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Impact of Exchange Rate Fluctuations on The Export Profitability of Strawberries: Evidence from The San Quintín Valley, 2023

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ABSTRACT: This article examines the impact of USD/MXN nominal exchange rate fluctuations on the operating profitability of strawberry producers in San Quintin, Baja California, during the 2022-2023 agricultural cycle. Using a mixed-methods design that combines econometric analysis of secondary data and structured surveys of 20 agricultural entrepreneurs, we assess the exchange rate pass-through on profit margins, controlling for adverse climatic conditions. Results reveal a significant negative correlation ($\beta = -0.45$, $p < 0.05$) between peso appreciation and crop profitability, amplified by yield and quality reductions linked to El Niño. 65% of producers reported declining profitability, with 75% identifying exchange rate volatility as a critical driver. We discuss implications for financial risk management, the need for currency hedging instruments, and targeted subsidy policies. This study contributes to agribusiness finance literature and risk management in export-dependent agricultural regions.

KEYWORDS: exchange rate, export profitability, financial risk management, berry agriculture, San Quintin, subsidy policies.

1. INTRODUCTION

Mexico is positioned as one of the world's leading strawberry exporters, with the San Quintin Valley (Baja California) serving as a strategic hub for supplying North American markets, especially during the winter. The partial dollarization of export revenues, coupled with a cost structure that increasingly relies on imported inputs (fertilizers, agrochemicals, irrigation technology), exposes producers to systemic exchange rate risk.

In the 2023 growing season, the appreciation of the Mexican peso against the dollar, coupled with the intensification of the El Niño phenomenon, generated a double shock to profit margins: a contraction of local currency revenues due to the conversion of sales denominated in USD, and an increase in operating costs due to the deteriorated fruit quality and greater need for phytosanitary control. Despite the macroeconomic and financial importance of the sector, the empirical literature lacks regional studies that quantify the sensitivity of agricultural profitability to the exchange rate under conditions of climate stress.

The objective of this research is to determine the impact of USD/MXN exchange rate fluctuations on the export profitability of strawberries in San Quintin during the 2023 cycle, identifying transmission channels and proposing financial management and public policy mechanisms. The study provides useful empirical evidence for academics, risk managers, and policymakers in emerging agricultural export economies.

2. THEORETICAL FRAMEWORK AND BACKGROUND

The transmission of exchange rate fluctuations to prices and profit margins in the agricultural sector is framed within the exchange rate pass-through theory (ERPT) and the theory of international competitiveness. When the local currency appreciates, foreign currency earnings translate into lower domestic currency flows, compressing the gross margin if costs are not completely flexible downwards (Krugman, 1987; Goldberg & Knetter, 1997). In economies with high dollarization of liabilities and dependence on imported inputs, the net effect on profitability depends on the elasticity of substitution between local and imported inputs, as well as the ability to pass on prices to international buyers.

Recent studies in Mexico indicate that peso depreciation temporarily benefits agricultural exporters, but this benefit quickly diminishes when the cost structure is import-intensive or when exogenous shocks (climatic, logistical) reduce productivity (Hernández Soto et al., 2021; Zamora Torres & Baez-Figueroa, 2022). International evidence shows similar results: in West Africa, CFA franc devaluation increased agricultural export revenues, but only when combined with macroeconomic stability and access to financing (Ndiaye, 2022; Shobande, 2019).

In San Quintin, strawberry production operates in an environment of high exposure to exchange rate and climate risk. The literature underscores the need to integrate financial hedging instruments (forwards, options, price contracts) and indexed agricultural insurance policies to mitigate cash flow volatility (Tulkin Sattarovich & Kuvonchbek Ravshanovich, 2018; Mundaca, 2016). This study addresses this empirical gap by quantifying the sensitivity of profitability to exchange rates and evaluating local producers' risk perceptions.

3. METHODOLOGY

3.1. Design and Approach

A sequential explanatory mixed-methods research design was employed. The quantitative phase analyzed production, price, and exchange rate data; the qualitative phase complemented this with structured surveys of producers to validate transmission channels and assess the effectiveness of existing mitigation strategies.

3.2. Data Sources and Sample

- **Secondary data**: Cultivated area, production volume, sales prices, and input costs (fertilizers, pesticides, packaging) obtained from the Agri-Food and Fisheries Information System (SIAP, 2023) and reports from the Ministry of Economic Development (SEDECO).
- **Exchange rate**: Annual and monthly average USD/MXN rate published by the Bank of Mexico (Banxico).
- **Qualitative sample**: 20 agricultural entrepreneurs from the San Quintin Valley, selected using non-probability convenience sampling, stratified by scale (small, medium, large) to ensure operational representativeness.

3.3. Variables and Empirical Model

- **Dependent variable**:

Operational profitability of the crop (%) = (Total revenue – Total costs) / Total revenue × 100.

- **Independent variables**:
  - o ΔTC: Percentage change in the USD/MXN exchange rate (peso appreciation = positive values).
  - o CLIMATE: Dummy/bimodal variable for adverse conditions (El Niño 2023 = 1).
  - o IMPORTED_COST: Percentage of imported inputs relative to total cost.
- **Statistical technique**: Multiple linear regression with ordinary least squares (OLS) estimation. Multicollinearity (VIF), heteroscedasticity (Breusch-Pagan), and residual normality tests. Content analysis for qualitative data. Software: SPSS v.28 and Stata/Excel for cross-validation.

3.4. Ethical Considerations and Limitations

Survey data were collected with informed consent. The sample is limited to a single agricultural cycle and a specific region, which restricts external generalization. Nevertheless, the findings offer a benchmark for longitudinal studies and regional panels.

4. RESULTS

4.1. Production Dynamics and Climatic Context

During the 2023 cycle, San Quintin recorded a harvested area of 2,800 hectares of strawberries, representing a 10% decrease compared to the previous cycle. This reduction is mainly attributed to atypical rainfall and temperature fluctuations associated with El Niño, which increased the incidence of fungal diseases and reduced the size and shelf life of the fruit (Fig. 1).

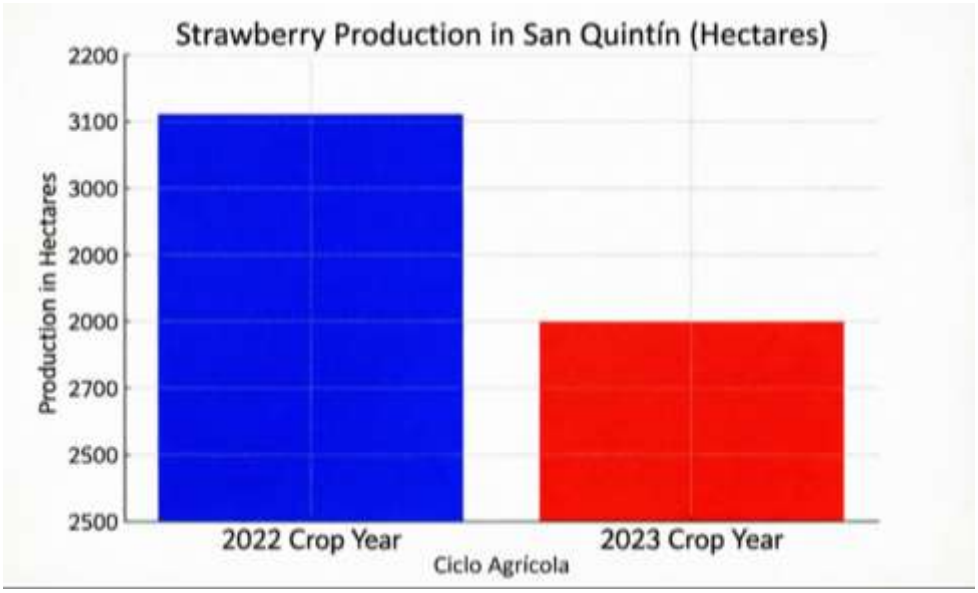

Figure 1. Strawberry production in San Quintin (2022 vs. 2023 cycles).

Note: The blue bar represents the estimated 2022 production; the red bar, the actual 2023 production.

Source: Prepared by the authors using data from SIAP (2023).

At the state level, strawberry production in Baja California showed high volatility between 2017 and 2022, with peaks in 2019 (200,571 ha) and sharp declines in 2020-2021, reflecting the sector's sensitivity to exogenous shocks and acreage adjustments (Fig. 2).

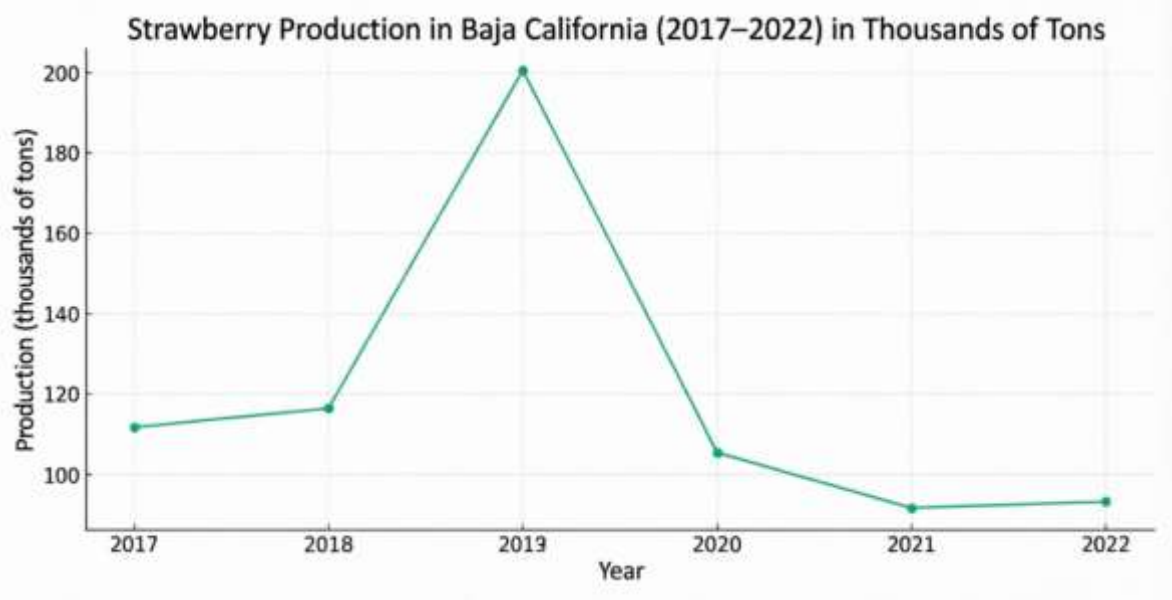

Figure 2. Evolution of strawberry production in Baja California (2017-2022).
Note: Cyclical trend influenced by climatic conditions, international prices, and investment policies.
Source: Prepared by the authors using data from SIAP (2022).

4.2. Impact of the Exchange Rate on Profitability

The regression analysis yielded a significant coefficient for the exchange rate variation: $\beta = -0.45$ ($p < 0.05$), indicating that for every 1% appreciation of the peso against the dollar, the crop's operating profitability decreases by 0.45 percentage points, *ceteris paribus*. The climatic variable (CLIMA) was also significant ($\beta = -0.38$, $p < 0.05$), confirming the combined effect of macroeconomic and environmental shocks (Fig. 3).

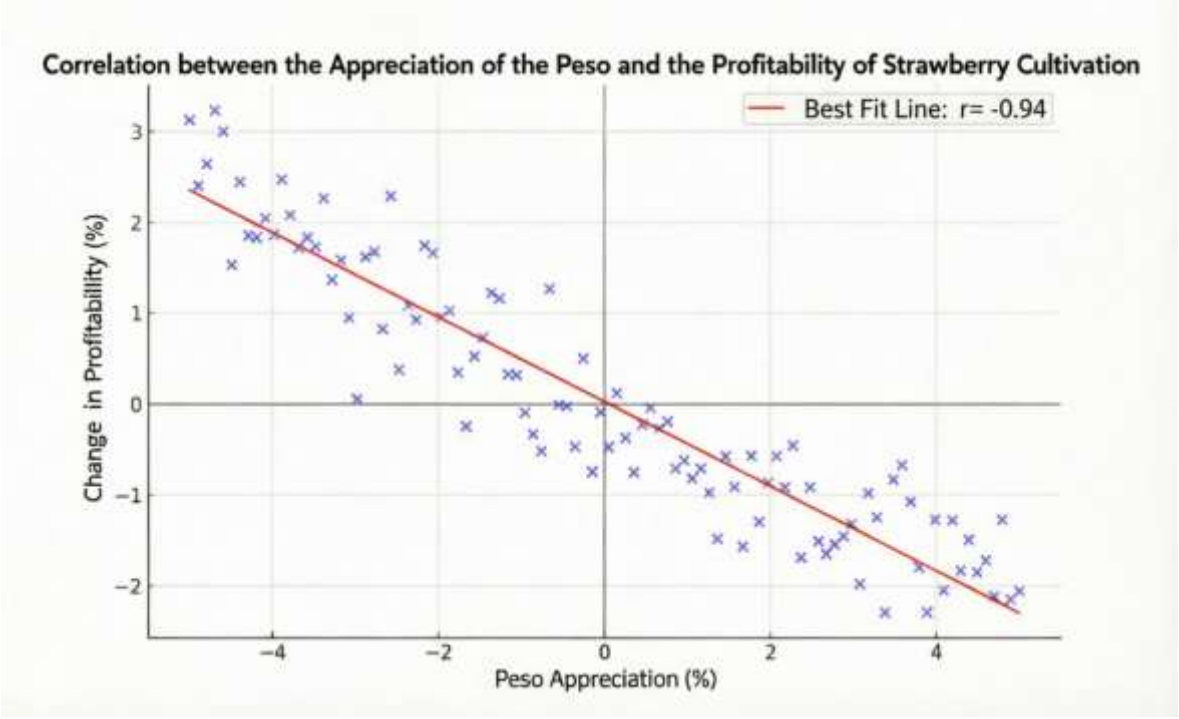

Figure 3. Correlation between peso appreciation and strawberry crop profitability.
Note: Blue dots represent simulated/actual observations; the red line indicates the linear fit (adjusted $R^2 \approx 0.20$). Moderate negative slope ($r \approx -0.45$).
Source: Author's own elaboration.

The historical evolution of the USD/MXN exchange rate (2021-2024) shows a marked appreciation trend in 2023 (average 16.97 MXN/USD), followed by a slight correction in 2024 (17.10 MXN/USD), a context that intensified the pressure on exporters' margins (Fig. 4).

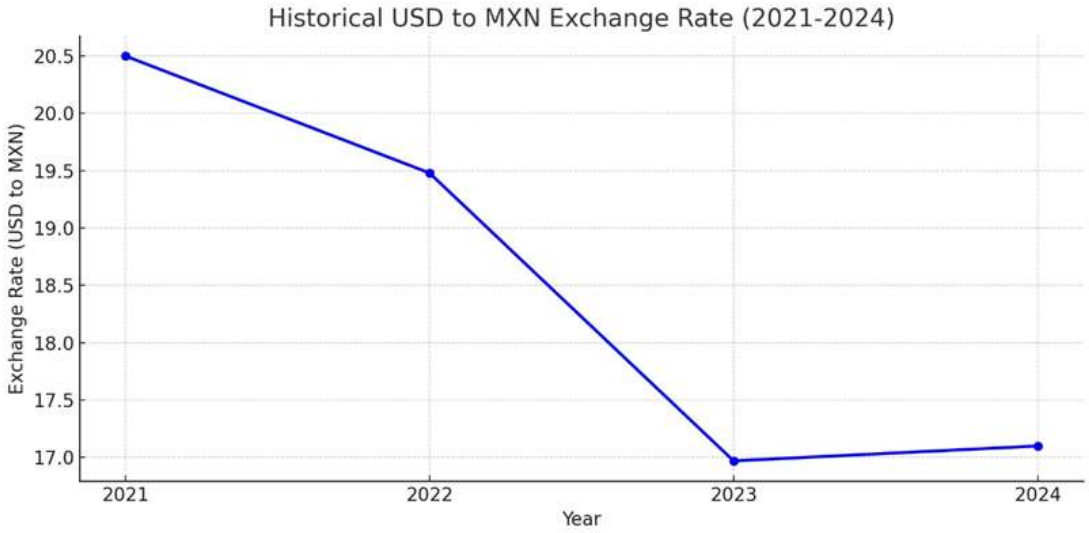

Figure 4. Historical USD/MXN Exchange Rate (2021-2024).
Note: Annual average. The 2023 appreciation coincides with the lowest reported profitability cycle.
Source: Prepared by the authors using data from Wise/Banxico.

4.3. Survey Results and Risk Perception

65% of respondents reported a decrease in profitability during the 2023 cycle. Within this group, 75% identified exchange rate volatility as a critical factor, while 80% indicated that adverse weather conditions complicated the overall management of the crop (Fig. 5).

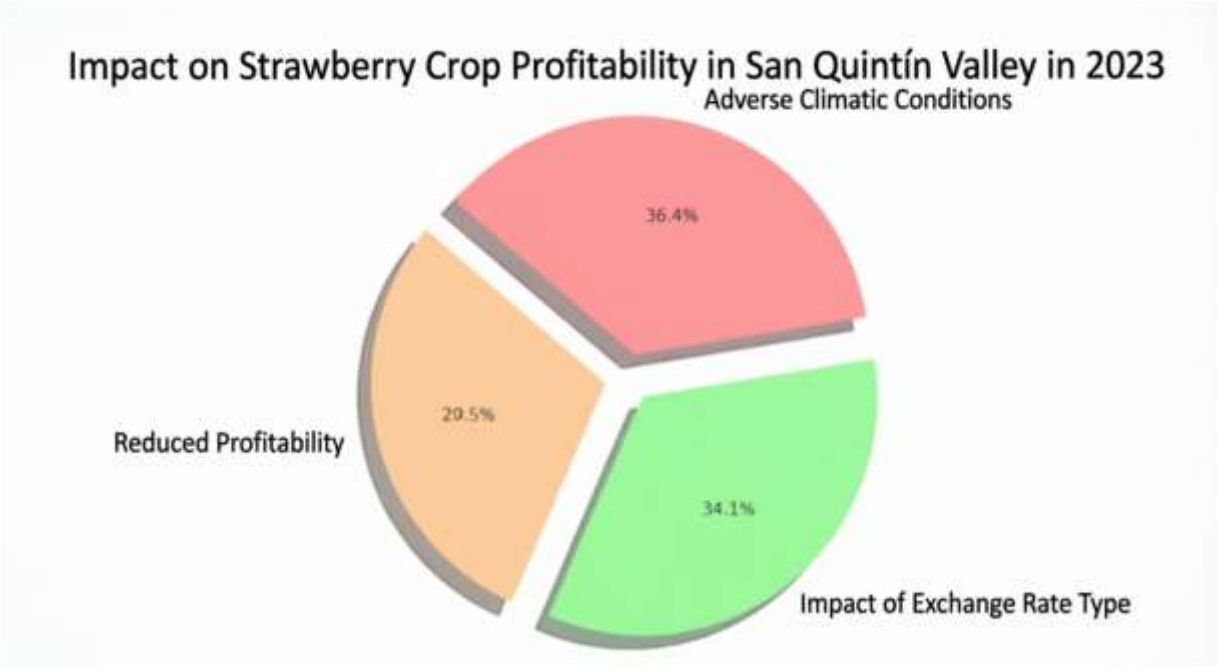

Figure 5. Factors affecting profitability in strawberry cultivation in San Quintin, 2023.
Note: Pie chart showing the intersection of financial and climate risks.
Source: Prepared by the authors using data from a survey of 20 agricultural entrepreneurs.

Regarding the role of the State, 75% of producers considered that targeted subsidies for imported inputs and agricultural insurance schemes indexed to climate/exchange rate could significantly mitigate exposure to external shocks (Fig. 6).

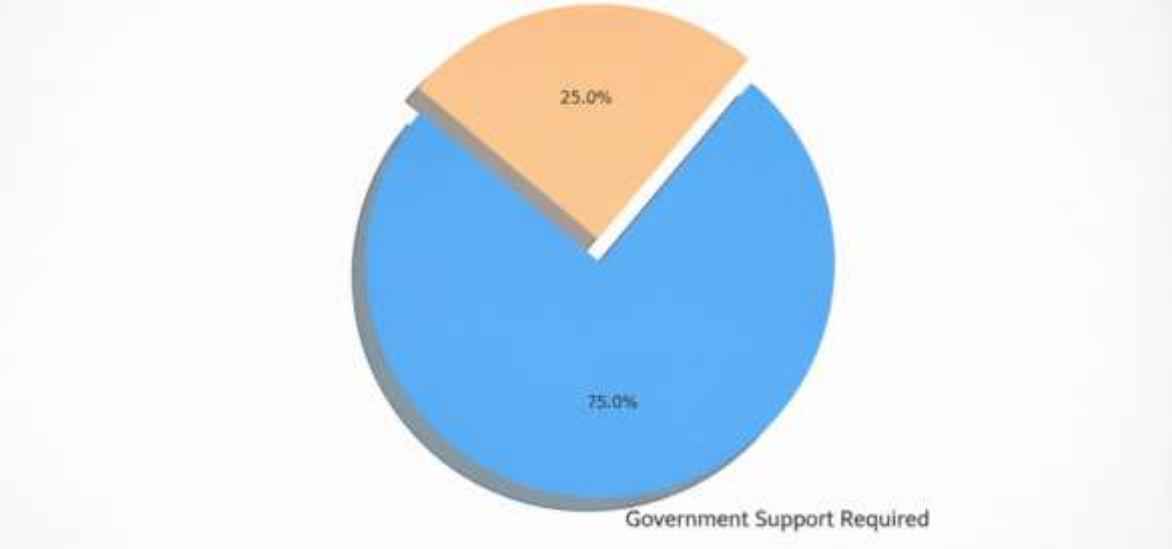

Figure 6. Perception of the need for government support in the agricultural sector.
Note: The highlighted segment represents the consensus on risk mitigation instruments.
Source: Prepared by the authors using survey data.

5. DISCUSSION

The findings confirm the central hypothesis: the appreciation of the Mexican peso exerts downward pressure on the export profitability of strawberries in San Quintin, a mechanism consistent with the incomplete exchange rate pass-through theory in markets with rigid import costs. The magnitude of the coefficient (β = -0.45) suggests moderate-to-high elasticity, implying that margins are sensitive to short-term exchange rate movements, especially in cycles with high dollarization of operating costs.

The interaction with climatic variables introduces a compound risk. Lower fruit quality not only reduces the selling price but also increases post-harvest costs and rejections, exacerbating the negative effect of the exchange rate. This finding aligns with the literature on high-value agriculture in Mediterranean coastal regions, where operational resilience depends on market diversification and the adoption of protected agriculture (Palencia et al., 2013; Velasco-Aulcy et al., 2018).

From a corporate finance perspective, the results highlight the underutilization of currency hedging instruments in the sector. Most producers operate with a net long exposure to USD without hedging strategies, making them vulnerable to sharp exchange rate adjustments. Policies that facilitate access to forwards, vanilla options, or minimum price contracts, along with temporary subsidies conditioned on the adoption of sound risk management practices, could stabilize cash flows and improve the sector's financial sustainability.

Limitations of the study include the sample size and the single-cycle time frame. Future research should employ panel data at the plot level, incorporate international berry price variables, and evaluate the empirical effectiveness of hedging strategies implemented by cooperatives or producer associations.

6. CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates that fluctuations in the USD/MXN exchange rate and adverse weather events have a significant and combined negative impact on the profitability of strawberry production in San Quintín during the 2023 cycle. The appreciation of the peso reduces local currency income derived from exports denominated in USD, while weather conditions deteriorate yield and quality, increasing operating costs.

Policy and Financial Management Recommendations:

1. ***Foreign Exchange Hedging Instruments***: Promote access to forward contracts and USD put options for exporting producers, with technical support from financial institutions and agribusiness chambers.
2. ***Indexed Agricultural Insurance***: Design policies that trigger payouts upon reaching predefined thresholds of peso appreciation or extreme precipitation, reducing information asymmetry and administrative costs.
3. ***Targeted and Temporary Subsidies***: Implement partial compensation mechanisms for imported inputs during periods of prolonged peso appreciation, preventing permanent market distortions.
4. ***Investment in Climate Resilience***: Finance infrastructure for advanced irrigation, shade greenhouses, and early warning systems, complemented by training in agricultural financial management. 5. Conservative Sales Forecast:

Exporters are advised to project cash flows using a slightly appreciated reference exchange rate relative to the current spot rate, incorporating a safety margin to preserve operating liquidity.

Establishing a stable financial environment for the berry sector requires coordination between exchange rate policy, derivatives market regulation, and agricultural extension services. Longitudinal and comparative studies with other producing regions (Michoacán, Guanajuato) will allow for refining risk models and optimizing the allocation of public and private resources.

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