RESEARCH ON THE EFFECTS OF DROUGHT ON RED CLOVER IN BIHOR COUNTY

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RESEARCH ARTICLE

Abstract
This research analyzes the impact of drought on red clover (Trifolium pratense L.) in Bihor County, in the context of variable climatic conditions from 2023-2024. Drought is a major threat to agriculture, affecting not only plant development, but also the quality and quantity of hay obtained.
The study was conducted in several locations in Bihor County, where meteorological conditions, including precipitation, were monitored in correlation with red clover production. The obtained results indicate a significant decrease in yield, which underlines the vulnerability of this crop to water stress. .

Keywords: red clover, drought, productivity, climate impact, agriculture, water stress.
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INTRODUCTION

Drought is a complex natural phenomenon characterized by a prolonged absence of precipitation, leading to a significant water deficit in the soil, hydrological resources, and atmosphere. Unlike other natural disasters such as floods or storms, drought develops gradually and progresses slowly, but its long-term effects can be devastating. This phenomenon is influenced by climatic and geographical factors as well as human activities, with its intensity and duration varying across regions.

The impact of drought is felt across multiple dimensions. In agriculture, it leads to a significant decline in production, affecting crops sensitive to water shortages and reducing the availability of animal feed. In ecosystems, drought disrupts the natural balance, diminishing biodiversity, increasing the risk of desertification, and intensifying the frequency of wildfires. On a social and economic level, drought generates financial losses, forces population migration from affected areas, and increases social tensions due to competition for limited water resources.

Drought is one of the most serious threats to agriculture globally, severely affecting production of essential crops and food security. To soften the impact of drought, integrated measures are essential, such as improving water management infrastructure, adopting sustainable agricultural practices, and implementing policies to conserve natural resources. While drought is inevitable, its effects can be managed through careful planning and constant adaptation to changing conditions.

In Romania, drought has become an increasingly frequent phenomenon, with significant effects on agricultural systems, especially in regions that depend on natural water resources for irrigation. Bihor County, located in the western part of the country, faces pronounced climate variability, and the impact of drought on local agriculture requires special attention.

Bihor County is located within the historical region of Crișana, and borders Hungary to the west. It is an area of significant geographical diversity, cultural richness, and economic potential, serving as a key gateway between Romania and Western Europe. It covers an area of approximately 7,544 square kilometers, making it one of the larger counties in Romania. The landscape is diverse, ranging from the plains of the western part, suitable for agriculture, to the rolling hills and mountains in

the east, including the Apuseni Mountains. The Criş Rivers (Crişul Repede, Crişul Negru, and Crişul Alb) traverse the county, providing water resources and picturesque landscapes.

MATERIAL AND METHOD

The aim of this paper is to evaluate the impact of drought on red clover productivity in Bihor county, analyzing both climatic factors and agronomic parameters that influence the development and yield of this crop. Through case studies and data analyses, the paper aims to identify the correlations between environmental conditions and red clover productivity, while also providing recommendations for more efficient management of water resources and improving the adaptability of crops to water stress conditions.

This research not only contributes to understanding the impact of climate change on agriculture in Bihor, but also to the development of viable strategies to ensure a sustainable and resilient agriculture in the face of climate challenges.

RESULTS AND DISCUSSIONS

In 2024, the red clover crop in Romania was affected by the severe drought that negatively influenced agricultural production. Although red clover (Trifolium pratense) is a leguminous plant that can provide significant benefits, including soil improvement through nitrogen fixation, adverse climatic conditions have significantly reduced yields.

In general, red clover grows well in areas with an average annual rainfall of more than 600 mm, and its water requirements are very specific.

In 2024, however, many farmers reported that yields were well below this threshold due to a lack of adequate rainfall and extreme temperatures.

This situation was compounded by the fact that red clover is sensitive to both drought and excess water, making soil selection and water resource management crucial to crop success. Also, very high temperatures affected germination and vegetative growth, thus influencing the final result.

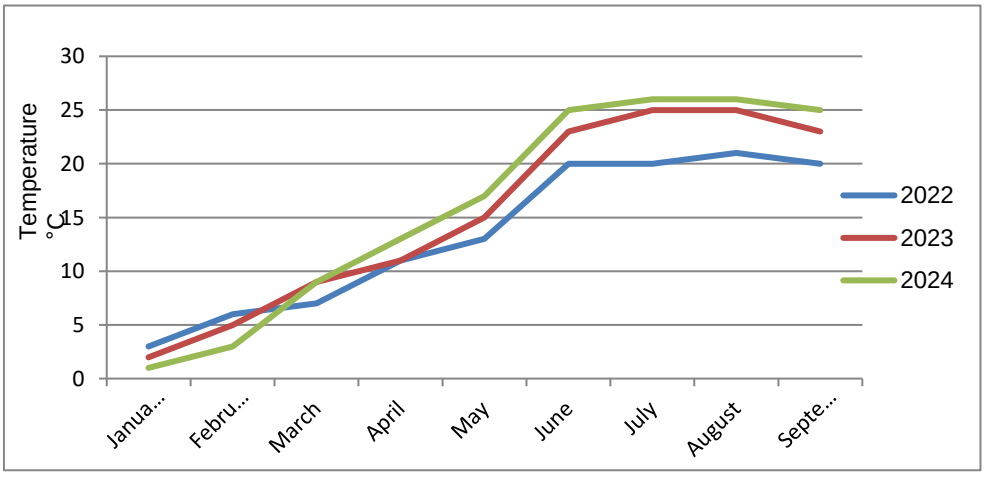

Figure 1 **Temperature comparison Bihor county**

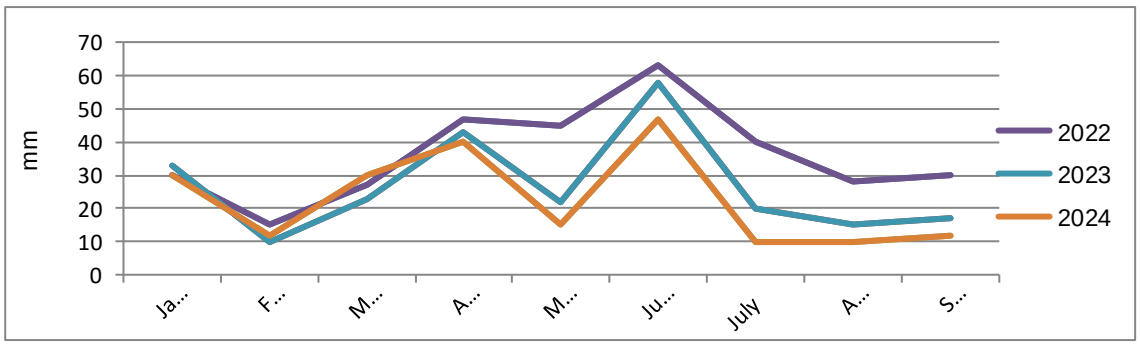

Figure 2 **Rainfall comparison Bihor county**

In the summer of 2024, Bihor County was affected by high temperatures and intense drought, which led to significant agricultural damage. Maximum temperatures frequently exceeded 35°C during heatwave periods, and on some days even higher values were recorded, exacerbated by the lack of precipitation.

Comparing the years 2022, 2023 and 2024, Romania faces a very difficult agricultural situation due to severe drought affecting crops, including red clover. The year 2024 was forecast to be one of the driest on record, with a significant drop in production for many crops.

For red clover, severe drought led to a reduction in biomass and affected the overall development of the plant, leading to a decrease in yield. If in 2023 the production of red clover was relatively constant, in 2024 there is a considerable decrease in production due to the absence of precipitation and heat waves, which compromised the harvest potential.

Red clover needs an adequate amount of water to support its development, and drought can lead to the following negative effects:

1. Growth retardation – Water deficit reduces the growth rate of the plant and decreases the total biomass produced.
2. Decreased production of leaves and flowers – Water fluctuations negatively affect the formation of leaves and inflorescences, essential elements for use as fodder and for nitrogen fixation.
3. Reduction of nitrogen fixation – Red clover fixes atmospheric nitrogen through bacteria in the root nodules. In drought conditions, bacterial activity decreases, which affects the plant's ability to obtain nitrogen, thus reducing its nutritional potential.
4. Competition with other plants – Under severe drought conditions, red clover can become more vulnerable to competition from other species, including weeds, which may have a higher tolerance to water deficit.

This is the graph illustrating the production of red clover in Bihor county for the years 2022, 2023 and 2024, comparing production in drought conditions with normal production in 2022. We observe a significant reduction in production due to drought, from 11 t/ha in normal conditions to 5 t/ha in drought conditions, which represents a loss of about 50%.

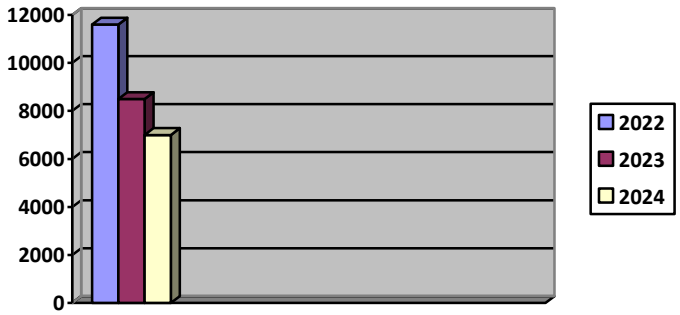

Figure 3 **Production of hay obtained in 3 years of vegetation**

Table 1

The area declared at the Agency for Payments and Interventions in Agriculture in the years 2023-2024

Area cultivated with clover in the year 2023	Area cultivated with clover in the year 2024
3092,62 ha	2989,70 ha

CONCLUSIONS

The impact of drought on red clover crops in Romania is significant, affecting both the yield and the quality of the production. Adaptation to these climatic conditions becomes a necessity, and the implementation of sustainable agricultural practices, together with the development of drought-resistant varieties and investments in agricultural infrastructure, can help reduce the negative effects of drought. Collaboration between researchers, farmers and decision-makers will be essential to develop

efficient and sustainable solutions for the future of Romanian agriculture.

In conclusion, 2024 was a challenging year for red clover growers in Romania, who faced extreme climatic conditions that directly impacted productivity.

The study highlights the need to implement adaptation measures, such as sustainable irrigation and varietal selection of clover, to increase resilience to adverse climatic conditions. This research contributes to the understanding of the impact of drought on agriculture in Bihor and offers practical suggestions for managing water resources in the future, considering the emerging challenges related to climate change. An effective solution to ameliorate the impact of drought on red clover is the development and use of cultivars red clover more resistant to drought conditions. These varieties are adapted to better conserve water and maximize production even under water stress conditions.

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