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New developments at the Lysimeter Station in Szarvas

Mihály Jancsó[1*], Ágnes Kun[1], Árpád Székely[1], Timea Szalóki[1],
Marks Ibadzade[1,2] and Csaba Bozán[1]

Summary

The NAIK ÖVKI Lysimeter Research Station (Szarvas, Hungary) was established in 1971. Backfilled gravitational, floating-type and weighing lysimeters were installed that time. To meet the requirements of the up-to-date research, all the 320 non-weighing lysimeters were renewed in 2018. Moreover, 8 brand new weighing lysimeters were built with the surface of 3 m² each. A new innovative micro-irrigation system was also built to start research on precision irrigation management. At present, energy crops, rice, sorghum and fiber hemp are examined at the Station. Our primary goal is to improve the irrigation farming in Hungary and to develop new technologies and information about the water and nutrient requirements of different crop plants. We are working on the environmental effects of alternative water sources (e.g. agricultural originated waste water) and nutrient management options. To provide complex knowledge about the water use of plants, new meteorological stations, different soil moisture sensors, EC probes, plant canopy analyser and infrared camera were set into the system.

Keywords: gravitation lysimeter, irrigation management, water and nutrient use efficiency, drought tolerance

Introduction

Water is a limited resource that is a key element for economic, social and environmental sustainability. Among others, agriculture is one of the main fresh water users. To check the effects of different measures on soil-water management, water balance and transport of nutrients (Eder et al. 2015), lysimeters are effective scientific infrastructures for short term and long term investigations (Szaloki and Szaloki 2003). This function of the equipments makes them appropriate for irrigation research and to describe the quantity and the quality of the irrigation water (Howell et al. 2015). Transport of harmful compounds and elements in the agricultural systems are also easier to follow with these techniques.

Nowadays, alternative water sources are more and more important for agricultural production. Effluent water from intensive agricultural technologies can be reused as irrigation water if the quality meets the requirements (Kun et al. 2017).

The NAIK ÖVKI Lysimeter Research Station of the National Agricultural Research and Innovation Centre (NAIK), Research Institute of Irrigation and Water Management (ÖVKI) is located in Szarvas (south-east Hungary, latitude 46°86'N, longitude 20°52'E). The Station was built in the year of 1971 when 320 non-weighable backfilled gravitation lysimeters (1m³) were set up on a 1 hectare experimental field. These lysimeters are connected to 5 measuring cellars. The source of irrigation water is usually the oxbow of Körös-river or the specific agricultural originated waste water types. Today, main research priorities at the station are testing of irrigation methods, unravelling nutrient cycles and breeding for drought tolerance of rice. To meet the requirements of the up-to-date research activities and join to international R&D projects, the following new developments were applied in the recent years.

New developments of the research infrastructure

The core research infrastructure of the NAIK ÖVKI Lysimeter Research Station is the 320 non-weighing lysimeters which were renewed in 2018. New plastic lysimeter vessels were installed and the connecting tubes were changed.

Moreover, 8 new weighted lysimeters were built with the Metrisystem Ltd. (Hódmezővásárhely, Hungary). We have the opportunity to measure the water and nutrient balance on 3 m² surface per lysimeters. The soil columns are 120 cm. The resolution of the weighting system (EMX-100 core) is 0.1 kg. The first plants in this system are winter wheat varieties with different water use efficiency and different reactions to drought stress (*Figure 1*).

To measure the changes in soil moisture content, Boreas TSM-06 (72pcs) and TSC-06 (12pcs) were installed to the lysimeters. The weather conditions are now registered by an Agromet-Solar automatic weather station (Boreas Ltd., Hungary).

Measurements of plant physiological and developmental changes are crucial for our research and breeding activities. An SS1 SunScan Canopy Analysis System with radio connection (Delta-T Devices, UK) is used for plant stress research as well as a thermal camera (Flir One Pro) to check the effect of drought on different plant species.

A new innovative micro-irrigation system was also built to start research on precision irrigation management (*Figure 1*). The system is computer controlled and experiments can be irrigated in 8 sections with high resolutions by plots on a 0.5 ha area. The source of irrigation water is either the oxbow lake of river Körös or tap water.

At present, energy crops, winter wheat, rice, soy, sorghum and fiber hemp are examined at the Station.

[1] Research Institute of Irrigation and Water Management, National Agricultural Research and Innovation Centre, Anna-liget 35, H-5540 SZARVAS

[2] Szent István University, Páter Károly 1, H-5540 GÖDÖLLÖ

[*] Ansprechpartner: Mihály Jancsó, jancso.mihaly@ovki.naik.hu

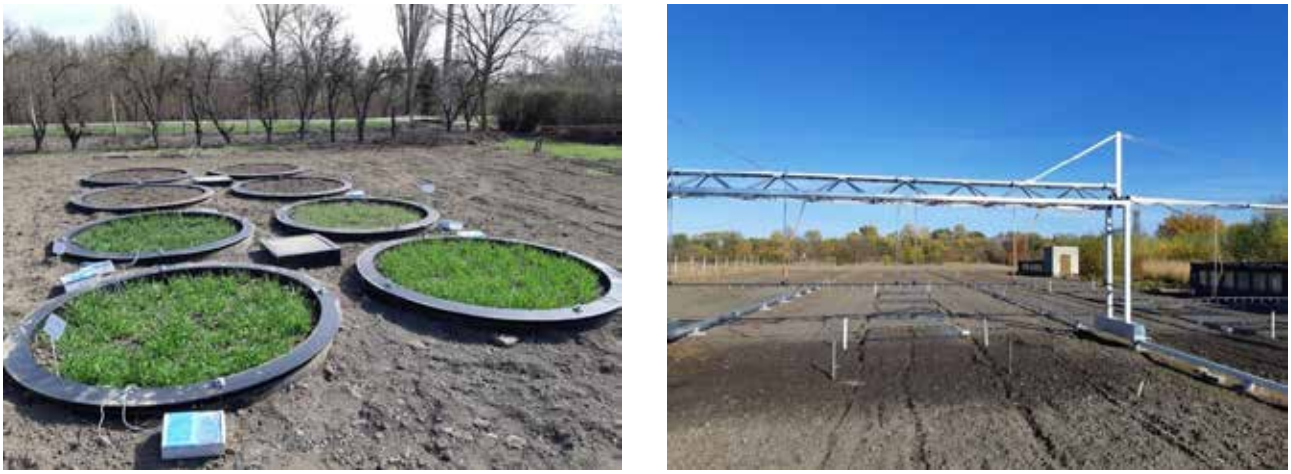

Figure 1: **New weighted lysimeters (left) and the computer controlled precision irrigation system (Szarvas, Hungary).**

With the renewed lysimeter station and the new equipments, we have started joint research projects with the Cereal Research Non-profit Co., the Research Institute of Karcag and the Szent István University.

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