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Comparative study of ‘in situ’ methods for potential and actual evapotranspiration determination

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Introduction

There is a stable tendentious in the world during the past several years for increasing the yield from serials (wheat, maize, etc.). This is not only because of results in genetic area, but also because of new perfect agricultural technology applying in plant science. Determining the potential production and its main components - potential evapotranspiration (ETP), transpiration coefficient (TRC) and water use efficiency (WUE) is the right way to find the solution for improving the situation. Two types of methods potential and actual evapotranspiration determining are compared in the study. The first type includes neutron gauge, tensiometers, gypsum blocks and lysimeters. The actual and potential evapotranspiration were calculated by water balance equation. The second type of methods uses a simulation model for all calculation. The experiments were carried out in the experimental field of the Poushkarov Institute of Soil Science near Tzalapitza village – Plovdiv region in Southern Bulgaria.

The results find with the best of the methods could be used for applying the principles of sustainable irrigation scheduling in random region of Bulgarian territory.

Materials and methods

The experimental field of the Poushkarov Institute of Soil Science near Tzalapitza village – Plovdiv region in Southern Bulgaria is situated on about 188 meters above sea level on left riverside of Maritza River. The mean air temperature is 11.7 ^{o} C.

The review of the methods for soil water content determination ***shows*** that only ***gravimetric*** and ***neutron probe methods*** could be used in ***all range of available water content*** (between wilting point and field capacity) and for estimation of the ***simulation model*** predictions. These ***methods*** will be ***compared*** in ***present study***.

Discussion

The yields in the irrigated variant and in the lysimeter were obtained after 6 times irrigation as follow: between 05.04-05.05. – irrigated with 53.6 mm 2 times; between 06.05-12.06. – irrigated with 67.8 mm 3 times; between 13.06-05.07. – irrigated with 16.1 mm ones.

The soil water dynamics over post-dormancy period determined by gravimetric and neutron probe methods and simulation model are shown on Fig. 1. The actual evapotranspiration determined by neutron probe method and calculated by simulation model are shown on Fig. 2.

Fig. 1. Soil water dynamics over post-dormancy period determined by gravimetric and neutron probe methods and simulation model

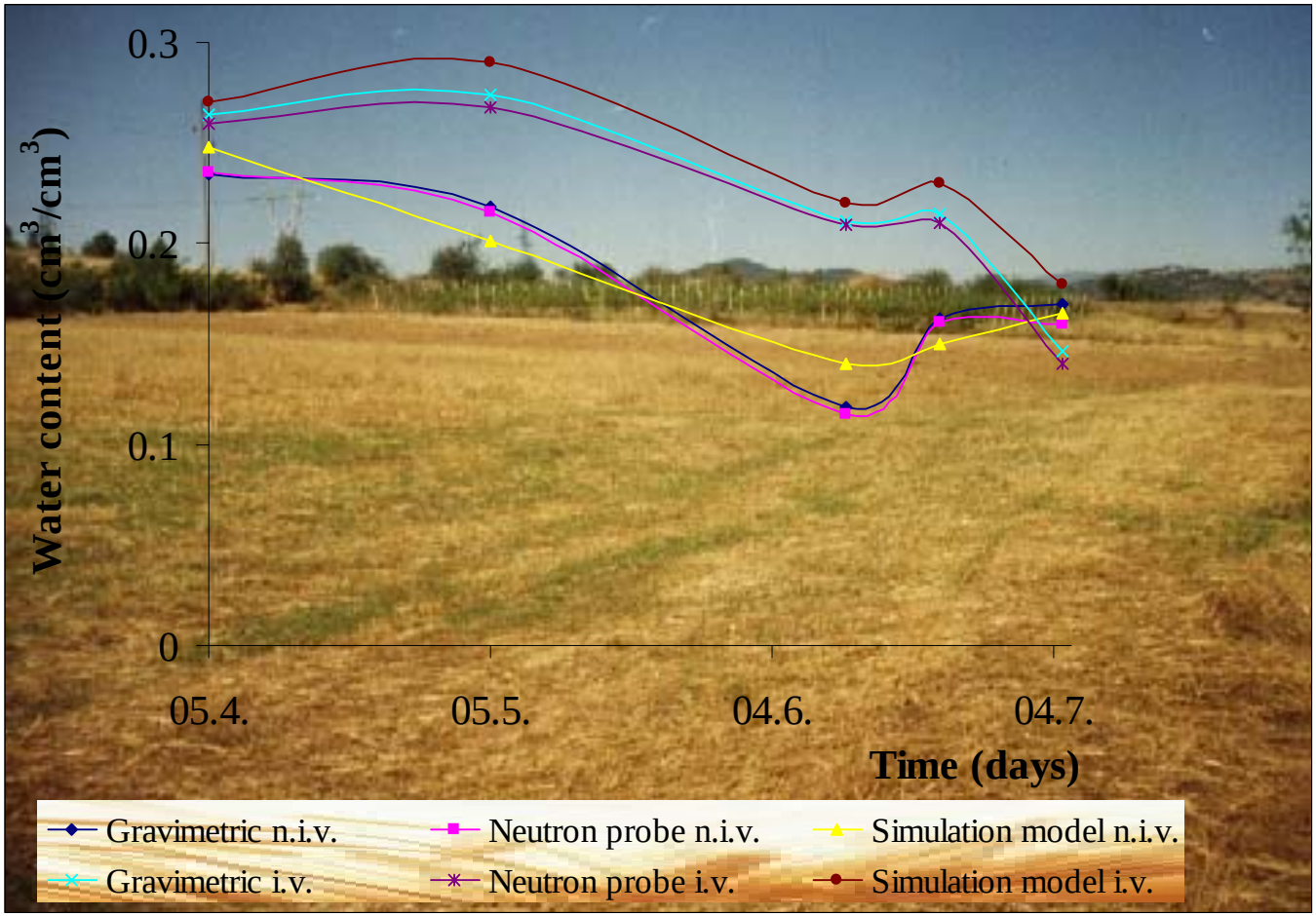
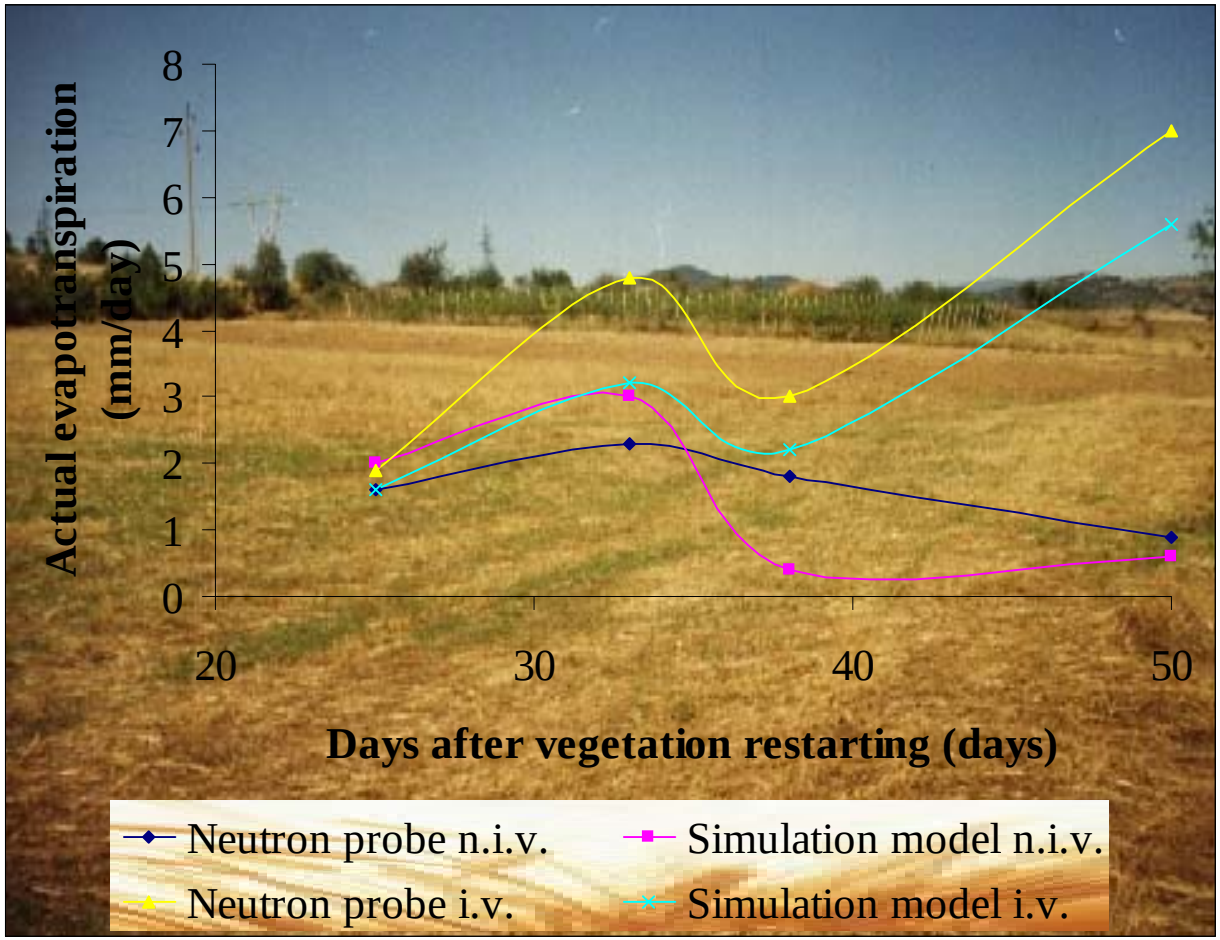


Fig. 2. Actual evapotranspiration over post-dormancy period determined by neutron probe method and calculated by simulation model.



The yields and the two important water efficiency parameters are presented in table 1.

Table 1. *Yields*, water use efficiency (***WUE***) and coefficient of transpiration (***TRC***) for winter wheat.

Variants	Methods	Yields (kg/ha)	WUE (kg/kg)	TRC (kg/kg)
Non-irrigated	Neutron probe	6450	156	388
	Simulation model	3950	286	633
Irrigated	Neutron probe	8150	179	478
	Simulation model	7800	178	500
Lysimeter	Neutron probe	7640	214	510

Conclusions

- ***The most important advantage of the neutron probe method is that it is no as time-consuming as gravimetric method.***
- ***The simulation model and lysimeter could be successfully used for winter wheat irrigation management and scheduling in Tzalapitza region.***