

YIELD AND EVAPOTRANSPIRATION RATIO IN IRRIGATED AND UNIRRIGATED SUNFLOWERS

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A field trial has shown that in the climatic conditions of Vojvodina Province the irrigation practice does not have a positive effect on sunflower yield because sunflowers use efficiently the reserve soil moisture accumulated in the prevegetation period. Thanks to its well-developed root system, sunflowers grown in dry farming on the chernozem soil of Vojvodina Province take up 213 mm of reserve soil moisture which irrigation, the uptake of reserve soil moisture is considerably irrigation. It is thus quite difficult to define the actual and the potential evapotranspiration of sunflowers grown in the pedoclimatic conditions of Vojvodina Province. According to the yields obtained, it appears that the potential evapotranspiration in conditions without irrigation, which varies between 430 and 513 mm in dependence of weather conditions in the year of growing, is more realistic than the potential evapotranspiration in irrigation. The obtained results indicate that sunflowers need not be irrigated in Vojvodina Province. Instead, they should be grown in certain parts of the province which, according to water balance, are not suitable for other field crops, e.g., soybean, sugarbeet, or corn.

Introduction

In Yugoslavia, sunflowers are grown on a considerable acreage. It is thus of interest to see how they respond to irrigation. Previous long-continued investigations and results from commercial production have indicated that the irrigation practice has no positive effect on sunflower yield. To find an explanation for this, we decided to study the evapotranspiration of sunflowers grown in conditions with and without irrigation and the relationship between the evapotranspiration and the yield of sunflower.

Method

Experiments were conducted at the experimental field of Institute of Field and Vegetable Crops at Rimski Šančevi in the period 1977-1980. The experiments included NS sunflower hybrids which were grown in irrigated and unirrigated plots. sprinkling irrigation was applied on the basis of the soil moisture content in the soil layer 0-60 cm, at the technical minimum of 70% of field water capacity (FWC) and 60% FWC. The control variant was unirrigated. Soil moisture was determined by thermogravimetric method, by drying soil samples in a dryer at 105-110 °C.

Soil cultivation, crop tending, and other agricultural practices were conducted at optimum dates. Seed yield was recorded for each hybrid, for a basic plot of 33.6 m² in three replications. Average yields for all hybrids per treatment were analysed.

The evapotranspiration of sunflowers (from reserve soil moisture, rainfall during growing season, and irrigation water) was determined in each treatment by the analysis of water balance.

The expenditure of reserve soil moisture was determined by measuring soil moisture contents at 10 - 20 cm intervals to the depth of 2 meters at the beginning and the end of the season.

Results and discussion

The field trial showed that the irrigation practice does not have a positive effect on the yield of sunflower grown in the climatic conditions of Vojvodina Province (Table 1). The 1979 and especially the 1980 yield were reduced by disease attacks (*Phomopsis*, *Sclerotinia*). The analysis of soil water balance.

Tab. 1- Yields of sunflowers (t/ha) with and without irrigation

Variant	1977	1978	1979	1980
70% FWC	2,115	3,349	2,228	1,245
60% FWC	2,551	3,423	2,212	1,471
Control	3,232	3,630	2,943	2,103

showed that the irrigated sunflowers used a considerably lower amount of reserve soil moisture than the unirrigated sunflowers (Table 2). Having developed a vigorous root system, the sunflowers in the unirrigated control plot took up 214 mm of reserve soil moisture or more than 40% of the total uptake during.

Tab. 2 - Evapotranspiration of sunflowers (mm) in conditions with and without irrigation

Year	Variant	Evapotranspiration (mm)			Total
		Rainfall	Reserve moisture	Irr. rate	
1977	70% FWC	265	79	110	454
	60% FWC	265	111	60	436
	Control	265	165	-	430
1978	70% FWC	320	47	135	502
	60% FWX	320	68	120	508
	Control	320	139	-	459
1979	70% FWC	265	93	95	453
	60% FWC	265	92	110	467
	Control	265	214	-	479

the growing season. The irrigated sunflowers took up 47 to 111 mm of reserve soil moisture, depending on the values of the technical minimum in the trial: the uptake of reserve soil moisture decreased as the pre-irrigation soil moisture increased, and vice versa.

The total expenditure of water for the evapotranspiration of sunflowers remained constant in the irrigated and the unirrigated plots. It was even higher in the latter plot on account of a better use of reserve soil moisture and higher seed yield. It was thus quite difficult to define the actual and the potential evapotranspiration of sunflowers grown in the pedoclimatic conditions of sunflowers grown in the pedoclimatic conditions of Vojvodina Province. According to the yield obtained, it appears that the values of potential evapotranspiration in conditions without irrigation were more realistic than those in irrigation, which is completely reverse with the other crops. It was evident that sunflowers were able to provide the required amount of water from soil reserves. Irrigation or abundant rainfall wither brought no

effect or intensified the occurrence of certain diseases. Highest yields were obtained with the evapotranspiration rates of 430-513 mm, depending on weather condition of the year of growing.

Conclusion

In the climatic conditions of Vojvodina Province, the irrigation practice does not have a positive effect on sunflower yield because sunflowers use efficiently the reserve soil moisture accumulated in the pre-vegetation period thanks to its well-developed root system. In conditions without irrigation, sunflower take up 213 mm of the reserve soil moisture in the layer 0-2 meters, which exceeds 40% of the total requirement for the growing season. In irrigation, the uptake of reserve soil moisture is much lower, ranging from 74 to 111 mm.

The total expenditure of water for the evapotranspiration of sunflowers remains constant in irrigated and unirrigated plots or it is even higher in latter plots. According to the yields obtained, it appears that the values of potential evapotranspiration in conditions without irrigation are more realistic than those in irrigation. In our case, the values of potential evapotranspiration which secured highest yields ranged from 430 to 513 mm.

The obtained results indicate that sunflowers should not be irrigated in Vojvodina Province but should be grown in certain parts of the province which, according to water balance, are not suitable for other field crops, e.g., soybean, sugarbeet, or corn.