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THE EFFECTS OF CLIMATE CHANGE ON FIELD CROPS

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Abstract: *Climate change in recent years, especially since 2020, has caused significant discomfort to both people and animals, and has also affected plant growth, particularly annual field crops. In many cases, a lack of water during germination and emergence has sometimes led to the complete loss of the crop, necessitating reseeding or complete replacement with another crop. The authors of the study highlight that a problem affecting spring-sown crops is moisture deficiency, associated with high temperatures during the grain formation and filling stages, which affects both yield and quality. Research shows that of the five years covered by the study (2021–2025), the most severe heat waves and atmospheric droughts – associated with soil drought during the growing season – have occurred in the last two years, which is why we propose using existing irrigation systems as well as constructing new ones to meet the water needs of the crops.*

• Introduction

Over the years, the world’s population has faced a wide range of problems and difficulties related to climate change. Resulting from development, the rapid growth of major industries, deforestation, and human activities, these issues pose real challenges that affect people’s lives, the economy, and the entire environment. ***Climate change*** manifests itself through extreme weather events, such as very high temperatures, increasingly frequent and prolonged *droughts, very strong winds, increasingly reduced or even non-existent precipitation over long periods of time, as well as drought* [1,4,18,21].

As far as ***Romania*** is concerned, climate change manifests itself in prolonged periods of drought, a lack of rainfall, and even severe heat waves with very high temperatures. Without rainfall, crops cannot grow properly, and prolonged drought can lead to the depletion of soil water reserves. In other words, agriculture is dependent on climatic conditions [5,10,13,14].

Drought is a climatic phenomenon that has become increasingly common in recent years, characterized by insufficient precipitation. Increasingly severe climate change has caused it to occur more frequently, leading to a series of particularly serious consequences for agricultural production and food security [13,14,16,18]. This phenomenon affects particularly summer crops such as ***corn, sunflowers, and soybeans*** [7,9].

A prolonged lack of precipitation has a disastrous effect on the soil, as it can lead to its physical and structural degradation [8,14,20]. Western Romania has been and remains one of the most severely affected areas in Western and Central Europe due to prolonged drought, which depletes the soil’s water reserves, while irrigation systems cover only a very small portion of the total arable land cultivated with field crops [7,21].



• Material and method

This study considered the main field crops grown in western Romania, namely: common wheat, barley and two-row barley, oats, grain corn, sunflowers, grain rapeseed, and grain soybeans, which account for the majority of the region’s arable land. Accordingly, a quantitative and qualitative analysis of the collected data was conducted.

The main objective of this study is to determine the effect of climate change on grain yield in major field crops. Data on average grain yields per hectare for the two periods (1991–1995 and 2021–2025) are taken from the database of the National Institute of Statistics of Romania, for the western region of the country. In selecting the crops studied, we consider the type of crop (spring or fall), the agronomic group (cereals, legumes, oilseeds), and the suitable growing regions (based on temperature, humidity, and soil).

• Results and discussions

The western and southwestern regions of Romania are characterized by **high agricultural potential, due to their favorable geographic position, sub-Mediterranean climatic influences, diverse topography, and fertile soils**. In the Banat region, an analysis of the years 2021 and 2022 reveals a sharp transition from a year marked by isolated temperature extremes (2021) to a year dominated by a severe and widespread soil drought (2022), which profoundly affected agriculture in the Western Plain and, more broadly, throughout the entire Western Region of Romania.

In Timiș and Caraș-Severin counties, the lack of rainfall in the spring and summer, combined with consistently high temperatures, led to a **severe and extreme soil drought**. *Spring crops*, particularly *corn and sunflowers*, suffered massive yield losses, and the soil in the Western Plain was severely degraded due to the prolonged water deficit. Furthermore, while 2021 was a year of record-breaking midsummer temperatures, 2022 was defined as a year of hydro-climatic crisis in Banat, marking the beginning of a series of recent years with precipitation deficits.

An analysis of the data below regarding the two time periods studied (1991–1995 and 2021–2025) clearly shows the evolution of average yields for the main crops in the western part of the country.

Average grain yield per hectare - Western Romania (Timiș, Arad, Hunedoara, Caraș - Severin)

Year/ crop	1991	1992	1993	1994	1995	2021	2022	2023	2024	2025
Wheat	-	-	-	-	-	5235	5006	4997	5299	5279
Barley and barley grain	2833	2025	2580	3657	3100	5086	4832	4736	5354	5223
Oats	1220	1604	1189	1584	1697	2949	2336	2426	2566	2858
Corn grains	3809	1739	2679	3188	3377	5426	2713	5134	3838	2104
Sunflower	1179	1128	1258	1426	1373	2438	1829	2380	2031	1474
Rapeseed	534	177	-	1222	1000	3045	2980	3438	2623	2936
Soybeans	1541	557	725	1056	1205	1914	1252	2179	1449	1336

Regarding the yields of the crops analyzed for the 2021–2025 period, these vary depending on the growing year and the type of crop. Therefore, we observe greater stability in grain yields for **fall small-grain cereals** (***wheat, barley and two-row barley, oats***) compared to **spring crops** (***grain corn, sunflowers, and soybeans***). Fall small-grain cereals benefit from a greater amount of water accumulated in the soil during the cooler months. In contrast, spring crops are much more exposed to higher temperatures and prolonged periods of drought that set in during the warm months of late spring and throughout the summer.

• Conclusions

The Western Region of Romania is one of the most important regions for field crops, both in terms of climate and soil conditions. The fertility of the soils in this region is an advantage for plant cultivation and growth, especially in light of climate change, which is becoming increasingly pronounced in Romania.

Under conditions of prolonged drought (both atmospheric and soil-related), irrigation plays a crucial role in meeting the water requirements necessary for healthy plant growth and development, as well as for grain formation and filling, leading to greater yields and qualitative harvests.