12th INTERNATIONAL SCIENTIFIC CONFERENCE
RURAL DEVELOPMENT 2025
RESILIENCE TO GLOBAL CHANGE
1-3rd October, 2025, Vytautas Magnus University Agriculture Academy, Lithuania

VYTAUTAS MAGNUS UNIVERSITY AGRICULTURE ACADEMY

Proceedings of the 12th International Scientific Conference Rural Development 2025

Edited by assoc. prof. dr. Judita Černiauskienė

ISSN 2345-0916 (Online)

Article DOI: https://doi.org/10.15544/RD.2025.022

THE SPANISH COMBINED AGRICULTURAL INSURANCE SYSTEM AS A STRATEGIC TOOL FOR THE SUSTAINABILITY AND RESILIENCE OF BLUEBERRY CULTIVATION: A FINANCIAL AND ECONOMIC ANALYSIS IN THE CONTEXT OF GLOBAL CHANGE

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Spain's blueberry sector, a strategic pillar of its agri-food economy, is highly vulnerable to escalating climate risks, making effective risk management imperative for its sustainability. This study provides a thorough financial and economic analysis of the Spanish Combined Agricultural Insurance System (SSAC), a well-established public-private partnership, and evaluates its effectiveness as a tool for stabilizing income and fostering resilience in this vital sector. Using a quantitative methodology, the study combines a descriptive and longitudinal analysis of a decade's worth of data (2016–2024) from official sources (ENESA, MAPA) on insured capital, premiums, subsidies, and indemnities. The analysis is structured on three levels: the aggregate system, the sectoral line for soft fruits, and a specific case study on the underwriting data for blueberries in Huelva, its main production hub. The results reveal a high insurance penetration rate, critically supported by public subsidies covering approximately 50% of the premium cost. The system demonstrates a robust capacity as a financial buffer, effectively mitigating income shocks from increasing claims. The analysis identifies Huelva's near-total hegemony in the national blueberry insurance market (concentrating >90% of the capital) and a strategic preference among its farmers for insurance modules that balance protection and cost. The study concludes that the SSAC is an indispensable strategic asset for the resilience of the Spanish blueberry sector. However, its long-term efficacy hinges on its ability to evolve dynamically. We recommend policy enhancements focused on greater product flexibility, integrating technology into loss assessment, and creating incentives for on-farm preventive measures. These adaptations are essential to align the insurance framework with the challenges posed by global change and to ensure the continued competitiveness of this vital rural industry.

Keywords: *agricultural insurance, risk management, blueberry cultivation, resilience, sustainability, climate change.*

INTRODUCTION

The soft fruit sector in Spain, and particularly blueberry cultivation, has undergone an exponential expansion over the last two decades, establishing itself as a strategic pillar of the national agricultural economy and an engine for development in specific regions such as the province of Huelva. With a cultivated area in Andalusia of around 4,520 hectares and a production volume that positions Spain as the second-largest producer in the European Union, surpassed only by Poland (Freshuelva, 2024), the blueberry is not just a high-value-added crop but also a significant generator of employment and a cornerstone of agri-food exports. However, this economic prominence coexists with an intrinsic vulnerability. The exposure to an increasing frequency and intensity of adverse climate risks (late frosts, heatwaves, drought, hailstorms), the volatility of international markets, and phytosanitary uncertainties create a highly complex scenario for producers. In this context, risk management ceases to be an option and becomes an imperative for the survival and competitiveness of farms (García-Machado *et al*., 2024). This research provides a thorough financial and economic analysis of the Spanish Combined Agricultural Insurance System (SSAC) and evaluates its effectiveness as a strategic tool for fostering sustainability and resilience in the Spanish blueberry sector. The main purpose is to determine whether the SSAC effectively mitigates financial risks associated with climate change, thereby supporting the long-term viability of this vital industry. The specific objectives are: (1) to analyze the financial performance and evolution of the SSAC at the aggregate, sectoral, and sub-sectoral (blueberry) levels over the last decade; (2) to assess the role of public subsidies and risk concentration in the system's operation; and (3) to evaluate how blueberry farmers strategically use the available insurance modules to manage their risk exposure.

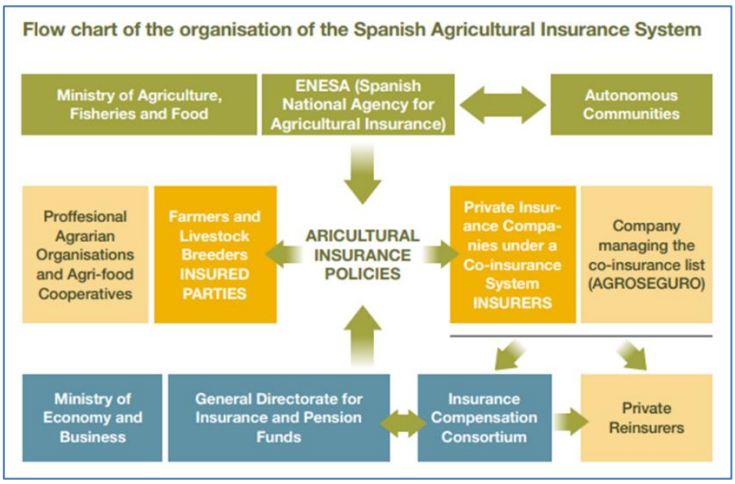
THEORETICAL FRAMEWORK: INSURANCE AS A STRATEGIC TOOL FOR AGRICULTURAL SUSTAINABILITY

The long-term success of any agricultural sector hinges on two interconnected concepts: sustainability and resilience. Sustainability, in an economic sense, refers to a farm's ability to remain profitable and viable over the long term without compromising its resource base. Resilience is the capacity of the agricultural system to withstand, adapt to, and recover from shocks and stressors, such as those posed by climate change and market volatility (Meuwissen *et al*., 2019). In this context, risk management is not merely an operational task but a core component of strategic planning for sustainability.

Agricultural insurance is a primary instrument for managing the unavoidable risks inherent in farming. However, its role can be understood at two levels. Operationally, it acts as a palliative tool, providing financial compensation after a loss occurs. Strategically, a well-designed insurance system acts as an ex-ante mechanism that enables long-term planning and investment by stabilizing farm income (Miranda & Glauber, 1997). By placing a floor on potential losses, it reduces cash-flow uncertainty, which in turn facilitates access to credit, encourages investment in new technologies, and promotes the adoption of more sustainable practices that might otherwise be perceived as too risky (Barnett & Mahul, 2007). Public-private partnership (PPP) models, like the SSAC, are particularly relevant as they leverage public subsidies to overcome market failures like adverse selection, ensuring high participation rates and creating a stable risk pool that makes the insurance both accessible and effective as a strategic asset for the entire sector (Smith & Glauber, 2012).

THE SSAC AS A CONSOLIDATED AND SUCCESSFUL PUBLIC-PRIVATE MODEL

To appreciate our findings, one must first understand the unique architecture of the SSAC. The SSAC, born from Law 87/1978 and a result of the consensus of the Moncloa Pacts, represents a paradigm case study at the international level due to its unique and enduring public-private collaboration structure. It is not a simple insurance market but a state policy designed to provide stability to the primary sector (Machetti Bermejo, 2015). This system is articulated through several key actors whose interaction is fundamental (Ruiz Hernández-Vaquero, 2024). Figure 1 shows the SSAC's architecture. On one hand, the State Agency for Agricultural Insurance (ENESA), attached to the Ministry of Agriculture, Fisheries, and Food, annually designs the Insurance Plan, defines the policy conditions, and, crucially, manages the state subsidies for the premiums. These subsidies are the cornerstone that facilitates the accessibility of the insurance. On the other hand, the Spanish Association of Insurance Companies (Agroseguro), a co-insurance pool, manages the underwriting, claims adjustment, and the payment of indemnities. Finally, the Insurance Compensation Consortium acts as the public reinsurer, providing a level of solvency to the system that protects it against catastrophic events.



Source: ENESA (2019, pp. 11)

Figure 1. The Spanish Combined Agricultural Insurance System (SSAC).

This institutional framework operates under clear principles: voluntary participation in underwriting, solidarity (the obligation to insure all plots of the same crop to disperse the risk), and a fundamental premise: damages from insurable risks cannot be the subject of extraordinary aid, which fosters a culture of professional risk management. The system has shown enormous dynamism, evolving from covering just a few crops in 1980 to a "modular" system today that allows farmers to choose the level of coverage that best suits their needs, covering practically all agricultural productions. For the blueberry, framed within the "Strawberry and Other Soft Fruits" line, this translates into a flexible and adapted offer of coverage against a wide range of adversities, constituting a decisive financial safety net.

THE GLOBAL BLUEBERRY MARKET: A TECTONIC SHIFT IN PRODUCTION AND TRADE

From Niche Product to Global "Superfood": The Rise of the Blueberry

To understand the relevance of a risk management instrument like agricultural insurance for blueberries in Spain, it is essential to contextualize this fruit in its global macroeconomic dimension. Over the last two decades, the blueberry

has transitioned from a niche crop to a globalized commodity, establishing itself in the "superfood" category (Rashwan *et al*., 2023). This growth has been driven by increasing consumer awareness of its health benefits, innovation in varietal genetics that has enabled its cultivation in new latitudes, and the development of global logistics chains that ensure its year-round availability (FAO, 2024). This section offers an overview of the current state of the sector at the global, regional, and national levels, laying the groundwork for the subsequent microeconomic analysis.

Global Production and Cultivated Area

The global expansion of the blueberry is reflected in the figures for area and production. In 2023, the worldwide production of cultivated blueberries reached approximately 1.78 million metric tons, harvested from a total planted area of 262,417 hectares. The production map has undergone a tectonic shift, with the epicenter of growth moving from North America to other regions. China has consolidated its position as the world's largest producer by volume, followed by the United States, Peru, and Chile (IBO, 2024). In this context, Spain holds a prominent fifth position worldwide (see Table 1).

Table 1. Top 10 Cultivated Blueberry Producing Countries by Total Volume (Fresh + Processed) in 2023

Rank	Country	Production (000 MT)
1	China	563.46
2	United States	282.82
3	Peru	233.87
4	Chile	132.33
5	Spain	70.86
6	Mexico	67.32
7	Canada	63.24
8	Poland	62.00
9	Morocco	56.06
10	South Africa	35.00

Note: in thousands of metric tons.
Source: Author's own elaboration based on IBO (2024).

Analysis by Major Producing Regions

The global industry is structured around three major geographical blocks (IBO,2024):

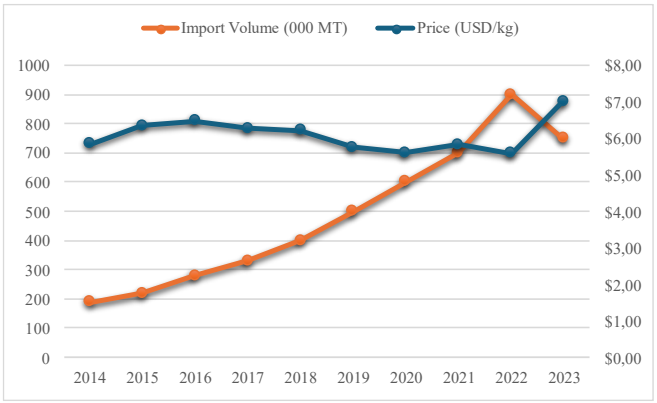
— *The Americas*: This region continues to be a dominant player, albeit with redefined roles. Peru has established itself as the undisputed leader in fresh blueberry exports, with a unique ability to influence global prices. The United States and Canada represent a mature market with a massive consumer base, while Chile is undergoing a process of varietal conversion, and Mexico has positioned itself as a strategic supplier to the North American market.

— *Asia-Pacific*: This is the region with the highest production growth, driven almost entirely by China. Most of its production supplies its vast domestic market.

— *EMEA (Europe, Middle East, and Africa)*: This region is a mosaic of realities. Europe is a consumer market of high importance and a growing producer. Spain, mainly in the province of Huelva, and Morocco lead production in the spring window. Poland is the main producer in Eastern Europe. In Africa, beyond Morocco, countries like South Africa and Zimbabwe are becoming high-quality counter-season suppliers for European and Middle Eastern markets.

Global Trade Dynamics and Price Trends

The blueberry is an eminently globalized product. In 2023, the main exporters of fresh blueberries were, in order, Peru, the Netherlands (acting largely as a re-export hub for Europe), Mexico, Chile, and Spain. Blueberry prices show significant volatility (see Figure 2), strongly linked to supply-demand imbalances derived from climatic events. The 2022/23 season was a clear example: the reduction in Peruvian supply due to El Niño caused a significant rise in the global average price, reaching $7.01/kg, a level not seen since 2016 (IBO, 2024; FAO, 2024). This price sensitivity to production shocks in a single country underscores the sector's inherent risk and the critical importance of financial management tools for producers.



Source: International Blueberry Organization Report (IBO, 2024) based on Global Trade Data from Agronometrics.

Figure 2. Evolution of the Global Import Volumes and Average Price for Fresh Blueberries.

The European Scenario and the Role of Spain

Europe stands as the world's second most important consumer market. Demand has grown exponentially, and although internal production has increased, the continent remains a net importer. In 2023, the production of the EMEA region (which includes Europe) was nearly 370,000 tons, a 0.83% increase from the previous year (IBO, 2024).

Within this framework, Spain plays a strategic role. With a total production of 70,860 tons in 2023, it ranks as the fifth-largest producer worldwide and the undisputed leader in Europe's spring production window. Spanish production accounts for 30.5% of the EU's blueberries, making Spain the second-largest producer at the community level, behind only Poland (Freshuelva, 2024). This volume is overwhelmingly generated in the province of Huelva, which stands as the absolute epicenter of the sector nationwide.

The Epicenter of Spanish Blueberries: The Province of Huelva

Descending from a global to a provincial analysis means entering the heart of Spain's blueberry industry. The province of Huelva is not just the main producing region; it is "el corazón del berry europeo", an emblem of innovation and economic development for Andalusia. With nearly 12,000 hectares dedicated to soft fruits, generating over 270,000 tons of product and sustaining around 160,000 direct and indirect jobs, the sector represents more than 11% of the provincial GDP and reached a record €1.693 billion in exports in 2024 (Fernández-Pacheco, 2025). Within this powerful sector, the blueberry has emerged as a key crop, concentrating almost 97% of the national production (Freshuelva, 2024). Its production model, based on earliness and high technification, is a success story, but it is also a concentrator of risks that justifies a detailed analysis.

- *Productive Hegemony and Evolution*: The area dedicated to blueberries in Huelva has seen constant growth, from 2,538 hectares in the 2016/2017 season to 4,520 hectares in the 2024 season. However, this growth has been subject to strong inter-annual volatility. For example, in 2023, production suffered a drop of around 25% due to unfavorable weather conditions (Freshuelva, 2023).
    - *Market Strategy*: The Earliness Advantage: Huelva's model is based on its early production window, from January to July, which has been enhanced by incorporating early varieties. This strategy, while successful, also concentrates production in the spring months, when it faces strong competition from other origins, mainly Morocco ((Freshuelva, 2023).
- *Export Orientation and Main Markets*: The production from Huelva is clearly oriented towards foreign markets. For the 2024 season, the main destinations are Germany (30.67%), the Netherlands (15.49%), Poland (11.52%), and the United Kingdom (10.18%) (Freshuelva, 2024).
- *The Multifactorial Nature of Risk in Practice*:
    - **Climatic Risk:** A constant threat. Storm *Filomena* in 2021 delayed production, while the lack of "chill hours" in 2023 caused a 25% drop in production (Freshuelva, 2023).
    - **Water Risk:** Perhaps the most structural challenge. The "constant uncertainty due to lack of water" has led to cuts in irrigation allocations of up to 25% (Freshuelva, 2023; 2024). This situation has mobilized significant investments from public administrations, such as the more than €42.5 million allocated by the Government of the Autonomous Community of Andalusia for water infrastructure in the province for 2025 (Fernández-Pacheco, 2025).
    - **Market Risk:** The temporal overlap with Moroccan production causes peaks of "oversupply in the markets, with the consequent drastic drop in price" (Freshuelva, 2022).
    - **Production Risks:** These include rising costs and difficulties in managing labor availability (Freshuelva, 2023; 2024).

DATA AND RESEARCH METHODS

To conduct a rigorous quantitative analysis of the Spanish Combined Agricultural Insurance System (SSAC), this research has relied on official data sources of the highest reliability. The primary sources of information are:

1. The *Annual Reports of the State Agency for Agricultural Insurance (ENESA)* for the fiscal years 2020 to 2024. These public documents provide a comprehensive summary of the main indicators of agricultural insurance, allowing for a longitudinal analysis of its evolution (ENESA, 2021, 2022, 2023, 2024, 2025a).
2. The *Historical Underwriting Summary of Agricultural Insurance from the Ministry of Agriculture, Fisheries, and Food (MAPA)*. This public database allows for obtaining the historical underwriting series for each insurance line in a disaggregated manner, serving as the main source for the specific analysis of the soft fruit line (MAPA, 2025).
3. The *Internal data provided by ENESA* with specific information on insurance contracts and claims related to blueberries in Spain and Huelva within Line 328 - Strawberry and Other Soft Fruits. The data covers Plans from 2021 to 2024 and the different underwriting modules (ENESA, 2025b).

The methodology employed in this section is descriptive and longitudinal. A time series analysis for the period 2016-2024 is conducted at an aggregate level to identify trends and the evolution of the system's most relevant macroeconomic indicators. Subsequently, the analysis narrows down to a sectoral level, focusing on the specific "Strawberry and Other Soft Fruits" line, using the most detailed data available up to the 2024 fiscal year. This approach sets the framework for the specific analysis of the blueberry subsector. The logic of this multi-level approach is to first establish the macroeconomic context of the insurance system, then narrow the focus to the specific soft fruit line to which blueberries belong, and finally to conduct a micro-level analysis of the blueberry subsector itself, allowing for a comprehensive and contextualized understanding.

RESEARCH RESULTS

Aggregate Level Results: Evolution of the Agricultural Insurance System (2016-2024)

The analyzed period (2016-2024) is characterized by a consolidation of the system, but also by growing tension due to an increase in claims. As shown in Table 2 and Figure 3, the insured capital has experienced sustained growth, increasing from €12.788 billion in 2016 to a historic high of €18.174 billion in 2024. Similarly, the premium income (the total cost of the insurance) has grown from €706 million to €1.020 billion over the same period.

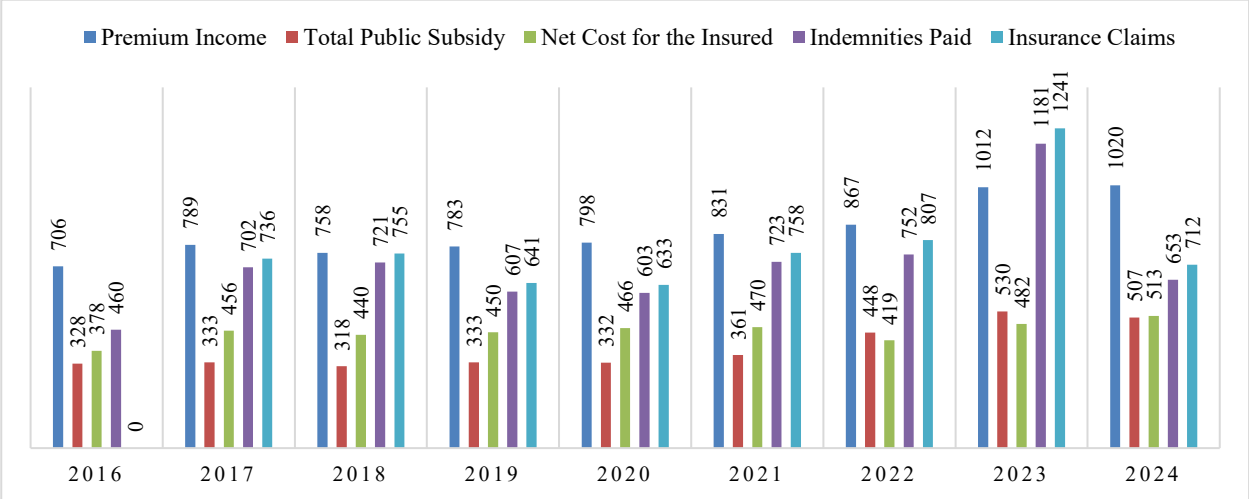
However, the most revealing indicator is the loss ratio. The indemnities paid to farmers and ranchers culminated in the 2023 fiscal year, a year marked by an exceptionally severe drought, reaching a record figure of €1.181 billion against €1.241 billion of insurance claims (ENESA, 2025a). This figure represented a significant imbalance, far exceeding the collected premium volume. In 2024, although indemnities moderated to €653 million, the figure remains much higher than those from the first half of the analyzed period, confirming the consolidation of a new, higher-risk climate scenario (ENESA, 2025a).

Table 2. Evolution of the Main Indicators of Agricultural Insurance in Spain (2016-2024).

Fiscal Year	No. of Policies	Insured Capital	Premium Income	ENESA Subsidy	CCAA Subsidy	Total Subsidy	% Subsidy / Premium	Indemnities	Insurance Claims
2016	423,888	12,788	706	256	72	328	46%	460	n/a
2017	426,603	13,770	789	253	80	333	42%	702	736
2018	419,875	14,079	758	226	92	318	42%	721	755
2019	397,074	14,258	783	239	93	333	42%	607	641
2020	415,184	15,260	798	238	94	332	42%	603	633
2021	408,903	15,620	831	262	99	361	43%	723	758
2022	389,334	16,329	867	336*	111	448	52%	752	807
2023	366,510	16,916	1,012	401	129	530	52%	1,181	1,241
2024	374,336	18,174	1,020	367	140	507	50%	653	712

Note: Figures in millions of euros, unless otherwise indicated. *The ENESA subsidy in 2022 includes amounts granted in 2023, approved by Royal Decree-Law 4/2023.
Source: Author's own elaboration based on ENESA (2021, 2022, 2023, 2024, 2025a).

The budgetary effort of public administrations has been key. The total subsidy (State+Autonomous Communities) has increased from €328 million in 2016 to €507 million in 2024, allowing public support to cover, on average, 50% of the premium cost in the last fiscal year (see Table 2).



Source: Author's own elaboration based on ENESA (2021, 2022, 2023, 2024, 2025a).

Figure 3. Financial Flows of the Spanish Agricultural Insurance System (2016-2024).

Sectoral Approach: Insurance in the Soft Fruit Sector

The "Strawberry and Other Soft Fruits" insurance line is a clear exponent of the strategic importance of insurance in high-value sectors. The historical data from MAPA allows for a detailed analysis.

Table 3 shows a very significant growth across all variables. The number of policies has increased by 26% between 2016 and 2024, and the insured area has grown by 44%, reaching 9,625 hectares. The most eloquent indicator is the insured capital, which has seen a 48% increase, exceeding €271 million in the last season for blueberries and €546 million for the entire soft fruit line nationwide. This growth is superior to that of the system as a whole, indicating the dynamism of the sector and its increasing reliance on professional risk management (see Table 3).

Table 3. Evolution of Key Indicators for the "Strawberry and Other Soft Fruits" Insurance Line (2016-2024)

Indicator	2016	2017	2018	2019	2020	2021	2022	2023	2024
No. of Policies	942	1,048	1,154	1,168	1,188	1,145	1,096	1,078	191
Area (Ha)	6,679	7,724	8,688	9,048	8,897	8,908	8,941	9,026	9,625
Insured Capital (€M)	182.97	200.93	225.81	251.38	242.71	237.86	248.48	248.12	271.40
Premium Income (€M)	5.24	5.47	5.81	6.18	5.43	5.20	5.31	5.44	6.28
ENESA Subsidy (€M)	1.56	1.40	1.52	1.64	1.42	1.45	1.47	1.71	1.81
Indemnities (€M)	-	-	-	-	-	2.9	3.0	3.0	0.96

Note: Disaggregated data for indemnities at the line level are only publicly available in the most recent reports.
Source: Author's own elaboration based on MAPA (2025) and ENESA (2025a).

The Specific Case of Blueberry in Huelva: A Detailed Analysis

The true scope and effectiveness of the SSAC as a risk management tool are revealed when descending to the level of a specific crop in its main production area. Thanks to the detailed information provided by ENESA, we can perform a precise radiography of blueberry insurance in the province of Huelva, the epicenter of national production.

The data for the period 2021-2024 (with provisional data for the 2025 plan) reflect a story of growth, but above all, a story of increasing risk and a forceful response from the insurance system.

As detailed in Table 4, the underwriting of blueberry insurance in Huelva has shown remarkable dynamism. The number of policies has increased by 30% in just four years, from 353 in 2021 to 458 in 2024. This increase in the number of farmers who trust the insurance is accompanied by an even more significant rise in the insured area (up 14%, exceeding 3,000 hectares) and, above all, in the insured capital, which has grown by 25% to reach €172 million.

However, the most eloquent and dramatic indicator is the total claims paid. Indemnities paid to blueberry producers in Huelva have escalated exponentially, from just €216,146 in 2021 to €1.82 million in 2024. This increase of nearly 750% in claim compensations is the most striking evidence of the crop's growing exposure to climate risks and the absolutely critical role that insurance plays in stabilizing farm income (see Table 4). Furthermore, the data reveals an overwhelming provincial hegemony. This creates a significant geographical concentration of systemic risk for the entire soft fruit insurance line nationwide (see Table 5).

Table 4. Evolution of Key Indicators for Blueberry Insurance in Huelva (2021-2025)

Indicator	PLAN 2021	PLAN 2022	PLAN 2023	PLAN 2024	PLAN 2025*
No. of Policies	353	381	379	458	90
Area (Ha)	2,646.52	2,837.36	2,893.30	3,030.12	214.31
Insured Capital (€)	138,235,720	151,524,121	165,474,131	172,122,534	9,416,265
Premium Income (€)	1,480,238	1,626,644	1,770,510	2,104,943	163,300
ENESA Subsidy (€)	527,743	568,750	783,315	852,319	66,508
Indemnities (€)	216,146	1,523,441	1,660,487	1,820,362	-

Note: The subsidy from the Autonomous Community of Andalusia is granted directly and is not reflected in this table.
*Data for the 2025 Plan are provisional as of September 15, 2025.
Source: Author's own elaboration based on data from ENESA (2025b).

The concentration of blueberry production in Huelva is directly reflected in the insurance underwriting data. Table 5, prepared with the complete data for the 2021-2024 period, reveals the overwhelming hegemony of the province:

- **Provincial hegemony**: Consistently, Huelva has accounted for between 92% and 96% of the insured capital for blueberries in all of Spain over the last four years. For practical purposes, blueberry insurance in Spain is blueberry insurance in Huelva.
- **Relevance of Blueberries**: Within the province itself, blueberries have gained weight, representing 34,2% of the insured capital for the entire soft fruit line in 2024, compared to the 31,5% it represented in 2021.

Table 5. Comparative Analysis of Insurance Underwriting (2021-2024)

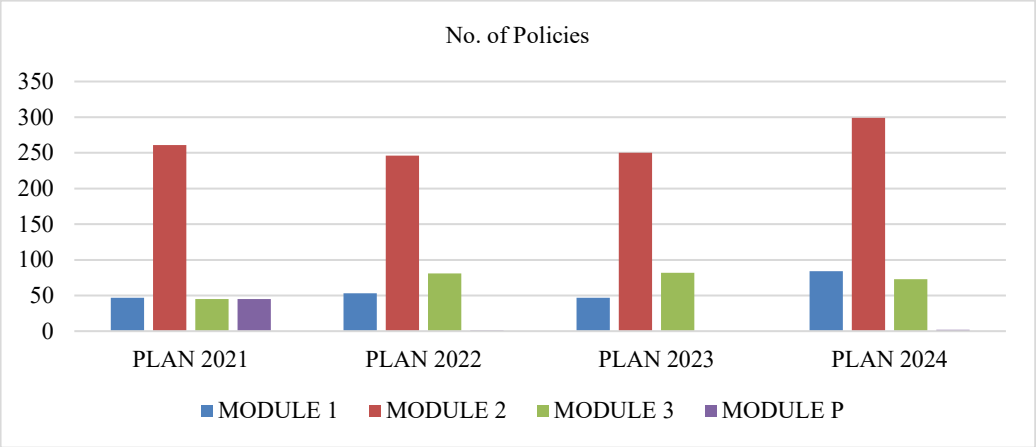
Scope	2021	2022	2023	2024
Insured Capital Soft Fruits Spain (€M)	453.84	489.10	508.84	546.44
Insured Capital Soft Fruits Huelva (€M)	436.23	468.21	482.75	512.37
% Huelva of Spain (Soft Fruits)	*96.1%*	*95.7%*	*94.9%*	*93.8%*
Insured Capital Blueberry Spain (€M)	143.15	156.68	170.94	186.88
Insured Capital Blueberry Huelva (€M)	138.24	151.52	165.47	172.12
% Huelva of Spain (Blueberry)	*96.6%*	*96.7%*	*96.8%*	*92.1%*
% Blueberry Huelva of Soft Fruits Huelva	*31.7%*	*32.4%*	*34.3%*	*33.6%*
% Blueberry Spain of Soft Fruits Spain	*31.5%*	*32.0%*	*33.6%*	*34.2%*

Source: Author's own elaboration based on ENESA (2025b).

As mentioned, the farmer must choose an insurance module for all their plots. This decision is a financial risk management exercise. Ministerial Order APA/418/2024 and the line's Special Conditions define the options (MAPA, 2024; Agroseguro, 2025):

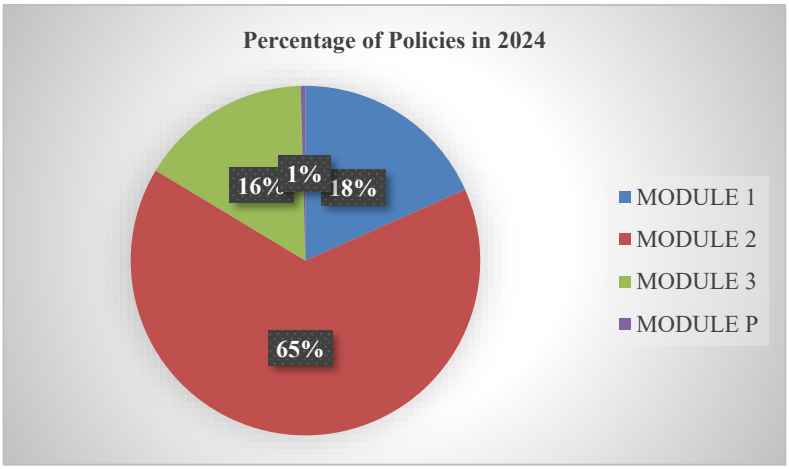
- **Module 1** ("*All risks per holding*"): The most basic option. It covers all risks, but the indemnity is calculated on an aggregate basis for all of the farmer's plots within the same agricultural district, acting as a safety net against catastrophic damages. It usually has a high absolute deductible (e.g., 20%).
- **Module 2** ("*Risks per holding and risks per plot*"): A hybrid model. The most frequent and high-impact risks (like frost and hail) are indemnified at the individual plot level, offering more precise protection. The other risks are still calculated at the holding level. This module offers a balance between cost and protection.
- **Module 3** ("*All risks per plot*"): The highest coverage module. All covered risks are assessed and indemnified independently for each plot. It provides the best protection against localized damages but also has the highest premium.
- **Module P** ("*Named perils per plot*"): An "*à la carte*" insurance option. The farmer chooses which specific risks to cover (e.g., only hail, or hail and frost). It is the most economical option but leaves the producer exposed to all other adversities.

The underwriting data for Huelva in 2024 shows a clear and sophisticated strategy by producers. As seen in Figures 4 and 5, there is an overwhelming and growing preference for Module 2, which in 2024 accounted for 65% of the subscribed policies (see Figure 5). It is followed by Module 1 (18% of policies) and Module 3 (16%). This distribution suggests that blueberry farmers engage in a very calculated risk management: they seek robust plot-level protection for the most frequent and damaging risks (frost, hail) but opt for more affordable holding-level coverage for other adversities, demonstrating a deep understanding of the tool.



Source: Author's own elaboration based on ENESA (2025b).

Figure 4. Distribution of Blueberry Policies in Huelva by Module (2021-2024).



Source: Author's own elaboration based on ENESA (2025b).

Figure 5. Percentage of policies for Modules 1, 2, 3, and P, PLAN 2024.

DISCUSSION

The quantitative analysis of the Spanish Combined Agricultural Insurance System (SSAC) data, particularly for the blueberry line in Huelva, reveals several interconnected dynamics that merit in-depth discussion.

Firstly, the results confirm a very high insurance penetration rate in the sector, evidenced by the sustained growth in the number of policies and, above all, in the insured capital. This fact cannot be understood without the second key finding: the critical dependence on public subsidies. With support covering, on average, 50% of the total premium cost at an aggregate level and exceeding 60% in the specific soft fruit line in Huelva, it is clear that the subsidy acts as an

indispensable catalyst that makes the insurance economically accessible for most producers. This co-financing model proves to be successful in achieving large-scale risk mutualization, a fundamental objective of agricultural policy.

Secondly, the historical series of the loss ratio is telling. The exponential growth in indemnities, especially the historic peak in 2023 at the system level and the drastic increase of nearly 750% in blueberry insurance in Huelva between 2021 and 2024, is not an anomaly but the statistical materialization of the increased frequency and intensity of climate risks. The system has demonstrated a solid capacity as a financial buffer, injecting vital liquidity into the sector in times of crisis and fulfilling its function as an income stabilizer. However, this imbalance, where indemnities far exceed premiums, highlights the actuarial tension the system is under and the vital importance of the public reinsurance mechanisms through the Insurance Compensation Consortium.

Thirdly, the comparative analysis reveals an extraordinary geographical and productive risk concentration. The fact that the province of Huelva accounts for over 90% of the insured capital for blueberries in Spain turns the provincial sector into a systemic risk element for the entire soft fruit line nationwide. A major adverse event localized in Huelva would have national repercussions, which justifies and reinforces the logic of the principle of solidarity and the reinsurance mechanisms that underpin the model.

Finally, the strategic choice of insurance modules by blueberry farmers in Huelva is a highly relevant finding. The overwhelming preference for Module 2 indicates a high degree of sophistication in risk management. Producers do not default to maximum coverage but perform a cost-benefit analysis, opting for precise plot-level protection for the most probable risks (frost, hail) and more affordable holding-level coverage for the rest. This shows that farmers perceive insurance not as an expense, but as a financial management tool to be optimized.

Comparative Analysis

Our findings on the critical role of public subsidies in achieving high penetration rates are consistent with the broader literature on agricultural insurance, which identifies public subsidies as a critical factor for achieving high participation rates and ensuring the viability of insurance schemes (Glauber, 2013). Studies on the U.S. Federal Crop Insurance Program, for example, have repeatedly demonstrated that premium subsidies are the primary driver of participation (Smith & Glauber, 2012). Similarly, analyses of insurance systems within the EU confirm that public support is essential for overcoming market failures and ensuring the viability of agricultural insurance as a risk management tool (Meuwissen *et al*., 2019).

The Spanish model's effectiveness provides a strong case for the success of integrated public-private partnership (PPP) structures, a conclusion also reached in comparative studies of risk management policies in the EU (Meuwissen *et al*., 2019). However, the Spanish model's unique feature is the deep integration of the co-insurance pool (Agroseguro) and the public reinsurer (Insurance Compensation Consortium), a structure that differs from the more market-driven U.S. model and provides an additional layer of stability against systemic shocks like widespread drought, as evidenced by the 2023 data. The strategic behavior of Huelva's farmers in selecting insurance modules aligns with principles of risk aversion and utility optimization, confirming that farmers act as rational economic agents when provided with flexible and well-designed risk management tools (Barnett & Mahul, 2007).

CONCLUSIONS

This research concludes that the Spanish Combined Agricultural Insurance System is a strategic and indispensable pillar for the resilience and economic viability of the blueberry sector. Our analysis provides strong evidence that the SSAC functions effectively as a strategic tool, not merely a palliative one. By stabilizing farm income in the face of escalating climate risks—demonstrated by its capacity to respond with record indemnities—the system fosters an economic environment conducive to long-term planning, investment, and thus, sustainability. The high underwriting rate, critically enabled by a robust system of public subsidies, consolidates it as a successful state policy in risk mutualization. However, the system faces an unprecedented structural challenge due to climate change. Its past success does not guarantee future viability without proactive evolution and continuous adaptation to a new and more volatile risk paradigm.

IMPLICATIONS, LIMITATIONS, AND FUTURE DEVELOPMENTS

Theoretical Implications

From a theoretical perspective, this case study provides several contributions. First, it offers a robust empirical validation of the effectiveness of public-private partnership (PPP) models in agricultural insurance, demonstrating that public intervention through subsidies and reinsurance is a key factor in overcoming market failures (adverse selection and moral hazard) and achieving high participation rates. Second, the analysis of module choice provides empirical evidence of the rational behavior of farmers as risk managers, who not only decide whether to insure but also perform a sophisticated analysis to stratify and optimize coverage for different types of risk, in line with the postulates of expected utility theory.

Practical Implications and Policy Recommendations

The results of this research have direct implications for the different actors in the system. Based on the analysis, the following recommendations are proposed:

1. *Deepen Policy Customization*: Building on the success of the modular model, advance towards greater granularity in coverages by developing specific options for different blueberry varieties and production systems (e.g., organic, hydroponic), adjusting guarantee periods and coverages to their concrete phenological risks.
2. *Enhance Loss Adjustment with Technology*: Accelerate the adoption of new technologies such as satellite remote sensing and drones, as envisioned for the 2025 horizon, to improve the objectivity, accuracy, and speed of damage assessment, thereby increasing farmer confidence and system efficiency.
3. *Link Insurance to Prevention and Sustainability*: Study the implementation of premium bonuses for farmers who adopt proven preventive risk management measures (e.g., anti-frost systems, irrigation optimization) and sustainable agriculture practices. This would transform the insurance from a purely palliative tool into an instrument that actively incentivizes resilience and adaptation to climate change.
4. *Maintain Political Commitment and Communication*: The public subsidy remains a critical element for the system's viability. It is crucial to maintain firm political commitment and to continue educational outreach that highlights the value of the collective effort supporting the system, explaining its operation and continuous improvements.

Limitations and Future Research

The main limitation of this study is its exclusively quantitative focus. While official data allow for a rigorous analysis of "what" happened, they do not always explain the "why" behind farmers' decisions. The initial design of this research contemplated a qualitative phase, through semi-structured interviews with blueberry producers, which was postponed due to logistical constraints.

Therefore, the main line for future research should be to complement this quantitative analysis with qualitative research that deeply explores farmers' perceptions of the insurance: their assessment of the adequacy of coverages, their experience with the claims adjustment process, barriers to entry for the uninsured, and their future demands. Additionally, other research avenues open up, such as conducting actuarial studies to model the impact of new climate risks (heatwaves, water stress) on blueberries, or the economic analysis of the cost-benefit of linking insurance premiums to the adoption of sustainable agriculture measures. Furthermore, as suggested during the peer-review process, future studies could employ econometric models to more precisely quantify the impact of insurance on income variability and investment decisions at the farm level.

The future of Spain's competitive blueberry sector will depend on the robustness and intelligence of its risk management systems. The Combined Agricultural Insurance, a success story of Spanish agricultural policy, must continue to be the foremost of these tools, evolving to protect a sector that is the heart of a dynamic and resilient model of rural development.

Acknowledgements. We acknowledge the support of ENESA and Freshuelva in supplying the data that underpins this research.

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