EFFECT OF IRRIGATION REGIME UNDER SALINE CONDITIONS ON GROWTH AND YIELD OF SUNFLOWER PLANT

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INTRODUCTION

In Egypt, about 33% or 2 million acres of irrigated lands suffer from salinity and poor drainage to varying degrees with a less in crop production estimated at 30% of the potential production.

Basic research on the salt tolerance of plants is therefore important in relation to the use of salt lands and should help in the choise of the most suitable plants for cultivation (Kovda, 1973).

Although several studies were made on the differences in salt tolerance of varieties of many field crops, little information on sunflower are still limited.

One of the important proplems in irrigation under saline conditions involves determining the irrigation regime which allows obtaining on the on hand, good crop yields assuring the best possible use of the water and on the other hand adequate leaching of the salts.

Therefore, the objective of this study is to extend a quantitative knowledge concerning the effect of irrigation intervals under saline conditions on plant growth and yield of sunflower.

MATERIALS AND METHODS

A field experiment was conducted at Sakha Experimental Station, Kafr El-Sheikh Governorate. The experimental design consists of complete randomized blocks with three replicates.

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A piece of land varying in its salinity was chosen and divided into equal plots of 6 × 7 m in area. Composite soil samples were taken from each plot representing the root zone reaching a depth of 30 cm to determine its salinity. According to the values of total soluble salts which ranged from 0.15 to 0.8%. The plots were divided into three groups: 0.15 - 0.30%, 0.30 - 0.45% and 0.45 - 0.60% each representing a range of salinity. All the plots were supplied with a suitable system of irrigation and drainage.

Seeds of Giza 1 and Maiak varieties were planted at a rate of 60 seed/row and were thinned about 3 weeks after planting to 21600 plants/acre, the plots were fertilized with the equivalent of 200 kg/acre superphosphate added before planting, 100 kg/acre added before 1*st* irrigation. The plants were then irrigated at 8, 10, 12 and 14 days intervals during the growing season. Plant height, stem diameter, yield of seeds and the weight of 100 seeds were recorded.

RESULTS AND DISCUSSION

1. Effect of salinity on growth and yield:

The mean values of the plant height, stem diameter, head diameter, yield of seeds and the weight of 100-seeds of Giza I and Majak sunflower varieties as affected by soil salinity are given in table 1.

As a result of increasing salinity levels, the reduction percentage for each of the agronomic characteristics varied significantly among the two varieties. Taking the plant height at salinity level S_0 as a measure for the variability, the relative depression of S_1, S_2 and S_3 were 88%, 62% and 44% respectively for variety Giza 1 and 80%, 56% and 43% for the variety Maiak. Although the plant height of Giza 1 seems to greater than Maiak at S_0, the rate of decline in the former was relatively higher than the later one as the salt level increased to S_3. However, such differences, as revealed from the analysis of variances, indicated that the effect due to salinity, variety; and their interactions were highly significant.

Salinity treatments significantly reduced the stem diameter in both two varieties. It is noteworthy that differences in stem diameter as a result of varying salinity treatments for variety I exceeded the other one.

The salt depressing effects on head diamter were clearly noticeable in both two varieties. The negative response in head diameter for Giza I was relatively less at S_3 than the other variety (Maiak).

TABLE 1

Effect of salinity on growth and yield of sunflower plant

Salinity level*	Plant height, cm	Stem diameter, mm	Head diameter, cm	Seed yield/plant g	Weight of 100 seed, g
			GIZA I VARIETY		
S_O	198	34	24.6	63.2	6.6
S_1	176	32	22.4	54.3	5.7
S_2	122	25	14.3	35.2	3.5
S_3	88	16	69	13.8	1.8
			MAIAK VARIETY		
S_O	192	35	23.8	65.9	7.2
S_1	154	31	20.3	57.2	6.8
S_2	108	23	13.4	34.4	3.2
S_3	82	17	7.2	16.7	2.2
L.S.D. (0.05)**					
Salinity	1.38	0.15	0.49		0.26
Variety	0.96	0.11	0.35		0.18
Salinity × variety	1.94	0.22	0.70		0.19

* S_0 Soil containing T.S. 0.1%
* S_1 Soil containing T.S.S. 0.15 - 0.30%
* S_2 Soil containing T.S.S. 0.30 - 0.45%
* S_3 Soil containing T.S.S. 0.45 - 0.60%
** Highly significant.

In summarizing the given growth measurements, it would appear that the tolerance index is differs for the two varieties to give a good comparison between the two varieties, the yield therefore is so far the best indicator for both salt tolerance index and for the choise among the two varieties at the different levels.

As seen in table 1, the seed yields of the two varieties were approximately equal and declined equally as salinity increased. A reduction of 78 and 75% in yield was attained at soil salinity of 0.45 - 0.60% (S_3) for Giza 1 and Maiak respectively. The average weight of a single seed also behaved similarly as the total weight at the higher salinity level where the reduction was only 73 and 69% for Giza 1 and Maiak respectively. This lead to the conclusion that the main factor

in yield depression was the weight of the single seed rather than the number of seeds.

The reduction in sunflower yield may be related to the restricting plant growth. It is interesting to note that the restricted growth arises mainly from the effect of soil salinity on root growth and its development (Hayward and Bernstein, 1958).

From the previous data, it could be concluded that sunflower plant may be grown and good yield obtained even on soil with a moderately salinity degree. Giza I variety was the most tolerant.

2. Effect of irrigation intervals on growth and yield of sunflower:

Although both two varieties reacted similarly among salinity conditions, therefore, date for the two varieties were combined for presentation the effect of irrigation intervals and salinity on growth and yield of sunflower.

Data in table 2 indicate that plant height and stem diamter did not show consistent trends with increasing irrigation periods. Head diameter and seed weight tended to decline as irrigation periods increased or decreased than 10 days.

Data also reveal that sunflower plants grown under saline conditions tended to flower in early stage than those grown in none saline soil. In other words when soil salinity increased sunflower plants flowered after 69 and 67 days at irrigation invervals 8 and 10 days, respectively. On the other hand, with increasing intervals to 12 days sunflower plants were early flowered after 64 days, while in non-saline soils after 71 days. This phenomenon may be related to the fact that when these plants were subjected to unfavourable conditions, physiological disturbances may be occurred and resulted in enhancing flowering maturity (Strognov, 1962).

The harmful effect of irrigation periods under saline conditions in this study is clearly mainifested on the seed yield. Addition of water every 10 days resulted in the maximum weight of 100 seed. The lowest weight of 100-seed and number of seeds per plant was obtained when the water was added every 14 days. This may be explained that sunflower plants lost its ability to absorb water and its nutrient requirement gradually especially for the longer irrigation period. Therefore, soils with relatively highly water retention increasing the time of irrigation do not permit profitable moisture utilization and nutrient supply.

TABLE 2

Effect of irrigation intervals and salinity on sunflower plant.

Tipe of soil	Irrigation periods, days	Date to flower-ing*	Plant height, cm	Stem diameter mm	Head diameter cm	Seed yield /plant, g	Weight of 100-seed, g
Normal soil	8	78	164	37	24.8	69.2	6.66
	10	74	165	34	22.7	67.2	6.88
	12	71	163	36	23.8	65.5	7.22
	14	70	160	38	22.6	62.3	7.43
Saline soil	8	69	160	30	20.7	51.2	4.8
	10	67	152	31	19.0	52.6	5.0
	12	64	154	28	17.3	49.0	4.9
	14	63	159	30	14.2	34.8	3.8

* Number of days from planting to when 50% of the planting were in bloom.

CONCLUSIONS

From the previous data, it could be concluded that under controlled irrigation sunflower plant may be grown and good yield obtained even on soil with high salinity degree. In this case, irrigation at 10 days interval will give better result with respect to sunflower yield to permit available soil moisture, plant nutrient and adequate leaching of salts from soil. On the other hand, for non-saline soils irrigation at 12-14 days will give the best yield.

SUMMARY

A field experiment was carried ou at Sakha Experimental Station, Kafr-El-Sheikh Governorate in 1977-1978 to demonstrate the effectiveness of soil salinity and irrigation intervals on sunflower growth and yield. The data obtained revealed that soil salinity as well as irrigation invervals significantly affected the flowering and sunflower yield was more pronounced by increasing the time of irrigation and soil salinity was mainly related to unprofitable soil moisture supply and nutrient needs

to root absorption. It could be concluded that irrigation at 10 days interval will give better results with respect to sunflower yield to permit available soil moisture and nutrient supply especially under saline conditions.

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