Crop Coefficients of Winter Wheat under South Serbia Conditions

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ABSTRACT— ***Field trials with irrigation of winter wheat have been set in the river valley of Southern Morava, near Niš, at the alluvium soil type, in the period 2009-2011. Irrigation was carried out by sprinkler irrigation method, and its term was determined by observing dynamics of soil moisture down to 60 cm of depth. Considering both investigated years, the highest grain yield of winter wheat was reached at the irrigated variant with pre-irrigation soil moisture 70% of FWC (8678 kg ha^{-1} and 9180 kg ha^{-1}), and for that reason the observed values of ET at this variant from 381.1 to 393.1 mm represent potential evapotranspiration (PET) or CWR of winter wheat for the conditions of southern Serbia. The values of $K_{c\ ini}$ (0.53), $K_{c\ mid}$ (1.10) and $K_{c\ end}$ (0.28) obtained by our experimental study are different from those developed for other areas. The development of regionally based K_c exceptionally helps in irrigation management and gives precise application of water in these areas.***

Keywords— Winter Wheat, Crop Coefficient, Potential Evapotranspiration, Irrigation.

1. INTRODUCTION

Water deficiency during winter wheat vegetation is an important limiting factor in achieving high and stable grain yield. Optimal soil moisture for growing agricultural crops can only be reached in the conditions of irrigation. Water consumption of winter wheat for evapotranspiration (ET), in the conditions of optimal soil humidity during whole vegetation period, is called potential evapotranspiration (PET). Determining value potential evapotranspiration or crop water requirements (CWR), is the initial base for planning production in the conditions of irrigation. CWR is defined as "the depth of water needed to meet the water loss through evapotranspiration of a crop, being disease-free, growing in large fields under non restricting soil conditions, including soil water and fertility, and achieving full production potential under the given growing environment" (Doorenbos and Pruitt, 1984). PET values ar obtained by direct measurement or by calculation based on climate data. Direct measurements of PET are complex and are done in research institutions. Therefore, in order to simplify the determination of CWR, it was proposed a number of indirect methods of calculation.

The concept of expressing crop water requirements through reference evapotranspiration (ET_o) was accepted at the research institutions and irrigation practices. Analysis of numerous data of referent evapotranspiration (ET_o), obtained by various calculation methods and direct observations, was the base for recommendation of FAO Penman-Monteth equation as the standard method for calculating ET_o (Allen *et al.*, 1998). The crop water requirements or evapotranspiration crop (ET_c) is calculated by multiplying the reference crop evapotranspiration by a crop coefficient.

Crop coefficient (K_c) during the growing season varies and depends on the growth stages of crops. The vegetation period is divided into four distinct growth stages: initial, crop development, mid-season and late season. For the calculation of daily ETc is necessary to determine the daily value of K_c value, using the curve coefficient crops. Only three values for Kc are required to describe and construct the crop coefficient curve: those during the initial stage ($K_{c\ ini}$), the mid-season stage ($K_{c\ mid}$) and at the end of the late season stage ($K_{c\ end}$) (Savva and Frenken, 2002). The values of K_c affect crop species and varieties, soil properties, climatic conditions and growing practice of crop. Therefore, the values of Kc obtained in earlier studies (Doorenbos and Pruitt, 1977; Doorenbos and Kassam, 1979; Wright, 1982; Pruitt, 1986;