

AGRICULTURAL RISK INSURANCE AS A TOOL FOR IMPROVING THE ECONOMIC EFFICIENCY OF CROP PRODUCTION IN THE CONTEXT OF CLIMATE CHANGE IN MOLDOVA

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Abstract: *Climate change and the increasing frequency of extreme weather events represent major challenges for agricultural production in the Republic of Moldova. Crop production is particularly vulnerable to climatic hazards such as droughts, hailstorms, and frosts, which generate significant fluctuations in agricultural output and farmers' incomes. In this context, agricultural risk insurance plays an important role as a financial instrument for mitigating production risks and improving the economic efficiency of agricultural activities. The aim of this study is to analyse the role of subsidized agricultural risk insurance in strengthening the resilience of crop production in Moldova. The research is based on statistical data provided by the National Bureau of Statistics and the Agency for Interventions and Payments in Agriculture, covering the period 2013–2024. The results indicate a significant expansion of the subsidized agricultural insurance program after 2021, reflected in the increase in the number of insurance applications and the volume of subsidies allocated. The analysis also shows that hail, drought, and frost represent the most frequently insured risks, while the territorial distribution of subsidies reveals a strong concentration in several districts with intensive crop production. The findings highlight the importance of agricultural insurance as a policy instrument for reducing climate-related risks and enhancing the economic efficiency and resilience of the agricultural sector.*

Key words: agricultural insurance; climate change; crop production; risk management; agricultural subsidies.

JEL: Q18, G22.

Introduction

Climate change represents one of the most significant challenges affecting global agricultural production. Rising temperatures, changes in precipitation patterns, and the increasing frequency of extreme weather events such as droughts, floods, and heat waves are already affecting crop productivity and agricultural stability (Alotaibi, 2023; Yuan et al., 2024). Because agricultural production depends heavily on climatic conditions, these changes can disrupt crop growth cycles, increase pest and disease pressures, and reduce agricultural yields (Yuan et al., 2024).

Extreme weather events have significantly increased production risks in agriculture and have generated substantial economic losses worldwide. Droughts, excessive rainfall, and temperature fluctuations can negatively affect crop yields and farm incomes, thereby increasing the vulnerability of agricultural systems (Zeng et al., 2025). In this context, effective risk management strategies are essential to reduce production uncertainty and support the sustainability of agricultural activities.

Agricultural insurance is widely recognized as an important financial instrument for managing production risks and stabilizing farmers' incomes. By transferring part of the production risk to insurance providers, farmers can mitigate the financial consequences of adverse climatic events and maintain production activities despite unfavorable environmental conditions (Kramer et al., 2022). Moreover, agricultural insurance may encourage farmers to adopt innovative technologies and efficiency-enhancing production practices, contributing to improved farm economic performance.

In the Republic of Moldova, agriculture plays a crucial role in the national economy but remains highly vulnerable to climate-related risks. The sector is strongly affected by droughts, frosts, and

other extreme weather events that cause significant fluctuations in agricultural output and farmers' incomes (Cimpoieș & Grubleac, 2023). Severe droughts have led to substantial reductions in agricultural production, highlighting the vulnerability of crop production to climate variability. Under these conditions, agricultural risk insurance represents an important policy instrument for improving the resilience and economic efficiency of crop production.

Basic content

Agricultural production is strongly influenced by climatic conditions, which makes the sector highly vulnerable to various natural risks. In Moldova, agriculture remains an important component of the national economy despite the gradual decline of its contribution to GDP. The sector remains a key pillar of the economy, making a strong contribution to exports and employing roughly one-third of the workforce. However, agricultural output has been highly volatile in recent decades, largely as a result of increasing climate variability.

Table 1. Agricultural production dynamics and major climate shocks in the Republic of Moldova

Year	Gross agricultural production (million MDL)	Plant production (million MDL)	Share of plant production (%)	Climate event
2007	12,825	7,941	61.9	Severe drought
2009	13,300	7,861	59.1	Drought affecting crop yields
2012	19,922	11,968	60.1	Extreme drought
2015	27,193	18,082	66.5	Recovery after climatic shocks
2020	30,061	20,389	67.8	Severe drought
2021	48,434	37,838	78.1	Strong recovery year
2022	40,617	27,208	67.0	Climate instability
2024	41,632	28,014	67.3	Production stabilization

Source: own design based on the data from National Bureau of Statistics

Analyzing agricultural production dynamics and major climate shocks (Table 1), we can mention that agricultural production in the Republic of Moldova generally increased between 2000 and 2024, even though this growth was marked by considerable variability, largely driven by climate conditions. By 2024, gross agricultural output was about 33.4 billion MDL higher than in 2000, indicating a clear expansion of the sector over the period analyzed. Nevertheless, there were several years when production dropped significantly, mainly due to extreme weather events such as droughts.

Plant production represents the dominant component of the agricultural sector, accounting on average for around 70% of total agricultural output. Consequently, fluctuations in crop yields have a major impact on the overall performance of agriculture. The data show that years characterized by severe droughts, such as 2007, 2009, 2012, and 2020, were associated with significant reductions in agricultural production, highlighting the strong dependence of the sector on climatic conditions.

The most favorable year during the analyzed period was 2021, when gross agricultural production reached 48,434 million MDL, representing the highest level recorded in national statistics. This exceptional performance was largely driven by favorable climatic conditions and improved crop yields. Nevertheless, the considerable volatility observed in agricultural production over time demonstrates the high vulnerability of the sector to climatic risks.

Under such circumstances, the implementation of effective risk management mechanisms becomes essential for stabilizing farm incomes and reducing production uncertainty. One of the most important instruments for supporting farmers' agricultural income and protecting crop yields is agricultural crop insurance. Crop insurance programs aim to mitigate production risks by providing financial compensation when farmers experience losses caused by adverse events, thereby reducing the negative economic consequences of unfavorable climatic conditions (Ramsey & Santeramo, 2017).

In many countries, governments play a significant role in the development of agricultural insurance systems by defining the conditions of insurance contracts, establishing premium levels, subsidizing insurance costs, and acting as reinsurers for insurance companies providing such services. These programs are designed to protect farmers against a wide range of risks, including drought, pest infestations, lightning, strong winds, and excessive moisture.

For example, in 2023 the European Commission approved a €1.3 billion state aid scheme in Poland aimed at subsidizing agricultural insurance premiums for certain crop and livestock products. The objective of this measure is to ensure income stability for farmers and address market failures that could discourage producers from purchasing insurance due to high premium costs. Furthermore, public reinsurance mechanisms are often required for catastrophic risks such as drought, since private insurance companies are frequently reluctant to provide coverage for such high-risk events.

In the Republic of Moldova, where agriculture is highly exposed to climatic uncertainties, the development of agricultural risk insurance has become a key policy instrument for strengthening the resilience and efficiency of crop production.

The country's agricultural insurance system started to develop with the adoption of Law No. 243/2004 on subsidizing agricultural risk insurance. Under this framework, farmers who insure their crops against production risks through licensed insurance companies can benefit from state support covering roughly 50% to 60% of the insurance premium. This policy has been in effect since 2005, following the Government's approval of the regulation on subsidizing agricultural production risk insurance, and has since served as an important mechanism to support farmers in managing weather-related risks.

The regulation aims to compensate farmers for part of the costs associated with insuring agricultural crops and livestock against various production risks. Under this mechanism, farmers can benefit from subsidies if they conclude an insurance contract in accordance with the established regulations and pay the remaining portion of the insurance premium, which represents the difference between the total premium and the subsidized amount provided by the state. The level of subsidization is determined according to the list of eligible risks and the list of agricultural crops, livestock species, and poultry covered under the program. Financial resources for these subsidies are allocated from the National Fund for the Development of Agriculture and Rural Environment.

In addition to insurance subsidies, the government may also provide additional financial support to farmers in order to mitigate the negative consequences of adverse weather events. For example, following the severe drought that affected the agricultural sector in 2012, the Government adopted Regulation No. 766, which provided financial assistance to help farmers overcome the economic losses caused by that climatic shock.

Overall, the introduction of subsidized agricultural insurance in Moldova represents an important step toward strengthening the risk management framework in agriculture. By facilitating farmers' access to insurance and covering part of the premium costs, the government seeks to limit production-related risks, ensure more stable farm incomes, and strengthen the sector's capacity to cope with growing climate variability.

To assess how this support mechanism has functioned in practice, it is important to examine trends in farmers' participation in the subsidized agricultural insurance program, as well as the level of public funding allocated to it. Indicators such as the number of subsidy applications submitted, approval rates, and the total value of subsidies granted between 2013 and 2024 offer valuable insights into the program's evolution. For a clearer analysis, the period is divided into two main stages: the initial implementation phase (2013–2020) and the subsequent expansion phase (2021–2024).

Table 2. Dynamics of subsidized agricultural risk insurance in Moldova by program development phases (2013–2024)

Year	Applications submitted	Approval rate (%)	Subsidy allocated (thousand MDL)	Avg. subsidy per approved application (thousand MDL)
Phase I – Initial development of the program (2013–2020)				
2013	81	96.3	41,288.2	529.3
2014	122	54.0	22,760.5	344.9
2015	137	93.4	30,858.0	241.1
2016	118	73.7	8,875.8	102.0
2017	83	96.3	4,474.9	55.9
2018	122	97.5	7,409.5	62.2
2019	84	94.0	5,438.7	68.8
2020	82	98.8	7,522.4	92.9
Phase II – Expansion of the insurance support scheme (2021–2024)				
2021	463	90.7	41,673.9	99.2
2022	527	99.4	63,914.2	121.9
2023	162	95.1	50,603.7	328.6
2024	684	99.2	89,100.6	131.2

Source: Author's calculations based on data from the Agency of Interventions and Payments in Agriculture (AIPA).

The data presented in Table 2 reveal the evolution of the subsidized agricultural risk insurance program in the Republic of Moldova and highlight two distinct stages in its development. During the initial implementation phase (2013–2020), the number of subsidy applications remained relatively modest, generally fluctuating between 80 and 140 applications annually. Despite this limited participation, the approval rate was consistently high in most years, exceeding 90%, which reflects the institutional willingness to support farmers through this risk management instrument. An exception was recorded in 2014, when the approval rate dropped to 54%, suggesting possible administrative or financial constraints in the implementation of the program during that year. Financial allocations during the first phase also show considerable fluctuations. In 2013, the amount of subsidies allocated reached 41.3 million MDL, representing the highest level during the early years of the program. However, in the following years the allocated subsidies decreased significantly, reaching a minimum of 4.5 million MDL in 2017, which indicates a relatively limited scale of the insurance support mechanism during this period. The average subsidy per approved application also declined considerably, from 529.3 thousand MDL in 2013 to around 55–92 thousand MDL in the period 2017–2020, suggesting a reduction in the financial intensity of support per beneficiary. A significant structural change can be observed beginning with 2021, marking the expansion phase of the agricultural insurance support scheme. In that year, the number of subsidy applications increased sharply to 463, representing an increase of more than five times compared with 2020. This rapid growth reflects the strengthening of government support for agricultural risk insurance, particularly through increased subsidy rates covering a larger share of the insurance premium. The upward trend continued in 2022, when the number of applications reached 527, while the total subsidy allocated increased to 63.9 million MDL, demonstrating a substantial expansion of the program. The high approval rate of 99.4% in that year further confirms the strong institutional support provided to farmers participating in the insurance scheme. Although 2023 recorded a temporary decrease in the number of applications to 162, the financial support allocated remained relatively high at 50.6 million MDL, resulting in a significant increase in the average subsidy per approved application, which reached 328.6 thousand MDL. This suggests

that although fewer applications were submitted, the insured values or the scale of coverage per application may have increased.

The most notable development occurred in 2024, when the number of submitted applications reached 684, the highest level recorded during the analyzed period. At the same time, the total subsidy allocated increased to 89.1 million MDL, reflecting the continued expansion and consolidation of the subsidized agricultural insurance program. The approval rate of 99.2% also indicates the high accessibility of this support mechanism for farmers.

Overall, the evolution of the program demonstrates the growing importance of agricultural risk insurance as a key policy instrument for managing climatic and production risks in the agricultural sector. The significant increase in both the number of applications and the financial resources allocated after 2021 suggests a rising awareness among farmers regarding the importance of insurance mechanisms, particularly in the context of increasing climate variability and production uncertainty. The analysis of insured agricultural risks provides valuable insights into farmers' risk perception and the main climatic threats faced by the agricultural sector. In this context, the structure of insured risks, the corresponding insured areas, and the financial contributions of both farmers and the state subsidies offer a clearer picture of the role played by agricultural insurance in protecting crop production against adverse weather events during the period 2021–2024.

Table 3. Structure of insured agricultural risks in Moldova (2021–2024)

Type of risk	Total insured area (ha)	Farmer contribution (thousand MDL)	Subsidy allocated (thousand MDL)
Storms	108.2	77.6	0
Hail	19,556.3	18,466.2	39,641.7
Hail + spring frost	4,727.1	20,138.4	24,668.0
Hail + spring frost + torrential rain	730.4	7,554.0	7,268.9
Hail + torrential rain + excessive drought	11,582.2	15,300.0	16,593.5
Hail + excessive drought	7,814.4	9,747.9	12,687.1
Fires	842.0	9.6	28.7
Spring frost	677.2	3,055.5	4,222.1
Drought + hail	7,732.7	4,657.6	10,867.5
Early autumn/winter and late spring frost + hail	1,939.6	7,869.0	11,060.8
Early autumn/winter and late spring frost	5,114.9	9,218.4	15,555.9

Source: Author's calculations based on data from the Agency of Interventions and Payments in Agriculture (AIPA).

The analysis of the structure of insured agricultural risks during the period 2021–2024 shows that insurance coverage in the Republic of Moldova is concentrated mainly on hail-related risks, either individually or in combination with other climatic hazards. Hail as a single risk covers the largest insured agricultural area, amounting to 19,556.3 ha, which represents the highest value among all risk categories included in the program. At the same time, this risk category received the largest amount of subsidies, totaling 39,641.7 thousand MDL, indicating the significant financial impact that hail events can have on agricultural production.

Combined risk categories also play an important role in the agricultural insurance structure. For example, insurance contracts covering hail together with torrential rain and excessive drought account for 11,582.2 ha of insured agricultural land, with subsidies amounting to 16,593.5 thousand MDL. Similarly, risks combining hail and excessive drought cover 7,814.4 ha, while the corresponding subsidy allocations reach 12,687.1 thousand MDL. These figures highlight the growing importance of insurance products covering multiple climatic hazards, reflecting the increasing complexity of weather-related risks affecting crop production.

Another relevant category includes risks associated with frost phenomena, such as spring frost or combined early autumn, winter, and late spring frost events. Insurance contracts covering these risks represent 5,114.9 ha of insured area, with subsidies amounting to 15,555.9 thousand MDL, which indicates the significant potential damage that frost events can cause to sensitive crops, particularly fruit trees and early-season crops.

In contrast, certain risks such as storms and fires account for relatively small insured areas and lower financial allocations. For example, storm-related risks cover only 108.2 ha, while fires account for 842 ha of insured agricultural land, indicating that these risks are less frequently insured compared with hail, drought, and frost-related hazards.

Overall, the distribution of insured risks demonstrates that climatic hazards related to extreme weather events dominate the agricultural insurance market in Moldova. The predominance of hail, drought, and frost-related risks reflects the vulnerability of crop production to climate variability and extreme weather events. At the same time, the significant level of subsidies allocated for these risks highlights the important role of public financial support in encouraging farmers to adopt agricultural insurance as a key instrument for managing production risks and improving the resilience of agricultural systems.

The predominance of climatic risks such as hail, drought, and frost in the agricultural insurance portfolio also influences the structure of the insurance market and the distribution of public financial support among insurance providers. In order to better understand how the subsidized agricultural insurance mechanism operates in practice, it is important to examine the allocation of subsidies to the insurance companies that provide these services to agricultural producers.

Examining how subsidies are distributed among insurance companies helps to better understand the structure and concentration of the agricultural insurance market, as well as the role of private insurers in delivering the subsidized risk insurance scheme. In this regard, the pattern of subsidy allocations to insurance companies over the period 2013–2024 highlights both the growth of the agricultural insurance program and the increasing participation of insurers in managing production risks in the agricultural sector.

Table 4. Subsidies allocated to insurance companies for agricultural risk insurance by program development phases

Insurance company	2013–2020 (thousand MDL)	2021–2024 (thousand MDL)	Total (thousand MDL)
SA Intact Asigurări Generale	12,339.3	129,797.9	142,137.2
CA General Asigurări SA	7,491.9	91,778.4	99,270.3
CA Moldasig SA	18,695.2	10,233.5	28,928.7
CA Asterra Grup SA	15,965.8	14,697.2	30,663.0
Other insurance companies	64,363.9	1,134.1	65,498.0
Total	118,856.1	247,641.1	366,497.2

Source: Author's calculations based on data from the Agency of Interventions and Payments in Agriculture (AIPA).

The analysis of the distribution of subsidies allocated to insurance companies for agricultural risk insurance reveals significant changes in the structure and scale of the insurance market in the Republic of Moldova (Table 4). It is obvious that the total amount of subsidies allocated through the program increased substantially between the two analyzed periods. During the initial implementation phase (2013–2020), the total subsidies amounted to 118,856.1 thousand MDL, whereas in the expansion phase (2021–2024) the allocated amount more than doubled, reaching 247,641.1 thousand MDL. This increase reflects the expansion of the subsidized agricultural insurance program and the growing importance of insurance mechanisms as a tool for managing production risks in agriculture.

A significant concentration of subsidies among a limited number of insurance companies can also be observed. In the second phase of the program, SA Intact Asigurări Generale became the dominant

insurance provider in the agricultural insurance market, receiving 129,797.9 thousand MDL, which represents the largest share of the total subsidies allocated during this period. Similarly, CA General Asigurări SA also strengthened its position in the market, receiving 91,778.4 thousand MDL in subsidies during 2021–2024. Together, these two companies account for the majority of subsidies allocated in the expansion phase of the program.

In contrast, other insurance companies played a more significant role during the earlier stage of the program. During the period 2013–2020, the category of other insurance companies received the largest share of subsidies, totaling 64,363.9 thousand MDL, indicating a more fragmented market structure during the initial years of the agricultural insurance scheme. However, their participation declined considerably in the second phase, receiving only 1,134.1 thousand MDL during 2021–2024. Companies such as CA Moldasig SA and CA Asterra Grup SA maintained a more stable but comparatively smaller presence in the agricultural insurance market throughout the analyzed period. While Moldasig received 18,695.2 thousand MDL during the first phase, its share declined in the second phase to 10,233.5 thousand MDL, suggesting a relative reduction in its role within the expanding insurance program. Asterra Grup SA maintained relatively balanced allocations across both phases, receiving 15,965.8 thousand MDL in the first period and 14,697.2 thousand MDL in the second.

The allocation of subsidies among insurance companies reveals a clear trend toward market concentration, with a relatively small group of insurers capturing most of the subsidized contracts in recent years. This development reflects not only the expansion of the agricultural insurance scheme but also the emergence of specialized insurers with greater capacity and expertise in managing agricultural risks. At the same time, the marked increase in subsidy volumes after 2021 highlights the pivotal role of public financial support in accelerating the uptake of insurance, reinforcing its function as a key instrument for mitigating climate-related risks and improving the resilience of the agricultural sector. Differences in agricultural specialization, farm structure, and exposure to climatic risks may influence the level of participation in the insurance program at the local level. Therefore, analysing the distribution of subsidies by district allows for a better understanding of the geographical concentration of insured agricultural activities and the regions where agricultural insurance plays a more significant role in mitigating production risks.

Table 5. Districts receiving the largest agricultural insurance subsidies in Moldova (2021–2024)

District	Subsidy allocated (thousand MDL)	Share of total (%)
Briceni	67,117.0	37.3
Telenești	27,438.8	15.2
Ocnita	17,565.3	9.8
Edineț	17,532.4	9.7
Cahul	15,716.8	8.7
Ungheni	7,542.0	4.2
Other districts	27,050.5	15.1
Total	179,962.8	100.0

Source: Author's calculations based on data from the Agency of Interventions and Payments in Agriculture (AIPA).

The territorial distribution of agricultural insurance subsidies during the period 2021–2024 reveals a strong spatial concentration of financial support in a limited number of districts. As shown in Table 5, the district of Briceni received the largest share of subsidies allocated for agricultural risk insurance, amounting to 67,117.0 thousand MDL, which represents 37.3% of the total subsidies distributed during the analyzed period. This dominant share indicates a particularly high level of participation in the agricultural insurance program and suggests a significant exposure of agricultural production in this district to climatic risks.

Other districts also play an important role in the territorial distribution of agricultural insurance subsidies. Telenești ranks second, receiving 27,438.8 thousand MDL, corresponding to 15.2% of the

total subsidies, followed by Ocnița and Edineț, which account for 9.8% and 9.7%, respectively. The district of Cahul also records a significant share of 8.7%, while Ungheni accounts for 4.2% of the total subsidies allocated.

Overall, the five leading districts—Briceni, Telenеști, Ocnița, Edineț, and Cahul—together account for more than 80% of the total agricultural insurance subsidies, indicating a high geographical concentration of insured agricultural activities. These districts are characterized by intensive crop production and a relatively high exposure to climatic hazards such as hail, drought, and frost, which increases the demand for insurance coverage.

In contrast, the remaining districts collectively account for 15.1% of the total subsidies, suggesting a lower level of participation in the agricultural insurance program. This disparity may be explained by several factors, including differences in farm size, crop specialization, farmers' awareness of risk management instruments, and the perceived exposure to climatic risks.

Overall, the territorial distribution of agricultural insurance subsidies highlights significant regional disparities in the adoption of insurance mechanisms. The concentration of subsidies in a limited number of districts suggests that agricultural insurance is more actively used in areas where climatic risks are more pronounced and where agricultural production plays a dominant economic role. These findings underline the importance of targeted policy measures aimed at expanding the adoption of agricultural insurance in less represented regions in order to strengthen the resilience of the agricultural sector at the national level.

Conclusions

Climate change and the increasing frequency of extreme weather events represent major challenges for agricultural production in the Republic of Moldova. The analysis conducted in this study confirms that agricultural output, particularly crop production, is highly sensitive to climatic variability, with droughts and other adverse weather phenomena causing significant fluctuations in production levels. Although the overall trend of agricultural production shows long-term growth, the sector remains vulnerable to climate-related shocks that directly affect farmers' incomes and the stability of agricultural systems.

Under these conditions, agricultural risk insurance represents an important financial instrument for reducing production uncertainty and improving the economic efficiency of crop production. The empirical analysis demonstrates that the subsidized agricultural insurance program implemented in Moldova has evolved significantly over time. During the initial phase of the program (2013–2020), participation remained relatively limited, with a modest number of applications and fluctuating levels of financial support. However, starting from 2021 the program experienced a rapid expansion, reflected in the substantial increase in both the number of insurance applications and the volume of subsidies allocated through the National Fund for the Development of Agriculture and Rural Environment.

The analysis of insured risk categories indicates that climatic hazards dominate the agricultural insurance portfolio. Hail-related risks, either individually or in combination with other phenomena such as drought, torrential rainfall, and frost, represent the largest share of insured areas and subsidy allocations. This pattern reflects the significant exposure of crop production to extreme weather events and highlights the importance of insurance mechanisms for mitigating the financial consequences of climate-related losses.

The study also reveals a growing concentration of the agricultural insurance market. In recent years, a limited number of insurance companies have accounted for the majority of subsidized insurance contracts, reflecting both the expansion of the program and the increasing specialization of certain insurers in agricultural risk coverage. At the same time, the territorial analysis shows that agricultural insurance subsidies are unevenly distributed across the country, with a strong concentration in several districts such as Briceni, Telenеști, Ocnița, Edineț, and Cahul. These districts are characterized by intensive crop production and higher exposure to climatic risks, which increases the demand for insurance coverage.

Overall, the results of the study demonstrate that subsidized agricultural insurance plays a crucial role in strengthening the resilience of the agricultural sector in the context of climate change. By partially compensating farmers for insurance premiums and facilitating access to insurance services, public support mechanisms contribute to stabilizing farm incomes, reducing production risks, and encouraging the adoption of risk management strategies. Thus, expanding agricultural insurance programs, alongside greater farmer awareness and well-targeted regional policies, could significantly improve the effectiveness of this tool and contribute to the long-term sustainability and economic performance of crop production in Moldova.

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