

INTEGRATED IRRIGATION MANAGEMENT FOR POTATO UNDER THE PEDOCLIMATIC CONDITIONS OF WESTERN ROMANIA: THE ROLE OF SOIL PROPERTIES AND WATER QUALITY

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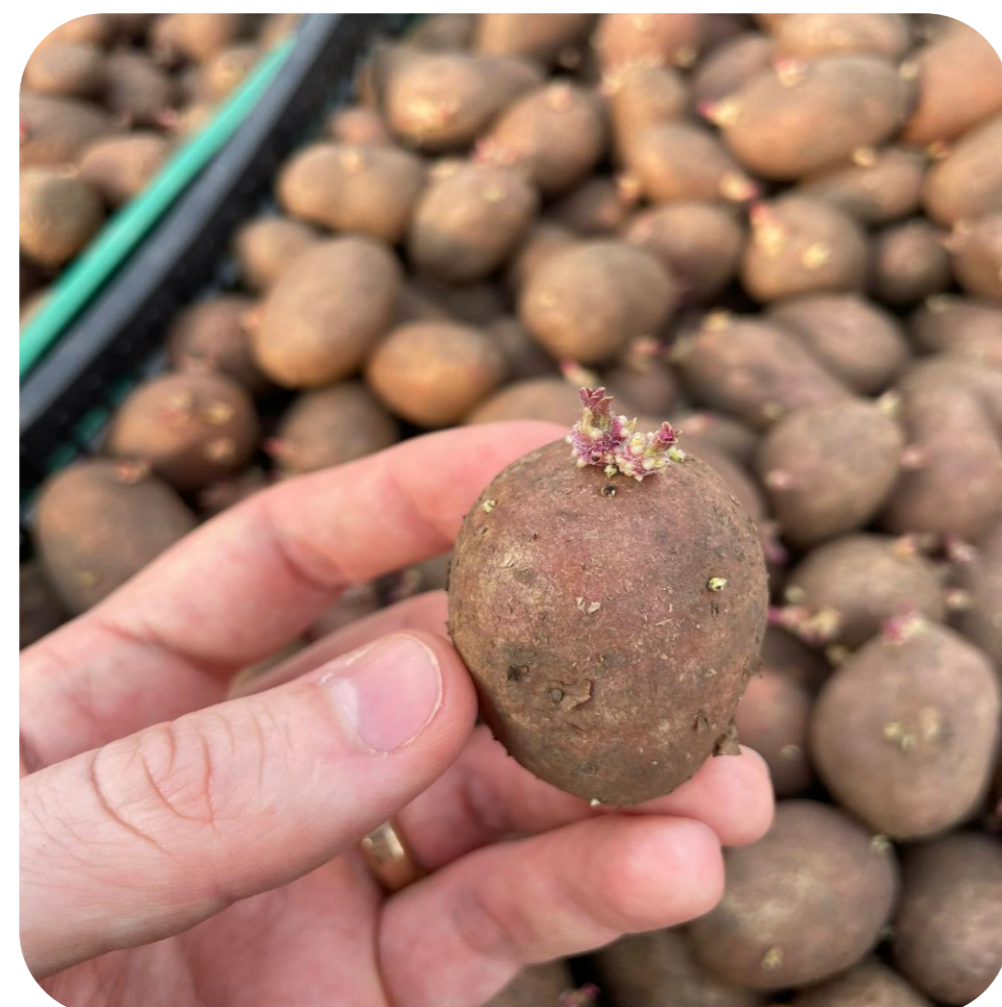
Abstract: Potato (*Solanum tuberosum* L.) is highly sensitive to water stress, especially during critical growth stages such as tuber initiation and bulking. In Western Romania, increasing climatic variability, uneven rainfall distribution, and frequent drought periods during the growing season significantly impact both yield and tuber quality, making irrigation a key factor in sustainable production. This study evaluates the necessity of irrigation by examining potato water requirements in relation to regional climatic conditions, including temperature patterns, evapotranspiration, and precipitation dynamics. It also considers soil properties such as texture, structure, and water-holding capacity, which influence water availability and irrigation efficiency. In addition, irrigation water quality parameters, including salinity and pH, are analyzed due to their effects on soil condition, nutrient uptake, and crop performance. The results indicate that water deficits during critical phenological stages lead to reduced yields and compromised quality. Modern irrigation systems, such as sprinkler and drip methods, along with monitoring tools like soil moisture sensors, can significantly improve water use efficiency and crop response. Overall, irrigation is not merely supplementary but essential for achieving stable and high-quality potato production under current climatic conditions. Proper management of both soil and water resources is crucial for ensuring sustainability and resilience in Western Romania.

Keywords: potato, irrigation, soil properties, water quality, evapotranspiration, climate variability, western Romania, agronomy.

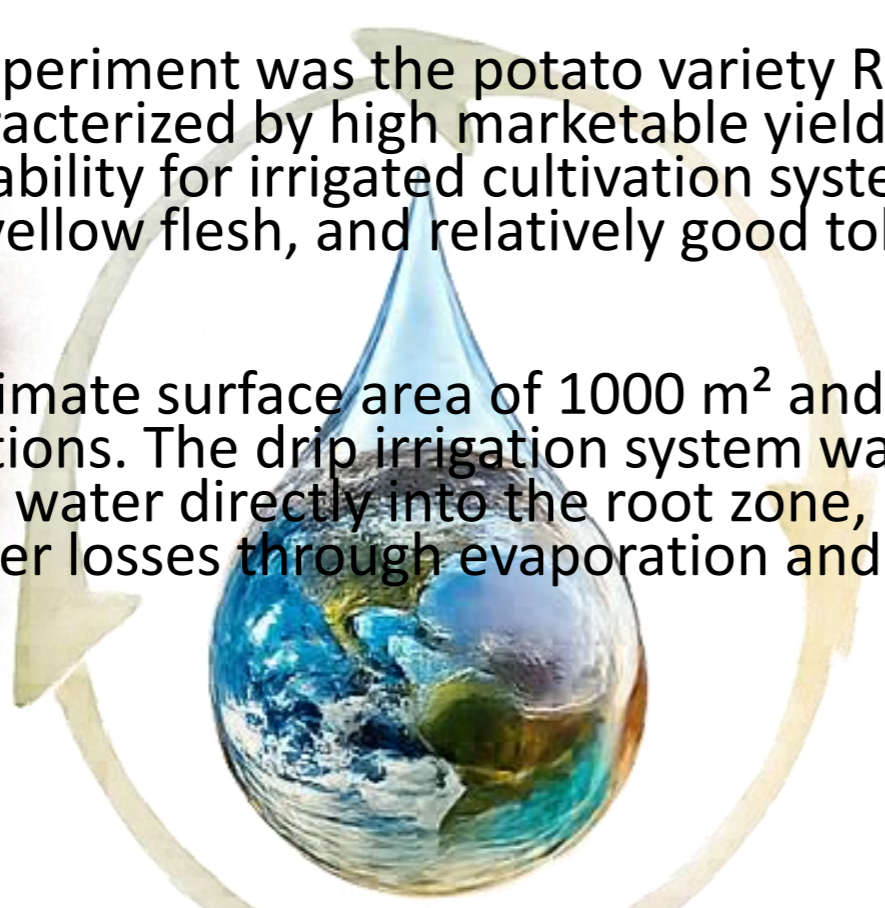
Introduction

- Potato (*Solanum tuberosum* L.) is considered one of the most water-sensitive field crops because its root system is relatively shallow and its water consumption increases significantly during key phenological stages. Under the climatic conditions of Western Romania, characterized by uneven precipitation patterns, higher temperatures, and increasing evapotranspiration, maintaining adequate soil moisture has become an important challenge for sustainable potato production. In this context, efficient irrigation practices, especially drip irrigation systems, represent an important solution for optimizing water distribution, improving crop development, and reducing unnecessary water losses during the vegetation period.
- In addition to climatic conditions, soil properties and irrigation water quality significantly influence irrigation efficiency and crop performance. Parameters such as soil texture, water-holding capacity, pH, and salinity affect water availability and nutrient uptake. Therefore, integrated irrigation management is necessary to ensure sustainable potato production under the pedoclimatic conditions of Western Romania.

Material and method



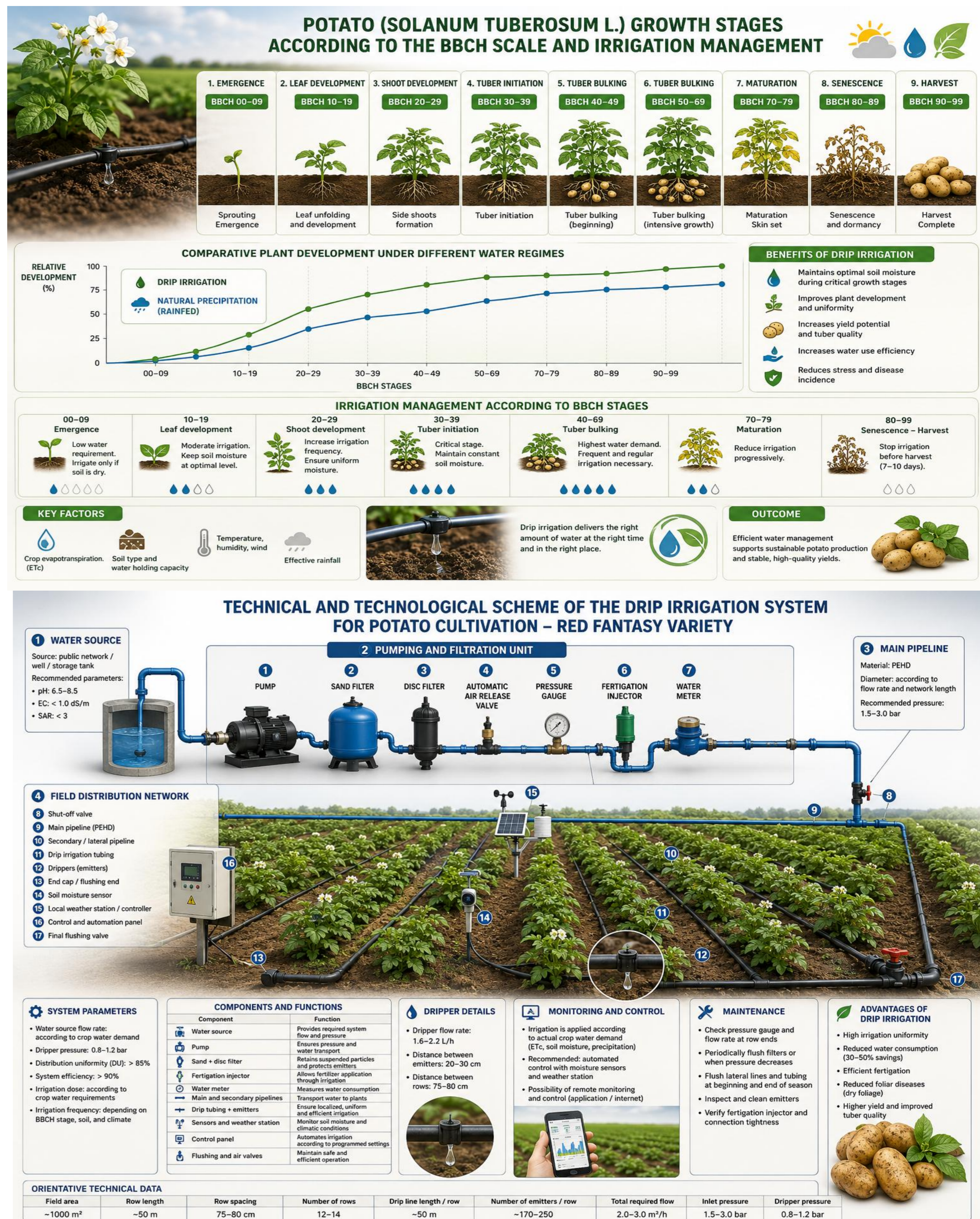
- The experimental study was conducted within the Educational Resort for Young Naturalists located in Timișoara, Western Romania. The area is characterized by a temperate-continental climate with increasing tendencies toward aridization, irregular precipitation distribution, and elevated temperatures during the vegetation season.
- The biological material used in the experiment was the potato variety Red Fantasy, a medium-early cultivar characterized by high marketable yield potential, good adaptability, and suitability for irrigated cultivation systems. The variety is recognized for its red skin, yellow flesh, and relatively good tolerance to environmental variability.
- The experimental plot had an approximate surface area of 1000 m² and was organized under drip irrigation conditions. The drip irrigation system was selected due to its capacity to deliver water directly into the root zone, improving irrigation efficiency and reducing water losses through evaporation and surface runoff.



Results and discussions

The technical scheme of the drip irrigation system used within the experiment was designed to ensure uniform and controlled water distribution directly into the active root zone of the potato plants. The system consists of the water source, pumping and filtration unit, main polyethylene (PEHD) pipeline, secondary distribution pipes, and drip lines positioned along each cultivated ridge.

To maintain efficient operation, the installation includes filtration components for retaining suspended particles, a pressure gauge for monitoring system pressure, control valves, and the possibility of integrating a fertigation injector. Water distribution is achieved through emitters placed at regular intervals, ensuring constant soil moisture within the root zone while reducing losses caused by evaporation and surface runoff. The system allows adjustment of irrigation frequency and water volume according to BBCH growth stages, climatic conditions, and crop water requirements, thereby improving water use efficiency and contributing to stable and uniform potato production.



The preliminary results highlight the positive effect of drip irrigation on potato development under the pedoclimatic conditions of Western Romania. Compared to the control variant, the irrigated plots maintained more stable soil moisture during the critical BBCH stages (30-69), supporting better vegetative growth and improved plant uniformity. The irrigated plants showed superior development indicators, while the non-irrigated variant was more affected by irregular rainfall and increasing evapotranspiration.

Drip irrigation improved water availability in the root zone, reduced water losses through evaporation, and ensured more uniform crop development across the experimental field. Although the experiment is still ongoing and harvest data are not yet available, current observations suggest that the irrigated variant may achieve higher yield potential, improved tuber uniformity, and better crop stability compared to the control.

Conclusions

Under the current climatic conditions of Western Romania, characterized by irregular rainfall and increasing drought tendencies, drip irrigation represents a promising solution for sustainable potato cultivation. Preliminary observations show that controlled irrigation contributes to maintaining optimal soil moisture during critical BBCH stages and supports improved crop development compared to non-irrigated conditions. The integration of irrigation management with soil and water quality assessment may significantly improve water use efficiency and production stability for potato crops cultivated under increasing climatic variability.