ECONOMIC VIABILITY OF CONVERTING FROM CONVENTIONAL TO ORGANIC COFFEE CULTIVATION IN SOUTHERN MINAS GERAIS

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ABSTRACT

Objective: This study aims to explore the economic viability of converting conventional coffee cultivation to organic practices on a rural property in southern Minas Gerais, assessing the economic and operational impacts of this process.

Theoretical Framework: The literature on sustainability in coffee production suggests economic benefits and a reduction in negative environmental impacts for farmers who adopt sustainability certifications. However, empirical evidence is mixed, with studies indicating a dependence on financial premiums to offset the lower productivity of organic cultivation.

Method: A case study was conducted on a property that uses both production systems. Data from the 2022/2023 harvest were collected and analyzed, comparing the operational costs and profitability between conventional and organic cultivation methods.

Results and Discussion: The findings indicate that the high cost of organic inputs negatively impacted the profitability of organic production, despite the significantly higher sales prices of organic produce. The low productivity of the organic plot resulted in losses, highlighting a gap in the efficiency of production management.

Research Implications: The findings of this study suggest the need for more effective management strategies and possibly the development of agricultural technologies that increase the productivity of organic cultivation, without compromising the principles of sustainable agriculture.

Originality/Value: This study contributes to existing literature by exploring the conversion of cultivation in a specific and coffee-producing region in Brazil, providing data on the real economic challenges faced by farmers during the transition to sustainable agricultural practices. The detailed analysis of costs and benefits reinforces the complexity and nuances involved in adopting sustainable agricultural practices on a local scale.

Keywords: Coffee Production, Conventional vs. Organic, Cost Analysis, Sustainability

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Economic Viability of Converting From Conventional to Organic Coffee Cultivation in Southern Minas Gerais

VIABILIDADE ECONÔMICA DA CONVERSÃO DE CULTIVO DO CAFÉ CONVENCIONAL PARA ORGÂNICO NA REGIÃO DO SUL DE MINAS GERAIS

RESUMO

Objetivo: Este trabalho visa estudar a viabilidade econômica da conversão de cultivo convencional para orgânico em café, numa propriedade rural no sul de Minas Gerais, avaliando os impactos econômicos e operacionais desse processo.

Referencial Teórico: A literatura sobre a sustentabilidade na produção de café sugere benefícios econômicos e redução de impactos ambientais negativos para os agricultores que adotam certificações de sustentabilidade. Contudo, as evidências empíricas são mistas, com estudos indicando uma dependência de prêmios financeiros para compensar a menor produtividade do cultivo orgânico.

Método: Foi realizado um estudo de caso em uma propriedade que utiliza ambos os sistemas de produção. Os dados de produção da safra 2022/2023 foram coletados e analisados, comparando os custos operacionais e a lucratividade entre os métodos de cultivo convencional e orgânico.

Resultados e Discussão: Os resultados indicam que o alto custo dos insumos orgânicos impactou negativamente na lucratividade da produção orgânica, apesar da venda da produção orgânica a preços significativamente superiores. A baixa produtividade do talhão orgânico resultou em prejuízos, evidenciando uma lacuna na eficiência da gestão produtiva.

Implicações da Pesquisa: As descobertas deste estudo sugerem a necessidade de estratégias de gestão mais eficazes e talvez o desenvolvimento de tecnologias agrícolas que aumentem a produtividade do cultivo orgânico, sem comprometer os princípios da agricultura sustentável.

Originalidade/Valor: Este estudo adiciona à literatura existente ao explorar a conversão de cultivo em uma região específica e produtora de café no Brasil, oferecendo dados sobre os desafios econômicos reais enfrentados pelos agricultores durante a transição para práticas agrícolas sustentáveis. A análise dos custos e benefícios reforça a complexidade e as nuances envolvidas na adoção de práticas agrícolas sustentáveis em escala local.


VIABILIDAD ECONÓMICA DE LA CONVERSIÓN DEL CULTIVO DE CAFÉ CONVENCIONAL AL ORGÁNICO EN EL SUR DE MINAS GERAIS

RESUMEN

Objetivo: Este estudio tiene como objetivo explorar la viabilidad económica de convertir el cultivo convencional de café a prácticas orgánicas en una propiedad rural en el sur de Minas Gerais, evaluando los impactos económicos y operativos de este proceso.

Marco teórico: La literatura sobre sostenibilidad en la producción de café sugiere beneficios económicos y una reducción de los impactos ambientales negativos para los agricultores que adoptan certificaciones de sostenibilidad. Sin embargo, la evidencia empírica es mixta, y los estudios indican una dependencia de las primas financieras para compensar la menor productividad del cultivo orgánico.

Método: Se realizó un estudio de caso en una propiedad que utiliza ambos sistemas de producción. Se recogieron y analizaron los datos de la cosecha 2022/2023, comparando los costos operativos y la rentabilidad entre los métodos de cultivo convencionales y orgánicos.

Resultados y discusión: Los hallazgos indican que el alto costo de los insumos orgánicos impactó negativamente la rentabilidad de la producción orgánica, a pesar de los precios de venta significativamente más altos de los productos orgánicos. La baja productividad de la parcela orgánica resultó en pérdidas, lo que destaca una brecha en la eficiencia de la gestión de la producción.

Implicaciones de la investigación: Los hallazgos de este estudio sugieren la necesidad de estrategias de gestión más efectivas y posiblemente el desarrollo de tecnologías agrícolas que aumenten la productividad del cultivo orgánico, sin comprometer los principios de la agricultura sostenible.
1 INTRODUCTION

The search for healthy food has led agricultural producers in many countries to adopt alternative methods of production. Some coffee growers are adopting this new technology model to find a better quality product for health, add value and increase profitability and consumer acceptance mainly in the foreign market (Macedo & Binsztok, 2007).

Organic farming is based on crop rotation, diversification, use of embroidery, and biological control of pests and diseases. On the other hand, traditional agriculture is supported by the intensive use of fertilizers and synthetic pesticides and presents lack of diversity, making this system biologically unstable, which favors the development of pests and diseases (Teixeira, 2015).

According to Santis et al. (2019), special and organic coffees are also a response to the growing demand for quality and traceable origin products. Consumers seek authentic experiences, connected with the history and care behind each grain. By choosing these coffees, customers feel that they support a more sustainable production chain and are contributing to the preservation of traditional crops, fostering the development of the coffee regions.

The adoption of organic farming has occurred mainly among family farmers. This form of agriculture reduces rural exodus and capital accumulation in the agricultural sector, which helps develop rural areas with income and labor generation. This strengthening also promotes the insertion of quality food into the internal market, thus consolidating the country's food security strategies (Conab, 2023).

According to Reis (2022), organically planted cereals show less accumulation of harmful substances, which contributes positively to both the environment and our health. In this way, organic farming collaborates to diminish the negative consequences of traditional
agricultural production on the environment, stimulating the preservation of the variety of life and the defense of natural resources.

While there is this belief that sustainable certified coffee production helps increase economic benefits for farmers and reduce negative environmental impacts, international empirical evidence on these aspects is not conclusive (Quoc Ho et al., 2018). In fact, in Brazil, studies such as those of Siqueira et al. (2011), Oliveira and Caixeta Filho (2013) and Oliveira (2015), present a strong need to win better sales prices to make viable the practice of organic farming, compensating for its lower efficiency. Moreover, the selling price was the factor that most impacted on the profitability of small coffee farmers.

Bray and Neilson (2017) analyzed several empirical studies that assessed the impact of certification programs on the livelihoods of small coffee producers and concluded that, while no consensus has yet been reached on all impacts of certification programs on livelihoods, several studies have identified positive impacts of certification in specific institutional and contextual contexts, but causality was difficult to establish.

According to Cabrera and Caldarelli (2021), in Brazil, the financial impacts related to the certification of organic coffees are not yet fully understood. The authors highlight the importance of public policies and initiatives by coffee associations and cooperatives to analyze in detail the costs involved in this process, as well as the prices and benefits obtained with the certification of the products. They underline the need for actions that clarify the agents involved about the advantages of this procedure. However, his research indicates that adherence to certification by producers, whether mechanical or manual, is feasible and can result in significant performance advantages.

In this context, the present study aimed to study the economic viability of converting an area of conventional coffee cultivation for organic cultivation into a rural property in the south of Minas Gerais. It is therefore hoped to contribute to the discussion on the adoption of organic coffee production by family farmers.

2 THEORETICAL FRAME

Coffee cultivation is an activity of extreme importance in Brazilian agriculture, essential for the economic growth of the country, especially for its significant contribution in tax collection and revenue generation (Fassio & Silva, 2015). According to the Brazilian Coffee Industry Association (Abic, 2023), there was a 1.34% increase in demand for the beverage in 2020 compared to 2019. Coffee production in Brazil is concentrated mainly in the states of
Minas Gerais, Espírito Santo, São Paulo, Bahia and Paraná (Embrapa, 2023).

After the liberalization of the world coffee market in the 90s, several exporting countries and processors looked for different ways of valuing the grain, with the emphasis on certification. Coffee was one of the first agricultural products to receive certification for global trade, being applied several types of certification in different places (Brazil, 2020).

For Prado (2014), the purpose of agricultural certification is to sustain ecologically adequate production, ensuring social and economic equity to ensure the viability of these practices. Distinguishing the product with a focus on excellence and social and environmental sustainability implies meeting the demands of the stricter market. Therefore, this distinction is transformed into a strategy for the company to obtain benefits when evaluating its merchandise or service provision (Pereira, 2014). For example, Fairtrade Fair Trade certification aims to support small farmers, and only producers organized in associations or cooperatives can apply for it (Coopfam, 2007).

The purpose of this certification is to ensure that fair trade agreements are made for disadvantaged small farmers working in cooperatives (Pereira et al., 2007). In the year 2019, there were 31 certified producer organizations in operation, with approximately 11,131 farmers. In Brazil, Fairtrade certification and surveillance are conducted by a specific certifier (Sebrae, 2023).

In March 2020, 820 farmers who grow organic coffee in Brazil were registered. The state of Minas Gerais is home to the largest part, with 38.9%, followed by São Paulo, with 15.8%, and Paraná, with 12% (Sebrae, 2023). It is the responsibility of the farmers to bear the costs related to certification and supervision of the crops. The production costs of organic coffee can be as much as 20% to 30% higher compared to conventional coffee, including certification costs (Giomo et al. 2007).

One of the first Fair Trade coffee programs in Brazil is located in Poço Fundo, southern region of Minas Gerais. In 1997, the organization began operations with the goal of obtaining organic certifications and Fair Trade and began exporting coffee with these certifications in 2003. The following year, the organization was transformed into the Cooperative of Family Farmers of Poço Fundo - Coopfam, to facilitate the sale of the products. Coopfam has about 200 producers that have properties from 0.5 ha to 25 ha and grow both conventional and organic coffee, both with Fair Trade certification. Its main market is the United States, followed by the United Kingdom and other European countries (Saes & Miranda, 2007).
3 METHODOLOGY

The data was obtained from the property Vargem do Amparo, located in the municipality of Poço Fundo, Minas Gerais. This property was selected because it has the two modes of coffee production, organic and conventional. The organic production compartment has the IBD FAIR TRADE certification, and the co-operative owners of the Cooperativa de Farmtores Familiar de Poço Fundo/MG (Coopfam).

For the realization of the research, the analytical model was used the case study method, which is a way of empirically characterizing a social phenomenon within its real context (Yin, 1998). Three stages marked the execution of the research, the following: Literature Review, Data Collection and in situ information. The collection of data and information in situ was carried out by means of methodological procedures generally used in what is called rural rapid diagnosis (Crawford, 1997).

For the study, a survey was made of the inventory of the property and the details of the plots, both in the production of organic coffee and in the production of conventional coffee. Next, the manner of handling the plots for raising the costs was verified. Finally, the harvest was checked, and the costs informed by the owner and the form of harvest that is one hundred percent manual were lifted.

In order to carry out the cost analysis, the profitability of the production of the two types of coffees was studied, using indicators described by Martin et al. (1998), of which:

- **Effective Operating Cost (EOC):** This refers to all expenses incurred by the property (or enterprise) during a production cycle or period examined and that will be used in the same period. Includes all elements considered as direct expenses, such as raw material, mechanical maintenance, manual labor, outsourced services, agricultural sales, transportation, financial expenses, taxes and overheads.

- **Total Operational Cost (TOC):** Refers to the combination of the COE with the annual depreciation of the physical assets of the site (improvements, machinery, instruments, equipment) and the exhaustion (or "depreciation") of perennial plantations.

- **Gross Income (GR):** corresponds to the amount obtained from the marketing of the bags of processed coffee produced and was established by:

\[
RB = PM \times Prod. \tag{1}
\]

Where:
Economic Viability of Converting From Conventional to Organic Coffee Cultivation in Southern Minas Gerais

\[ \text{RB} = \text{Gross Revenue} \]
\[ \text{PM} = \text{Average Price} \]
\[ \text{Prod} = \text{Productivity of benefited coffee bags in the field} \]

Next, the Operating Profit (LO) or operating margin, according to Marion (2010) has the purpose of calculating the organization's operating profit efficiency. In this study it was calculated by:

\[ LO = RB - COT \quad (2) \]

Where:

\[ \text{TOC} = \text{Total operating cost} \]

The LO calculates the Profitability Index (IL), represented by the remaining percentage of the operation's revenue after all operating expenses have been discharged. For Galhardo (2012), this index measures the percentage of profit of a company or property. In this study, it was determined by:

\[ IL = \left( \frac{LO}{RB} \right) \times 100 \quad (3) \]

Where:

\[ \text{IL} = \text{Profitability Index} \]
\[ \text{LO} = \text{Operating Profit} \]
\[ \text{RB} = \text{Gross Revenue} \]

The equilibrium price (SP) according to Bernardi (1998), was calculated with the aim of indicating the level at which the total revenue equals the total costs and expenses; making the profit equal to zero. Thus, equation (4) was used:

\[ PE = \frac{COT}{\text{Prod.}} \quad (4) \]

Where:

\[ \text{TOC} = \text{Total operating cost} \]
\[ \text{PROD.} = \text{Productivity of Coffee Bags Benefited per Hectare.} \]
Finally, the production of equilibrium (PRODE), which for Martin et al. (1998) is the calculation of productivity required to pay all costs (5):

\[
PRODE = \frac{COT}{PM} \quad (5)
\]

Where:

PRODE = Balance Production  
TOC = Total operating cost  
PM = Average Price

Return on Investment (ROI) is a measure of profitability that compares the profit made with the investment made. According to Carvalho et al. (2010), equation (6) is used for ROI calculation:

\[
ROI = \frac{Lucro}{Investimento} \times 100 \quad (6)
\]

Where:

ROI = Return on Investment

The Payback indicates the time required to recover the initial investment in a project. According to Carvalho et al. (2010), the simplified form for its calculation is given by equation (7):

\[
Payback = \frac{Investimento \text{ Inicial}}{Fluxo \text{ de Caixa Anual}} \quad (7)
\]

Where:

Payback = Time to Recover Initial Investment
4 RESULTS AND DISCUSSIONS

4.1 PROPERTY CHARACTERIZATION

The property Vargem do Amparo is located at an altitude between 845 and 1200 meters, with a tropical climate of altitude, presenting mountainous relief. It has an average annual temperature of approximately 20 degrees, and average monthly precipitation of 132 mm, presenting a dry period of 2 to 4 months, which according to Souza (2006), forms a favorable environment for Arabica coffee. Figure 1 shows the location and soil and altitude information of the property.

Figure 1
Location, Soil Type and Altitude of the Property studied

The cultivated area of coffee, of the Arabica type, is 3 hectares, being divided into 2 plots of 1.5 hectares, being one field with organic production and the other with conventional production. The plots are 2 meters apart between rows by 1 meter between plants, with a total of 5,000 coffee trees in each field. The management of production is 100% manual. Throughout the harvest, the maintenance service of the crop is carried out by the owners and in the harvesting period it is hiring temporary labor. The two plots were planted in the year 2000,
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being conducted in a conventional manner until 2007, when one of them started to be managed organically.

The transition period counted from the last application of chemical and agro-toxic fertilizers to the obtaining of the organic seal. This certification was only granted after the degradation of the pesticide residues in the soil. In other words, it started the conversion process in 2000 and was certified in 2008. Table 1 shows the conversion process of the organic production batch.

Table 1

Transition from Conventional to Organic Tallion

<table>
<thead>
<tr>
<th>Year</th>
<th>Fertilizer</th>
<th>Classification Of The Production System</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 to 2003</td>
<td>Two chemical and one organic coatings</td>
<td>Conventional</td>
</tr>
<tr>
<td>2004 to 2007</td>
<td>Three Organic Shroud</td>
<td>Sustainable</td>
</tr>
<tr>
<td>2008</td>
<td>Three Organic Shroud</td>
<td>Organic</td>
</tr>
</tbody>
</table>

Source: Elivandro (2023)

The information on the costs (fertilization, defense and harvesting) of coffee production for the 2022/2023 harvest is summarized in Table 2, for organic coffee and in Table 03 for conventional coffee. The costs were presented within the 2022/2023 crop, in their averages, for operation of inputs, handling and harvests and their compositions differentiated by the plots were analyzed. It was observed that the production of organic coffee was far below its potential, causing injury to producers.

Table 2

Financial Analysis of the Organic Coffee Production Box Safra 2022/2023

<table>
<thead>
<tr>
<th>Discrimination</th>
<th>Quant.</th>
<th>Value (R$)</th>
<th>Total (R$)</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Variable Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee sprout</td>
<td>8 Services</td>
<td>90</td>
<td>720</td>
<td>4.1</td>
</tr>
<tr>
<td>Pruning and Cleaning</td>
<td>2 services</td>
<td>120</td>
<td>240</td>
<td>1.53</td>
</tr>
<tr>
<td>Bracket</td>
<td>17 services</td>
<td>140</td>
<td>2,380</td>
<td>15.26</td>
</tr>
<tr>
<td>Pie of the castor bean</td>
<td>2 services</td>
<td>100</td>
<td>200</td>
<td>1.28</td>
</tr>
<tr>
<td>Spraying</td>
<td>2 services</td>
<td>100</td>
<td>200</td>
<td>1.28</td>
</tr>
<tr>
<td>Seedling cavation</td>
<td>2 services</td>
<td>140</td>
<td>280</td>
<td>1.79</td>
</tr>
<tr>
<td>Planting of seedlings</td>
<td>1 services</td>
<td>100</td>
<td>100</td>
<td>0.64</td>
</tr>
<tr>
<td>Cleaning coffee feet</td>
<td>2 services</td>
<td>100</td>
<td>200</td>
<td>1.28</td>
</tr>
<tr>
<td>Cleaning the Tub</td>
<td>3 Services</td>
<td>100</td>
<td>300</td>
<td>1.92</td>
</tr>
<tr>
<td>Travel from Toyota</td>
<td>5 Services</td>
<td>80</td>
<td>400</td>
<td>2.56</td>
</tr>
<tr>
<td>Total (A):</td>
<td></td>
<td>5 020.00</td>
<td>32.20</td>
<td></td>
</tr>
</tbody>
</table>

(B) Variable Cost
Harvesting

<table>
<thead>
<tr>
<th>Measure</th>
<th>68 Measures</th>
<th>40</th>
<th>2,720</th>
<th>17.44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying and Cleaning</td>
<td>8 Hours</td>
<td>55</td>
<td>440</td>
<td>2.82</td>
</tr>
<tr>
<td>Transport</td>
<td>2 Travel</td>
<td>100</td>
<td>200</td>
<td>1.28</td>
</tr>
</tbody>
</table>

(C) Fixed Cost

<table>
<thead>
<tr>
<th>Fertilizers</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer</td>
<td>22 Bags</td>
<td>210</td>
<td>4,620</td>
<td>29.63</td>
</tr>
<tr>
<td>Pie of the castor bean</td>
<td>40 Bags</td>
<td>53</td>
<td>2,120</td>
<td>13.59</td>
</tr>
<tr>
<td>Fort Gould Action</td>
<td>2 Liters</td>
<td>85</td>
<td>170</td>
<td>1.09</td>
</tr>
<tr>
<td>Aminovite HYTB</td>
<td>1 Liters</td>
<td>100</td>
<td>100</td>
<td>0.64</td>
</tr>
<tr>
<td>Norga</td>
<td>1 Liters</td>
<td>200</td>
<td>200</td>
<td>1.28</td>
</tr>
</tbody>
</table>

Total (B + C): 10 570.00 67.80

COE (A+B+C) 15 590.00 100

Depreciation 510.83

TOC 16 100.83

COE = Effective Operating Cost; TOC = Total Operating Cost.
Source: Elivandro (2023)

On checking the variable expenses, one can see that the level of organic production (Table 3) in relation to conventional production (Table 4) was a little higher, even though it had a lower production. This is due to the fact that in this crop it was necessary to replace some coffee seedlings due to the frost of the year 2021 and the fact that organic coffees, within the forecast by the certifier, need greater attention. In addition, it was necessary to clean the coffee feet to harvest the beans, which demanded a higher expense than conventional production.

When analyzing the indicators of the organic stock (Table 3), there was a lower production in the 2022/2023 crop, compared to the conventional one. It can be observed that the fixed cost compared with the conventional grove (Table 4) is much higher and that the input ends up being almost double the conventional coffee, referring to the cost of maintenance of the organic crop was higher than that of the conventional grove.
When analyzing the 2022/2023 harvest of conventional coffee production (Table 3), it is observed that the fixed cost is lower when compared with the crop of the organic coffee production field. In this case, it turns out that the cost of organic fertilizer ends up being higher than that of conventional production, coming out in excess of R$ 2,940.00. As regards variable costs, conventional production was higher than organic production, because this ratio was directly proportional to production, given that conventional coffee production was much higher than organic production. Consequently, the cost of harvesting is also higher.

Table 4 lists the profitability indicators of the 2022/2023 harvest. Regarding the harvest studied, it is verified that the average produced in conventional cultivation did not remain outside what was forecast by Embrapa, which is 28 Sacas per hectare in Brazil, based on the first survey of the Coffee Harvest 2023 (Embrapa, 2023). You can see that after the analysis of the equilibrium production, even if you harvest 25 bags, you would not still be in the loss,
coming in the whole extension of the plot that corresponds to 1.5 hectares collecting 35 bags, bringing above profitability to the producers.

Table 4

<table>
<thead>
<tr>
<th>Economic Viability Indicators Crop 2022/2023*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Returns TRUE on success or FALSE on failure.</strong></td>
</tr>
<tr>
<td>Gross Revenue</td>
</tr>
<tr>
<td>Operating Profit</td>
</tr>
<tr>
<td>Profitability Index</td>
</tr>
<tr>
<td>Balance Point</td>
</tr>
<tr>
<td>Production Of Balance</td>
</tr>
<tr>
<td>Return On Investment</td>
</tr>
<tr>
<td>Payback</td>
</tr>
</tbody>
</table>

Payback = Time to Recover Initial Investment
*Production of 35 bags for the field with conventional cultivation and 8 bags for the field with organic cultivation.
Source: Elivandro (2023)

In relation to profitability (Table 4), even producing a little below the forecast per hectare, for the producers it was compensatory. Yeah, there was a profit in the production of the 2022/2023 crop.

It is worth mentioning that in the sale of organic coffee the owners managed to get R$ 1,830.00 per bag, more than double the conventional coffee. However, in relation to the operational profit, the crop was not effective, since, in the end, it gave a loss of R$ 1,460.83 to the producers.

Oliveira and Caixeta Filho (2013), studying a property in the state of São Paulo, showed that the adoption of the organic technique gave the coffee grower higher profits than the conventional system at the end of the conversion period, when there is an increase in the price of the bag. The authors concluded that it may be economically viable to adopt organic production in coffee growing, but it is with extreme dependence on the price differential between the conventional and organic systems. In fact, in the present study, this dependence can be observed with the calculation of the equilibrium point.

After this calculation, one can see that, with this same production, in order for there to be no loss, it would be necessary to sell the bag at R$ 2,012.60. Or, in the light of the equilibrium production analysis, to have gathered close to 9 sacks of coffee. This damage may have been caused by the high cost of the input (Table 2) that the crop needed and due to the low productivity. This same dependency on price for organic production was found by Oliveira (2015) and Siqueira et al. (2011).
Therefore, it can be seen that the result of the high cost of the input significantly affected the profitability of organic production. In addition, the low production of the field was a loss for the producers, even though the organic coffee bag was sold at a higher price than the conventional one.

While the ROI in conventional planting was 38.89%, in organic production there was a loss of 9.07%, which directly affects Payback which, while in conventional production would recover the value invested in approximately 2.5 years, in organic production it would take 11.02 years to recover the value invested.

The data obtained for this study, referring to the 2022/2023 crop, reflect the fall in production due to frost that occurred in 2021 (Embrapa, 2023; Emater, 2023), which affects the results obtained in the study. In this way, it was chosen to analyze a second scenario, where there would be no occurrence of frost and production and the production of the two systems would be the estimated value per Embrapa (2023), of 28 bags/hectare. This analysis is important for the administration of coffee growing, since it makes it possible for the coffee producers to monitor the plantation in a more efficient manner, to optimize production, and it assists in laying the foundations for strategies directed towards a better production of the groves.

Table 5 presents the profitability indicators for the two production systems, considering the observed and estimated production.

**Table 5**

*Economic viability indicators considering the values observed in the 2022/2023 harvest and the estimated value for a frost-free harvest*

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONVENTIONAL PRODUCTION</th>
<th>ORGANIC PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed production¹</td>
<td>Estimated production²</td>
</tr>
<tr>
<td>Gross revenue</td>
<td>R$31,010.00</td>
<td>R$37,212.00</td>
</tr>
<tr>
<td>Operating profit</td>
<td>R$8,684.17</td>
<td>R$10,321.17</td>
</tr>
<tr>
<td>Profitability Index</td>
<td>28 %</td>
<td>27.73%</td>
</tr>
<tr>
<td>Balance point</td>
<td>R$637.82</td>
<td>R$640.25</td>
</tr>
<tr>
<td>Balance production</td>
<td>25 bags</td>
<td>30 bags</td>
</tr>
<tr>
<td>Return on investment</td>
<td>38.89%</td>
<td>38.38%</td>
</tr>
<tr>
<td>Payback</td>
<td>2.57 years.</td>
<td>2.60 years</td>
</tr>
</tbody>
</table>

Payback = Time to Recover Initial Investment

¹ 35 bags/pocket
² 42 bags/pocket for both production systems
³ 8 bags/pocket

Source: Elivandro (2023)
The indicators in Table 5 reflect the increase in estimated production, compared to observed, with higher values for gross revenue. The operating profit in the organic system ceases to be negative and becomes positive with the estimated production. Thus, disregarding the occurrence of frost, this system demonstrates a greater capacity to generate income for the producer, when compared to the other possibilities of production. This is also reflected in the profitability index.

While equilibrium point values are close in conventional production, there is a reduction of equilibrium point values in organic production, with estimated production. In this way, there is a reduction in the risks for the producer, since it is necessary to generate less revenue to avoid losses.

With the estimated production figures, it appears that the conventional system would also have a positive economic viability, even if I try to spend more on the harvest. As to organic production, it would have a greater economic viability than the conventional one, around 30%, which reinforces that if the handling of the crop takes place without interference that can affect the average result of production, the two types of coffee have profitability. However, organic production is larger than conventional production.

In the study of the real production of the property, one can perceive how much frost damaged the production of the coffees, making the conventional one was a little below the established average (around 25 sacks/hectare) and how much significantly affected organic production. This is carried out at an altitude a little higher than the conventional one, being more affected by frost, which made it necessary to do replanting. These are situations that the producer can face on several occasions in agriculture, significantly affecting its profitability.

In relation to conventional and organic production, in this scenario, if the production does not have interference it is more compensatory to organic production, because profitability is almost 58%. As well as contributing towards the preservation of the Environment, the producer manages to obtain a far greater profitability. This added value that organic coffee has makes it motivating producers to grow this type of coffee.

In this study, the total cost per bag of coffee in the conventional compartment was R$ 628.09 and the organic one R$ 759.64. With this, the cost for the production of an organic is greater than that of conventional production. So it turns out that marketing is also much more advantageous. In the 2022/2023 harvest, the financial value was almost double the amount of the conventional bag.

The detailed Payback analysis for conventional and organic coffee production provides information on the time required for each type of investment to recover the initial capital.
applied. In the conventional production scenario, a payback of approximately 2.6 years was achieved, reflecting a relatively rapid recovery of the initial investment. In organic production, due to frost, the payback resulted in approximately 11 years, which would not make this production viable due to the time it would take to recover the value invested. However, with the estimated production, it would take 0.7 months to get the invested value, which would reduce the producer's risk.

The ROI in conventional production is very close in the conventional system, with both production results. In contrast, organic production reflects in the real scenario the interference of frost, ROI of -9.07%, indicating that production costs were not fully recovered by the revenues generated, which results in financial loss. In the simulation without the frost, the ROI is 136%, showing how compensatory production is, even though the price of input and labor is high.

5 CONCLUSION

The results found in the present research indicate that, from the strictly financial point of view and in the short term, the conventional production of coffee was more viable than the organic one. However, it is important to consider other factors that may influence the choice between these two cultivation methods. Organic production, despite its initial negative ROI, can bring long-term benefits, such as environmental sustainability and the possibility of reaching niche markets that value organic products and are willing to pay more for them.

It also appears that the reduction in the value of inputs, which is very burdensome for the producer, is of fundamental importance. But another situation that also affects profitability is the low production of coffee, which was evidenced by the occurrence of frost in 2021, which affected the 2022/2023 crop. With this, it is necessary after the harvest, to carry out the handling of the crop in a correct manner, so that one can have a production that brings profit to the producer.

The study of the cost of production is essential for the producers to be able to analyze what was not beneficial in each crop and to correct for the next one. This allows small producers to sustain their activities, even during adverse periods, whether from the market or natural phenomena. Economic and financial feasibility analyzes generate strategic information that makes it possible to create more effective standards with the aim of achieving positive results in rural production. However, it should be pointed out that the decision between investing in conventional or organic coffee production methods transcends purely financial analyzes,
encompassing considerations of sustainability, environmental impact and alignment with the demands of an increasingly conscious market.

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