

Water Renovation in Ukraine
Project no. 22320101



Water Renovation in Ukraine

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The project is co-financed by the Governments of the Czechia, Hungary, Poland and Slovakia through Visegrad Grants from International Visegrad Fund. The mission of the fund is to advance ideas for sustainable regional cooperation in Central Europe.

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Precision irrigation planning: microirrigation techniques

Árpád Illés, Assistant lecturer

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Introduction

- The irrigated area in Hungary is only a few %
- The distribution of rainfall during the growing season is becoming increasingly unpredictable
- Average temperatures are rising
- There are significant differences in the amount and distribution of rainfall between growing seasons

Importance of the irrigation

Long-term nutrient supply experiment FAO 420 Hybrid

• Visegrad Fund



13/06/2022



26/06/2022

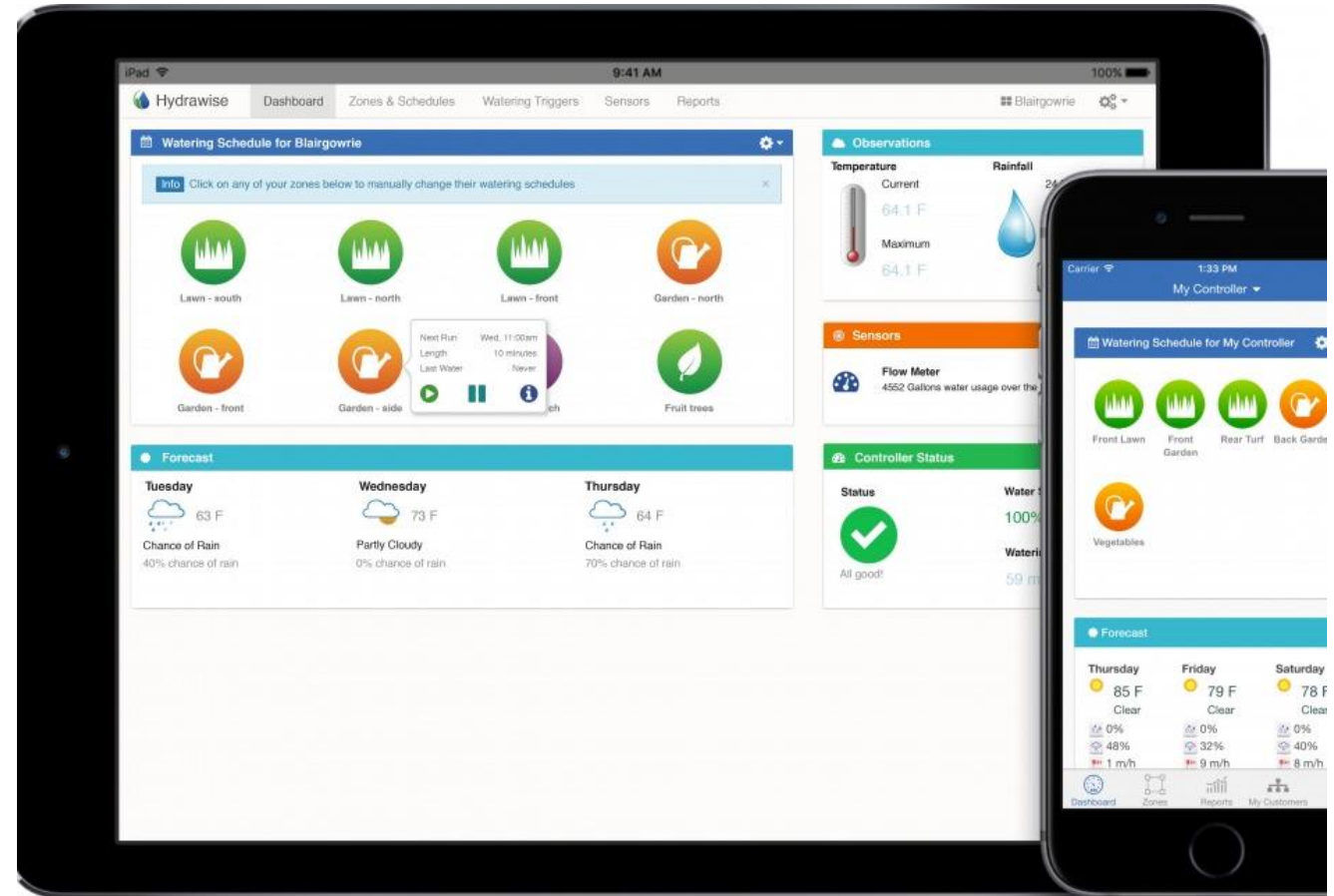


26/07/2022

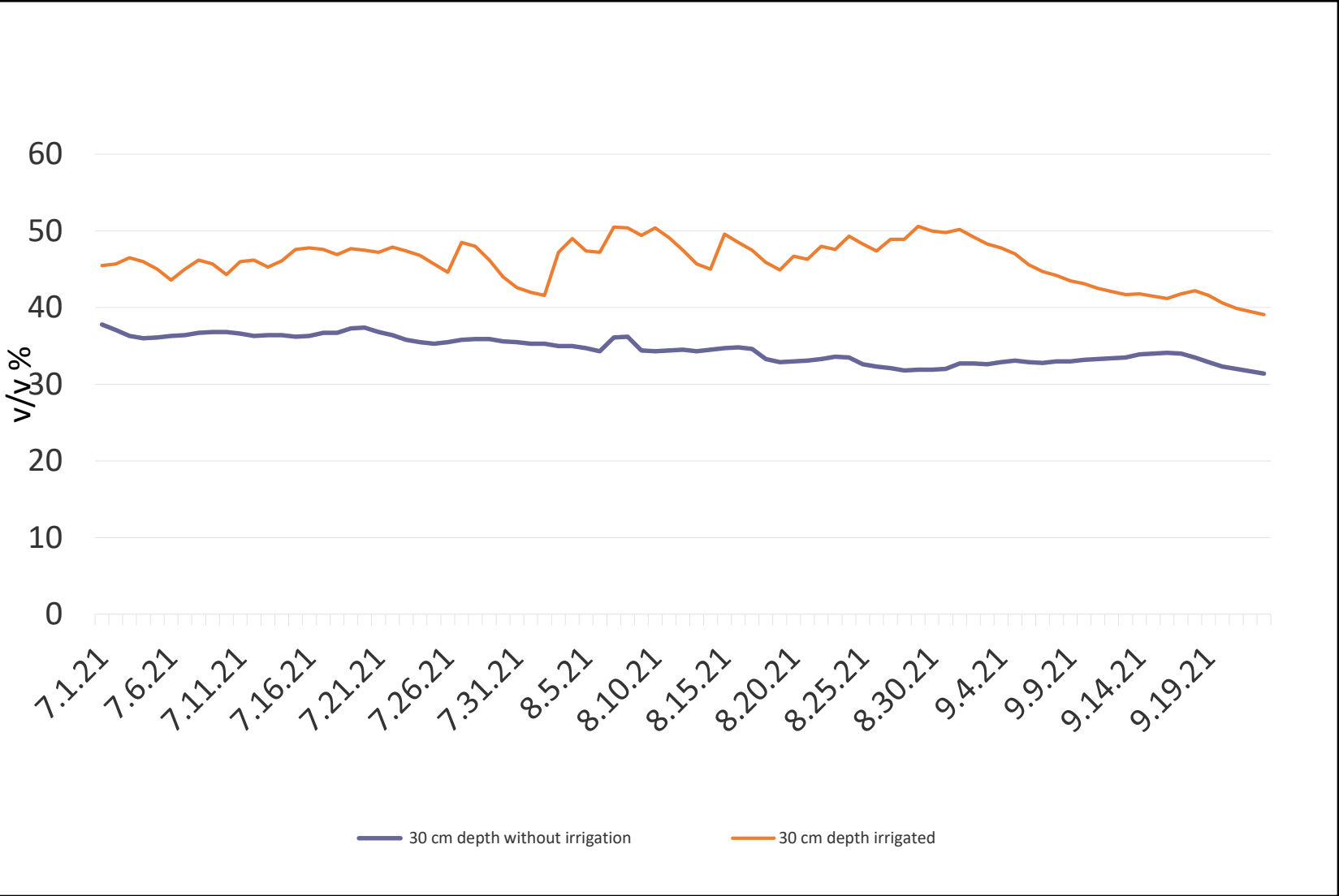
Parametering of the irrigation

• Visegrad Fund

- Keeping soil moisture in the optimal range - for soil with an undisturbed structure V_k Max min at 45.63 v/v%
- Irrigation dependent on water capacity value based on soil type
- Chernozem soil, dead water content 14 v/v%
- Night and morning watering
- Extra watering in hot weather (20 °C), no watering above 25 °C (evaporation)
- Watering only depending on the decrease in soil moisture



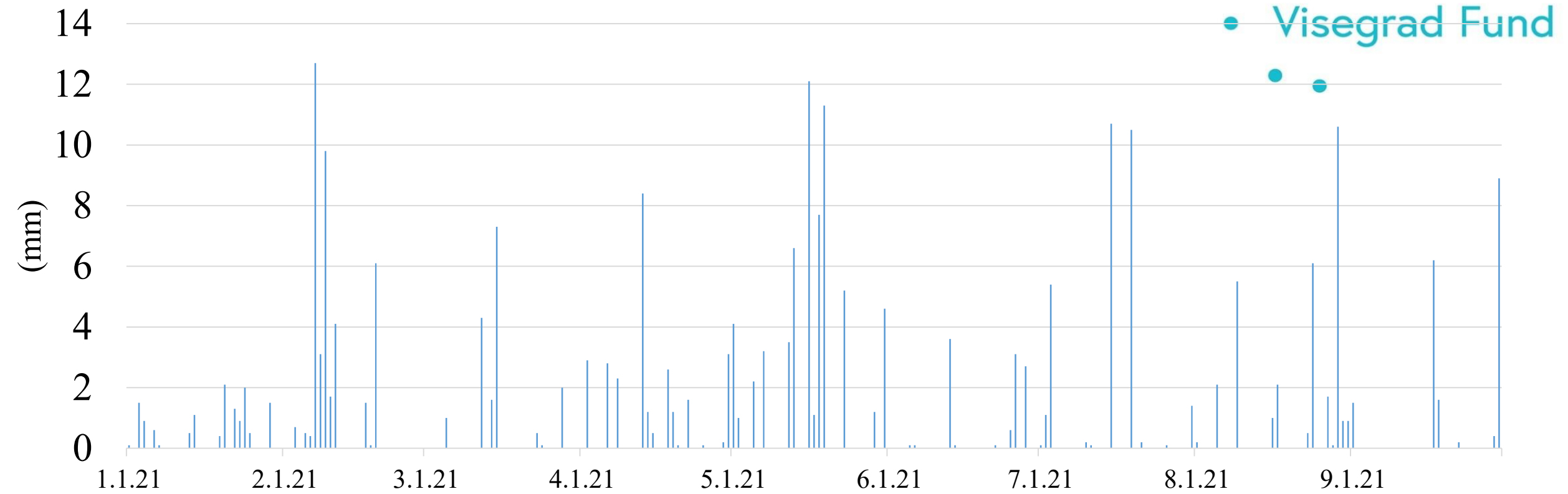
Dripping irrigation soil measurement during the growing season



- The sensors placed 30 cm deep.
- Irrigation with a drip tape placed on the row per row
- Moisture measurement next



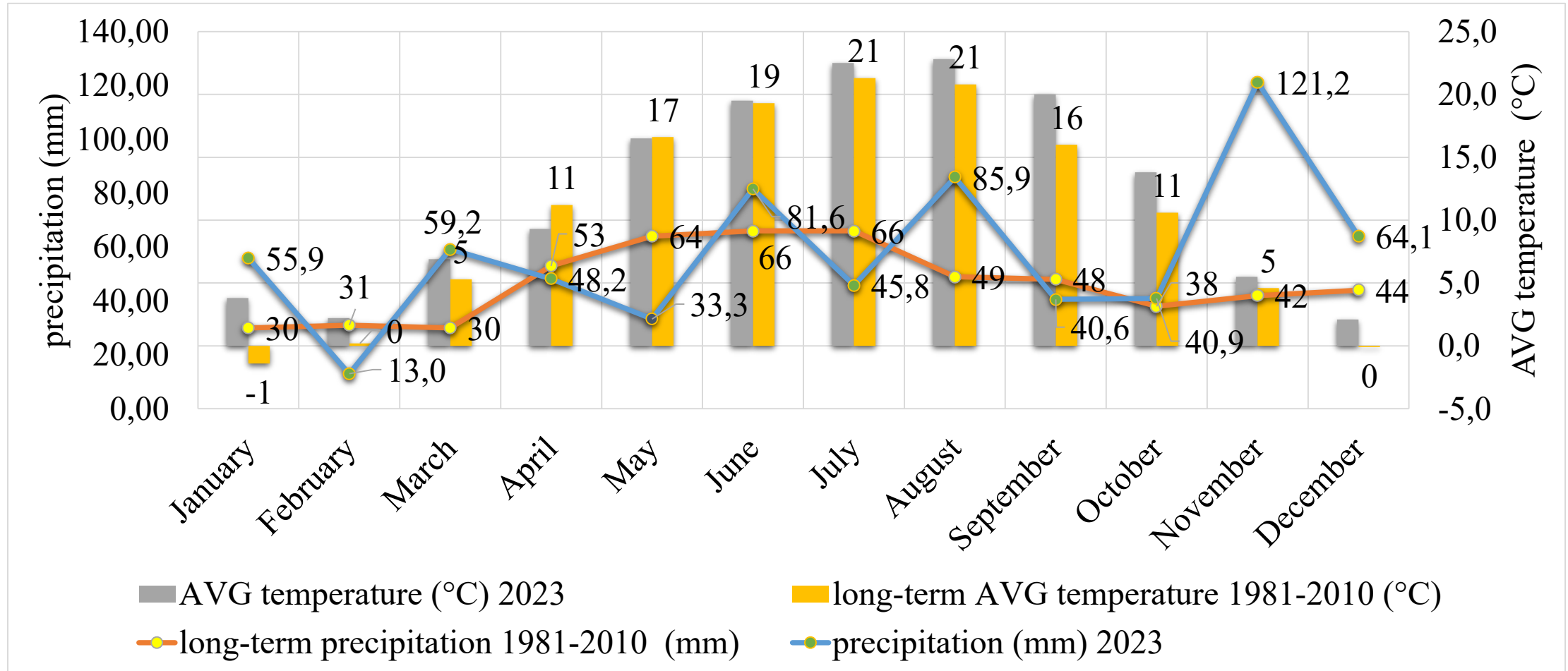
Agrometeorological data - 2021 growing season



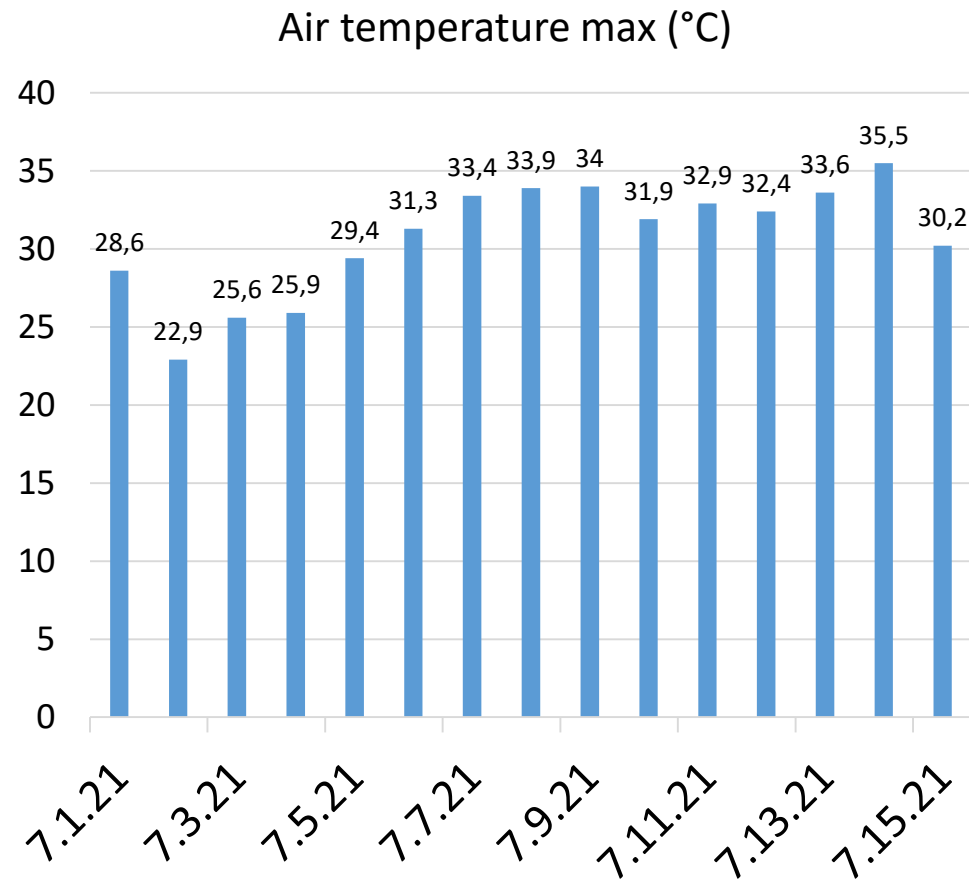
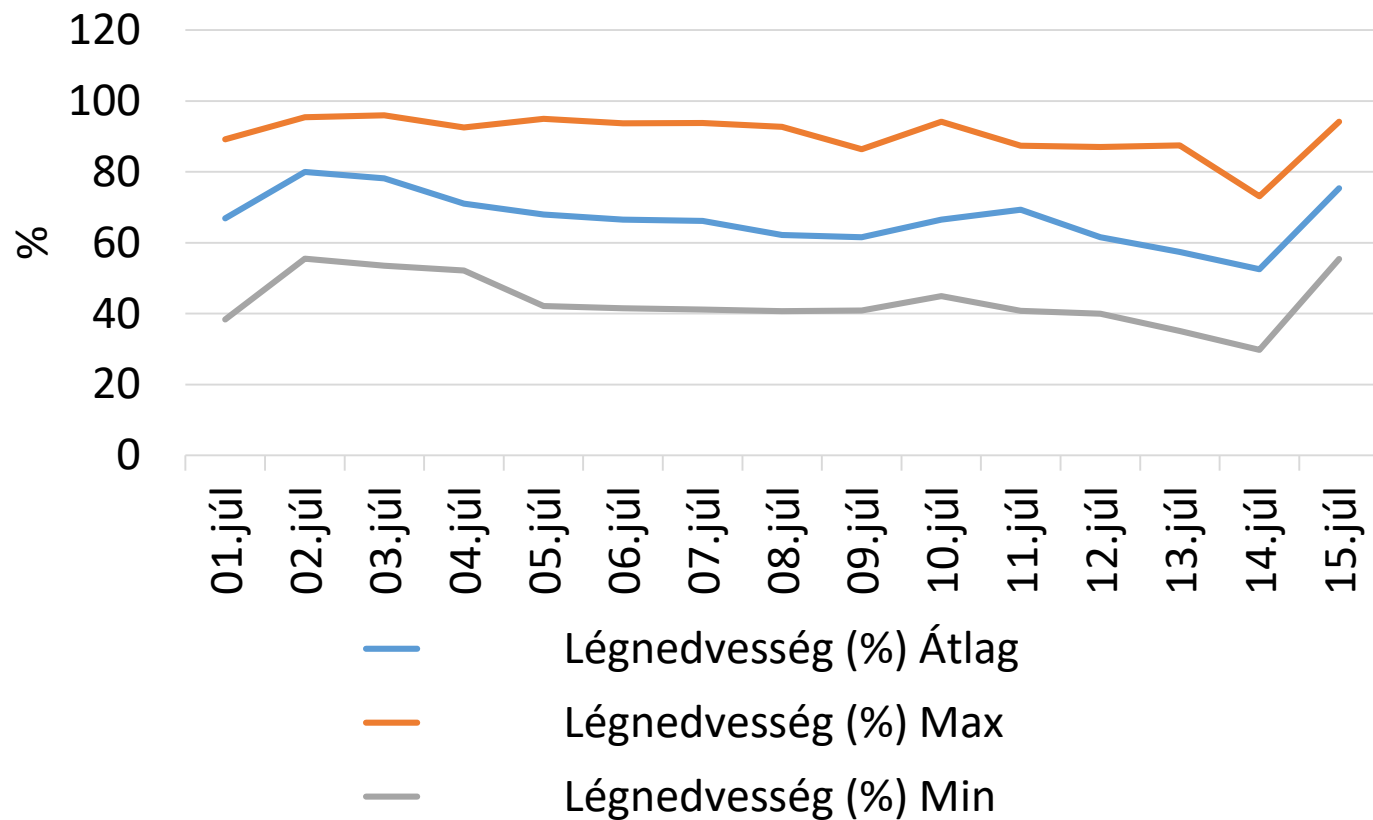
- 250 mm difference in rainfall compared to 2020
- 05.20-07.25.to 49,7 mm precipitation
- June 10.4 mm precipitation 9 days with maximum temperature above 30 °C
- 38 days with maximum temperature above 30 °C during the growing season

Figure 1: Precipitation conditions for the 2021 growing season of maize at the University of Debrecen Bősörményi campus experimental area

Weather parameters for the 2023 growing season compared to the long-term average

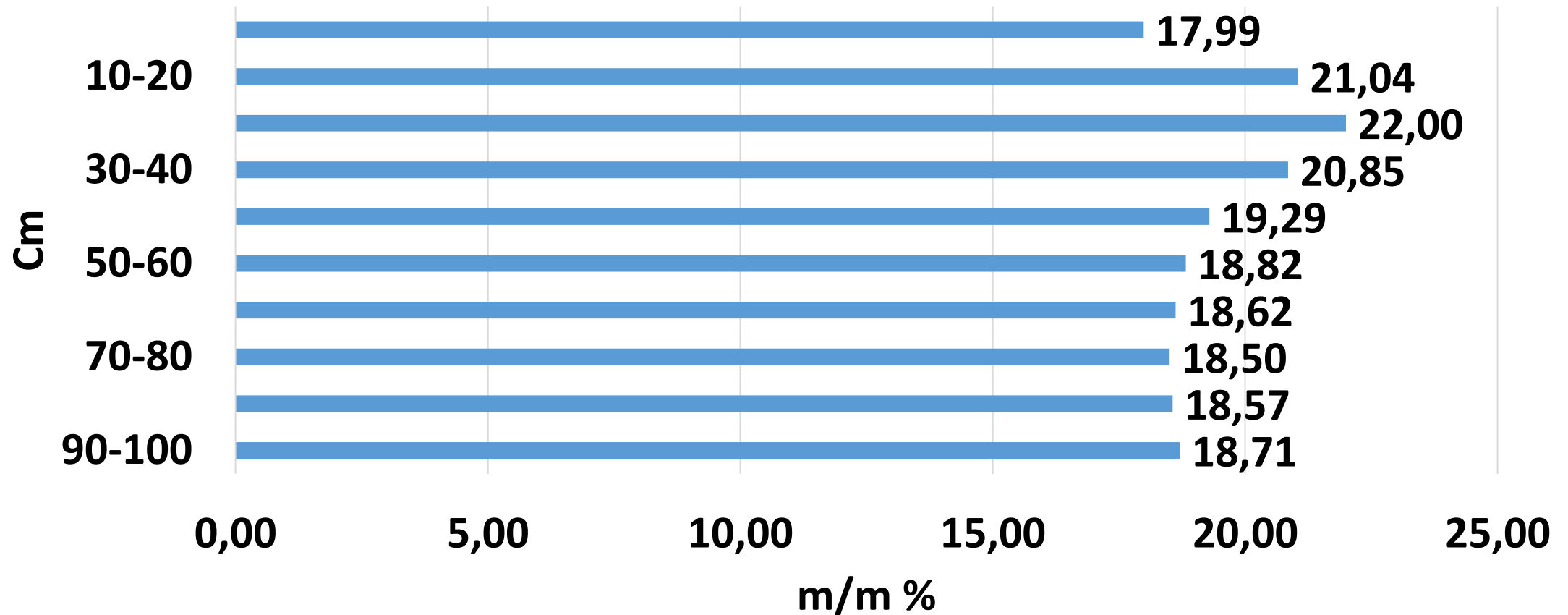


Atmospheric drought during flowering



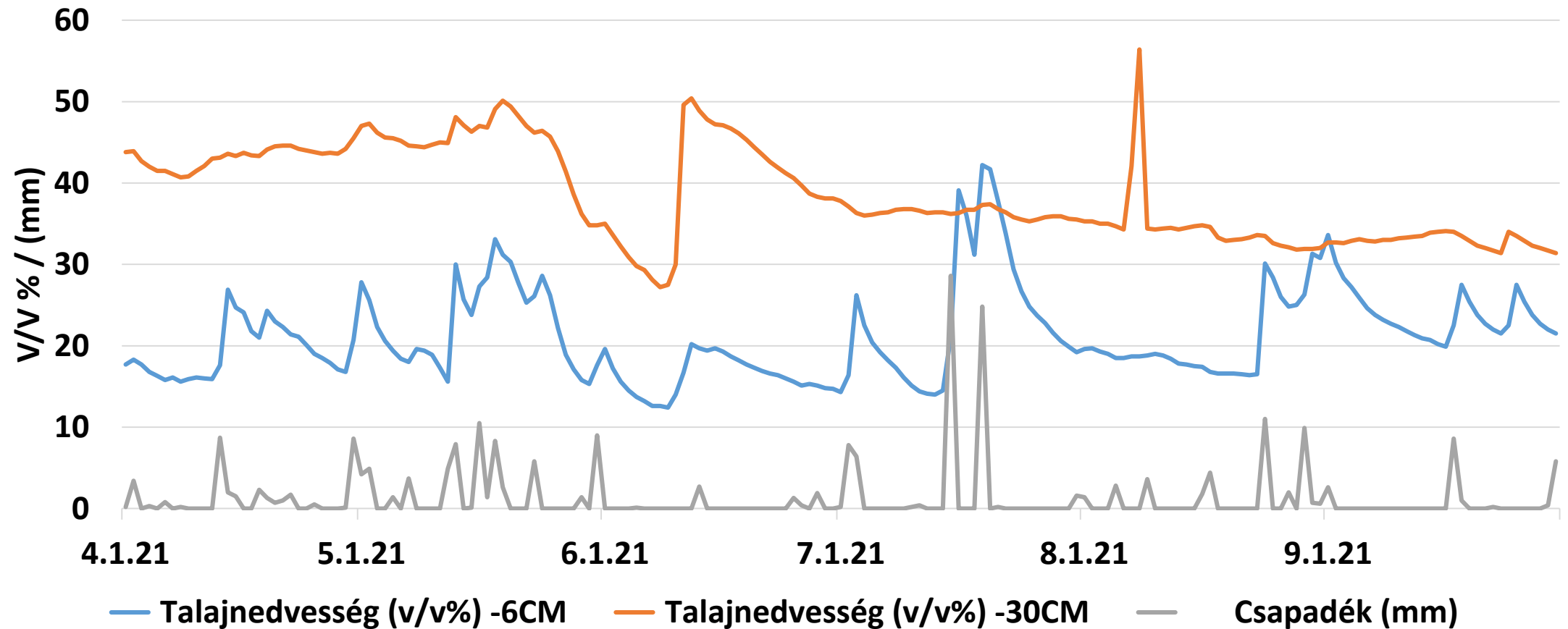
Average moisture content available in the soil before sowing

• Visegrad Fund



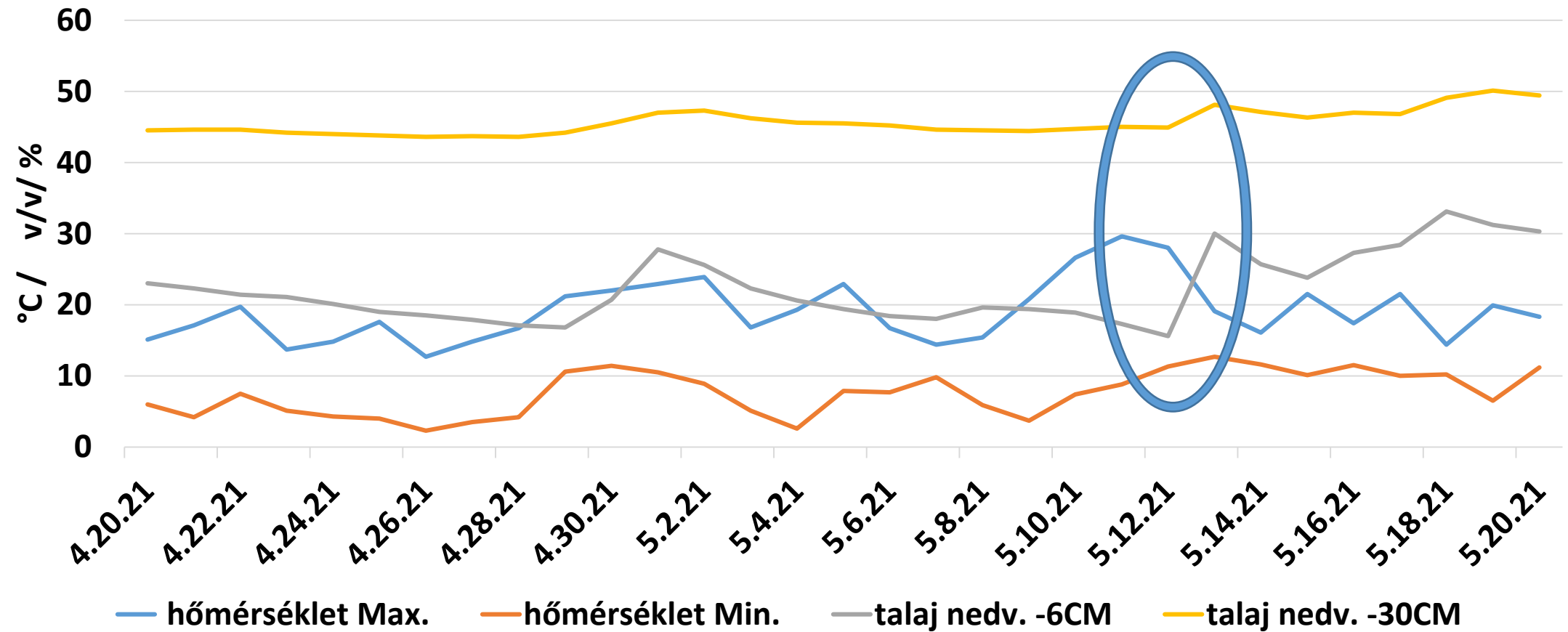
Soil moisture available before the start of the 2021 growing season to a depth of 0-100 cm (N=3)

Soil moisture and rainfall characteristics in the 2021 growing season



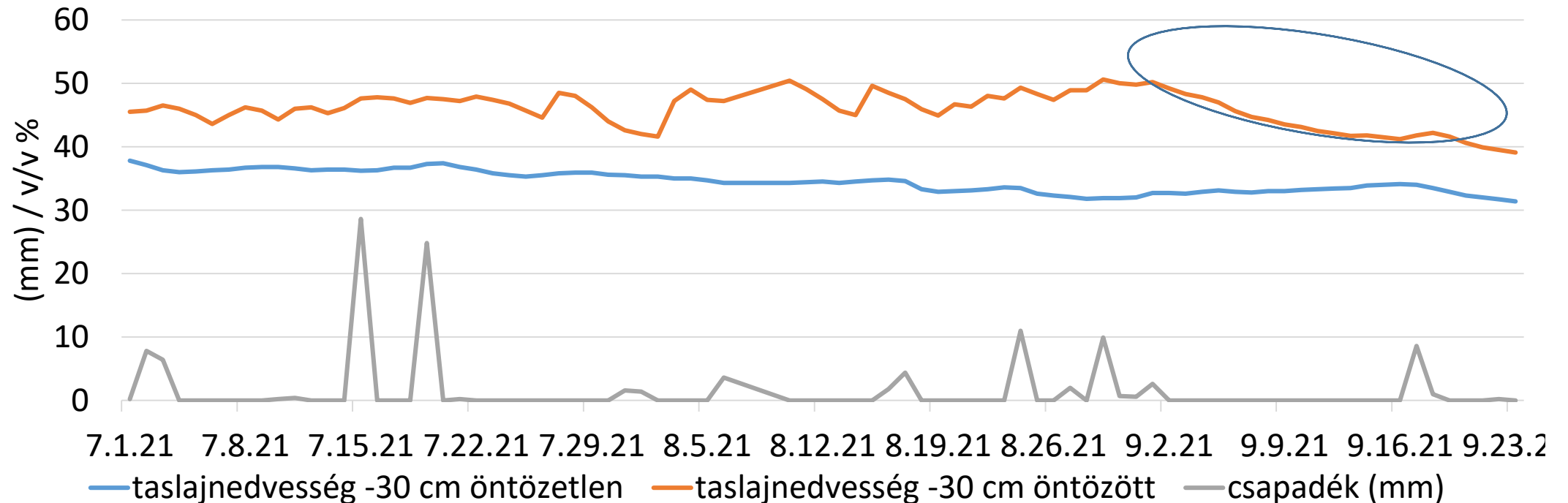
Comparison of the results of soil sensors and precipitation in the 2021 growing season of maize in the Böszörményi út experimental area in Debrecen

Soil temperature and moisture characteristics from sowing to emergence



Characterisation of the important period for sowing at the beginning of the 2021 growing season. Debrecen

Effect of irrigation on soil moisture in -30 cm layer



- 2021 growing season rainfall 232.8 mm
- Total irrigation water applied 283,78 mm
- 2021 actual precipitation and irrigation during the current season 516,58 m

Quantity and distribution of irrigation water applied during the 2021 maize growing season

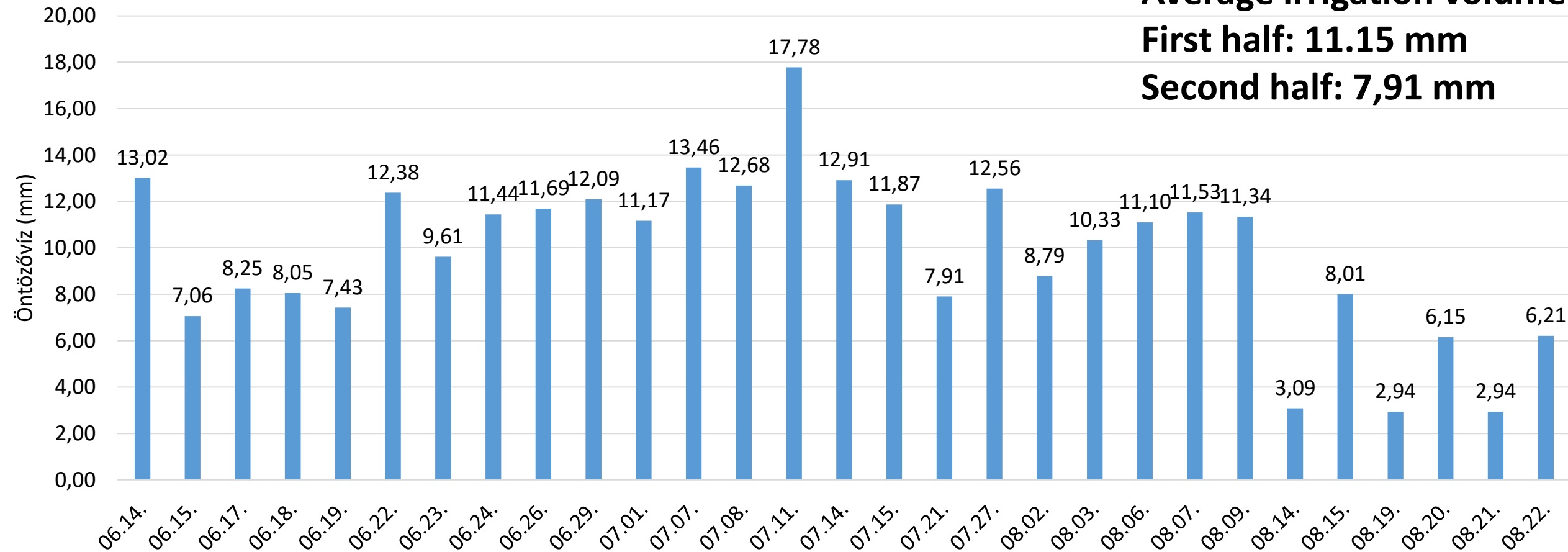
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irrigation water applied (mm)

Average irrigation volume:

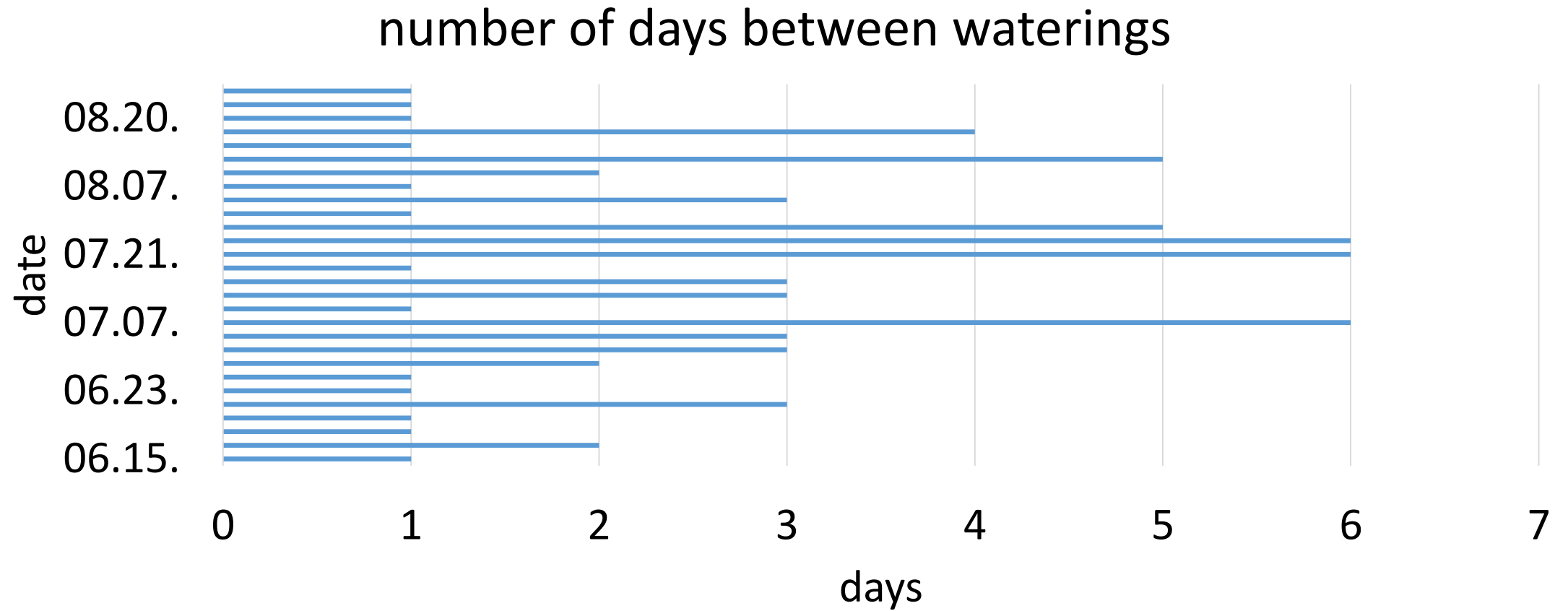
First half: 11.15 mm

Second half: 7,91 mm

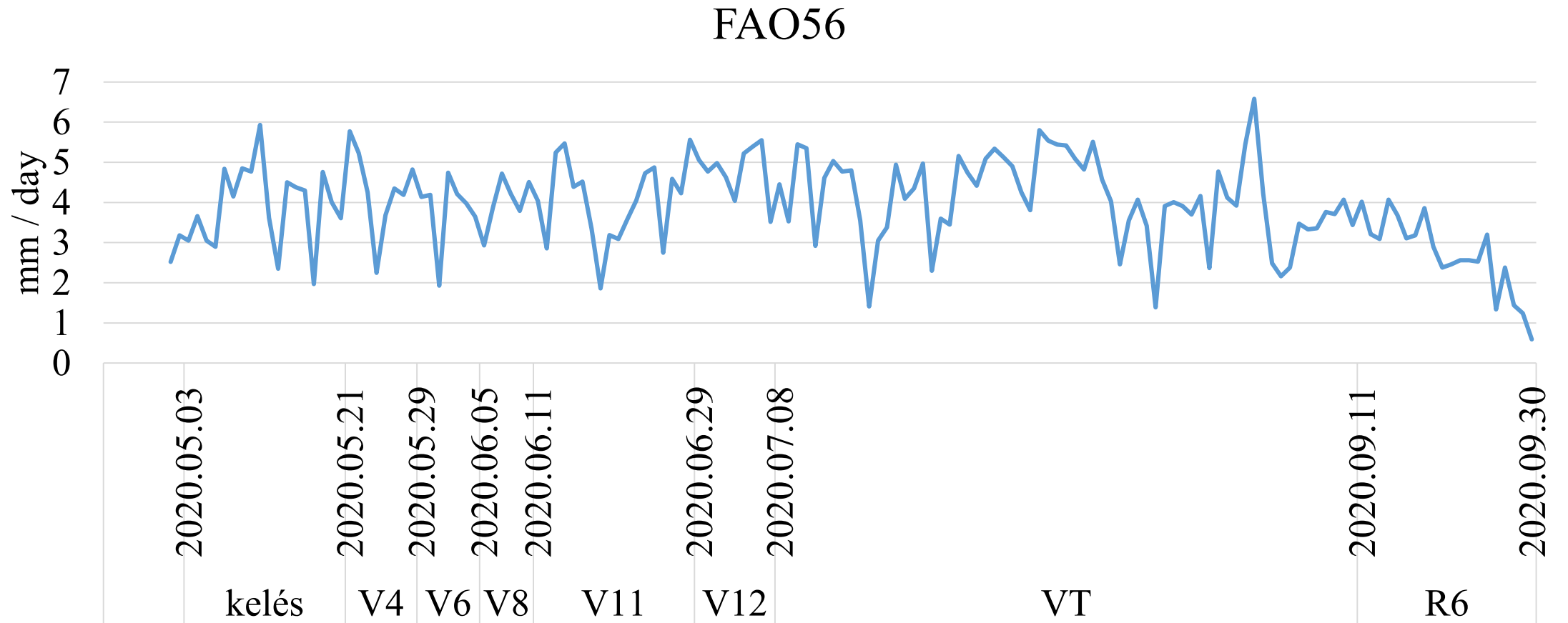


- Total irrigation water applied 283,78 mm
- 2021.06.20-2021.07.15.20 137,09 mm

Number of days between waterings



Daily water requirement for maize based on FAO56 evaporation standard



Irrigation conditions

- Keeping soil moisture in the optimum range - for soil with undisturbed structure V_k
Max min at 45.63 v/v%
- Soil type based water capacity value dependent irrigation
- Leached chernozem soil, dead water content 14 v/v%
- Night and dawn watering
- Excess irrigation in hot weather (20 °C), no irrigation (evaporation) above 25 °C
- Irrigation only as a function of soil moisture loss

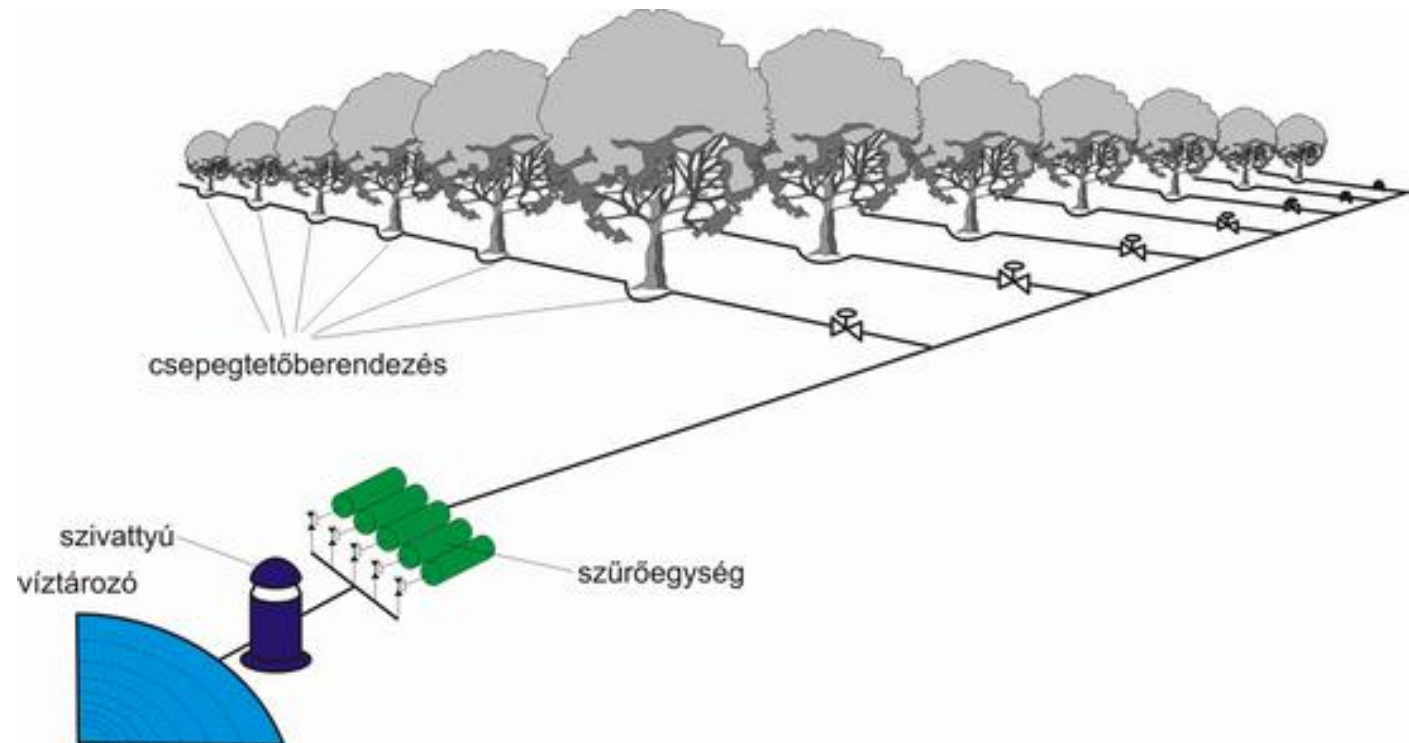
Micro irrigation

1. Dripping irrigation

Drip irrigation is the best way to achieve localised irrigation.

Their characteristics are:

- low pressure,
- very low intensity,
- water filtration equipment required.



Micro irrigation

1. Dripping irrigation

Benefits:

- economical use of water,
- low evaporation and leakage losses,
- low energy demand,
- can be used on sloping ground.

Disadvantages:

- water needs to be purified
- hard water to soften (Fe content)



Micro irrigation

2. Micro nozzle irrigation

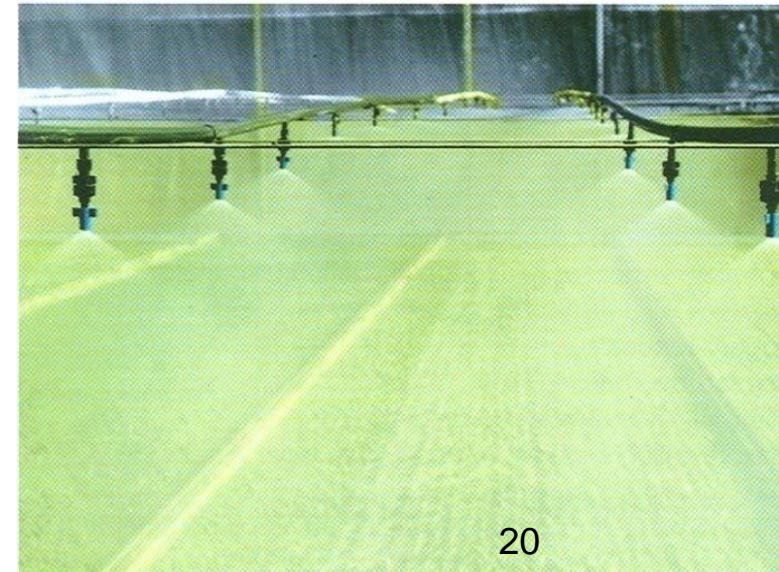
• Visegrad Fund

With micro nozzle irrigation, the nozzles are placed close to the plant, targeting the root zone.

Because of the small radius of action, low pressure is sufficient.

The irrigation water is mostly delivered to the soil or the plant in the form of jets.

Nozzles are either baffle or rotor type.



Micro irrigation

2. Micro nozzle irrigation



Micro irrigation nozzles are prone to clogging

Filtration: sieve, lamella, or medium filters 80-100 MESH
(number of holes per 1 inch)

Uniform pressure: ensured by a pressure regulator. A pressure regulator integrated in the nozzle is preferable.

Control irrigation:

- flow meter
- soil moisture content,
- rain sensor,
- Air humidity sensor,
- time switch,
- temperature signal, etc.



Subsurface dripping irrigation



The different technical parts of drip irrigation

- 24 volt AC retractable solenoid



The different technical parts of drip irrigation

- Filter lamellar 1" , 5m³/h
120mesh/130micron
- Filter with steel insert 1" ,
5m³/h 120mesh/130micron



Sand separation filter

(Hydrocyclone) max. 5 bar,
min.40-120 l/min, 1"

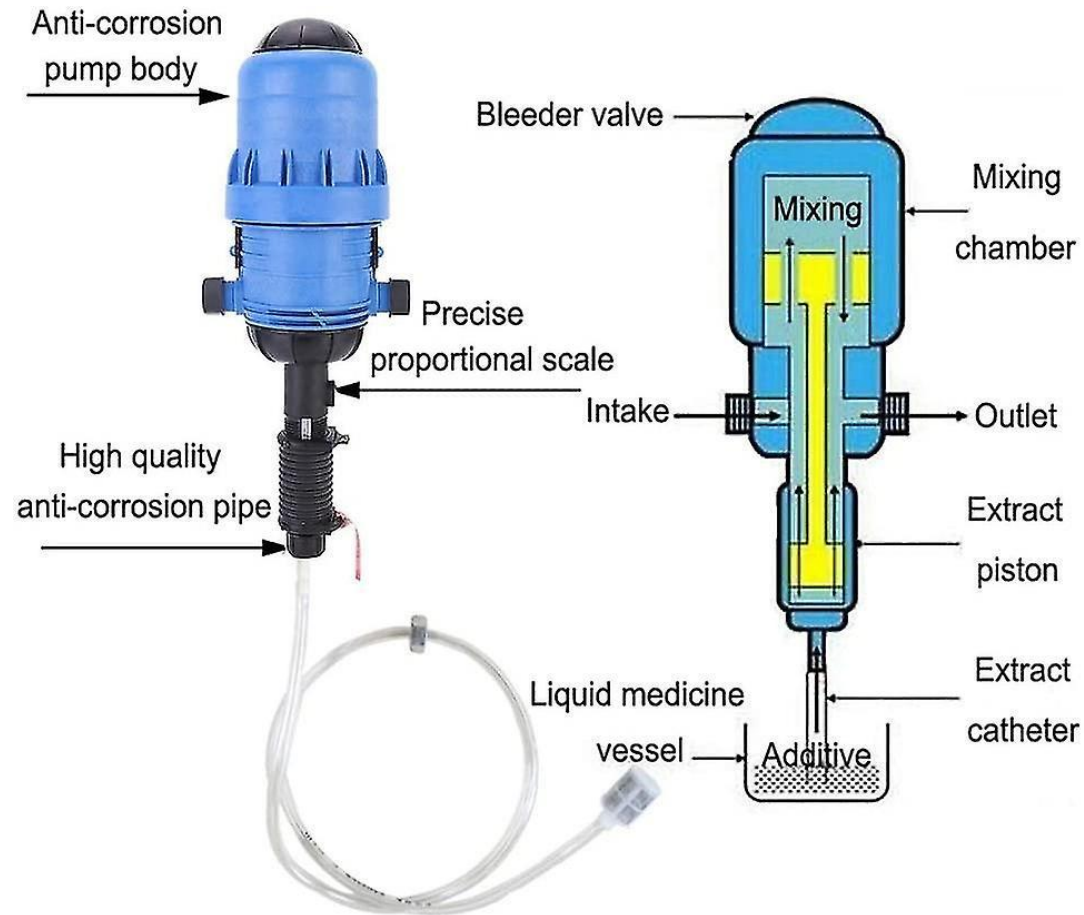


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Fertilizer Injector Dispenser

• Visegrad Fund





Dripping irrigation hoses

Irrigation control software

- Setting parameters
- Via mobile phone

19:16 Potencial latokep

Az öntöző időrend Potencial latokep

1 zóna 2 zóna 3 zóna 4 zóna

Időjárás előrejelzés

vasárnap
26°C
Részben felhős
57% 76% 22km/h

hétfő
27°C
Napos
1% 54% 25km/h

kedd
29°C
Napos
9% 63% 18km/h

Otthoni Zónák Távoli Jelentések Segítség

19:17 Potencial latokep

Megfigyelések

Hőmérséklet Aktuális 24°C Max. 24°C

Csapadék Egy napja 6.8 mm Múlt héten 12.4 mm

Érzékelők

Vizora
Az elmúlt múlt héten hét vízfelhasználása 9650

A vezérlő állapota

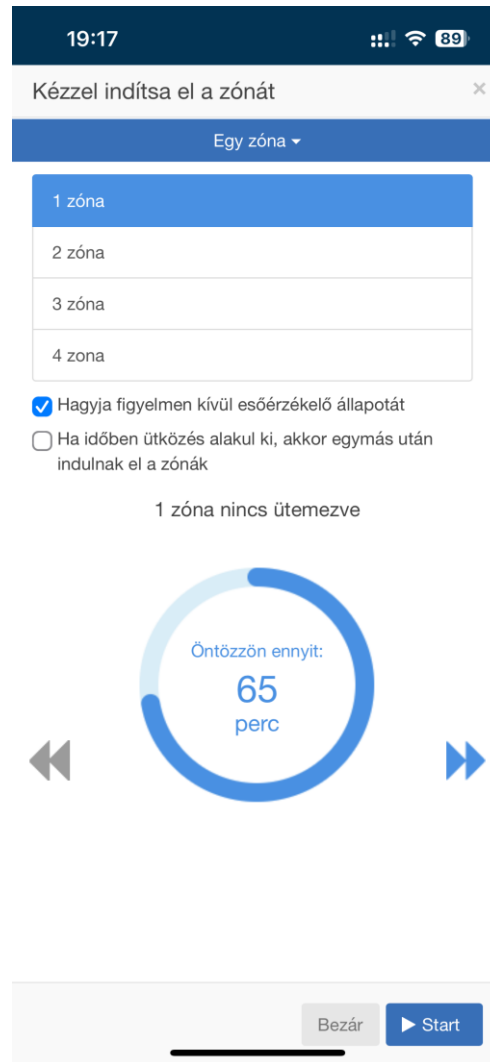
Állapot Nincs internetkapcsolat

Vízmeztakarítás 100%

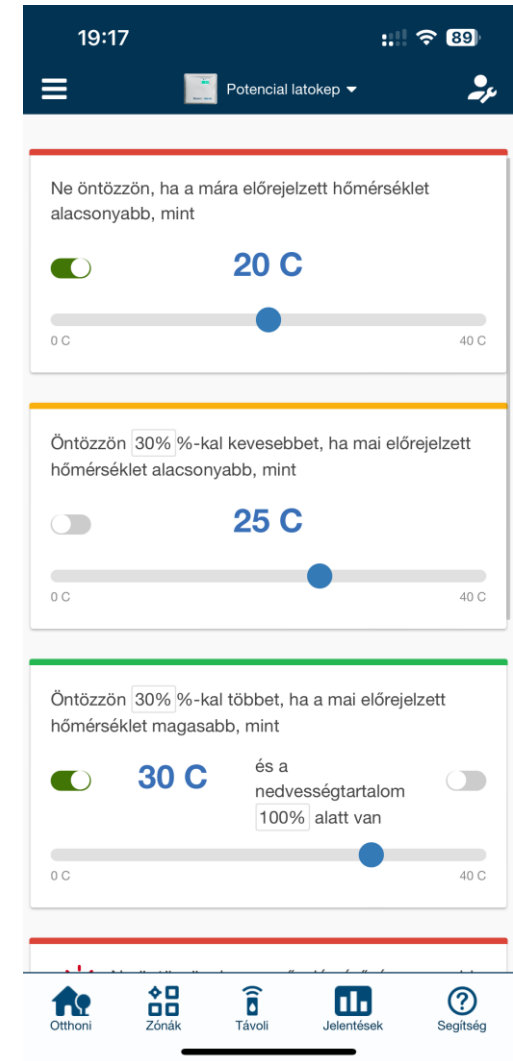
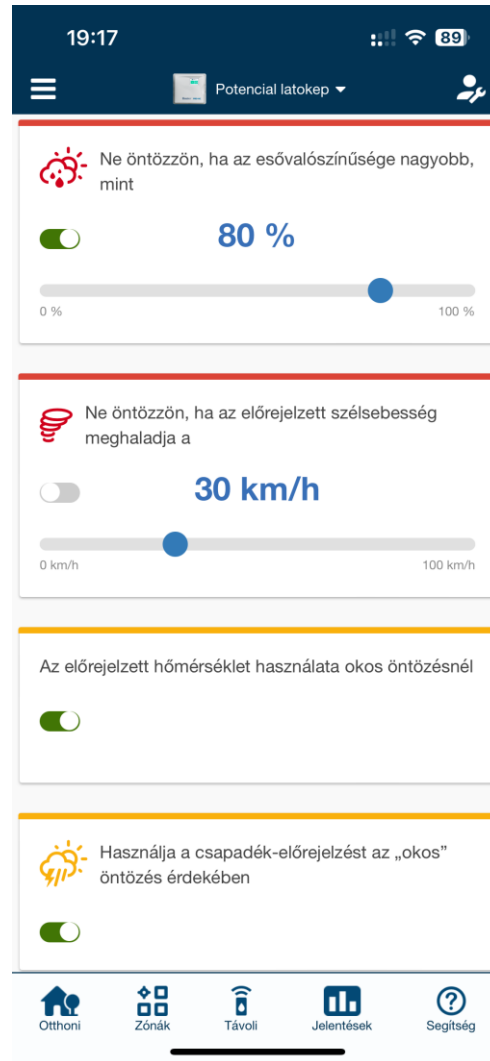
Öntözés idő (hét) 766 perc

Otthoni Zónák Távoli Jelentések Segítség

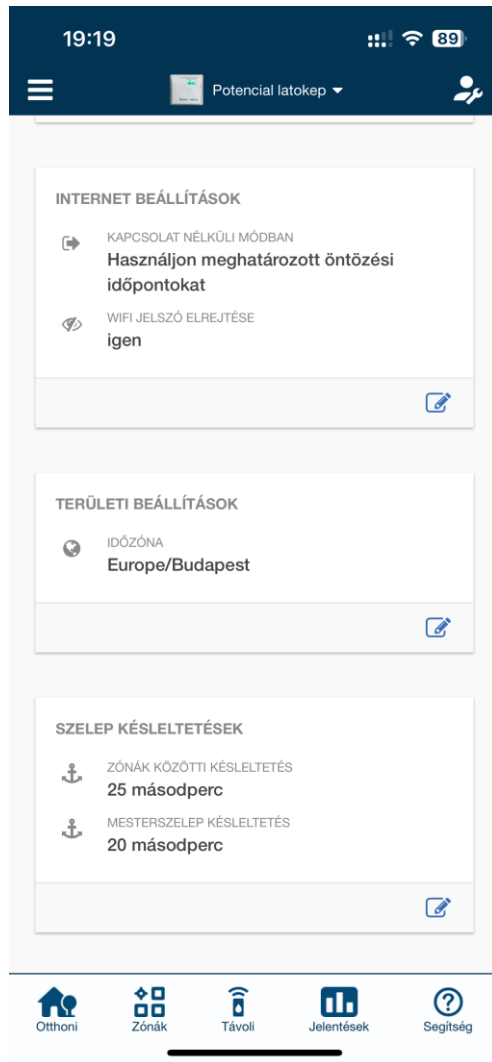
Irrigation control software



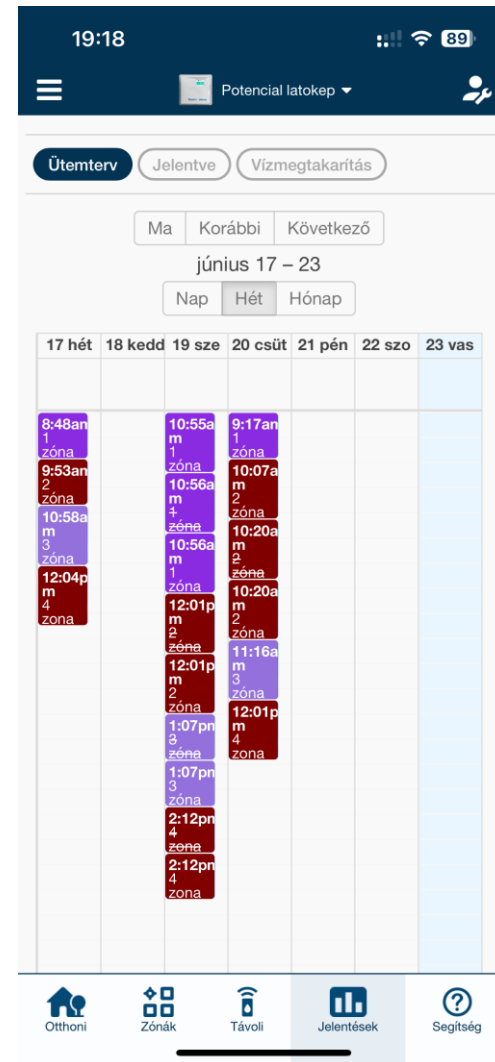
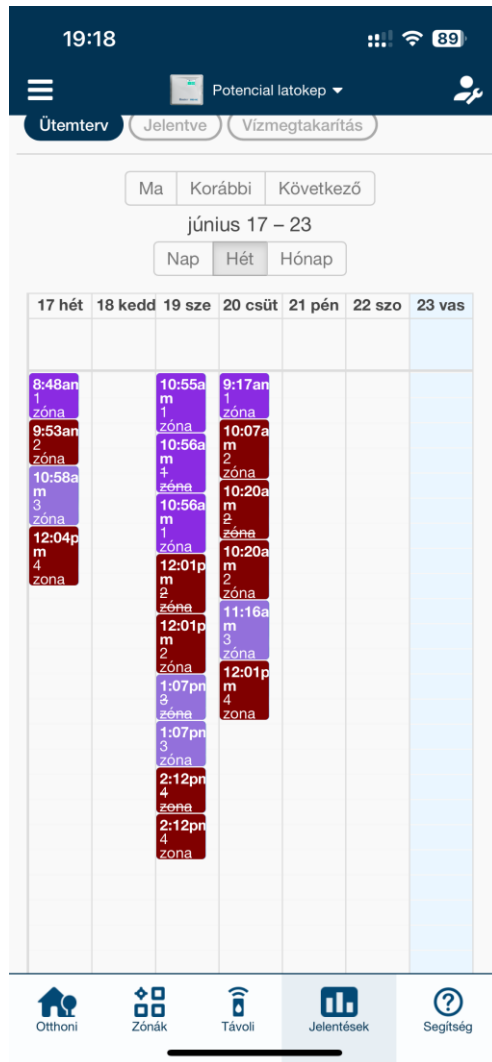
Irrigation control software



Irrigation control software



Irrigation control software



Care must be taken with drip pipes during storage



Some photos
about our
experiment



The theoretical last irrigation date the formation of the black layer



Stages to black layer:



Full-dent & milk line

~55% grain moisture



1/2 milk line

~35-40% grain moisture



2/3 milk line

~30% grain moisture



Thank you for your attention!