

The Role of Agricultural Insurance in Managing Risks and Strengthening Food Security: Evidence from Algeria

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Abstract:

The strategic role of agricultural insurance in Algeria is to mitigate agricultural risks and secure the nation's food supply. Climate change, water scarcity, and global market shifts threaten Algeria's agricultural sector, a major economic sector. These variables threaten national food security. This article investigates crop insurance procedures and their efficacy in Algeria, identifies major impediments to widespread adoption, and offers data-driven recommendations for improvement. Agriculture insurance provides financial security and may encourage profitable investment, but its benefits are often underutilised. Farmers' lack of understanding and trust in the system, high prices, and a lack of alternative products to mitigate drought risks are the main challenges. Recent statistical evidence supports the analysis's emphasis on coordinated policy. This includes increasing government subsidies, expediting the development of innovative products such as index-based insurance, improving agricultural education, and strengthening public-private collaboration. Algeria needs these measures to use agricultural insurance effectively and build a strong, food-secure agricultural future.

Keywords: Agricultural insurance; Risk management; Food security; CNMA; Climate risk.

Jel Classification Codes: Q14; Q18; G22.

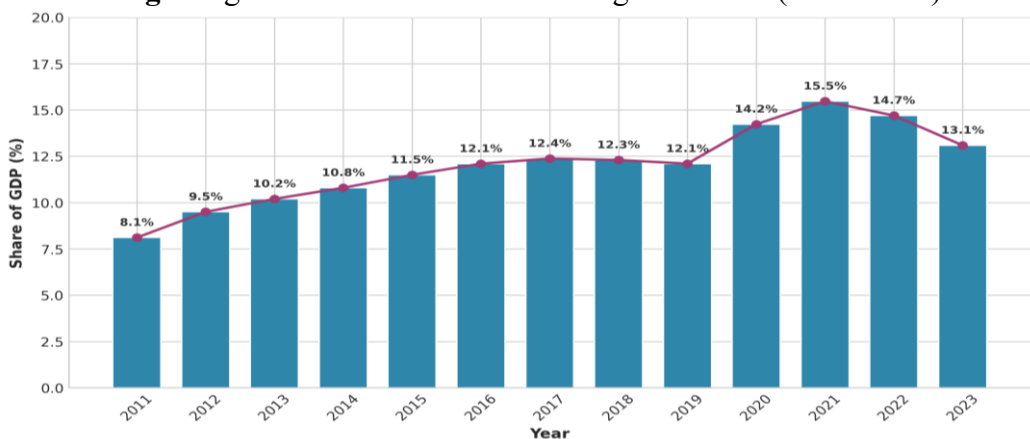
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1. INTRODUCTION

Algeria encounters structural challenges in ensuring a sustainable, nutritious, and affordable food supply, rendering food security a critical strategic priority. These challenges are compounded by persistent economic and environmental volatility. A principal structural vulnerability lies in the country's heavy dependence on food imports, particularly staple cereals such as wheat, which exposes Algeria to global price shocks and supply-chain disruptions. This reliance makes Algeria more vulnerable to food poverty, as it is more likely to be affected by changes in global market prices and supply chain disruptions. Algeria spent almost \$9 billion on food imports in 2022, with a large share going to cereals.

Even with these problems, the agriculture sector's economic contribution has shown a favourable, though unstable, trend. From 2011 to 2021, its percentage of the Gross Domestic Product (GDP) grew from 8.11% to a peak of 15.47%. It then dropped to 13.09% in 2023 (see Figure 1). This upward trend reflects sustained government interventions aimed at supporting the sector and advancing the long-term objective of national food security. Algeria's score of 58.9 on the 2022 Global Food Security Index (GFSI), which ranks it 68th out of 113 nations, underscores the need for stronger, more flexible plans to make the country's food supply more resilient.

Fig.1. Agriculture's Contribution to Algeria's GDP (2011–2023)



Source: (World Bank , 2025)

Climate change and environmental degradation are the main causes of the growing number of threats that Algerian agriculture faces. Desertification, severe water shortages, and the widespread effects of climate change, such as frequent droughts and extreme weather events, are among the most important environmental problems. Collectively, these factors constrain crop production and undermine the sustainability of farming practices nationwide. Furthermore, economic hazards — notably the volatility of seed and fertiliser prices on global markets — intensify the uncertainty confronting farmers, driving up food prices and depressing productivity. This combination of circumstances makes things difficult: Algeria's dependence on food imports makes it more vulnerable to the impacts of climate change. This reliance can make local agriculture less economically viable, setting off a loop that leaves the whole food system less able to handle future shocks. In this scenario, agricultural insurance is an essential risk management instrument that can stabilise farm revenues, promote investment in productivity, and ensure the continuity of agricultural production, thereby fortifying the pillars of food security.

Research Question: To what extent is agricultural insurance in Algeria effective in mitigating agricultural risks and enhancing food security, and what strategic reforms are required to strengthen its performance?

Objectives: To thoroughly address this inquiry, the study establishes the following objectives:

To examine the current state, procedures, and efficacy of Algeria's agricultural insurance market using recent statistical data.

To identify the principal structural, financial, and educational barriers impeding the widespread adoption of crop insurance among farmers.

To gain useful insights by comparing how different countries handle agricultural insurance.

To suggest concrete, data-driven policy changes that will make agricultural insurance in Algeria more effective and useful.

Research Gap and Scientific Contribution: While previous Algerian studies—notably the study by (Siddique, Rehman, Khan, & Altaf, 2020) and

its repeated update by (Tidjani, 2024) —have demonstrated a positive statistical correlation between total agricultural insurance premiums and national output, they treated insurance as a single, homogeneous input and did not go so far as to examine the extent of structural compatibility between the specific structures of insurance products and the country's underlying risk profile. This study addresses that gap in two ways. First, it deconstructs the Algerian agricultural insurance portfolio by product family—named-risk insurance, yield index insurance, and emerging parametric contracts — and evaluates each in light of the risks of drought and catastrophic flooding, which current named-risk products systematically exclude. Second, it presents the first systematic evaluation of the parametric/index-based schemes that Algeria has recently begun piloting—developed in collaboration with the World Bank and the United Nations Development Programme (UNDP)—placing them within a comparative framework drawn from the experiences of Spain, India, and Tunisia. Thus, the research goes beyond merely documenting whether insurance affects production to determining which insurance product design is realistically capable of closing the gap in agricultural protection in Algeria and strengthening national food security.

Methodology: This study employs a descriptive-analytical framework to examine official data on crop insurance and its effects in Algeria. The research is based on a thorough examination of documentary sources, encompassing official statistics from the Algerian Ministry of Finance's 2024 Insurance Market Activity Report, data from the National Agricultural Mutual Insurance Company (CNMA), scholarly studies, and reports from international organisations. A comparative examination of agricultural insurance systems in Spain, India, and Tunisia is used to contextualise Algeria's experience and to extract pertinent policy insights.

2. Theoretical and Conceptual Framework

2.1. Agricultural Insurance: Definitions and Main Products

Agricultural insurance is increasingly recognised as a modern risk-management strategy that strengthens the resilience of farming systems to climate-induced variability in yields and income. (Madaki, Kaechele, &

Bavorová, 2023). Farmers pay an insurance company a premium to protect themselves against certain risks that could lower their revenue or productivity. The literature identifies three principal product families, each characterised by unique design principles, informational prerequisites, and welfare consequences (Tidjani, 2024).

2.1.1. Multi-Peril Crop Insurance (MPCI)

MPCI pays for losses in produce or revenue due to a wide range of natural disasters, such as drought, hail, frost, pests, and disease. Coverage starts at the beginning of the growing season and ends at harvest time. Losses that happen while the crop is in storage are not covered. Because MPCI depends on farm-level loss assessment, it incurs considerable administrative costs and is nearly always paired with large government subsidies in countries. (Risk Management Agency, 2018)

2.1.2. Named-Peril Insurance

Named-peril contracts cover only the specific hazards listed in the policy, usually fire, hail, explosion, or frost. This design reduces moral hazard and keeps premiums lower, but it does not protect farmers from disasters not on the list. The majority of the products Algeria currently sells are of this kind: CNMA plans cover fire, explosions, and hail, but they do not cover floods and droughts, which are the most dangerous things (Tidjani, 2024).

2.1.3. Index-Based Insurance (IBI)

IBI automatically pays out when an objective, spatially observable index, such as rainfall accumulation, temperature thresholds, or satellite-derived vegetation indices, exceeds a defined trigger level. This means that no field-level loss adjustment is needed. This architecture significantly reduces transaction costs, lowers moral hazard, and speeds up settlement. The main problem with it is basis risk, which is the difference between what the index indicates and the actual loss at a given farm. (Kirchner & Mußhoff, 2024) IBI works well for weather risks that can be measured and are tied to their location (Breustedt, Bokusheva, & Heidelberg, 2008). With support from the World Bank, Algeria has begun testing an IBI-based crop

yield index. With UNDP's help, the country is also developing parametric insurance for droughts and forest fires. (Nathaniel & Barrett, 2015)

Table 1. Typology of Agricultural Insurance Products

Insurance Type	Mechanism	Key Strengths	Main Limitations
Multi-Peril Crop Insurance (MPCI)	Compensates for yield/revenue loss from a wide range of natural perils based on farm-level assessment.	Comprehensive; addresses correlated shocks.	High administrative cost; requires subsidy; coverage ends at harvest.
Named-Peril Insurance	Covers only explicitly listed risks (e.g., fire, hail, frost).	Lower premiums; targeted protection.	Excludes catastrophic perils (drought, flood); prevalent in Algeria.
Index-Based Insurance (IBI)	Pays when an objective index (rainfall, temperature, NDVI) passes a threshold.	Low transaction costs, rapid settlement, and scalability.	Basis risk: does not cover all loss types.
Yield Insurance	Compensates when realised yield falls below a guaranteed level.	Direct production-linked protection.	Requires historical yield data; difficult for livestock.
Revenue / Income Insurance	Hybrid protects against combined price and yield shortfalls.	Stabilises farm income directly.	Complex design; data-intensive; adverse selection risk.

Source: Adapted from the author.

2.2. Agricultural Risk Taxonomy

Effective insurance design requires a precise mapping of the risks it is intended to cover. The agronomic risk management literature identifies five broad risk categories (Wamsler & Lawson, 2011): Weather, pests, diseases, and equipment failures generate yield uncertainty, posing production and technical risks. Crop insurance traditionally covers these risks. This group rules Algeria owing to drought, desertification, and groundwater depletion. Market and price risks stem from volatility in output prices and input costs such as seeds, fertilisers, and animal feed. Price and revenue insurance work, but they need futures markets or correct price indexes. Farm debt risks include changing interest rates, lender withdrawal, and loan service difficulties when yields or prices fall. Farmer economics are at risk from unexpected changes in agricultural policy, such as subsidy levels, input price restrictions, and export regulations. Farm operator illness or death, workforce shortages, and social upheavals are human risks. Life and health insurance dominate this category.

Table 2. Key Agricultural Risks and Their Characteristics

Risk Type	Examples in Algeria	Impact on Production / Food Security
Production & Technical	Recurring drought, desertification, locust outbreaks, and equipment breakdown.	Yield losses, crop failure, and a threat to the staple food supply.
Market & Price	International wheat price spikes; rising fertiliser costs.	Reduced farm income; higher food prices; surge in import costs.
Financial	Exposure to variable credit rates; difficulty accessing rural credit.	Debt accumulation, disinvestment, and reduced input use.
Institutional	Changes in agricultural subsidies; regulatory shifts in CNMA products.	Uncertainty hinders long-term planning and insurance uptake.
Human & Personal	Farmer illness; rural exodus; labour shortages.	Farm abandonment; productivity decline.

Source: Compiled by the author.

2.3. Agricultural Insurance and Food Security: Conceptual Linkages

The relationship between agricultural insurance and food security operates through several causal channels identified in the empirical literature. First, insurance provides a direct income-stabilisation effect: indemnity payments replace revenue lost to catastrophic events, preventing asset liquidation and maintaining productive capacity across bad years. Second, by reducing downside income variance, insurance relaxes credit constraints and allows risk-averse smallholders to invest in improved inputs and technologies, thereby raising expected yields. (Li, Gui, Du, & Wen, 2024) Document this 'income mediation' channel empirically for Chinese provinces, finding that insured farmers plant larger areas and use more diversified production systems. Third, at the aggregate level, sustained increases in domestic production translate into lower import dependency and improved food availability—the first pillar of food security as defined by the FAO. Critically, however, these effects materialise only when insurance penetration is sufficiently broad, and product design is well matched to actual production risks. The Algerian case demonstrates that low coverage rates and a narrow peril scope can render even a well-intentioned insurance sector largely irrelevant to national food security outcomes. (Rani, Dubey, & Anjum, 2024)

3. Agricultural Insurance in Algeria: Current State (2019–2024)

3.1. Historical and Regulatory Background

The French colonial government established a mutual reinsurance fund in Algeria in 1907, the country's first formal agricultural insurance. The government took over the industry in 1966, after the country became independent. In 1972, the Caisse Nationale de Mutualité Agricole (CNMA) was established, a major step forward. It later became the country's largest agricultural insurer. Law 08-16, which went into effect on August 3, 2008, made insurance coverage required for all agricultural activities that received public support. It also established a policy of state solidarity for disasters that cannot be insured against. Executive Decree 21-81 of 23 February 2021 added Takaful insurance to the list of regulated products, creating a new way to sell them. Even though the laws have changed, the sector remains very underdeveloped compared to international standards and the economic importance of Algerian agriculture. (CNMA, 2025). Table 3 presents the evolution of agricultural insurance premiums, set in the context of overall growth in the damage insurance market. The data reveal a dramatic divergence: while the total insurance market expanded consistently—growing by 5% in 2024 alone to reach 172 billion DA—agricultural insurance premiums contracted by 31% between 2019 and 2023.

Table 3. Agricultural Insurance Premium Trends in Relation to the Market

Year	Total Damage Insurance (Billion DA)	Agricultural Insurance Premiums (Million DA)	Agric.Share of Damage Ins (%)	Annual Change Agric.Insurance (%)
2021	144.8	2,385	1.6	−0.6
2022	155.9	2,445	1.6	+2.5
2023	144.7	1,997	1.4	−18.3
2024*	150.5*	est. ~2,100*	~1.4*	—

Source : (Algerian Ministry of Finance, 2024).

The 18% contraction in agricultural insurance premiums observed in 2023 is particularly striking given that the same year saw the total damage insurance market reach 144.7 billion DA. Agricultural insurance's share thus fell to 1.4% of damage premiums—compared to automobile insurance (46.2%) and property damage insurance (46.4%). Even transport insurance, representing a considerably smaller segment of the economy, generated

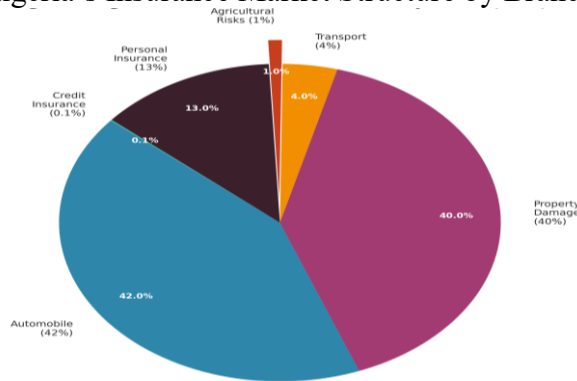
more than four times the volume of agricultural insurance. Partial data for the first three quarters of 2025, published by the Conseil National des Assurances (CNA), confirm that the broader Algerian insurance market maintained its upward trajectory, recording cumulative premiums of 142.9 billion DA for January–September 2025, a 7.3% year-on-year increase. The agricultural branch recorded 1.9 billion DA over the same period, with a strong 22.5% growth, driven primarily by the livestock sub-branch (+41.6%). This recent acceleration suggests that targeted product innovation and awareness campaigns can reverse the negative trend, but penetration remains critically low in absolute terms.

3.2. Market Structure, Products, and Performance

In 2024, the Algerian insurance market comprised 25 companies, of which 12 were damage insurers, 8 life insurers, 2 Takaful operators, and 2 specialised entities. CNMA, classified as a mutual insurer, generated 13,647 million DA in total premium income in 2024 (8% of total damage insurance), ranking fourth among all damage insurers. Within its agricultural insurance portfolio, CNMA offers products covering named perils (fire, explosion, hail), animal mortality for livestock and beekeeping, aquaculture risk, and—since 2022—a pilot crop yield index product developed with World Bank support. A parametric drought and forest fire product is under development in partnership with UNDP. Despite this portfolio breadth, the product suite does not yet cover the catastrophic risks posed by widespread drought or flooding, which pose the greatest threat to Algerian crop production. (Algerian Ministry of Finance, 2024). The Algerian insurance sector has shown steady growth, with total market production increasing by 5% from 163.5 billion DA in 2023 to 172 billion DA in 2024. The market is dominated by damage insurance, which constitutes 87% of the total, while personal insurance accounts for the remaining 13%. However, within this large market, the agricultural insurance branch remains critically underdeveloped. In 2024, agricultural insurance production reached 2.335 billion DA. While this represents a 17% increase from the 1.997 billion DA recorded in 2023, its share of the total

damage insurance market is a mere 1.6% (see Figure 2). This marginal position is disproportionate to the agricultural sector's significant 13.09% contribution to the national GDP.

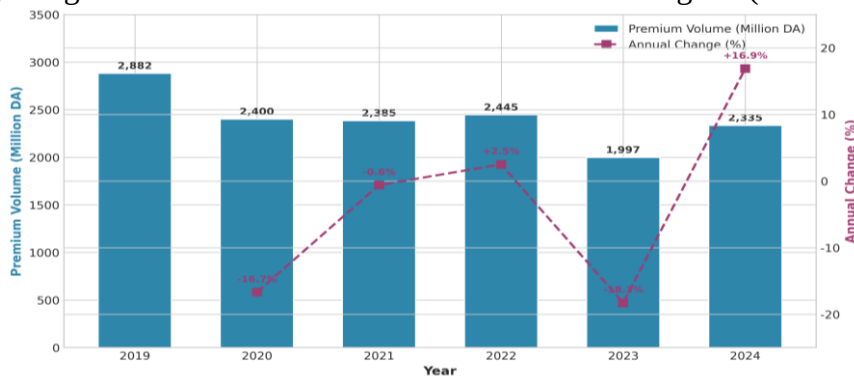
Fig.2. Algeria's Insurance Market Structure by Branch (2024)



Source: (Algerian Ministry of Finance, 2024)

The performance of the agricultural insurance branch has been volatile. After reaching a high of 2.882 billion DA in 2019, premium volumes declined significantly, hitting a low in 2023 before recovering in 2024 (see Figure 3). This instability suggests underlying structural challenges in product design, distribution, and farmer engagement.

Fig.3. Agricultural Insurance Premium Production in Algeria (2019–2024)

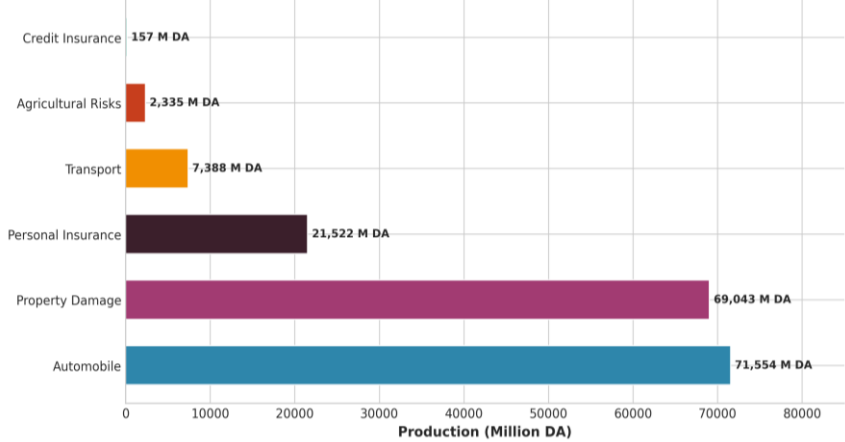


Source: (Algerian Ministry of Finance, 2024)

Compared with other insurance branches, the underperformance of agricultural insurance is even starker. In 2024, automobile insurance generated 71.5 billion DA and property damage insurance generated 69 billion DA, each accounting for approximately 46% of the damage insurance market. Even the transport insurance branch, at 7.4 billion DA,

generated more than three times the premium volume of agricultural insurance (see Figure 4).

Fig.4. Comparative Insurance Branch Production in Algeria (2024)

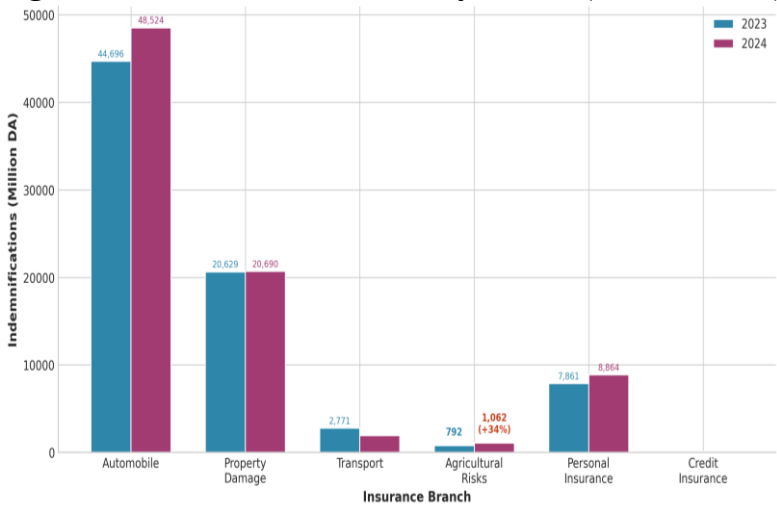


Source: (Algerian Ministry of Finance, 2024)

3.3. Indemnifications and Financial Sustainability

In 2024, the agricultural branch paid out 1.062 billion DA in claims, a 34% increase from the 792 million DA paid in 2023. This significant rise in indemnifications, particularly given the 17% growth in premiums, highlights the sector’s exposure to rising risks (see Figure 5).

Fig.5. Insurance Indemnifications by Branch (2023 vs. 2024)



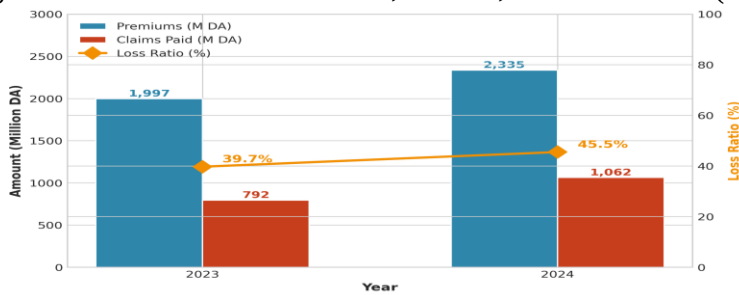
Source: (Algerian Ministry of Finance, 2024)

Table 5. Key Market Benchmarks Contextualising Agricultural Insurance

Insurance Branch	2024 Premiums (Million DA)	Share of Damage Insurance	YoY Growth
Automobile	71,554	48%	+7
Property Damage (IRD)	69,043	46%	+3
Transport	7,389	5%	-14
Agricultural Risks	2,335	2%	+17
Credit Insurance	157	<1%	+101
Total Damage Insurance	150,478	100%	+4

Source: (Algerian Ministry of Finance, 2024)

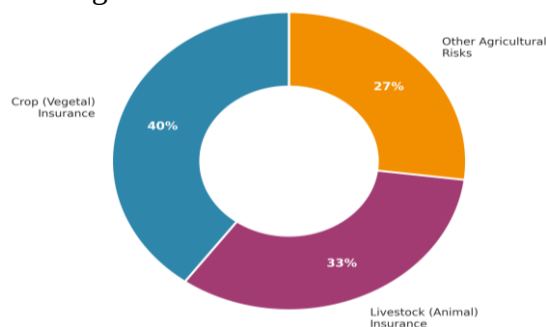
The loss ratio for agricultural insurance, calculated as claims paid divided by premiums earned, increased from 39.7% in 2023 to 45.5% in 2024. While this ratio is not yet at an unsustainable level, the upward trend warrants close monitoring.

Fig.6. Agricultural Insurance Premiums, Claims, and Loss Ratio (2023–2024)

Source: (Algerian Ministry of Finance, 2024)

3.4. The Role of CNMA and Product Portfolio

The National Agricultural Mutual Insurance Company (CNMA) is the dominant player in the Algerian agricultural insurance market. In 2022, its portfolio was primarily composed of crop (vegetal) insurance (40%), livestock (animal) insurance (33%), and other agricultural risks (27%).

Fig.7. CNMA Agricultural Insurance Portfolio Structure (2022)

Source : (CNMA, 2025)

Table 4. CNMA Agricultural Insurance Portfolio Structure (2022)

Insurance Segment	Share of Agricultural Portfolio (%)	Approximate Premium Value (Billion DA)	Growth vs 2021 (%)
Vegetal (Crop) Insurance	40%	0.60	+11
Animal (Livestock) Insurance	33%	0.50	+11
Other Agricultural Risks	27%	0.40	+11
Total Agricultural Insurance	100%	1.50	+11

Source: (CNMA, 2025)

The overall insurance market data from the 2024 annual report further illustrates the marginal position of agricultural insurance. The automobile branch alone accounts for 42% of damage insurance premiums (71.5 billion DA in 2024), and property damage for 46% (69 billion DA), while agricultural insurance contributes barely 2 billion DA—under 1.4%. Traditionally, CNMA’s products have focused on named perils such as fire, hail, and explosions, often excluding catastrophic risks like widespread drought, which are becoming the most significant threat to Algerian agriculture. This coverage gap is a major factor contributing to the low insurance penetration among farmers.

3.5. Statistical Relationship Between Insurance and Agricultural Production

An econometric study covering the period 2006–2020, conducted by (Siddique, Rehman, Khan, & Altaf, 2020) and replicated with updated data by (Tidjani, 2024), estimated a multiple linear regression model linking agricultural insurance variables—crop insurance, livestock insurance, and multi-risk agricultural machinery insurance—to an index of national agricultural production. The model yielded an R² of 0.795, indicating that the three insurance variables together explain approximately 79.5% of the observed variation in agricultural output over the study period. The composite correlation coefficient was 0.892, suggesting a strong positive association. At the disaggregated level, crop insurance exhibited a positive and statistically significant coefficient ($\beta = 0.013$), implying that a one-unit increase in crop insurance premiums is associated with a 0.013-unit increase in the agricultural production index. Livestock insurance showed a near-zero coefficient ($\beta = 0.001$), plausibly reflecting high contract non-

renewal rates in that sub-branch. Multi-risk machinery insurance carried a negative, statistically insignificant coefficient ($\beta = -0.006$), suggesting that this product type does not drive production gains in the current market configuration. These results should be interpreted with caution: the study period (2006–2020) was characterised by significant non-insurance policy interventions—input subsidies, irrigated area expansion, and livestock importation programmes—that may be correlated with insurance uptake, potentially introducing omitted-variable bias. Nonetheless, the positive crop insurance coefficient corroborates the theoretical link between coverage and productive investment documented in the international literature.

4. Challenges and Limitations

4.1. Low Farmer Awareness and Financial Literacy

A consistently documented obstacle to agricultural insurance adoption in Algeria is the widespread lack of awareness among farmers, particularly smallholders and those with limited formal education. Agricultural insurance is perceived as an abstract financial product whose benefits are contingent on the occurrence of a loss. This temporal disconnect reduces willingness to pay for many rural households (Giulio, Donatella, Yari, & Felice, 2021). The network of agricultural extension advisors, which could serve as the primary information channel, remains understaffed relative to the size of the farming population, limiting the reach of awareness campaigns. This low awareness is not unique to Algeria; comparative evidence from Nigeria shows that fewer than half of surveyed farmers recognised agricultural insurance as a climate-risk adaptation instrument, underscoring that weak awareness is a structural barrier across developing-country agricultural markets. (Madaki, Kaechele, & Bavorová, 2023)

4.2. Affordability and Premium Structure

For smallholder farmers—who constitute the majority of Algeria's estimated 2 million agricultural operators—insurance premiums represent a significant cash outflow in a context of thin margins and rising input costs. The increase in production input prices (seeds, fertilisers, animal feed) documented in recent years has simultaneously raised farming costs and

reduced farmers' disposable income for insurance premiums. Unlike Tunisia and India, where government subsidies cover 50% to 90% of premiums for targeted groups, Algerian public support for agricultural insurance premiums remains limited in both scope and amount, creating an affordability gap that structural demand cannot overcome. (Віленчук, NEDILSKA, Kurovska, Vikarchuk, & Klapkiv, 2022)

4.3. Technical Challenges in Loss Assessment and Claims Settlement

The limited availability of georeferenced agricultural production data, historical yield series at the plot level, and granular weather records creates significant difficulties for actuarially sound product pricing and for objective claims adjustment. Delays or disputes in claims settlement erode farmer trust—a particularly destructive dynamic in a context where trust in formal financial institutions is already fragile. The lack of reliable historical data also constrains the development of IBI products, as calibration of trigger indices requires long time series of both meteorological and yield observations. (Tan, Jian-ping, Yi, He, & Huang, 2022).

4.4. Narrow Peril Scope

Existing CNMA products cover a limited set of named perils—predominantly hail, fire, and frost—while systematically excluding the catastrophic climate risks of drought and widespread flooding, which pose the greatest threat to Algerian agricultural production. This misalignment between product design and the actual risk profile of Algerian farmers is a fundamental structural limitation. As climate change increases the frequency and severity of extreme drought events in North Africa, the proportion of uninsurable losses under current product offerings will continue to rise, widening the protection gap.

4.5. Slow Uptake of Takaful and Digital/Parametric Products

Although Executive Decree 21-81 of 23 February 2021 formally incorporated Takaful into the regulated insurance framework — introducing a Sharia-compliant, cooperative risk-sharing model expected to appeal to religiously observant rural populations — its penetration in the agricultural segment remains negligible. This is a missed opportunity, given that

Takaful has demonstrated considerable potential to broaden financial inclusion and to drive the quantitative development of the Islamic finance industry more generally (Krache, Almi, & Awashreh, 2025). Two interlocking constraints explain this slow adoption. First, a *technical-infrastructural constraint* undermines the credibility of the parametric and index-based products on which digital insurance depends. Actuarially sound index design requires dense, spatially disaggregated meteorological networks capable of measuring rainfall accumulation, temperature thresholds, and satellite-derived vegetation indices at the plot level. Algeria's meteorological station density remains sparse and unevenly distributed across its vast agricultural territories, amplifying basis risk — the divergence between the index trigger and the farmer's actual on-farm loss. When farmers perceive that an indemnity may not be paid despite a genuine loss (or, conversely, that no payout follows a visible drought), trust in the product collapses, and demand contracts accordingly. Second, a *financial-literacy and religious-awareness constraint* operates on the demand side. The conceptual novelty of both index-based triggers and the Takaful surplus-sharing mechanism exceeds the financial comprehension of many smallholders, who already regard conventional insurance as an abstract product. (Kirchner & Mußhoff, 2024) In the Takaful case specifically, limited awareness of how the cooperative model differs from and more fully complies with Islamic principles than conventional insurance means that its principal comparative advantage in the Algerian context remains largely uncommunicated. As documented in the context of Takaful and Re-takaful practice in Algeria, the sector faces persistent structural and awareness-related obstacles that constrain its growth despite a supportive regulatory environment (Almi, 2023). Absent targeted financial-education campaigns delivered through the agricultural extension network and religious-community channels, the latent demand that Takaful could theoretically mobilise stays dormant. These two constraints are mutually reinforcing: weak meteorological infrastructure raises the technical risk that erodes trust. At the same time, low financial and religious-product literacy prevents farmers from correctly valuing even well-designed contracts.

Addressing the digital adoption gap, therefore, requires a coordinated investment in both meteorological data infrastructure and demand-side financial and Takaful-specific education.

5. International Experiences: Lessons for Algeria

An analysis of agricultural insurance systems in other countries provides valuable insights for Algeria. Spain, India, and Tunisia offer relevant models, each with distinct features and outcomes.

5.1. Spain: The Spanish system is a mature public-private partnership (Agroseguro) characterised by high penetration rates (over 85% for high-value crops) driven by substantial government subsidies, which can average 50% and reach up to 90% for certain farmer groups. The model is voluntary but highly effective due to its comprehensive product offerings and strong financial support. (Glauber, Baldwin, Antón, & Ziebinska, 2021)

5.2. India: India's model relies on compulsory participation for farmers accessing credit. It is also heavily subsidised by federal and state governments. While this has expanded coverage, the system has faced challenges with basis risk in its index-based products and delays in claim settlements. (Kaur, Raj, Singh, & Chattu, 2021)

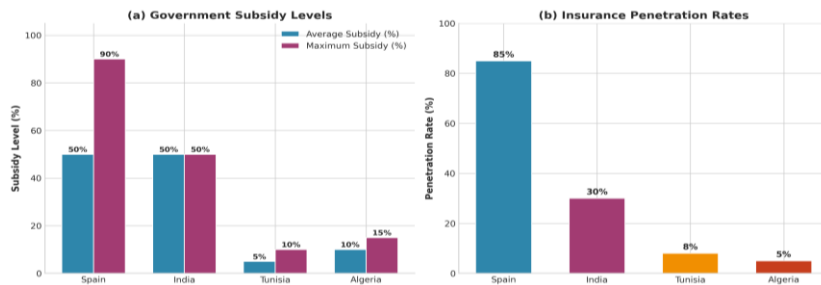
5.3. Tunisia: The Tunisian model is dominated by the Caisse Tunisienne d'Assurances Mutuelles Agricoles (CTAMA), which covers over 50% of the market. However, the overall penetration rate is extremely low, at less than 8%, and standard insurance products often cover only specific perils, such as hail, while excluding systemic risks like drought. To address this, Tunisia established a compensation fund for natural disasters (Law 2017-66), financed by state contributions (30 million TND annually), a solidarity tax, and a 2.5% contribution from farmers on the insured production value. This hybrid system aims to provide a safety net when the private market falls short, but it highlights the challenges of affordability and comprehensive coverage. (Atlas-Mag, 2017)

Table 6. Comparative Agricultural Insurance Systems—Spain, Tunisia, India, and Algeria

Feature	Spain (Agroseguro)	Tunisia (CTAMA)	India (PMFBY)	Algeria (CNMA)
Dominant product type	Multi-peril yield/revenue (MPCI)	Named-peril (hail, fire, livestock) + state catastrophe fund (Law 2017-66)	Area-yield index (MPCI-hybrid)	Named-peril (fire, hail)
Government subsidy rate	~50% average; up to 70–90% for vulnerable groups	Limited direct subsidy; state backstop fund for catastrophic perils	~50% central + state share	Limited / no standard subsidy
Peril coverage	Drought, flood, frost, pests, disease — near-comprehensive	Named perils (private): drought, flood, storm, frost (state fund)	All climate and biological perils	Fire, hail, and explosion only
Technology use	Remote sensing, actuarial modelling, GIS	Traditional field adjustment; drone pilots launched in 2019 (CTAMA-ULM)	Satellite, drones, mobile data	Traditional field adjustment
Estimated penetration	>30% for major crops; 0.7% of GDP	~8% of farmers (40,000 of 516,000 in 2016); 0.31% of total premiums	~25–30% of the cropped area	<5% of insurable area
Private sector role	Active (co-insurance pool with ENESA)	Limited (CTAMA ~50%; Astree 16%; Comar 13%)	Active (tendering system)	Minimal (CNMA dominant)

Source: the author's synthesis.

A comparative analysis reveals a clear theme: strong government financial and structural support is a critical success factor. Spain's high voluntary uptake is directly linked to its generous subsidies. In contrast, Tunisia's low penetration rate persists despite a state-supported disaster fund, indicating that the structure of support and the scope of private insurance products are equally important. The low affordability and penetration in Algeria correlate with its comparatively modest government support and limited product diversity (see Figure 8).

Fig. 8. International Comparison of Agricultural Insurance Systems

Source: the author's synthesis.

6. CONCLUSION

This study analyses the role of crop insurance in Algeria from 2019 to 2024, integrating quantitative analyses of official premiums and market data with a comparative evaluation of public support systems in Tunisia and India. The central finding is that the sector suffers from a fundamental structural dysfunction. Even though the overall insurance market is growing at 5–7% per year, agricultural insurance premiums fell by 31% between 2019 and 2023. This branch accounts for only 1.4% of total damage insurance, which is not a good position for agriculture, given its contribution to GDP and its importance to national food security. The reasons for this poor performance are clear: the product only covers defined risks and excludes catastrophic droughts and floods; there are no systematic premium subsidies; farmers lack sufficient information; and gaps in the data infrastructure make it hard to create actuarially sound IBI products. These represent institutional and policy failures rather than evidence of the intrinsic unsuitability of crop insurance as a risk-management instrument. The policy suggestions in this article—targeted premium subsidies, faster IBI deployment, linking insurance to credit, more advisory infrastructure, and partnerships between the public and private sectors to develop new products—are based on evidence specific to Algeria and adjusted to reflect experiences most relevant to Algeria. Preliminary figures for 2025 indicate that the agriculture sub-sector's recent 22.5% growth in Q1–Q3 may signal an early positive inflexion, possibly driven by new parametric product pilots and CNMA's revitalised awareness initiatives. Subsequent research should aim to identify the insurance-productivity relationship with meticulous causal clarity in the Algerian context, using household panel data collected before and after the implementation of the index-based pilot program. Such evidence will substantially reinforce the empirical basis for the policy suggestions proposed herein and establish a framework for evaluating the impact of crop insurance throughout the MENA region.

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