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ANÁLISE DE VIABILIDADE FINANCEIRA E DE RISCO DA MORANGUICULTURA: UM ESTUDO DE CASO PARA O MUNICÍPIO DE DATAS, MINAS GERAIS

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1 RESUMO

O morango é um híbrido (*Fragaria* x *ananassa*) que se estabeleceu no Brasil devido à sua adaptabilidade ao clima subtropical e temperado, típicos de locais de altitude ou das regiões Sul e Sudeste do país. É uma hortaliça altamente apreciada e consumida, assim como possui elevada rentabilidade quando comparada a outras culturas. Minas Gerais é o maior produtor nacional de morango, e o município de Datas vem ganhando destaque na produção mineira. O objetivo do trabalho foi realizar o levantamento dos custos de produção dessa hortaliça e analisar a viabilidade financeira para o seu cultivo no local em estudo, a partir dos seguintes indicadores de viabilidade: Valor Presente Líquido (VPL), Taxa Interna de Retorno (TIR) e Payback, além de complementação por meio de análise de sensibilidade. Os resultados apontaram que o custo para produzir morangos em Datas/MG foi de R$ 190.617,98/ha e que apesar do alto valor de investimento, os indicadores estudados apresentaram viabilidade econômico-financeira do empreendimento, com valor positivo para VPL (R$ 265.101,94), TIR igual a 54% e Payback de 2,52 trimestres. Portanto, verificou-se, para o ano de 2020 a cultura do morango foi viável no município de Datas, região do Vale do Jequitinhonha de Minas Gerais.

Palavras-chave: Análise de Mercado; Custo de produção; Morango; Vale do Jequitinhonha.

PEREIRA, N.A.S.; FERREIRA NETO, A.C; BONFÁ, C. S. E SANTOS, L.C. ANALYSIS OF FINANCIAL FEASIBILITY AND RISK OF STRAWBERRY CULTURE: A CASE STUDY FOR THE MUNICIPALITY OF DATAS, MINAS GERAIS

2 ABSTRACT

Strawberry is a hybrid (*Fragaria* x *ananassa*), which was established in Brazil due to its adaptability to the subtropical and temperate climate, typical of high altitude areas or in the South and Southeast regions of the country. High profitability when compared to other cultures.

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Minas Gerais is the largest national strawberry producer, and the municipality of Datas has been gaining prominence in Minas Gerais production. The objective of the work was to survey the production costs of this vegetable and analyze the financial viability of its cultivation in the study site, based on the following economic viability indicators: NPV, IRR, Payback, in addition to supplementation through of sensitivity analysis. The results showed that the cost to produce strawberries in Datas/MG was R$ 190,617.98/ha and that despite the high investment value, the studied indicators showed economic and financial viability of the enterprise, with a positive value for NPV (R$ 265,101.94), IRR equal to 54% and Payback of 2.52 quarters. Therefore, it was found that, for the year 2020, strawberry cultivation was viable in the municipality of Datas, in the Vale do Jequitinhonha region of Minas Gerais.

Keywords: Market analysis; Production cost; Strawberry; Jequitinhonha Valley.

3 INTRODUCTION

Strawberry cultivation (*Fragaria x ananassa*) was established in Brazil in 1945. From then on, according to Silveira and Guimarães (2014), with the expansion of planted areas in the country, the use of technologies increased, and there was a significant professionalization in the sector. In Brazil, approximately 5,200 ha of strawberry plants are cultivated annually, with production reaching 200,000 tons, with emphasis on the state of Minas Gerais, the largest national producer, with more than 2,800 hectares planted and production of approximately 120,000 tons (ANTUNES; BONOW; REISSENER JUNIOR, 2021).

This vegetable has effective markets in the southern and southeastern regions of the country and is an integral part of the diet of some Brazilian families. When subjected to the use of high technologies, such as irrigation and the use of *mulching* to cover beds, regional adaptability, strawberry cultivation provides high productivity of approximately 100 T ha-1 (DIAS *et al.*, 2019).

The growing interest in strawberry cultivation can be attributed to the broad knowledge and acceptance of the fruit by consumers, in addition to the great diversity of marketing and processing options. Cultivation requires considerable labor, which creates jobs on large and small properties; in the latter, the activity absorbs family members, becoming a business opportunity for the family farming model (DIAS *et al.*, 2019).

In Minas Gerais, 8,731 family farmers and 296 nonfamily farmers are responsible for strawberry production in 59 municipalities. Family farming is responsible for approximately 92% of the state's production on properties measuring an average of 0.5 hectares (EMATER MG, 2022).

In Datas, a municipality located in the interior of Minas Gerais, specifically in the Jequitinhonha Valley, the strawberry is known as the “red diamond”. This name was originated by fellow countrymen who in the past dedicated themselves to mining and started strawberry cultivation using experienced strawberry producers from the south of the state as references; as a result, the culture became the main agricultural activity in the municipality (EMATER MG, 2020).

However, implementing this vegetable requires high investment (OSTWALD *et al.*, 2022; CREPALDI, 1998). Dani (2011) reports that, for strawberry cultivation to be profitable for producers, it is essential to know the production costs in detail, which will make it possible to answer some questions, such as: what results are obtained and how they

can be optimized by means of evaluating results, sources of income and types of expenses? How can revenue be improved and expenses be reduced?

Additionally, according to Dani (2011), if the owner is unaware of his operating cost, there is the possibility that the product will be sold at very high prices or with a selling price below the real value, compromising his profit. Likewise, if the producer has real sales price and cost control, it is possible to know the profit margin and determine a break-even point for your business.

In view of the above, the objective was to analyze the economic and financial viability of strawberry cultivation in Datas, located in the Vale do Jequitinhonha region in Minas Gerais, using data collected by EMATER – MG as a basis.

4 MATERIALS AND METHODS

The region studied was the municipality of Datas in Minas Gerais, Brazil. The location has geographic coordinates of 18°26'54" South Latitude, 43°39'34" West Longitude and an altitude of 1288 meters at the headquarters. According to Koppen's classification, the climate typology of the site is Cwb, known as Tropical Altitude, and the predominant soil is Neossolo Dystrophic Litholic.

Data obtained in several studies relating to recent years were collected and addressed the economic viability of implementing strawberry cultivation with a focus on the composition of production costs, in addition to data obtained at the research site (Datas/MG), together with local producers, extension agents and a rural technical assistance company.

To compose the production costs, data provided by the Minas Gerais Technical Assistance and Rural Extension Company (EMATER/MG) for the year 2020 were used. The items that make up the production cost are the implementation of the culture, which includes soil analysis, plowing, harrowing, planting, application of lime and organic compost, fertilizers, irrigation, acquisition and preparation of seedlings, and application of mulching; cultural treatments, which include agricultural pesticides, weeding, fertigation, electricity and general cleaning; and harvesting, which includes services aimed at harvesting and postharvesting, cardboard boxes, bowls and plastic film for marketing. The production cost of these items can be seen in Table 1.

Table 1. Description of the items that make up the production cost of strawberry farming in Datas-MG, considering an area equivalent to 1 hectare.

Description	IC	TC	C	Total
Price (R$)	48.199,00	12.980,00	44.594,00	105.773,00

IC = culture implementation; TC = cultural treatments; C = harvest.
Source: EMATER MG (2020).

The cultivation system considered in the analysis was that practiced directly on the soil, which is widely used by small producers in the region. These generally use an intermediate technological level.

To analyze the financial viability of the enterprise, average values per kilo of strawberries in 2020 were considered, obtained from the Supply Center (CEASA) located in Contagem, metropolitan region of Belo Horizonte, Minas Gerais.

The commercialization value at this distribution center was considered in the present study because it is one of the main places responsible for the flow of strawberries grown in Datas/MG. The data obtained are presented in Table 2 and were extracted from the CEASA Minas website

(available at: http://www.ceasaminas.com.br/).

Table 2. Monthly variation in the average price of strawberries (kg) in Greater Belo Horizonte.

	Months of the year											
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PM	6,3	7,2	7,7	8,2	10,4	10,9	8,7	8,4	7,8	8,5	9,8	8,8

1 – January; 2 – February; 3 – March; 4 – April; 5 – May; 6 – June; 7 – July; 8 – August; 9 – September; 10 – October; 11 – November; 12 – December; PM = Average price in reais (R$). **Source:** CEASAMINAS (2020).

To assess economic and financial viability, the following indicators were used: Net Present Value (NPV), Internal Rate of Return (IRR) and updated Payback, which are described below:

- Net Present Value (NPV): The NPV, represented mathematically in Equation 1, represents the algebraic sum of cash flows discounted at an interest rate for the present moment. When the NPV is higher than the value of the investment, the activity can be considered economically viable (RODRIGUES *et al.*, 2007).

$$VPL = \sum_{j=O}^{n} R_j + (1+i)^j - \sum_{j=0}^{n} C_j + (1+i)^j \quad (01)$$

where NPV = net present value; R_j = current value of revenue in period j; C_j = current value of costs in period j; i = interest rate; j = period in which revenues and costs occur e; and n = ratio of total project time.

- Internal Rate of Return (IRR): represents the internal profitability of a project, obtained by discounting the cash flow observed in the analysis periods and which cancels out the value of the initial investment, that is, making the NPV equal to zero. The IRR is calculated based on Equation 2 (SIQUEIRA; SOUZA; PONCIANO, 2011).

$$0 = \sum_{j=0}^{n} R_j + (l+i)^j - \sum_{j=0}^{n} C_j + (l+j)^j \quad (02)$$

where R_j = current value of revenue in period j; C_j = current value of costs in period j; i = interest rate; j = period in which revenues and costs occur e; and n = ratio of total project time.

- Updated *Payback*: an indicator that shows how long the loan or investment will take to return to the investor or company (VERGARA *et al.*, 2017).

To calculate the Payback, simply add the expected net cash flow for each period until the value of the initial cost of the project is reached, thus giving the total investment recovery time, as evidenced by Equation 3.

$$\textit{Payback} \text{ atualizado} = \frac{VPL\,(Investimentos)}{VPL\,(Lucros)} * 12\ meses \quad (03)$$

Em que: VPL = Valor Presente Líquido

To obtain the economic-financial viability indicators, a time window of 8 quarters (2 years) was considered, and the long-term interest rate (TJLP) was 6.6% per year (BNDES, 2018).

After carrying out the economic-financial feasibility analysis, a sensitivity

analysis was carried out, since, according to Virgens *et al*. (2015), this analysis allows the design of possible scenarios that can contextualize a real scenario, considering variations in production, price and commercialization of the crop.

In this sense, in the present study, simulations were considered for five scenarios, namely, Scenario I: real (results adapted from EMATER/2020); Scenario II: 10% increase in costs; Scenario III: 10% reduction in productivity; Scenario IV: 10% reduction in sales value; and Scenario V: 10% increase in costs, 10% reduction in productivity and 10% reduction in commercial value.

Data analysis was developed in a Microsoft Excel® 2010 spreadsheet, and the discussion was carried out using descriptive statistics based on tables and graphs, thus allowing the exploration of the results found.

5 RESULTS AND DISCUSSION

5.1 Production costs

The analysis of data relating to the exploration of strawberry farming in the municipality of Datas/MG, based on data from the year 2020, allowed us to identify the value of R$ 191,647.98 per hectare as representing the production cost of the crop of strawberries in the region, as seen in Table 3.

Tabela 3. Description of the items that make up the cost of strawberry production in Datas-MG, considering an area equivalent to 1 hectare.

Description	**Price (R$)**	**Participation in the total production cost**
Implementation of culture	68.518,00	36%
Cultivation	26.360,00	14%
Harvest	89.188,00	46%
Land remuneration	2.000,00	1%
Administrative costs	5.581,98	3%
Total	191.647,98	100%

Source: Adaptation from EMATER MG (2020).

The factors that most impacted the cost of strawberry production in 2020 were expenses with i) harvesting, ii) implementation of the culture and iii) cultural treatments, in that order. The percentage representation of the factors that make up production costs can be seen in Table 3.

In relation to harvesting expenses, the item with the greatest impact was the expense of purchasing cardboard boxes, which consumed approximately 50% of the expenditure on this stage of cultivation (R$ 43,200.00). A similar result was observed in Zachow's study *et al.* (2018), in which the cost of the cardboard box corresponded to 59% of the variable cost of organic strawberries produced in a greenhouse.

A study carried out by Cunha (2015) on the financial viability analysis of organic strawberry production identified a greater expense with the cost of seedlings than with cardboard boxes, as the acquisition of seedlings corresponded to 31.20% of the total variable cost, while the acquisition of cardboard boxes corresponded to 9.65%. However, when only spending on fruit marketing was observed, 51% of the costs were directed toward the purchase of cardboard boxes.

In the municipality of Datas/MG, producers try to minimize this expense by

purchasing used boxes that are well preserved from middlemen, normally at half the price of a new box. Another solution to reduce resources spent on packaging would be to opt for returnable plastic boxes, as they are more durable, in addition to being a more sustainable alternative.

The amount needed to implement the crop, which represented the second highest cost identified in the study (Table 3), was directly affected by the purchase price of strawberry seedlings. In Datas/MG, this fact has increasingly encouraged producers to produce their own seedlings, which can directly impact the total cost of implementing the crop.

Taking into account the factors considered in this work, the variable that presented the lowest production cost was land remuneration, accounting for just over 1% of the final cost. This fact is justified because, in the municipality of Datas/MG, the practice of leasing land is not common, as most producers already have their own land or are able to cultivate their crops on borrowed areas. However, as the objective of the work was to analyze the production cost, it was necessary to account for all possible expenses.

5.2 Economic analysis

The economic-financial viability indicators applied to costs of implementing and conducting strawberry cultivation in the municipality of Datas/MG obtained the following results: NPV: R$ 265,046.06, IRR: 54% and *Payback:* 2.52.

Despite being a demanding vegetable with a high initial investment of approximately R$ 190 thousand/hectare, the profitability and return time on invested capital proved to be attractive, according to the aforementioned data.

Based on the NPV financial indicator, which comprises the value of future payments brought to the present, discounted at a capital cost rate, the project proved to be viable, with a positive NPV, considering the Minimum Attractive Rate (MAR) of 6.6% per year.

With regard to the IRR (internal rate of return) indicator, an important parameter used in evaluating projects, it is essential to highlight that it represents the percentage of return expected for the company. In the context of this specific research, it was found that the IRR exceeded 50% at the end of a period of eight quarters, established as a time window for analysis. It is important to highlight that this value exceeded the minimum attractiveness rate (MAR), which indicates favorable financial viability for the project in question.

The IRR is a fundamental metric to assist in investment decision-making, as it considers both cash flows and the discount rate. When a project's IRR exceeds the MARR, it suggests that the project is attractive and promising, as the expected return is greater than the minimum needed rate. This finding reinforces the viability and feasibility of the business studied, as evidenced by the analysis of this variable.

Within the scope of research related to the topic, a study conducted by Oliveira, Belarmino and Belarmino (2017) deserves to be highlighted. In this research, which involved the production of strawberries in a recirculating semihydroponic system, an IRR of 66.88% was obtained. This result is remarkably similar to that recorded in this work, reinforcing the consistency and reliability of the data obtained.

Regarding the *payback indicator*, which concerns the time needed to recover the initial investment, it was observed that 2.52 quarters would be necessary for the invested capital (R$ 191,617.98) to return to the farmer.

Results similar to those observed in this study were found by Zanatta *et al.* (2015) in research on strawberry cultivation in a semihydroponic system conducted in the municipality of São João do Sul/SC. The author found a positive NPV (R$15,983.00)

and IRR equal to 36%, considering a 5-year horizon in its cash flow and a MARR of 14%. The payback time in the scenario considered was 2 years and 10 months, that is, approximately 11 quarters.

By way of comparison, another crop with high production costs can be considered, such as carrots, in research conducted by Silva (2022), in which the author assessed the economic viability of growing this vegetable. According to the author, carrot production in the municipality of macaíba/RN presented an IRR of 89% and a positive NPV (R$81,178.71), considering a MARR of 15% and a time horizon of 3 years. The *payback indicator,* in turn, demonstrated that the producer was reimbursed between the 1st and 2nd years of production.

5.3 Sensitivity Analysis

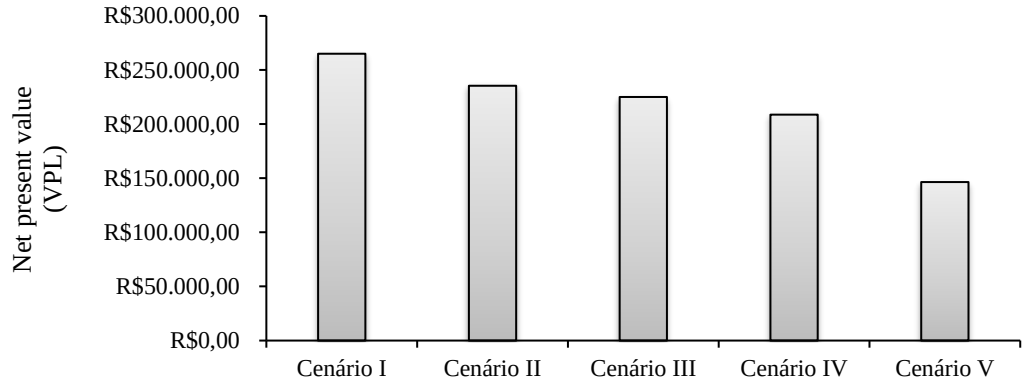
Considering risks (sensitivity analysis) in assessments makes the study more reliable, as possible values are used for a certain variable to assess its impact on the results of the project. (GITMAN, 2004)

The economic-financial viability indicators applied to the costs of implementing and conducting strawberry cultivation in the city of Datas/MG obtained the following results referring to scenario I (real situation): NPV: R$ 265,046.06, IRR: 54% and Payback: 2.52. Likewise, the other four scenarios presented positive results, namely, Scenario II: NPV: R$ 235,454.09, IRR: 46% and Payback: 2.63; Scenario III: NPV: R$ 265,046.06, IRR: 54% and Payback: 2.52; Scenario IV: NPV: R$ 208,758.75, IRR: 45% and Payback: 2.65; Scenario V: NPV: R$146,469.97, IRR: 31% and Payback: 2.94.

Based on the results obtained in the five scenarios considered, the enterprise proved to be viable in all simulations carried out, which highlights the high potential return of strawberry cultivation in the socioedaphoclimatic conditions of the municipality of Datas/MG.

In relation to the NPV economic viability indicator (Graph 1), a positive result was identified in all scenarios analyzed, including Scenario V, which was the worst condition considered, in which a 10% increase in production costs was predicted, a reduction of 10% in productivity and a 10% reduction in commercial value, together.

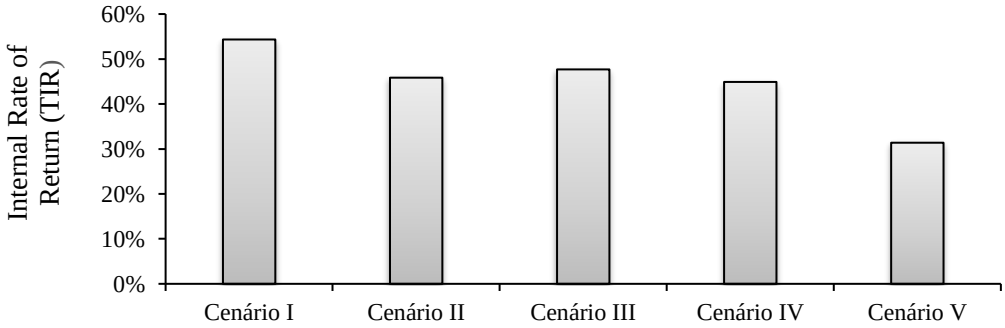
Graph 1. Net present value for different conditions foreseen in the sensitivity analysis for the municipality of Datas - MG.



Scenario I: real (results adapted from EMATER); Scenario II: 10% increase in costs; Scenario III: 10% reduction in productivity; Scenario IV: 10% reduction in sales value; and Scenario V: 10% increase in costs, 10% reduction in productivity and 10% reduction in sales value.
Source: Adapted from EMATER MG (2020).

The Internal Rate of Return (IRR) also indicated the economic/financial viability of strawberry cultivation in the municipality of Datas/MG in all scenarios considered, as seen in Graph 2. As evidenced and to corroborate the viability of the IRR, it was verified that the producer was reimbursed in the third productive quarter in all scenarios.

Graph 2. Internal Rate of Return in situations I, II, III, VI and V foreseen in the sensitivity analysis for the municipality of Datas/MG.

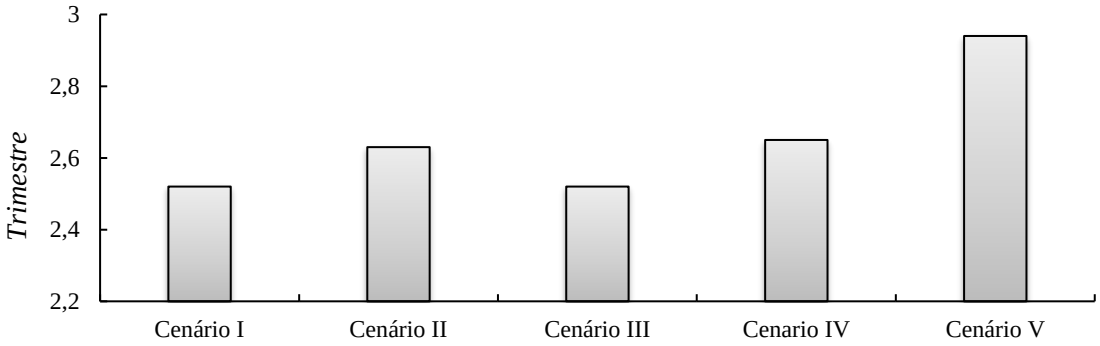


Scenario I: real (results adapted from EMATER); Scenario II: 10% increase in costs; Scenario III: 10% reduction in productivity; Scenario IV: 10% reduction in sales value; and Scenario V: 10% increase in costs, 10% reduction in productivity and 10% reduction in sales value.
Source: Adapted from EMATER MG (2020).

When comparatively analyzing scenarios I (real) and II (10% increase in production costs), the drop in profitability of more than R$55,000.00 can be highlighted. This fact proves how planning followed by technical guidelines is increasingly necessary to reduce costs and, consequently, increase profits. Therefore, the aforementioned scenarios (I and II) were the ones that presented the fastest return on the amount invested (*payback), both scenarios in 2.5 quarters.*

As seen in Graph 3, the worst payback scenario *was* V (10% increase in costs, 10% reduction in productivity and 10% reduction in sales value), where the break-even point is only found after 2.94 quarters.

Graph 3. *Payback* in situations I, II, III, VI and V foreseen in the sensitivity analysis for the municipality of Datas/MG.



Scenario I: real (results adapted from EMATER); Scenario II: 10% increase in costs; Scenario III: 10% reduction in productivity; Scenario IV: 10% reduction in sales value; and Scenario V: 10% increase in costs, 10% reduction in productivity and 10% reduction in sales value.
Source: Adapted from EMATER MG (2020)

6 CONCLUSIONS

Practices related to strawberry harvesting are those that have the greatest impact on the crop in Datas/MG, representing 46% of the total production cost. It is worth mentioning that the production cost of strawberries in this region was R$ 190,617.98 per hectare, and the analysis of economic-financial indicators, such as NPV (net present value), IRR (internal rate of return) and *payback*, showed the viability of the enterprise.

When carrying out a sensitivity analysis to evaluate the risk scenarios, it was found that no economic unfeasibility was identified for the strawberry cultivation activity in Datas/MG. This information is crucial, as it reinforces the robustness of the enterprise even in the face of possible variations in market conditions or production costs.

Thus, the results obtained indicate that strawberry harvesting and other aspects related to its production are key factors for the economic success of this business in Datas/MG, corroborating the viability of investing in this agricultural activity.

REFERENCES

ANTUNES, L. E. C.; BONOW, S.; REISSENER JUNIOR, C. Morango produção aumenta ano a ano. **Campos e Negócios**, Uberlândia, p. 87-90, 2021.

BNDES. **Taxa de Juros de Longo Prazo**. Brasília, DF: BNDES, 2018. Disponível em: https://www.bndes.gov.br/wps/portal/site/home/financiamento/guia/custos-financeiros/taxa-juros-longo-prazo-tjlp. Acesso em: 05 out. 2023.

CEASAMINAS. **Filtro preço médio por produto** - Série histórica disponível nos últimos cinco anos. Contagem: CeasaMinas, 2020. Disponível em: http://minas1.ceasa.mg.gov.br/detec/prc_medio_prd/prc_medio_prd.php. Acesso em: 20 out. 2021.

CREPALDI, S. A**. Contabilidade Rural**: uma abordagem decisorial. São Paulo, SP: Editora Atlas S.A, 1998.

CUNHA, P. D**. Custos de produção**: uma análise da viabilidade financeira na produção de morango orgânico. 2015. Trabalho de Conclusão de Curso (Graduação em Gestão do Agronegócio) – Universidade de Brasília, Brasília, DF, 2015.

DANI, D. **Determinação do Custo e da Rentabilidade na Cultura do Morango**. 2011. Trabalho de Conclusão de Curso (Graduação em Ciências Contábeis) – Universidade de Caxias do Sul, Caxias do Sul, 2011.

DIAS, M. S. C.; REIS, J. B. R. da S.; JESUS, A. M. de; CASTRICINI, A.; COSTA, A. C. F. da; LONDE, L. N.; PACHECO, D. D. Morango (*Fragaria x ananassa* Duch.). *In*: PAULA JUNIOR, T. J.; VENZON, M. **101 Culturas**: Manual de tecnologias agrícolas. 2. ed rev. e atual. Belo Horizonte: EPAMIG, 2019. p. 423-432.

EMATER MG. **EMATER-MG integra a rede morangos do Brasil.** Belo Horizonte: Emater-MG, 2022. Disponível em: https://www.emater.mg.gov.br/portal.do?flagweb=novosite_pagina_interna&id=26350. Acesso em: 07 jun. 2023.

EMATER MG. **Relatório sobre a produção de morango em Datas, Minas Gerais referente ao de 2020**. Datas: Emater-MG, 2020.

GITMAN, L. J**. Princípios de administração financeira**. 10. ed. São Paulo: Pearson Addison Wesley, 2004.

OLIVEIRA, I. P.; BELARMINO, L. C.; BELARMINO, A. J. Viabilidade da produção de morango no sistema semi-hidropônico recirculante. **Custos e Agronegócio Online**, Pelotas, v. 13 n. 1, p. 315-332, 2017.

OSTWALD, D.; WIEDTHAUPER, D. G.; ROSA, K. D.; NESSLER, T. L.; BARELLA, T. P. C.; ULRICH, V.; GUERRA, D.; SILVA, D. M.; LANZANOVA, L. S. Caracterização dos sistemas Hidropônicos de produção no município de Três Passos-RS. **Revista Extensão em Foco**, Palotina, n. 26, p. 220-234, jan./jul. 2022.

RODRIGUES, E. R.; CULLEN JÚNIOR, L.; BELTRAME, T. P.; MOSCOGLIATO, A. V.; SILVA, I. C. Avaliação econômica de sistemas agroflorestais implantados para recuperação de reserva legal no pontal do Paranapanema, São Paulo. **Revista Árvore**, Viçosa, v. 31, n. 5, p. 941-948, 2007.

SILVA, E. dos S. **Análise da viabilidade econômico-financeira da produção de cenoura (Daucus carota subsp. Sativus) no município de Macaíba/RN**. Trabalho de Conclusão de Curso (Graduação em Engenharia Agronômica) – Universidade Federal do Rio Grande do Norte, Macaíba, 2022.

SILVEIRA, G. S. R; GUIMARÃES; B. C. Aspectos sociais e econômicos da cultura

do morangueiro. **EPAMIG Informe Agropecuário**, Belo Horizonte, v. 35, n. 279, p. 7-10, 2014.

SIQUEIRA, H. M.; SOUZA, P. M.; PONCIANO, N. J. Café convencional versus café orgânico: perspectivas de sustentabilidade socioeconômica dos agricultores familiares. **Revista Ceres**, Viçosa, v. 58, n. 2, p. 155-160, mar./abr. 2011.

VERGARA, W. R. H.; OLIVEIRA, J. P. C.; BARBOSA, F. A.; YAMANARI, J. S. Análise de viabilidade econômico-financeira para aquisição de uma unidade de armazenagem de soja e milho. **Gestão da Produção, Operações e Sistemas**, Bauru, v 12, n 1, p. 41-61, 2017.

VIRGENS, A. P.; FREITAS, L. C.; LUZ, D. S.; MOREIRA, A. C. D. Análise econômica e de sensibilidade em projetos de reflorestamentos no estado da Bahia. **Enciclopédia Biosfera**, Goiânia, v. 11, n. 21, p. 120-127, 2015.

ZACHOW, M.; DOTTO, M.; FIEDLER, L.; TAGLIAPIETRA, O.; BERTOLINI, G. Formação do preço de venda do morango orgânico a partir dos custos de produção. **Revista de Ciências Empresariais da UNIPAR**, Umuarama, v. 19, n. 2, p. 243-256, jul./dez. 2018.

ZANATTA, M. G.; NAGAOKA, A. K.; NAGAOKA, M. P. T.; OLIVEIRA, J. L. B. **Análise de viabilidade econômica na produção de morango (*Fragaria x ananassa* Duch.) semi-hidropônico em São João do Sul-Santa Catarina**. Trabalho de Conclusão de Curso (Bacharelado em Agronomia) – Centro de Ciências Agrárias, Universidade Federal de Santa Catarina, Florianópolis, 2015.