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Irrigation scheduling based on pan evaporation values for cucumber (*Cucumis sativus* L.) grown under field conditions

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Abstract

This study was conducted to determine the most suitable irrigation frequency and quantity in cucumber grown under field conditions. The amount of water used was based on pan evaporation from a screened Class-A pan. Irrigation treatments consisted of two irrigation intervals (*I*1: 4 and *I*2: 8 day), and three plant-pan coefficients (K_{cp}1: 0.50; K_{cp}2: 0.75 and K_{cp}3: 1.00). Plants were first watered at the transplanting date and scheduled irrigations were initiated after 4- and 8-day intervals.

Irrigation quantities applied to the treatments varied from 320 to 509 mm; seasonal plant water comsumption or evapotranspiration of irrigation treatments varied from 391 to 597 mm; and the cuccumber yield varied from 17.99 to 45.20 ton ha^{-1}. The highest total yield was obtained from $I2K_{cp}3$ treatment. Moreover, $K_{cp}3$ treatments had the highest early yield. E_t/E_{pan} ratio according to treatments ranged from 0.29 to 1.25. Irrigation treatments had significant effects ($P < 0.01$) on yield and there were significant positive linear relations ($P < 0.01$) between the fruit number and irrigation water and between the plant water compsumption and the yield.

In conclusion, $K_{cp}3$ treatment with 8-day-irrigation interval is recommended for cucumber grown under field conditions in order to get higher cucumber yield and to save time and labor. Furthermore,

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the E_t/E_{pan} equation of the best irrigation treatment ($I2K_{cp}3$) of this study ($E_t = 1.05E_{pan} + 96.72$) should, therefore, be used in the scheduling irrigation programs in similar conditions.

Keywords: Irrigation; Cucumber; Pan evaporation; Irrigation scheduling

1. Introduction

The usual purpose of irrigation is to favorably maintain the water status of plants. It, therefore, seems normal that irrigation should be scheduled by using some measures of plant water status (Campbell and Turner, 1990). Being aware of the water sensitivity of plant species on their response to water is needed to choose the most suitable irrigation method and scheduling for them (Meiri et al., 1992).

Yield increase in intensive farming practices mostly depends timely and adequately application of required irrigation water. Therefore, beside the correct determination of the plant water compsumption and irrigation interval, it is vital to determine the period when plants are susceptible to water in order to get the highest yield from per unit area.

In scheduling irrigation programs, methods based on pan evaporation have widespread usage due to its simple and easy application (Elliades, 1988). Pan evaporation (Class-A pan) can be utilized in irrigation programming incase there are available pan coefficients in hand. Therefore, evapotranspiration of grown plants can be deduced by pan evaporation with the help of predetermined coefficients (Doorenbos and Pruitt, 1975). The studies have shown that there is a close relationship between the plant water compsumption and pan evaporation; therefore, pan evaporation can be used in irrigation scheduling for farmers (Kanber, 1984). Moreover, Class-A pan is commonly used due to the fact that it is the most suitable and resultant system for the plant, water, and climate interrelationship.

There are three stages in the calculation of the ratio between the plant water consumption and evaporation: (a) deciding to the most suitable irrigation method; (b) chosing the most suitable E_t/E_{to} ratio; and (c) checking this ratio in the field trials (Goldberg et al., 1976).

Cucumber belongs to the family Cucurbitacea. It is a typical vegetable that grows in warm, temperate, and cool tropical areas. Cucumber processing is not complicated and cucumbers can be pickled, canned, or frozen. There is an increasing demand for cucumber, hence it is considered as one of the most important economical vegetables. Worldwide cucumber production is close to 40 million t per year on about 2,400,000 ha, and its production in Turkey is about 1,750,000 t on 60,000 ha area (Anonymous, 2003).

The aim of this study, was to determine the effects of different irrigation intervals and pan coefficients (K_{cp}) on the yield and water consumption of cucumber plants and to choose the most suitable irrigation schedule for cucumber plants grown under the field conditions by using pan evaporation and related plant-pan coefficients.

2. Materials and methods

This study was carried out in a farmer's field located in Central Van, in 2001 (between 35°55′ and 39°24′N latitude and 42°05′ and 44°22′E longitude and 1725 m altitude). The