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## RESPONSE OF SUNFLOWERS TO IRRIGATION AND NITROGEN FERTILIZER

Sunflower culture has expanded greatly in Andalucía in the last 10 years, mostly on unirrigated land. It is sometimes irrigated under special circumstances, especially in dry years when the amount of irrigation water may be limited. For this reason, the effect of various levels of irrigation and of nitrogen fertilization on sunflower seed yield and oil content have been studied at Córdoba since 1973. In this paper we report our results in field plots in 1975.

Sunflower cv. Peredovik was grown in a sandy loam alluvial soil (xerofluvent) at a density of 42,000 plants per hectare. Natural rainfall during the growing period February to June 1975, was 289 mm. Irrigated plots received (A) 100% or (B) 50% of water needs as indicated by Thornthwaite evapotranspirometers, in three applications during the critical period from flowering to maturity. Maximum irrigation water supplied during this period was equivalent to about 251 mm of rain.

Plots were fertilized with ammonium sulphate, in the amount of 333 kg/ha (No. 1) or 167 kg/ha (No. 2) of nitrogen, two-thirds of which was introduced into the plots before sowing and the rest applied as a side-dressing in the spring. Control plots (No. 3) received no nitrogen. All plots were fertilized with 100 kg/ha of  $P_2O_5$  and 100 kg/ha of  $K_2O$ . Plots were 6 x 2.1 m with 2.1 m between plots and 4 m between blocks to avoid water movement between treatments. Treatments were arranged in randomized blocks, with four replicates.

Precipitation was as follows (mm): 33 in February (from 11 to 28), 103 in March, 61 in

April, 66 in May, 26 in June and none in July. Average daily temperatures steadily grew (except the last three weeks in February when the temperature was 10-9°C). It was 8-14°C in March, 11-17°C in April, 19-16°C in May, 20-23°C in June and 24-30°C in July.

Seed yields are given in Table 1. The yield of plots (A) given 100% of water requirements as indicated by the evapotranspirometers was 3756 kg/ha. Plots (B) given 50% of water needs yielded 95%, and unirrigated control plots (C) yielded 80% of maximum. Differences between plots A and C, and B and C, were highly significant statistically. The difference between A and B was not significant.

The yield of plots (N<sub>1</sub>) given 333 kg/ha of nitrogen was 3,396 kg/ha. Yields of plots N<sub>2</sub> and N<sub>3</sub> were not significantly different from those of N<sub>1</sub>.

The increase in seed yield over non-irrigated plots, expressed as kg/ha of seed per m<sup>3</sup> of irrigation water, was 0.27 for treatment A, and 0.54 for treatment B.

None of the treatments had a significant effect on the ratio of hull to kernel. The ratio varied between 0.28 to 0.38.

Head diameter in the plots given one half of maximum irrigation needs was significantly greater than in the non-irrigated check plots (Table 2). There was no obvious explanation for greater head size in plots B than in plots A. There were no significant differences as a result of different levels of nitrogen fertilization.

The difference in oil content of seed from plots given the maximum water dosage and unirrigated control plots, was highly significant (Table 3). Differences between other levels of irrigation were not significant. Oil content of seed decreased with increasing dosages of nitrogen (Table 3). The difference between seed from plots without nitrogen and the two fertilized plots was highly significant. The difference bet-

ween two levels of nitrogen fertilization was not significant.

Because of the current prices of a kg of sunflower seed and a m<sup>3</sup> of irrigation water, it is profitable to apply a low level of irrigation to sunflower during the critical period in a dry year. Under the conditions of these experiments in 1975, application of nitrogen fertilizer did not appear to be economically justifiable. The ability of sunflowers to produce a reasonably good crop with very limited rainfall (in the third consecutive year of drought), was demonstrated once again.

Table 1

Seed Yield of Sunflower (kg/ha) from Plots with Various Levels of Irrigation and Nitrogen Fertilization

Nitrogen treatment.	Irrigation treatments			Mean
	100%	50%	check 0	
N <sub>1</sub> = 333 U.N.	3,700	3,537	2,952	3,396
N <sub>2</sub> = 167 U.N.	3,835	3,705	3,129	3,556
N <sub>3</sub> = 0 U.N.	3,733	3,514	3,136	3,461
Mean	3,756	3,585	3,072	-

Table 2

Head Diameter (cm) of Sunflower from  
Plots with Various Levels of Irrigation  
and Nitrogen Fertilization

Nitrogen treatments	Irrigation treatments			Mean
	100%	50%	check 0	
N <sub>1</sub> = 333 U.N.	18.10	17.90	16.27	17.42
N <sub>2</sub> = 167 U.N.	17.80	17.61	15.76	17.06
N <sub>3</sub> = 0 U.N.	16.48	18.75	16.90	17.38
Mean	17.46	18.09	16.31	-

Table 3

Oil Content of Sunflower Seed from Plots  
with Various Levels of Irrigation and Nitro-  
gen Fertilization

Nitrogen treatments	Irrigation treatments			Mean
	100%	50%	check 0	
N <sub>1</sub> = 333 U.N.	45.73	54.33	44.38	45.14
N <sub>2</sub> = 167 U.N.	47.81	45.93	44.64	46.13
N <sub>3</sub> = 0 U.N.	49.02	47.82	46.52	47.78
Mean	47.52	46.36	45.18	-