DETERMINING THE WATER CONSUMPTION OF CUCUMBERS GROWN IN SOLARIUMS IN THE WESTERN PART OF ROMANIA

DETERMINAREA CONSUMULUI DE APĂ AL CASTRAVEŢILOR CULTIVAŢI ÎN SOLARII, ÎN CONDIŢIILE DIN ZONA DE VEST A ROMÂNIEI

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Abstract. *The experiment referred to in this paper was conducted in Husasău de Tinca, Bihor county, a place situated at 35 km distance from Oradea, in a private vegetable micro-farm and on alluvial soil. The soil presented an average total porosity on the depths of 0-20 cm, 20-40 cm and 40-60 cm; the apparent density of 1.41 to 1.65 g/cm^3 characterizes a low-compression soil (0-20 cm); on the other depths there is a moderate-compression soil. The field-capacity for water presents an average value, ranging from 23.6 to 24.3%, while the wilting coefficient ranges between 9.2 to 11.1%. During the high-season months, the daily water consumption of the plants is expected to be, on average, of about 50-60 m^3/ha, depending on the species. Water consumption is an important aspect related to cucumbers, since insufficient quantities of water determine the ceasing of growth, the emergence of a greater number of male flowers, fruit deformation and bitter taste. Cucumbers are not resistant to drought and therefore, if irrigation is not ensured, the turning of late flower in young fruit is threatened.*

Key words: plant water consumption, cucumber crops, solariums

Rezumat. *Experienţa a fost amplasată în localitatea Husasău de Tinca, judeţiul Bihor, la 35 km de Oradea, într-o microfermă legumicolă privată pe un sol aluvionar. Solul are porozitatea totală mijlocie pe adâncimile 0-20 cm; 20-40 cm; şi 40-60 cm, densitatea aparentă de 1,41-1,65 g/cm^3 caracterizează un sol slab tasat (0-20 cm), pe celelalte adâncimi evidenţiază un sol moderat tasat. Capacitatea de câmp pentru apă are valoare mijlocie, variază de la 23,6 la 24,3%, iar coeficientul de ofilire se situează între 9,2-11,1%. Consumul de apă zilnic al plantelor se estimează în lunile de vârf în medie la cca 50-60 m^3/ha în funcţie de specie. Consumul de apă al castraveţilor prezintă importanţă deoarece insuficienţa duce la oprirea creşterii, apariţia unui număr mai mare de flori mascule, deformarea fructelor şi apariţia gustului amar, fiind puţin rezistenţi la secetă, dacă nu sunt ajutaţi prin irigare se pericliteazăă legarea florilor târzii şi creşterea fructelor tinere.*

Cuvinte cheie: consumul de apă al plantelor, cultura castraveţilor, solar

INTRODUCTION

Water is an essential element for plants, as physiological and biochemical processes may take place only in its presence. Water is a constitutive element, a medium of physiological and biochemical reaction, a carrier of mineral and

synthesis substances, acting as heat regulator for tissues, through the processes of sweating and evaporation (Ruxandra Ciofu et al., 2003).

Most vegetable plants need high quantities of water since, given their eco-physiologic features, they are included in the category of vegetables with high consumption of water and reduced absorption capacities (Apahidean Al.S. et al., 2003).

MATERIAL AND METHOD

The experiments presented here describe cucumber crops obtained in solarium conditions, in a conventional cultivation system, in the Western part of Romania, for either black polyethylene mulch, or non mulch varieties.

The direct methods for determining water consumption rely on the control of soil moisture with the help of gravimetric, tensiometric, electrometric methods, etc. Among such methods, the tensiometric one is more and more widely used, this situation being facilitated by the construction of electronic tensiometers that are very accurate and easy to use.

The indirect methods for determining water consumption are based on the relationship between the water consumption of plants (which is directly determined) and the reference evapo-perspiration (ET_0). The reference evapo-perspiration may be calculated with the help of a large variety of methods, using weather elements; it may also be measured with the help of evaporimeters and lysimeters (Domuţa et al., 2000).

Applying indirect methods, one can obtain reference values of evapo-perspiration (ET_0), which are turned into water consumption with the help of the crop coefficients Kc. Kc coefficients are obtained by a specific methodology - by comparing the optimal daily consumption of water to the reference evapo-perspiration daily average (Domuţa, 2005).

RESULTS AND DISCUSSIONS

Soil sampling (every 10 days) and the preservation of the water reserve between the lower value and the field capacity ensured the optimal water regime for plants.

Table 1

Estimation of water quantities in soil (0-150 cm) and average daily water consumption of cucumber crops in solarium conditions, for mulch and non-mulch types (Husasău of Tinca, 2009)

Type	Interval		No. of days	Initial reserve	Watering	Total in the soil	Final reserve	Total consumption of water	Daily consumption of water m^3/ha
	From	Until							
Non-mulch	24.06	31.07	38	3970	1450	5420	4010	1410	37,1
	01.08	31.08	31	4010	1090	5100	3370	1730	55,9
	01.09	30.09	30	3370	800	4170	3210	960	32,0
	14.06	30.09	99	3970	3340	7310	3210	4100	41,4
Mulch	24.06	31.07	38	4010	1450	5460	4100	1360	35,8
	01.08	31.08	31	4100	1090	5190	3540	1650	53,2
	01.09	30.09	30	3540	800	4340	3390	950	31,7
	14.06	30.09	99	4010	3340	7350	3390	3960	40,0

At the beginning and the end of each month, soil samples were taken from depths of 0-150 cm, thus ensuring optimum conditions for calculating the actual consumption level (ETRopt) of the crop. (Domuţa et al., 2000). The final calculations, of the water quantity in the soil, are presented in table 1.

The decadal determination of soil moisture, on a 0-50 cm depth, ensured that the water reserve was preserved between the minimum threshold and the field capacity; thus plants received optimum water supplies, in accordance with the water consumption needs of mulch and non-mulch cucumbers.

It may be observed that the water supply determined at the establishment of the cucumber crop was below the field capacity of the soil, at a depth of 0-150 cm, 5611 m^3/ha.

The total water consumption at the non-mulch cucumber type was of 4100 m^3/ha. At the mulch type, the water consumption decreased by 3.0% (140 m^3/ha). The difference of 140 m^3/ha results from the fact that, at the non-mulch type, cucumbers consumed (and respectively lost, due to evapo-transpiration) 140 m^3/ha more water. As a result, the quantity of water consumed from the reserves of soil water, in the total water consumption of cucumbers, is higher: 18.5% versus 15.6% (table 2).

Table 2

Analyzing the influence of mulching upon the total water consumption in the case of cucumbers grown in solarium conditions Husasău of Tinca, 2009

Year	Type	Total consumption of water		Sources providing for the required consumption of water			
				From the soil reserve		From irrigation	
		m^3/ha	%	m^3/ha	%	m^3/ha	%
2009	Without mulch	4100	100	760	18,5	4840	81,5
	With mulch	3960	97,0	620	15,6	4840	84,4
	Difference	-140	-3,0	-140	-2,9	0	+ 2,9

CONCLUSIONS

1. Decadal determinations of soil moisture have indicated that, in order to preserve the water reserve between the minimum limit and the field capacity on a depth of 0-50 cm, the following irrigation norms have been put into practice: 500 m^3/ha in June (2 watering stages); 950 m^3/ha (4 watering stages) in July; 1090 m^3/ha (four watering stages) in August; and 800 m^3/ha (3 watering stages) in September.

2. The total water consumption of the mulched cucumber crop had a value of 3960 m^3/ha, by 140 m^3/ha less than the total water consumption of the non-mulched version.

3. Daily water consumption values of mulch cucumbers were also lower. The values of he daily water consumption of mulched and non-mulched cucumbers were of 37 m^3/ha/day and 35.8 m^3/ha/day in June, July; of 55.9 m^3/ha/day and 53.2 m^3/ha/day in August; and of 32.4 m^3/ha/day and, respectively, 31.7 m^3/ha/dat in September.

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