THE IMPACT OF MODERN IRRIGATION SYSTEMS ON CORN CROP, WITHIN A FARM LOCATED IN GIURGIU COUNTY

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Abstract. *This study aims to analyze the maize crop in Giurgiu County, focusing on the assessment of climatic conditions and the water requirement for this crop. The study is carried out within the Agro Mares SRL farm, a reference agricultural unit in Giurgiu, which has implemented modern irrigation systems to face climate challenges. The analysis is based on climatic and agronomic data collected during 2021-2023, using calculation methods such as Thornthwaite and Lowry-Johnson to determine evapotranspiration and water consumption. Through this approach, the paper provides a detailed perspective on the impact of climate variability on the corn crop and the efficiency of the irrigation systems implemented. The study emphasizes the importance of continuous monitoring of climatic conditions and efficient management of water resources, highlighting the need to adopt advanced technologies and sustainable agricultural practices. The implementation of pivot irrigation systems, controlled remotely via GPS and the Internet, has proven to be an effective solution for optimizing water consumption and ensuring high productions under conditions of climatic variability. The adaptation of agricultural strategies to the new climatic realities and the implementation of effective technological solutions are essential to ensure the sustainability and profitability of modern agriculture.*

Keywords*: maize, irrigation, water consumption, sustainability, modern agriculture*

INTRODUCTION

In the Romanian context, maize is one of the main agricultural crops, playing a crucial role in the rural and national economy. Romania is one of the largest producers of corn in the European Union, with Giurgiu County being among the regions with significant production. Maize is valued for its high nutritional value, with a high content of carbohydrates, proteins and other essential substances. Maize also has important agroecological advantages, such as drought resistance, the ability to be grown as a monoculture, and the efficiency of using fertilizers and irrigation water. In recent decades, climate change has imposed significant challenges on global agriculture, including maize. Rising temperatures, rainfall variability and extreme weather events affect agricultural productivity and require effective adaptive strategies. In this context, the proper management of water resources and the implementation of advanced irrigation technologies become essential for maintaining and increasing Agricultural yields.

The paper contributes to the deep understanding of the interactions between climatic conditions, the water requirement of agricultural crops and irrigation technologies, providing practical recommendations for farmers and agricultural managers in the Giurgiu region and other areas with similar conditions.

MATERIAL AND METHODS

In the experimental field, the Agro Mares SRL farm, from Giurigiu county, the determination of water consumption for the corn crop was carried out for the last three years, respectively 2021, 2022 and 2023, and the implementation of pivot type irrigation systems in 2023 on an area of 343 ha.

Plant water consumption is the total amount of water lost by evaporation from the soil surface and transpiration through plants, over a specified time period, under ideal soil moisture conditions. Calculation of ETP is essential for efficient irrigation management and for determining the water requirement of agricultural crops.

In this study, the climatic elements of the studied years were analyzed, namely:

- The thermal and annual regime, respectively its evolution during the analyzed period, with the differences compared to the multi-annual averages also being calculated;
- The rainfall regime and those during the vegetation period recorded at Giurgiu, respectively the evolution and deviation from the multiannual averages;
- Evapotranspiration (ET), monthly, annual values and during the vegetation period calculated using the Thornthwaite and Lawry-Johnson formulas; The data obtained using these formulas are multiplied by the correction coefficients from the literature for each month for the given conditions.
- Annual hydroclimatic balances and throughout the vegetation period.

RESULTS AND DISCUSSIONS

Average annual temperatures gradually increased from 12.73°C in 2021 to 14.04°C in 2023, suggesting a warming trend over this period. The average temperatures from April to September (IV-IX) increased from 20.25°C in 2021 to 21.66°C in 2023.

Effective irrigation planning and management becomes essential to compensate for possible water deficits resulting from higher temperatures and variable rainfall.

Due to the fact that rainfall was deficient in all 3 years and had a significant impact on maize, it follows that it required additional irrigation, especially during the critical growing period (April-September). Water deficit can negatively affect vegetative development phases, panicle formation and grain filling.

The hydroclimatic balance in Giurgiu county for the years 2021-2023 (fig. 1, 2, 3.) shows significant variations in precipitation and potential evapotranspiration, with a direct impact on the corn crop. Every year, proper irrigation management, continuous monitoring and adaptation of agricultural practices are essential to ensure optimal and sustainable production.

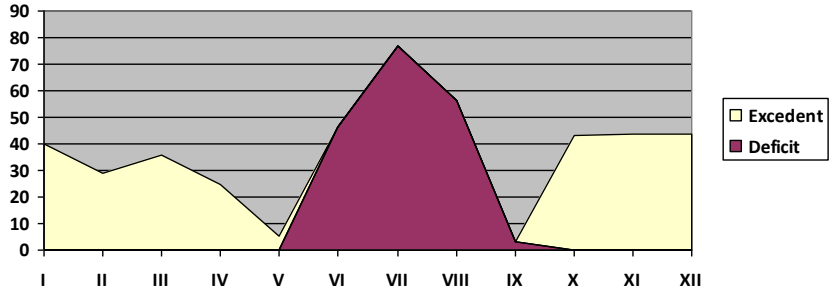

Fig. 1. Hydroclimatic balance at Giurgiu for 2021

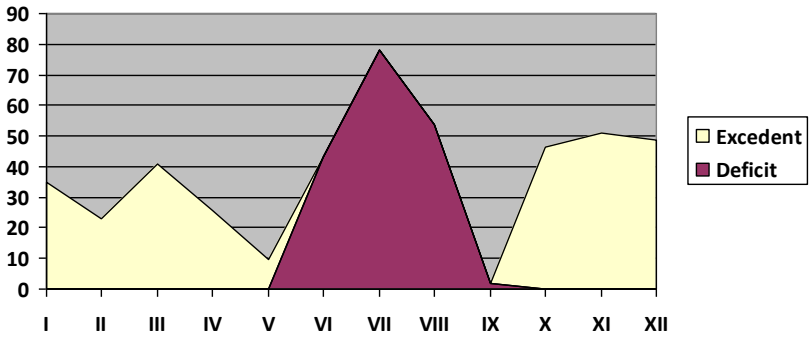

Fig. 2. Hydroclimatic balance at Giurgiu for 2022

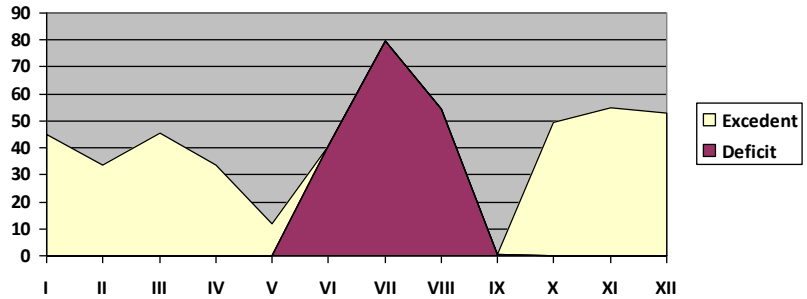

Fig. 3. Hydroclimatic balance at Giurgiu for 2023

In figure 4, the annual precipitation was on average below 400 mm, insufficient to cover the water needs of the crops, which had average values of ETRO consumption above 4000 mm annually. Every year, the water requirement not covered by rainfall was very high, which indicates the need for efficient management of irrigation resources to meet the crop requirements. April and May had relatively better rainfall coverage compared to June, July and August, where rainfall was very low compared to ETRO consumption, resulting in coverage below 10%.

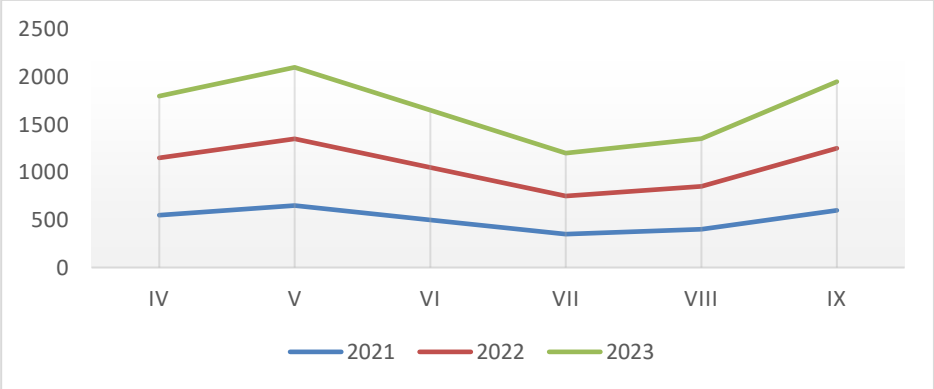

Fig. 4. Rainfall (mm) for 2021, 2022 and 2023

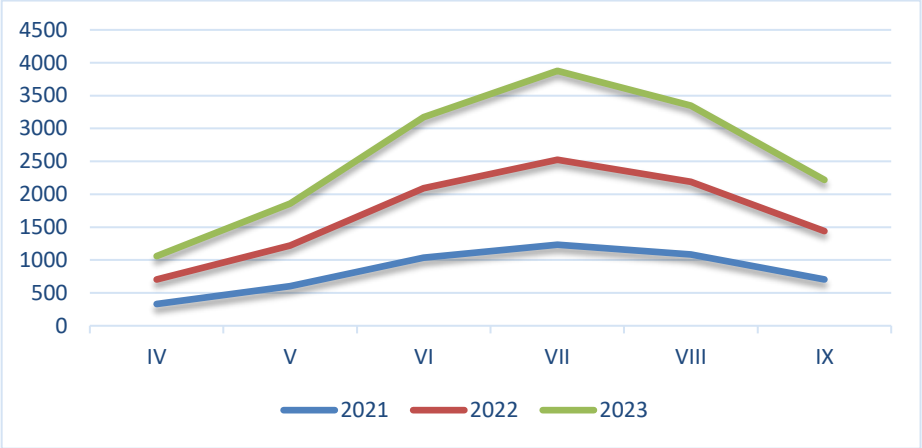

Fig. 5. ETRO calculated for 2021, 2022 and 2023

ETRO (Evaporative Transpiration - fig. 5.) consumption was extremely high in all three years, reflecting a significant water demand for the corn crop.

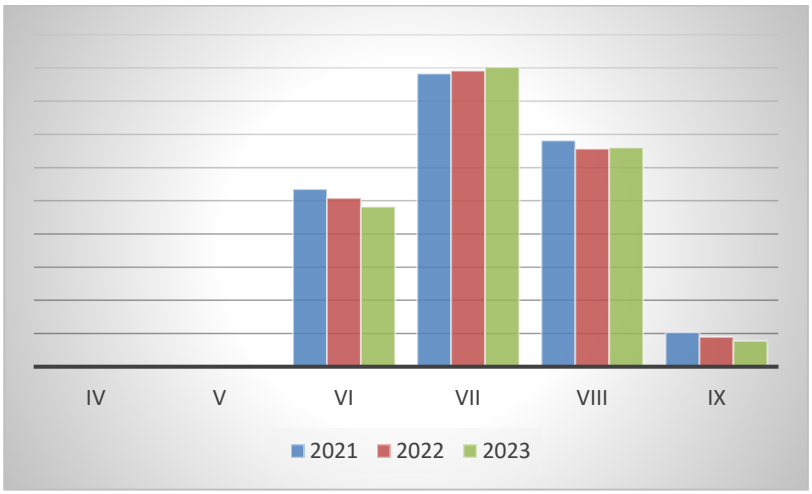

Fig. 6. Water requirement (mm) in 2021, 2022 and 2023

The data (fig. 6.) suggest that to ensure optimal maize production, it is crucial to implement efficient irrigation systems to compensate for the water deficit not covered by rainfall.

CONCLUSIONS

The study on irrigation systems and climatic conditions in Giurgiu in the period 2021-2023 reveals significant changes in the thermal and pluviometric regime, the impact of these

changes on corn crops, as well as the efficiency of the various irrigation methods and equipment implemented at the Agro Mares SRL farm.

Water deficits during the critical months for corn (April - September) necessitated additional irrigation to prevent yield losses.

Using the Thornthwaite and Lowry-Johnson methods, it was determined that the average annual water requirement for maize crop varied between 4504 mc/ha and 5851 mc/ha during the studied period.

The irrigation systems implemented at the Agro Mares SRL ensured an adequate coverage of the water requirement, contributing to the maintenance of optimal yields even in conditions of pluviometric deficit.

Pivot irrigation systems offer many advantages, including reduced soil compaction and water loss, as well as the ability to regulate the speed and intensity of watering. The technical specifications of these systems include optimized water and energy consumption, adequate operating pressures and effective water filtration to prevent clogging and equipment wear. These characteristics allowed efficient management of water resources and rapid adaptation to changing climatic conditions.

Fig. 7. Pivot irrigation system implemented at the agricultural unit – Agro Mares SRL (original photo)

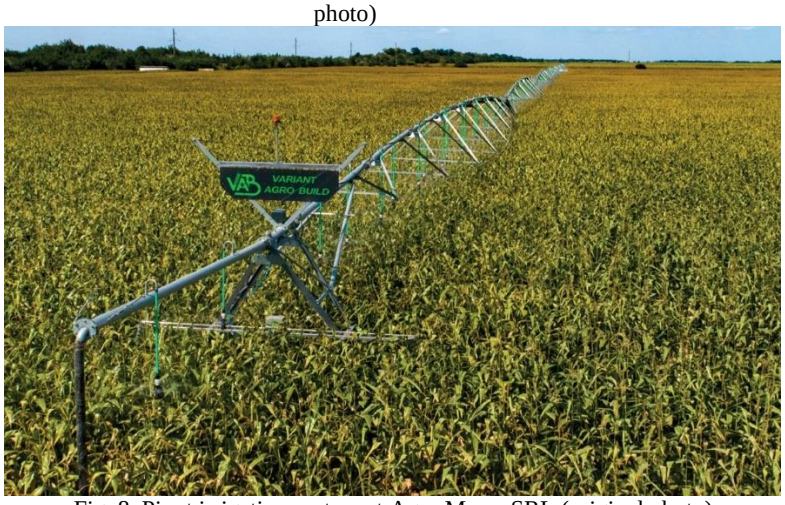

Fig. 8. Pivot irrigation system at Agro Mares SRL (original photo)

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