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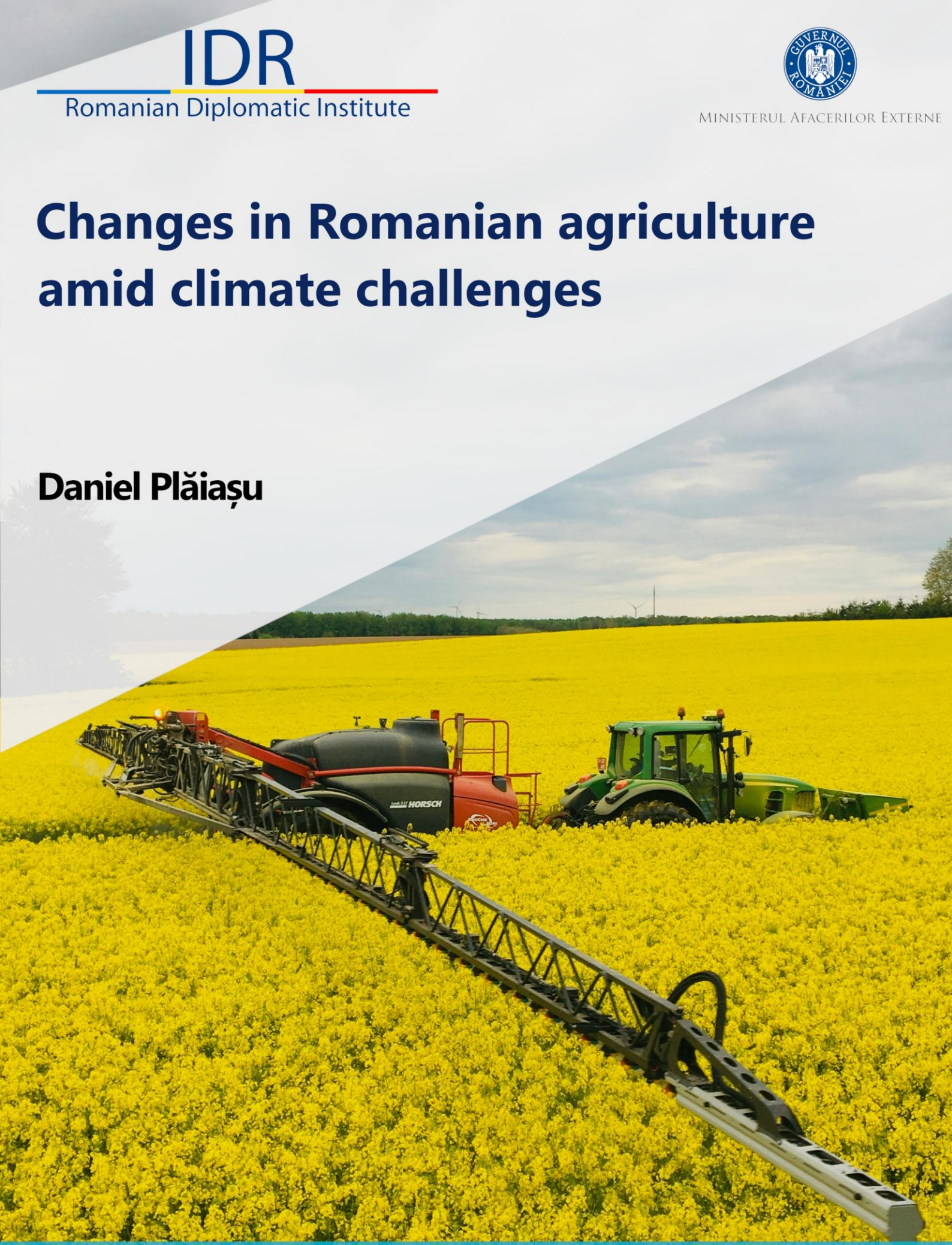
Changes in Romanian agriculture amid climate challenges

Daniel Plăiașu



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Changes in Romanian agriculture amid climate challenges[1]

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Abstract

Agro-climatic data from the European Copernicus program show that Romanian farms, alongside those in the south of the continent, are among the most exposed to risks generated by climate change. Romanian farmers used to say that 'for every five good years, there is one bad year,' but for over a decade and a half, reality has shown the exact opposite: for every five bad years, they have had one good year. Extreme weather phenomena such as droughts, hail, late frosts, and even floods have increased in frequency and intensity, affecting increasingly large areas for longer periods. How are farmers responding to these challenges, what solutions do they have, and what changes does this imply for agricultural practices and decision-makers in the field?

Keywords: agriculture; agricultural policies; climate change; Common Agricultural Policy; National Strategic Plan; new agricultural technologies; food security.

[1] This publication draws exclusively on open-source materials. The opinions expressed herein are solely those of the author and do not necessarily reflect those of the institution.

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INTRODUCTION. THE CONTEXT OF AGRICULTURAL POLICIES IN ROMANIA

Agro-climatic data from the European Copernicus[3] program show that Romanian farms, alongside those in the south of the continent, are among the most exposed to risks generated by climate change[4]. Romanian farmers used to say that 'for every five good years, there is one bad year,' but for over a decade and a half, reality has shown the exact opposite: for every five bad years, they have had one good year. Extreme weather phenomena such as droughts, hail, late frosts, and even floods have increased in frequency and intensity, affecting increasingly large areas for longer periods. How are farmers responding to these challenges, what solutions do they have, and what changes does this imply for agricultural practices and decision-makers in the field?

As a member of the European Union since 2007, Romania benefits from funds allocated through the Common Agricultural Policy (CAP), both in the form of support schemes and investment financing lines, while being obliged to comply with the norms and regulations adopted at the Union level[5]. For this very reason, it is impossible to discuss institutional policies in Romania without referencing the CAP regulations, the European Green Deal, the Farm to Fork strategy, or other measures regarding agriculture, environmental protection, and climate change[6]. Like any other EU member state, Romania has a National Strategic Plan (NSP) which includes updated legislation, practice and funding guidelines, as well as financial allocations for each individual agricultural sector, grouped into direct payments, measures, and sub-measures.

The NSP is a framework document that defines, for the duration of a European financial cycle, the structural elements of public agricultural policies (including those targeting the impact of climate change): eco-schemes, conditionalities, regulations and directives for environmental protection and climate action, measures and sub-measures for financing

[3] Copernicus Climate Change Service (2019): Agroclimatic indicators from 1951 to 2099 derived from climate projections. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). DOI: 10.24381/cds.dad6e055 (Accessed on 13- october-2025)
[4] Georgoulias, A. K., Akritidis, D., Lorilla, R. S., Kontoes, C., Ceglar, A., Toreti, A., and Zanis, P.: Impact of climate change on agro-climatic zones in Europe under different RCPs, EGU General Assembly 2023, Vienna, Austria, 23–28 Apr 2023, EGU23-1235, https://doi.org/10.5194/egusphere-egu23-1235, 2023. (Accessed on 13-october-2025)
[5] https://www.consilium.europa.eu/en/policies/the-common-agricultural-policy-explained/
[6] https://agriculture.ec.europa.eu/index_en

agricultural projects, as well as compensatory payments or the granting of subsidies. Taken together, the National Strategic Plan and the Common Agricultural Policy represent a broad legislative framework regulating a total financial allocation worth nearly 400 billion euros at the EU level, of which approximately 16 billion euros are earmarked for Romania until 2027. For the next cycle, 2028-2034, member states will propose new National Strategic Plans, the implementation and financing of which will be decided subsequently by the European Commission.

Using the current NSP as a benchmark and referring specifically to the legal and political aspects[7], we will examine in the following sections the challenges and concrete measures through which Romanian farmers and agricultural decision-makers aim to tackle climate change.

What are farmers dealing with?

In Romania, the greatest challenges posed by climate change are prolonged droughts and high temperatures during the growing season (extreme heat), particularly from June to September. Furthermore, in recent years, farmers have been facing other extreme weather phenomena: late frosts in April and May (2025 and 2026) or hail in late spring and throughout the summer. At the same time, in certain more localized areas, there are issues regarding soil erosion, water management, and desertification trends. In this context, both government stakeholders and, most notably, farmers have understood the necessity of adopting measures and technologies that respond to the pressures and effects caused by climate change. Currently, we can identify three distinct categories of approaches:

- **Reactive** – implemented in response to the impact of current weather phenomena;
- **Proactive** – measures taken to limit or combat the effects of climate change as a whole;
- **Predictive** – measures aimed at increasing the adaptability and resilience of the agricultural sector in the long term.

PRACTICAL STEPS TOWARD A SUSTAINABLE AGRICULTURE

From the perspective of national and European institutions, all these approaches to climate change in agriculture aim at implementing environmental commitments and

[7] For those interested in the full legal framework defining public agricultural policies in Romania and the EU, the 'Legislation' section of the Ministry of Agriculture's website may be consulted: https://www.madr.ro/legislatie-dezvoltare-rurala

decarbonization (particularly through soil carbon sequestration); however, for farmers, the objective is much more pragmatic: finding solutions to continue their activity even under difficult climatic conditions.

1. The transition from conventional agriculture (ploughing) to conservation and regenerative tillage systems (minimum-till, no-till, and strip-till)

This is the most common change made by Romanian farmers, and this decision is not accidental. In a conventional tillage system, three passes are required for crop establishment, which implies higher resource consumption and elevated costs. Ploughing alone requires a minimum of 20-25 litres of diesel per hectare, plus an average of 10 litres for harrowing and approximately 6-8 litres for sowing. In comparison, using minimum-tillage or no-tillage (zero-tillage) technologies, 1-2 passes are sufficient, thereby reducing the need for fuel and inputs. In a two-pass minimum-till system (soil preparation and sowing), maximum consumption reaches 17-18 litres per hectare, while in no-till with direct drilling, it drops to 8–10 litres. However, the most important aspect is soil water conservation, especially during sensitive summer periods or during the autumn sowing season (barley, wheat, rapeseed).

Multiple scientific research papers published by the National Agricultural Research and Development Institute Fundulea (INCDA Fundulea)[8], as well as by specialists from the Universities of Agricultural Sciences and Veterinary Medicine in Bucharest and Cluj-Napoca[9], have shown that using minimum-till or no-till technologies can preserve up to 25% more soil moisture. This availability plays a decisive role in crop development and productivity during dry spells. For example, in the Bărăgan region, where average annual precipitation is 400-500 mm and summer temperatures frequently exceed 30 degrees Celsius, using conservation

[8] Cociu, A. I., Zaharia, Q. V., & Constantin, N. (2010). Tillage system effects on water use and grain yield of winter wheat, maize and soybean in rotation. Romanian Agricultural Research, (27), 77–85. https://www.incda-fundulea.ro/rar/nr27/rar27.10.pdf; Chețan, F., Bărdaș, M., Simon, A., Russu, F., Ceclan, O. A., Tărău, A., Crișan, I., & Gaga, I. (2023). Influența sistemului de lucrare a solului asupra conservării apei în sol și a producției de porumb la SCDA Turda. Analele INCDA Fundulea, 90, 115–125. https://www.incda-fundulea.ro/anale/90/90.11.pdf; Nicolae Șarpe, INCDA Fundulea (2008). Forty years of research regarding the No-Tillage System in maize under Romania Conditions. Analele INCDA Fundulea, 76, 123-132. https://www.incda-fundulea.ro/anale/76/76.10.pdf

[9] Moraru, P. (2015). The Role of Minimum Tillage in Protecting Environmental Resources of the Transylvanian Plain, Romania. Romanian Agricultural Research. Rusu, T. Minimum Tillage Systems and Its Effect on Soil Structure, Humus Conservation and Water Management. Cosma, S. (2013). Effect of tillage systems on soil properties, humus and water conservation. Agricultural Sciences. https://doi.org/10.4236/AS.2013.45B007

systems can mean the difference between a corn yield of 6-7 tons per hectare and one of only 1-2 tons per hectare.

For most farmers, the shift from ploughing to minimum-till or no-till represents a reactive approach, based on the experience of severe droughts over the last 5-10 years. In 2020 and 2024, according to data from the Ministry of Agriculture and Rural Development (MADR)[10], up to 2-2.1 million hectares of corn, sunflower, and other spring crops were damaged by drought and extreme heat, with loss percentages ranging between 30% and 100% of production. Personally, in 2024, I met farmers who harvested only 80-90 kg of corn per hectare, compared to an average of at least 7 tons per hectare in a normal year. Relative to the total cultivated areas and average annual production, in 2020 and 2024, up to 65% and 85% of areas respectively were affected by crop failure, and national production dropped by as much as 80% for corn and sunflower.

Year	Crops	Sown Area (mil. ha)	Area affected by severe drought (mil. ha)	% of loss from total production
2020	Corn/Maize	~2.6	1.3-1.6	**50-60%**
2020	Sunflower	~1.1	0.5-0.7	**40-60%**
2020	Other spring crops	~0.3	0.1-0.15	**30-50%**
2024	Corn/Maize	~2.5	1.9-2.0	**75-80%**
2024	Sunflower	~1.2	0.8-1.0	**65-80%**
2024	Other spring crops	~0.3	0.15-0.2	**50-70%**

Table 1. Source: Aggregated data available on the Ministry of Agriculture and Rural Development website, www.madr.ro

Unfortunately, there are no updated statistics showing the exact percentage of arable land cultivated under conventional systems versus conservation systems (minimum-till, strip-till, and no-till). The few estimates conducted 6-7 years ago by industry leaders (Bayer, Syngenta, Corteva, Horsch, or John Deere) cited figures between 5% and 20% of arable land. However, I believe these are significantly underestimated, considering those studies were carried out before the 2024 drought or even the one in 2020.

[10] Guvernul României. (2024). Ordonanţa de Urgenţă nr. 120/2024 privind aprobarea schemei de ajutor de stat sub formă de grant acordat producătorilor agricoli pentru culturi agricole afectate de seceta pedologică din perioada septembrie 2023-august 2024. Publicat în Monitorul Oficial al României, Partea I, Nr. 1040 din 16 octombrie 2024.

As an agricultural journalist, I can say that in the last 3-4 years, I haven't encountered a single large farm – exceeding 600-700 hectares – that still uses the plough as its primary soil preparation tool. While combating climate change may seem like an abstract goal for farmers, the necessity of remaining productive and financially viable is an essential motivation for investing in technologies better suited to the new climatic context. Furthermore, starting in 2024, European funding for the purchase of new agricultural machinery and equipment (Measure M121 of the National Strategic Plan[11] and Sub-measure 4.1 – Investments in Agricultural Holdings[12]) favours minimum-till and no-till machinery. This is achieved by awarding higher scores to projects that include this type of equipment or circular economy elements, in accordance with Article 28 of the EU decision on the implementation of agri-environmental measures. From my point of view, we are currently in the midst of an agronomic transition from conventional to conservation technologies, and I believe that within 5-7 years, these will become the primary agronomic approach at the national level.

2. Changing varieties and hybrids, and adjusting crop rotation and diversification structures

In recent years, there has been a noticeable decline in areas cultivated with corn and sunflower (the primary spring crops) and an increase in areas dedicated to winter crops (wheat, barley, rapeseed), alongside the introduction of new, more climate-resilient crops into rotation, such as sorghum or even sweet potatoes. In the European Union, to qualify for agricultural subsidies (which range from 100 to 400 euros per hectare depending on the specific crop, and 195 euros per hectare for pastures), a farmer cannot practice monoculture as is common in the US or other countries. European legislation, through GAEC 7[13] (Good Agricultural and Environmental Conditions), mandates crop rotation; the same crops cannot be grown year after year on the same plots but must be changed every agricultural season. Furthermore, for effective pest and disease management, it is recommended that crops like rapeseed be rotated at intervals of at least two years.

Under these circumstances, few farmers are willing to completely abandon spring crops (especially corn and sunflower) to cultivate only winter crops (wheat, barley, rapeseed, etc.).

[11] https://apia.org.ro/planul-national-strategic-2023-2027-pns-al-romaniei/
[12] https://www.afir.ro/domenii-de-interventie/detalii-si-anexe-sm-41/
[13] https://eur-lex.europa.eu/legal-content/RO/TXT/?uri=CELEX:32022R1317

Instead, what I have observed is a shift in the varieties and hybrids being used. Many companies, including Corteva-Pioneer, Bayer, and KWS, have chosen to establish research and testing platforms in Romania, launching new sunflower and corn hybrids annually with higher levels of drought resistance. Additionally, a notable trend in corn cultivation is the shift from late and extra-late hybrids (**FAO groups 500-650**) to early hybrids (**FAO groups 200-400**). The logic behind this transition is that, although early hybrids have a lower yield potential, they develop faster and can reach maturity even with lower precipitation during the summer months (June-August). This contrasts with late hybrids, whose peak water requirement period coincides with the driest months of the year, posing a major risk of total crop loss (up to 100%).

3. New inputs and the adoption of cover crops

Speaking of new technologies, we must also consider new agricultural inputs (the substances and products used in farming). Over the past 2–3 years, industry companies have launched biostimulants and biofertilizers, such as *Methylobacterium symbioticum* or poly-beta-hydroxybutyric acid (PHB), which possess specific properties to support crops during periods of water and heat stress. Similarly, an increasing number of farmers are using soil conditioners and amendments with water-retention properties, such as biochar.

Furthermore, since 2023, European legislation (through GAEC 6 – Minimum soil cover to avoid bare soil in periods that are most sensitive) prohibits European farmers, including those in Romania, from performing ploughing operations during the summer (June 15 – September 30), requiring them to maintain soil cover on at least 80% of the holding's arable land during this period. Currently, most farmers choose to perform soil tillage after September 30 and keep the stubble unworked during the summer; however, more frequently, cover crops are being used, consisting of a diversified mix of plants: mustard, grass pea, peas, vetch, radishes, buckwheat, clover, or other nitrogen-fixing plants.

Farmers who have adopted the practice of cover cropping are often those who were pioneers of conservation technologies 10-15 years ago and are particularly receptive to climate change issues as well as market innovations. For them, using new agricultural inputs and amendments, alongside growing cover crops, serves a dual purpose: soil water retention during the summer (by reducing evapotranspiration) and improving soil structure by increasing nutrient bioavailability.

With the implementation of these practices, we are already seeing proactive agronomic approaches, as farmers are directly interested in limiting and mitigating the impact of climate change on their own holdings.

4. Trading green certificates

The "Farmer Voice Romania 2024" study, supported by Bayer[14], showed that the penetration rate of new technologies and agronomic approaches is directly correlated with the size of the cultivated areas and the level of professional training of farmers or farm employees. Thus, the larger the cultivated area at the farm level or the higher the farmer's level of education (undergraduate or postgraduate studies), the more we find technologies and agronomic approaches oriented toward the conservation of water, soil, and other natural resources, including tools aimed at combating climate change. Although they statistically represent a minority, the study revealed that these farmers are also the ones setting future trends in the field.

It is already well known that the European Union has set a goal to achieve climate neutrality – net-zero carbon emissions – by 2050. There are industries making major efforts to reduce carbon emissions to zero or near-zero (such as the construction sector), but also industries where, regardless of the effort exerted, a certain level of emissions will continue to exist even after 2050, as is the case with transport. However, there is one sector of activity with the potential to reach a negative carbon emission ratio – meaning a field where current activity can result in carbon capture – and that is agriculture. Through regenerative practices, cover crops, and the use of soil amendments such as biochar, agriculture can fix into the soil the carbon emitted into the atmosphere by other industries.

In the EU, we have the Emissions Trading System (ETS), through which carbon dioxide emission rights are traded for industrial companies operating within the community bloc, calculated for each ton of total emissions – the so-called "Green Certificates." For several years, specialized traders in this market have decided to integrate agriculture and forestry into the transaction system, offering financial bonuses to farmers who choose no-till farming or who sow cover crops containing plants with a high carbon absorption capacity. In practical terms, farmers or farmers' associations sign an agreement with a green certificate trading company.

[14] https://www.bayer.com/ro/ro/farmer-voice-romania-2024 and the data analysis available here https://www.bayer.com/sites/default/files/farmer-voice-romania-2024.pdf

Based on the agricultural practices used and the crops established, the amount of carbon sequestered in the soil is calculated, and a certain sum of money is paid. Subsequently, the trader can sell that emission right, via certificates, to industrial entities that emit carbon dioxide into the atmosphere.

This system is still in its early stages, but farmers who have already implemented conservation technologies and agronomic approaches are increasingly using it to supplement their income. How does it work? One hectare cultivated under a no-till system can sequester 0.7 to 1 ton of CO2 in the soil, for which the farmer receives approximately 50 euros per hectare. Additionally, one hectare of cover crops can sequester another ton of CO2, for which the farmer is remunerated with another 50 euros per hectare. If the same farmer has adopted both agricultural practices (no-till and cover crops), they can receive 100 euros per hectare with no extra effort, simply by signing an agreement with a trader and allowing their representative or specialized inspectors to verify the activities carried out in the field.

5. Energy investments on farms: solar panels, micro-wind turbines, and biogas

Beyond the trading of agricultural green certificates, European and national legislation and public policies encourage the implementation of climate change mitigation measures through the energy efficiency of holdings. Whether through projects carried out under the National Recovery and Resilience Plan (the Environment and Waste Management component[15], coordinated by the Ministry of Environment) or specific measures within the National Strategic Plan (Ministry of Agriculture through AFIR – Rural Investment Financing Agency)[16], farmers can access European and national funds for investments in: installing photovoltaic panels, small-scale wind turbines, renewable energy storage units, or the construction of biogas plants that produce electricity and/or thermal energy for on-farm use or delivery to distribution grids – provided these are not installed on arable land. What does this mean?

A farmer can draft a project and access a European funding line, including non-reimbursable grants ranging from 30% to 80% depending on the project score, to install photovoltaic panels on warehouses, stables, or farm headquarters. However, they are not eligible for funding if they wish to remove one hectare of arable land from production to install

[15] https://mmediu.ro/comunicare/comunicate-de-presa/ghidul-de-finantare-pentru-investitii-in-capacitati-de-productie-a-energiei-din-biogaz-pe-baza-de-gunoi-de-grajd-a-fost-pus-in-consultare-publica/
[16] https://www.afir.ro/comunicate/consultare-publica-privind-schema-de-energie/

photovoltaic panels on it. Furthermore, if a farmer makes such a decision, they will lose the agricultural subsidies granted for that specific area.

Among all these investments, I will emphasize biogas plants, as they can truly play an essential role in both climate change and the energy industry. In practical terms, these units use organic waste, particularly animal manure, to generate electricity, heat, or even biofuels. Although these are multi-million Euro investments targeting mostly very large farms or agricultural cooperatives with a livestock component, biogas plants have the potential to solve, or at least mitigate, two major problems: agricultural waste management (a major source of greenhouse gas emissions) and the energy autonomy of various local or national systems.

In Romania, few farms have been able to afford the construction of biogas plants. Generally, these are small-capacity units using cogeneration (combined heat and power – CHP) technology, primarily for self-consumption: lighting animal shelters, warehouses, and processing units, or providing heat to facilities dedicated to raising young cattle, swine, or poultry. In our country, biogas plants are used mainly as a means of reducing costs on large livestock farms, without serving national distribution grids.

However, in Denmark – the European leader in this field – there are large-scale biogas plants equipped with biomethane processing technologies, allowing the gas to be injected directly into the national gas distribution network. Two years ago, during a working visit there, I learned that the Danes were producing over 35% of their national methane gas requirement in biogas plants[17]. Unlike Romania, where the few biogas units operate independently and rely on cogeneration technology, Denmark has an agro-energy strategy through which most biogas plants are equipped to upgrade biogas into biomethane and are connected to the main gas distribution pipelines.

When considering the fight against climate change, the transition to green energy, and the repetitive crises affecting hydrocarbon markets, this technology can be a game-changer, helping both to reduce carbon emissions and to support a state's energy independence.

6. Irrigation – Romania's most important investment

Before 1990, during the communist period, Romania possessed an irrigation network that covered over 3.2 million hectares of arable land. By 2024, according to MADR[18] data, the

[17] https://www.biogas.dk/wp-content/uploads/2025/11/Biogas-Outlook-2025-English-2nd-September.pdf
[18] https://www.anif.ro/wp-content/uploads/2025/01/Raport-de-activitate-al-ANIF-pentru-anul-2024.pdf

irrigated area had shrunk to only 800,000 – 1 million hectares. The transition from a state-controlled economy to a capitalist one, combined with a lack of funds and a national water management strategy, caused the old irrigation systems to deteriorate or be destroyed. However, against the backdrop of climate change and particularly prolonged droughts – such as those in 2020 and more recently in 2024 – the Romanian government has committed to rehabilitating irrigation systems for 2.6 million hectares by 2028, using both European and national funds. This investment is estimated at approximately €1 billion and is being implemented through the National Program for the Rehabilitation of Primary Irrigation Infrastructure (PNI).

Additionally, over the last 5-10 years, an increasing number of farmers have associated themselves into Irrigation Water Users' Associations (OUAI). Based on their own projects (either EU-funded or through private capital), they have invested in secondary and tertiary infrastructure (local canals serving their plots, pumps, or end-user irrigation equipment). Furthermore, following the updates to the Irrigation Law in 2021 and 2022, many farmers have invested in borehole systems or rainwater harvesting and reuse systems, particularly in the fields of vegetable farming and horticulture.

From the perspective of both farmers and policymakers, investing in irrigation and rehabilitating existing systems is essential for coping with climate change. One could even say that climate change – specifically severe summer drought episodes – has reconfigured Romania's agricultural priorities. In the last 2-3 years, any agricultural machinery and equipment distributor can confirm that irrigation represents the most stable market segment. Whether we are talking about pivots, linears, sprinklers, drip systems, hose reels, or other specific irrigation components, demand is high and farmer interest is very significant.

Despite all this, the year 2024 – which saw up to 55–60 tropical nights (with temperatures exceeding 20°C at night) and one of the longest droughts in history (6 months of severe and extreme drought, including up to 122 days without significant precipitation), correlated with a record number of heatwave days (49 days over 35°C) – revealed the limits of irrigation investments. For over a month and a half, the flow of the Danube and other major rivers was so low that irrigation became either impossible or was strictly prohibited.

THIS SITUATION HAS RAISED A KEY QUESTION: WHAT CAN WE DO WHEN CLIMATE CHANGE EXCEEDS OUR CAPABILITIES?

Since the end of 2024, discussions regarding climate risk management in agriculture have increasingly included predictive approaches, focusing on the adaptability and resilience of farms in the face of extreme situations.

A primary measure in this direction is the **Reform of the Agricultural Insurance System**. Until 2020, the number of Romanian farmers insuring their crops was exceptionally low – under 10% – and the only support mechanism for agricultural holdings affected by disasters and calamities consisted of emergency indemnities granted by the EU and the Romanian state from reserve funds, amounting to approximately €200–€300/ha. Starting last year, through Sub-measure 17.1, the state subsidizes 70% of farmers' insurance premiums[19]; however, even under these conditions, less than half of the farmers have taken out a policy. Simultaneously, work is currently underway to create a mixed (public-private) mechanism for the insurance and reinsurance of agricultural climate risks (drought, hail, late frosts, floods, etc.). The project is still under debate, but it will likely include a compulsory contributory component (an insurance sum per hectare and per crop) and an optional component specific to certain extreme weather phenomena.

Another measure already being implemented is the expansion and modernization of the **Integrated National Meteorological System (SIMIN)**[20] under the National Meteorological Administration (ANM), which is expected to allow for better prediction of extreme weather events. Furthermore, according to the Director General of the ANM, Elena Mateescu, the project includes the installation of over 100 agrometeorological stations specifically dedicated to monitoring parameters that impact agriculture. Finally, there are discussions regarding the allocation of new funds for the establishment of **shelterbelts** (forested areas along the edges of agricultural plots). Climate change does not only mean drought and long periods of high temperatures, but also soil erosion or excessive rainfall in short timeframes. In this regard, shelterbelts – especially in Southern Romania – are proving to be a necessity for soil conservation and for combating the trend of desertification driven by climate change.

[19] https://www.afir.ro/domenii-de-interventie/detalii-si-anexe-sm-171
[20] https://www.meteoromania.ro/despre-noi/proiecte/extinderea-retelei-nationale-de-observatii-din-cadrul-sistemului-meteorologic-integrat-national-simin/

Agriculture as a Pillar of Security in an Increasingly Volatile Environment

In the context of the multidimensional crises defining the contemporary global landscape, the paradigm of international security is undergoing a profound reconfiguration. Beyond traditional dimensions focused on diplomacy and investment in military capabilities, modern security is founded on logistical resilience and the ability of states to manage and protect their vital resources. From this perspective, the agricultural sector is no longer just an economic branch but has become a **strategic dual vector**: a major factor of vulnerability in the absence of adequate policies, but also a pillar of macroeconomic and geopolitical stability when managed efficiently.

Globally, arable land ranges between 1.5 and 1.8 billion hectares, and this finite resource is now under unprecedented pressure due to climate change, for which there are no political or administrative borders. The increasing intensity and frequency of extreme weather events affect agricultural production across all meridians and in all countries, representing a threat to global food security by diminishing domestic resources and limiting purchasing capacity on international markets.

Although Romania is not at the top of the European rankings regarding technological innovation and strategies developed to combat climate change, with the legislative and financial support of the EU, it is constantly adopting and integrating agronomic measures and practices to limit the climate vulnerabilities of domestic agriculture. Moreover, as highlighted in this article, agriculture is, on one hand, among the sectors most exposed to and affected by climate change, but on the other hand, it possesses the most concrete tools to combat it.

The sector's potential exceeds the scope of providing food; through its biological capacity to capture and sequester carbon in the soil, agriculture functions as an essential climate regulator. Furthermore, by utilizing biomass for the production of biogas and biofuels, it offers a viable and green alternative to hydrocarbon dependency. Thus, the transformation of agriculture through innovation and coherent public policies is not merely a sectoral necessity, but a mandatory condition for guaranteeing global security in a future marked by volatility.

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