weights, according to this classification. During the verifications, the auditors assign an evaluation for each item that can be "zero", when the item is nonconforming; "one" for compliance cases; or "NA" when the item does not apply to the audited property. Nonconformities may occur only on restrictive and recommended items. Certification will only occur when: the total compliance percentage is equal to or greater than 80 percent and when the required items are fully met.

The 95 CMC verification items are organized into six groups, two of which add up to 11 subgroups and the other groups do not have any subdivisions.

The certification methodology establishes that the auditor has no decision-making power over certification, which is only recommended. In this case, the decision is the responsibility of the Certification Management, a collegiate body created under the Ministry of Agriculture, whose operation is governed by specific rules. In case of a tie, the decision is up to the manager. In any case, the decision will be recorded in the proper form containing the result and the descriptive of all the evidence and auxiliary documents (field reports and reports) that supported the decision. Table 1 shows the consolidation of all verification items, according to the classification of groups and items given by the CMC standards.

Table 1. Classification of verification items and groups of *Certifica Minas Caf *

Group	Subgroup	Required	Restrictive	Recommended
Plantation	Propagation material	1	1	0
	Cultivation areas	2	8	2
	Chemical control of pests, diseases and weeds	5	5	0
	Irrigation	1	1	1
	Harvest and post-harvest	0	8	2
	Traceability	Single	4	4
Environmental responsibility	Environment legislation	0	1	1
	Soil conservation	0	3	0
	Water Conservation	2	4	4
	Air conservation and reduction of CO ₂ emissions	1	2	1
	Biodiversity conservation	1	0	0
	Proper disposal of waste	1	2	1
Social responsibility	Single	6	8	1
Capacity building	Single	0	9	0
Property Management	Single	1	1	0
TOTAL		25	57	13

Source: Prepared by the author- form F.GEC.055, of the CMC

If the deliberation for certification implies additional information or pronouncements from institutions with a notable expertise in the subject, it may be postponed until such information is obtained and considered in the analysis.

3. Methods

The survey included data from the annual certification audits for the years 2013 and 2015 in 46 farms with the same certification time and who owned all data referring to properties in the evaluated time. The choice of properties was randomly obtained, but the years were chosen due to the greater homogeneity of the data. Properties located in the southern region of Minas Gerais were chosen because it is the largest producing region in the state and accounts for more than 56 percent of the total properties certified by CMC.

As the purpose of this research was to evaluate the impact of certification on certified properties, it was decided to evaluate each property based on the same criteria adopted by the program. The methodology adopted by CMC implies the establishment of relative weights for each verification item, being the greater weight for items considered mandatory and the lower weight for recommended items. To determine the total in each group and subgroup, the assigned scores were withdrawn from each audit form, recording the percentages obtained. The scores for each property were compared in the years covered by the study. The score assigned to each group and the general score were submitted to the paired Student's T-test, a parametric test to determine whether two sets of scores from the same individuals (data in 2013 and 2015) do not show differences in relation to the average. The null hypothesis is that certification does not change the outcome of property evaluation.

All the verification items, in turn, were submitted to the McNemar Test to evaluate the degree of disagreement between the indicated years, in order to clarify which subgroups and items would be contributing to the final result of the group to which they belong (Pagano & Gauvreau, 2010). Regarding the McNemar Test, the discordant values (0 or 1) were arranged in a 2x2 contingency table. The null hypothesis (H₀) is no mismatch in the proportion of results. The test calculates the p-value, being considered significant when smaller than 0.05, rejecting the null hypothesis and confirming the alternative hypothesis (Pagano & Gauvreau, 2010). In obtaining data for the McNemar Test, the evaluations classified as not applicable by the auditors were disregarded. Statistical calculations were performed using the BioEstat software version 5.0 (Ayres, Ayres, Santos & Ayres, 2007).

4. Results

The average scores of the rural properties inserted in CMC, considering the sum of the scores obtained in each group of verification items evaluated in 2013 and 2015, changed little. However, T-test points out that this change cannot be considered significant. The results corroborate others obtained in previous quantitative research (Arnould, Plastina & Ball, 2009; Blackman & Rivera, 2011).

Among all the groups of verification items studied, the group "Plantation" (G1) was the only group that presented negative modification considered significant. The data indicate a worsening in average scores, when comparing 2013 and 2015. On the other hand, "Capacity building" (G5) and "Property Management" (G6) groups showed significant improvements over the years indicated. The "Traceability" (G2), "Environmental Responsibility" (G3) and "Social Responsibility" (G4) groups did not change significantly (Figure 6). Table 2 contains the numerical data of each of the charts presented in this section, referring to the general results and the results of each of the indicated groups.

Table 2. Overall results of the CMC groups, obtained by Student's T-Test

Group		Q3	Q1	Average	Standard Deviation	Average	p-Value
Plantation (G1)	2013	34.7000	32.3000	34.2000	2.1540	33.4140	< 0.001
	2015	33.8750	29.9750	32.6000	3.8140	31.8510	
Traceability (G2)	2013	10.9800	9.4475	10.0700	0.9690	10.1474	0.4616
	2015	10.5275	9.3250	10.1500	1.0551	10.0255	
Environmental responsibility (G3)	2013	22.4100	20.2600	21.9250	2.8118	20.7255	0.6978
	2015	22.0850	20.2500	21.3300	1.9209	20.8826	
Social responsibility (G4)	2013	17.7850	14.5000	16.5100	2.5363	16.0798	0.3577
	2015	18.5750	15.5850	16.7150	2.5431	16.5286	
Capacity building (G5)	2013	7.5325	2.5525	5.9750	2.9418	5.2652	0.0102
	2015	7.3275	5.0600	5.7600	2.2077	6.2807	
Property Management (G6)	2013	2.8850	1.8500	2.4000	0.6109	2.4436	0.0234
	2015	3.2575	1.8600	2.8600	0.6826	2.6912	
CMC TOTAL	2013	97.6125	89.7000	92.0500	3.9705	93.0498	0.2077
	2015	95.7000	88.3500	93.5000	4.7339	92.0955	

From the data consolidated in Table 2, Box Plot graphs were elaborated for each group and for the overall certification result (Figures 1 and 2).

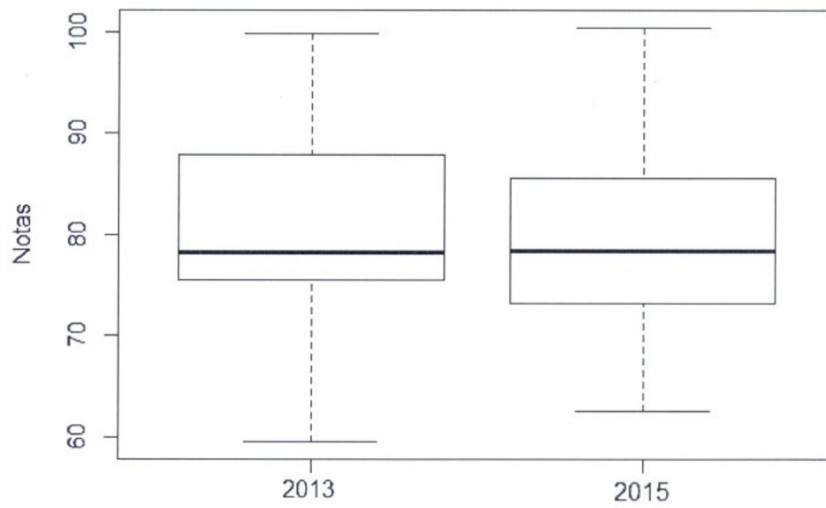


Figure 1. Boxplot of CMC scores for farms in 2013 and 2015

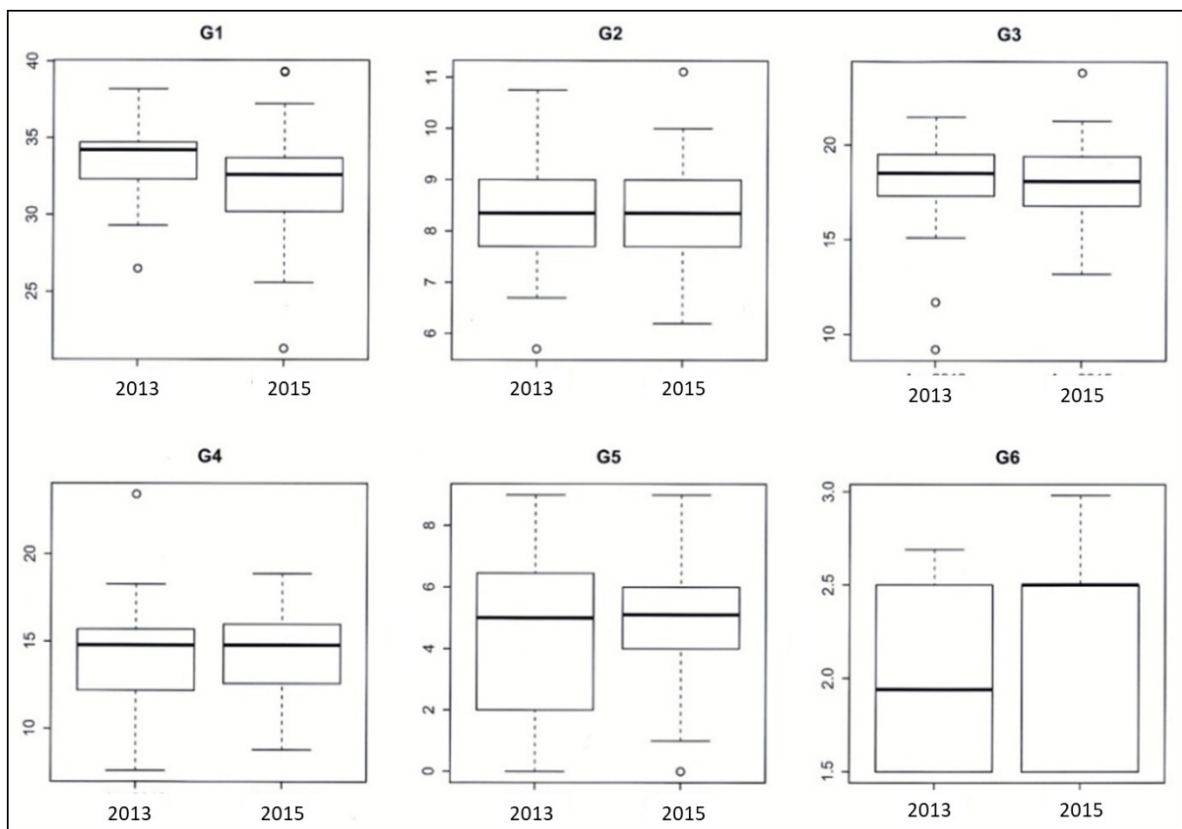


Figure 2. Boxplot of CMC scores by groups for farms in 2013 and 2015. "Plantation" (G1), "Traceability" (G2), "Environmental Responsibility" (G3), Social Responsibility" (G4), "Capacity building" (G5) and "Property Management" (G6)

4.1 Analysis of the Items of Each Group

The McNemar test allows observing which verification items and subgroups are contributing to the results of each group. This is possible by varying the number of compliant and noncompliant situations in a comparison between 2013 and 2015. In the survey, all CMC verification items were submitted to the McNemar test. However, only a few of them have been reproduced in this article, in the face of the discussions made here. Figure 3 shows the selected results.

Growing area (1.2)		2015		valor-p=0.0005	Pest and disease control (1.3)		2015		valor-p=0.0225		
		noncompliant	compliant				noncompliant	compliant			
2013	noncompliant	13	16	2013	noncompliant	0	11	2013	noncompliant	0	5
	compliant	44	420		compliant	2	416		compliant	9	21
Animals - Prep and drying area (1.5.9)		2015		valor-p=0.0010	Registration and marketing (2.6)		2015		valor-p=0.4240		
		noncompliant	compliant				noncompliant	compliant			
2013	noncompliant	1	0	2013	noncompliant	0	5	2013	noncompliant	0	5
	compliant	11	29		compliant	9	21		compliant	9	21
Environmental licensing (3.1.1)		2015		valor-p=0.1094	Workers eating area (4.13)		2015		valor-p=1.0000		
		noncompliant	compliant				noncompliant	compliant			
2013	noncompliant	34	8	2013	noncompliant	6	4	2013	noncompliant	0	11
	compliant	2	2		compliant	3	30		compliant	0	35
Sanitary facilities (4.14)		2015		valor-p=1.0000	Volume measurement (4.15)		2015		valor-p=0.0010		
		noncompliant	compliant				noncompliant	compliant			
2013	noncompliant	7	4	2013	noncompliant	0	11	2013	noncompliant	0	11
	compliant	4	29		compliant	0	35		compliant	0	35
Training - Pesticides (5.7)		2015		valor-p=0.038	Training- Pests and diseases (5.9)		2015		valor-p=0.0020		
		noncompliant	compliant				noncompliant	compliant			
2013	noncompliant	3	8	2013	noncompliant	13	9	2013	noncompliant	13	9
	compliant	1	34		compliant	1	23		compliant	1	23

Figure 3. McNemar’s test to compare CMC subgroups in the years 2013 and 2015

In subgroups 1.2, 1.3, 4.15, 5.7 and 5.9, it was observed that the certification provoked modifications, whereas in subgroups 1.5.9, 2.6, 3.1.1, 4.13, and 4.14, no differences were observed due to CMC.

5. Discussion

Among the six groups that contain the 96 verification items of the CMC standard, only for the group "Plantation" it can be stated that the mean scores awarded in 2015 are lower than the averages in the year in which the properties were certified. The group "Plantation" consists of five subgroups and 37 verification items, of which 9 are mandatory, 23 are restrictive and 5 are recommended. It has its focus on the production of coffee. To find an answer to this Group's outcome, the McNemar Test conducted the survey looking at the subgroups "Cultivation Area" (1.2), "Harvest and Post-Harvest" (1.3), and item 1.5.9, "Presence of animals in the drying areas". The other items of the group were not significant.

The subgroup "Cultivation area" contains 12 verification items, including 2 mandatory, 8 restrictive and 2 recommended. The proposal of certification in this subgroup is to evaluate the performance of farms in the organization aspects of soil occupation, by identifying maps and sketches of the lands and fields, which must also be identified in their field sites. All plots are expected to have soil fertility checked and at least one leaf analysis per year carried out on the property. Foliar fertilization, liming and fertilization of the soil should only be done by technical recommendation, duly verified in the records of these activities. The applications of limestone and soil fertilization should also be recorded per glebe or plot, indicating the products used the quantities and the accomplishment dates. The application equipment should be in perfect condition and there is a recommendation regarding the use of organic fertilizers whenever possible. None of the verification items of this subgroup presented variation that, alone, could be considered as significant. However, the items involving the performance of the activities through technical recommendation, or based on laboratory tests, were those that had the worst results, indicating that they contributed to the negative result of the Group "Plantation". As observed in Table 3, the subgroup 1.2, a total of 44 verification items considered as compliant in 2013, are no longer in compliance in 2015. And among these, 43 items are related to the provision of technical assistance for liming and soil fertilization

activities. These data seem to corroborate with research associating the decrease in the use of technology in coffee plantations in times of lower prices, especially affecting the activities of fertilization and phytosanitary control (Demoner, Sepulcri, O., Barori, S. A. & Matsushita, M. 2003). Nevertheless, data collected and disseminated by private certifiers try to demonstrate that there is a progressive adoption of more sustainable practices related to soil health and the use of fertilizers (Milder & Newsom, 2015). However, this assertion cannot be confirmed in this research.

In fact, the provision of technical assistance is a determining factor in the search for certification by rural producers (Barham & Weber, 2012). However, in the case of *Certifica Minas Café*, the assistance offered by EMATER does not include soil and foliar laboratory analyses to guide the activities of calcareous application and fertilization. Considering the profile of producers who join CMC and the permanent assistance of EMATER, not carrying out laboratory tests may be more associated to access to technical means than to the lack of knowledge of the advantages of using them. As these activities are not mandatory for certification, they do not seem to arouse the interest of producers in investing financial resources for their systematic and constant realization.

The expansion of technical assistance to include laboratory reports and laboratory studies that address soil care is considered to be one of the most critical issues in the sustainable development of coffee growing, in view of the necessary investments by both the private and public sectors (Potts et al., 2014). This may be the probable explanation for the results obtained in this item, confirming researches carried out in coffee plantations in Rwanda (Africa), where it was found that Fair Trade certification does not have a strong effect on the change in agricultural practices (Elder, Zerrieff & Le Billon, 2013), especially when such changes depend on producers investments.

Subgroup 1.3 consists of 10 verification items, 5 of which are mandatory and 5 restrictive. All items are related to the use of agrochemicals, requiring the purchase of products registered and enrolled for coffee cultivation and with agronomic prescriptions. Applications must be recorded (area, quantity, date, name of applicator), equipment must be in suitable conditions of use and technicians must use personal protective equipment. In addition, this subgroup determines that periods of re-entry and grace periods be respected, requiring special care in the storage of products and the destruction and return of empty containers.

The fact that there are five verification items in subgroup 1.3 that are considered mandatory by CMC standards entails a significant number of compliances in the years surveyed and it is observed that in general the subgroup presents a reduction in the number of nonconformities between 2013 and 2015. In section 1.3.10, the CMC standard requires empty pesticide containers to be returned within the legal return period, which is one year, according to Federal Law 7,802, dated July 11, 1989 (Brasil, 1989). That is, noncompliance with this item implies a noncompliance with a legal obligation. However, in two sample farms the return of the containers did not take place within the prescribed period. The audit found that empty containers were still on the property, despite the exhaustion of the legal deadline. The fact that certification auditors are state agents makes this circumstance peculiar, since it conflicts with the legal obligation to act in the face of the unlawfulness committed in contraposition to the commitment made to maintain secrecy regarding the audited aspects.

One of the most relevant problems related to agrochemicals is that coffee growing, characterized as a high yield monoculture, is associated with the intensive use of agrochemicals, not only in Brazil but also in several other producing areas. A comparison of certified and noncertified properties in Costa Rica indicated a significant reduction in herbicide use, but a much more modest reduction compared to pesticides and chemical fertilizers (Blackman & Naranjo, 2012). By 2015, however, there was no verification item in the CMC standard to promote the reduction in the use of agrochemicals. This research could verify, by verbal information obtained in an interview on 11.23.2015, by the representative of IMA, that in 2016 other items were being included to require producers to implement the integrated management of pests and diseases and avoid definitively the use of agrochemicals considered highly toxic and therefore responsible for a large number of serious incidents involving human and animal health as well as the destruction of the ozone layer.

In the subgroup "Harvest and post-harvest" (1.5), 9 items are evaluated, being 7 restrictive and 2 recommended. There are no mandatory items in this subgroup. The items refer to the appropriate time to start harvesting, the drying of coffee and the care of the equipment, machinery, utensils, and facilities used in these activities.

Throughout the subgroup, 26 verification items were compliant in 2013 and became noncompliant in 2015. In 42.3% of cases, the noncompliance was related to item 1.5.9 (11 compliant properties in 2013 failed to meet this item in 2015). The mentioned item requires that the areas for drying the coffee do not present evidence of the presence of domestic animals. The survey found that none of the sample properties changed from a noncompliant situation in 2013 to compliant in 2015. That is, there was no construction of fencing or other works in the drying areas in the properties of the sample to avoid the presence of domestic animals. That leads to the conclusion that

the certification program requirement has not been sufficient to lead owners to take effective measures in this regard. The finding of this research corroborates other studies of CMC, where it was found low compliance in the adequacy in the drying and preparation of coffee (Santos, Cunha, Santos & Gonçalves 2015).

The fact that 11 properties were considered compliant in 2013 and not compliant in 2015 may be associated with the care of the audit in the verification of traces of the presence of animals between the analysed years. Another factor may be related to the period in which the audit takes place: in the period of the harvest, there is a greater movement of people and the consumption of food in these areas, increasing the possibility of the presence of domestic animals, which tends to reduce in the off-season.

Basically, traceability is associated with the possibility of identifying the origin and destination of the coffee produced and is considered one of the most relevant points for certification of agricultural products (Pereira, Guimarães, Rosa, Antonialli & Romaniello 2014).

The Traceability Group is identified in this research as Group 2 and is composed of eight items of verification and is not subdivided into subgroups. Of the items, four are mandatory, which results in a high degree of fulfilment of their requirements when rural properties that are certified are analysed. The remaining four items are considered restrictive. It is a group composed of records activities: purchase, services performed, harvesting, preparation and drying, marketing and storage, on the farms and in cooperatives and general warehouses when intended for sale as CMC certified coffees.

Apparently, compliance with the restrictive items seems simple and results only from the insertion in the rural environment of the habit of recording the activities. However, in the experience of certification of organic products carried out in Brazil, it was reported that the main difficulty in the adequacy of the properties was related to the records of the developed activities and the constant complaints of producers regarding these derived obligations (Vriesman et al., 2012). This research came to the same conclusion. Although the data found cannot be considered statistically relevant, note item 2.6, which refers to the registration of coffee commercialization. The data show that in 2015, nine properties (corresponding to 22.35% of the sample) failed to make the required score. A different result in this item could result in a change in the outcome of the whole group.

This group has 6 subgroups and 24 verification items: 5 mandatory, 12 restrictive and 7 recommended (see Table 4.1). The T-test revealed a change between the means of scores obtained between 2013 and 2015, but it was not statistically significant (p -value = 0.6978). Nonetheless, the McNemar Test led the research look to the item with the highest number of nonconformities in this group: 3.1.1, whose objective is to investigate the adequacy of properties in relation to environmental licensing. Of the sample used in this research, 34 farms were irregular in relation to this verification item and remained like that in 2015. It was also observed that two of them, compliant in 2013, ceased to be compliant in 2015, and may denote that the licenses of these properties expired without renewal.

Environmental licensing of coffee growing in the State of Minas Gerais is defined by Normative Deliberation nº 74 of the State Environmental Policy Council (*Conselho Estadual de Política Ambiental* [COPAM], 2004). The licensing requirement depends on the potential pollutant of the activity, which in the case of coffee is considered average, and the size of the enterprise, which considers the useful area. The combination of size and polluting potential defines the class of licensing, which in the case of coffee growing can be: Exempt from licensing (in the case of properties with less than 30 hectares of floor space), Class 1, i.e., subject to the Environmental Operating Authorization - AAF (properties between 30 and 500 hectares of floor space); Class 3, subject to licensing (with properties between 500 and 2000 hectares of floor space), or Class 5, subject to environmental licensing, by means of the elaboration of EIA / RIMA (properties of more than 2000 hectares of floor space).

In this way, it is possible to conclude that all smallholdings (42.32% of CMC properties) would be exempt from environmental licensing, as well as part of small properties. The other properties would fall under Class 1, subject to the AAF procedure and a small group would be subject to Class 3 licensing. No CMC-certified properties would fit the Class 5 environmental licensing hypothesis. These data suggest that the resolution of noncompliance in this item 3.1.1 would especially require the implementation of an administrative activity of consulting the environmental organ about the licensing requirement. If there were an initiative of the respective government agencies, much of the noncompliance could be corrected, causing attention to be focused on those properties, which effectively are not licensed, either because they did not accomplish the licensing or did not provide the renewal of their licenses.

The fact that two properties were identified in the sample that were licensed in 2013 and that in 2015 were considered as noncompliant again exposes the managers of the program and its action against illegalities. CMC auditors face legal nonconformities and comply with the commitment not to prosecute violators, a commitment

assumed in the certification code of conduct. However, in doing so, they fail to act on the illegality found, allowing a rural property subject to environmental licensing remain operating, despite being without a license or with expired licenses.

As can be seen from the data obtained in the research, the group related to the social responsibility of the certified properties did not present significant changes, considering the data of the years studied. However, the results of the groups, item 4.15 had a significant change, because 11 properties considered noncompliant in 2013 were adequate to the standard in 2015, generating the conformity of all properties of the sample.

This item is directly related to the remuneration of workers, especially those who are linked to the property only during harvest and are partially or fully paid for production. Certification requires that the equipment for measuring the volume of harvested coffee (cans, baskets, boxes) be checked annually. The measure, although simple, results in fair payment to the worker who labours in such conditions.

The number of properties that do not comply with the requirements of the standard regarding the adequate place for meals by employees (item 4.13) and adequate sanitary facilities (4.14) remains high. Certification efforts do not appear to be sufficient for such changes to take place. The difficulty seems to lie in the fact that harvesting activities imply the daily displacement of workers, who sometimes perform their activities at points far from their head office. This would imply the existence of mobile food and sanitary equipment, accompanying the harvest, which would burden the interested producer not only in the acquisition of equipment, but also in its operation, solutions that are already used in coffee properties of medium and large sizes. A similar result was found in the literature, indicating that almost 41 percent of coffee-growing workers do not eat their meals in an adequate place (Pereira et al., 2014), despite the existence of regulatory norms of the Ministry of Labour that require adequate facilities.

The group entitled "Capacity Building", as mentioned above, presented a positive change in the average scores obtained between 2013 and 2015. Two verification items showed the best results. They refer to capacity building and training for the application of agrochemicals (5.7) and to training and integrated management of pests and diseases. Here there is an obvious correlation between the results of this group and the subgroup 1.3 discussed above.

In the item "Training of Agrochemical Applicators" (5.7), of the nine farms that had changes in their assessments between 2013 and 2015, eight were in the sense of compliance. Surveys on agricultural commodity in poor countries have pointed to critical situations in relation to agrochemical pollution. This factor is considered difficult to solve by traditional methods of public management, indicating that the certification mechanisms would have greater potential to present results, because the producers are typically small, numerous, and geographically dispersed. In this respect, the CMC program has demonstrated this efficacy, corroborating other studies that obtained similar results (Blackman & Naranjo, 2012; Bolwig, Gibbon & Jones, 2009).

As for the item "Training in the management of pests and diseases (5.9), there was a significant reduction of noncompliance between the evaluated years. The item provides that a certified property can evidence the achievement of training, by at least one person, in basic and specific skills on pests and diseases in coffee growing. Trained personnel should be able to identify major pests and diseases, learning notions about integrated management, forms, processes and control techniques, activity planning and benefits of their application. In the McNemar Test, it was evidenced that nine of the sample farms did not take this course in 2013 and started to do so in 2015. This advance of CMC had not yet been reported in previous surveys, which pointed out that compliance in personnel training did not reach 55% of total properties (Santos et al., 2015).

6. Conclusions

The results show that the increase in the means of scores obtained was not identified based on the criteria adopted for the certification. This leads to the conclusion that there is no evidence that the CMC program promotes the continuous improvement of farms' performance in the standard verification items certified in 2013. There was no comparison of the situation of properties before and after certification. On the other hand, it was verified that the fulfilment of several requirements of the norm reveals a commitment of the owners with the topics proposed by CMC.

Further research on the criteria used by the certification standard shows that the group "Plantation" presented a negative result, i.e., a decrease in the average score obtained between 2013 and 2015. As seen, the subgroups "cultivation areas" and "harvest and post-harvest", as well as the item referring to the hygiene of the areas of drying and preparation of coffee (item 1.5.9) may be responsible for the negative result of this group. It was also pointed out the positive changes identified in the subgroup related to the chemical control of pests, diseases, and weeds.

However, they were not enough to interfere with the outcome of the group “Plantation”.

This research revealed the difficulties of rural producers in carrying out activities involving technical assistance, such as laboratory tests for soil and foliar analyses and for liming and fertilization activities. The research has provided assumptions about the reasons for this evidence, such as the difficulty of access to the available technical means and the cost of such analyses. Nevertheless, the presence of EMATER in the program makes believe that it is not about the lack of knowledge of the advantages of adopting the best techniques. The research also suggests that the improvement of performance in these items can be achieved by reassessing the verification items, making some of them mandatory. Another suggested point is the expansion of the technical assistance currently available to include the performance of reports and laboratory tests, which can be considered an attractive of certification for small producers, to the detriment of the interest exclusively focused on the final price of certified coffee.

The low accession of certified producers to the registration procedures of the field activities was verified, whose adequate realization could alter the observed negative results, especially in the traceability, considered essential in the certification of agricultural products. In general, the negative results found in this paper pointed to the reduction of negative practices, but limited effects when it comes to encouraging the adoption of positive practices. It should not be forgotten that to obtain certification a minimum level of compliance with the requirements of the standard is required. Thus, certified properties can accommodate to the proposed requirements over the years, but the certification standards continue to be maintained.

A relevant and positive highlight of this research was the efficacy demonstrated by the adoption of the CMC criteria in the reduction of agrochemical pollution, through training in integrated pest and disease management, justifying the governmental efforts to serve the plurality of small producers, geographically dispersed. This finding seems sufficient to indicate the feasibility of continuing the certification and even its dissemination to other regions. It also indicates the possibility that this governmental strategy may be adopted for other agricultural products considered as strategic, justifying governmental efforts and the use of public resources.

For the managing bodies, two major challenges that this research revealed can be pointed out. Firstly, the need to promote the integration of CMC with other government agencies, such as environmental licensing bodies and differentiated service of licensing bodies to rural producers certified by the CMC program would be a relevant competitive advantage and could result in the effective compliance of properties to this legal requirement.

The second challenge is more complex and requires the construction of new solutions, since CMC is the first model of public certification of agricultural products. It is the delimitation of borders of action of the program managers as auditors of verification items considered mandatory by law. This is because, in addition to auditors, they fulfil the duty of being also inspectors of the norms and legal conducts. As this research has shown, at the limit of audit and inspection there may be a territory that has not yet been explored, announcing the conflict between these two ways of acting. Further research will be needed to deepen the discussion on this challenge.

The available data and the tests carried out did not allow comparing the situation of the property before certification. This is another limitation of this research, which will require further analysis to elucidate this aspect. We also leave here many possibilities for future research, such as the evaluation of the cost-benefit ratio between government investments required to maintain the program and the positive results that have been achieved. Another aspect is the study of the criteria adopted for certification, about the ability of these indicators to reflect more accurately the improvement of the environmental and social aspects of *Certifica Minas Café*.

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