Effect of Foliar Spray with Trace Elements and Irrigation with Saline Water on Growth and Yield of Cotton[1]

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ABSTRACT

This work was conducted to study the effect of spraying with certain trace elements under different salinity treatments on flowering, fruiting and yield of cotton.

While spraying with trace elements did not affect flowering, a direct positive relationship was obtained between salinity and the total number of flowers produced per plant. Both total produced and harvested number of bolls per plant were increased with increasing salt content to 2,500 ppm, but decreased with 5,000 ppm. An inverse relationship was obtained between the salt concentration and the boll setting percentage and a direct relationship was obvious between spraying with trace elements and boll setting percentage. Average boll size was not affected by either salinity or spraying with trace elements.

The yield of seed cotton per plant was increased only with 2,500 ppm of salinity level; whereas at the 5,000 ppm significant decrease in yield was observed. The increase in yield due to spraying with trace elements was attributed to the increase in number of bolls retained. Boll size was not affected by both salinity and trace elements treatments.

INTRODUCTION

It is now necessary to use all the fresh as well as drainage water for irrigation. Since most of newly reclaimed soils and waters contain measurable salinity; the cultivated plants under such conditions are affected and their yields are below the normal average. The decrease in yield depends on the kind of the crop. Cotton is known to be a relatively salt tolerant crop. Barakat and El Ghamry (1) reported that the yield of cotton was not reduced when irrigated with water containing about 3,000 ppm of total soluble salts. Using water of higher salt concentrations Sorour *et al.* (3) obtained a reduction in cotton yield. The reduction in cotton yield was associated with a reduction in the number of bolls retained and in their size. Barakat *et al.* (2) indicated that the cotton yield was initially

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increased with increased salinity of irrigation water but then decreased with further increase in salinity. They concluded that the stimulation effect of salt on yield depended on the cotton variety. Sorour and Abou Elleil (4) demonstrated that soaking cotton seed in trace elements increased flowering, boll set and the yield of seed cotton.

The objective of this work was to study the effect of spraying with certain trace elements on flowering, fruiting and yield of seed cotton under different salinity levels of irrigation water.

MATERIALS AND METHODS

The experiment was conducted in 1967 in the soil salinity laboratory of the Ministry of Agriculture at Alexandria. Cotton variety Giza 45 was grown in free drainage drums of 45 cm diameter and 50 cm depth using clay loam soil. The soil was washed in the drums several times to get rid of excess salts. The experiment contained 36 drums, 6 treatments × 6 replicets arranged in a complete randomized plot design. The six treatments used were as follows:

a) Irrigation with tap water (control).
b) Irrigation with tap water and spraying with trace elements.
c) Irrigation with water containing 2,500 ppm of 1 : 1 $CaCl_2$ and NaCl with no spraying with trace elements.
d) Irrigation with water containing 2,500 ppm of 1 : 1 $CaCl_2$ and NaCl and spraying with trace elements.
e) Irrigation with water containing 5,000 ppm of 1 : 1 $CaCl_2$ and NaCl and with no spraying with trace elements.
f) Irrigation with water containing 5,000 ppm of 1 : 1 $CaCl_2$ and NaCl and spraying with trace elements.

Seeds were planted on 28 March 1967 and the first irrigation was given on 17 April. The subsequent 8 irrigations were given during the growing season. Calcium nitrate fertilizer was given at the rate of 30 kgs N/acre. The spraying solution contained the following concentrations of trace elements:

Element	Concentration in ppm	Form
Zn	40	Zinc sulphate
Mo	50	Ammonium molybdate
Mn	20	Manganese chloride
Cu	20	Copper sulphate
B	80	Boric acid
F	40	Ferrous sulphate

Plants were sprayed two times during the season, the first was on 14 May and the second on the 28 May. At the flowering stage the flushed flowers were daily counted until the end of the season. The open bolls were harvested on the 15 September and the yield of seed cotton per plant was determined. The number of total bolls retained was recorded and the boll setting percentage was calculated from the total number of flowers produced and the total number of bolls retained. The average boll weight was obtained from the yield of seed cotton and the number of harvested bolls per plant.

RESULTS AND DISCUSSION

It is noted from Table 1 that the spraying treatment did not significantly affect the total number of flowers produced per plant. But there was direct significant relationship between the salinity of irrigation water and the flower-production (Table 1).

Fruiting and Boll Setting

It is shown in Tables 2 and 3 that there was a significant effect of salinity on both total number of bolls retained and number of harvested bolls per plant. The number of bolls

Table 1 The average number of flowers per plant as affected by spraying with trace elements and salt content of irrigation water.

	Salt content ppm				
Treatment	0	2,500	5,000	Total	Mean
Control	21.16	26.00	30.50	77.66	25.88
Sprayed	21.33	27.50	27.67	76.50	25.50
Total	42.49	53.50	58.17	154.16	
Mean	21.25	26.75	29.08		

L.S.D..(0.05) for salt content = 2.31
L.S.D. (0.01) for salt content = 3.12

Table 2 The average number of bolls produced per plant as affected by spraying with trace elements and salt content of irrigation water.

	Salt content ppm				
Treatment	0	2,500	5,000	Total	Mean
Control	17.83	16.83	17.16	51.82	17.27
Sprayed	16.83	19.66	16.66	53.15	17.72
Total	34.66	36.49	33.82	104.97	
Mean	17.33	18.25	16.91		

L.S.D. (0.05) for salt content = 0.33
L.S.D. (0.01) for salt content = 0.45
L.S.D. (0.05) for interaction = 1.83
L.S.D. (0.01) for interaction = 2.48

Table 3 The average number of harvested bolls per plant as affected by spraying with trace elements and salt content of irrigation water.

	Salt content ppm				
Treatment	0	2,500	5,000	Total	Mean
Control	14.00	13.16	12.83	39.99	13.33
Sprayed	14.16	16.50	12.18	42.84	14.28
Total	28.16	29.66	25.01	82.83	
Mean	14.08	14.83	12.50		

L.S.D. (0.05) for salt content = 1.277
L.S.D. (0.01) for salt content = 1.827
L.S.D. (0.05) for interaction = 2.204
L.S.D. (0.01) for interaction = 2.982

retained was increased significantly with the increase in salinity up to the 2,500 ppm and then decreased with further increase of salt concentration. A highly significant interaction between spraying treatment and salinity was obtained. The maximum number of bolls retained per plant resulted from the spraying treatment at salinity level of 2,500 ppm. The increase in boll production amounted to about 18% compared with the control.

Table 4 indicates a significant effect of spraying and salinity on the percentage of boll setting. An inverse relationship was noticed between the salinity and the boll setting percentage. The differences between the various treatments were highly significant. On the other hand, spraying with trace elements increased the boll setting percentage over the control. The difference proved to be significant only between the sprayed and the control treatment under the 2,500 ppm level of salinity. These results are in agreement with those obtained by Sorour *et al.* (3), and Sorour and Abou Elleil (4).

Yield and Yield Components

As indicated by Table 5, the 2,500 ppm salinity level significantly increased yield of seed cotton over the control. Conversely, the 5,000 ppm salinity level significantly decreased the yield. The effect of trace elements significantly increased the yield only at

Table 4 The boll setting percentage as affected by spraying with trace elements and salt content of irrigation water.

	Salt content ppm				
Treatment	0	2,500	5,000	Total	Mean
Control	63.52	50.60	41.70	155.82	51.94
Sprayed	66.95	59.90	43.23	170.08	56.69
Total	130.47	110.50	84.93	325.90	
Mean	65.23	55.25	42.46		

L.S.D. (0.05) for treatment = 3.93
L.S.D. (0.01) for treatment = 5.32
L.S.D. (0.05) for spraying = 4.82
L.S.D. (0.05) for interaction = 7.29
L.S.D. (0.01) for interaction = 9.86

Table 5 The average yield of seed cotton (gm) as affected by spraying with trace elements and salt content of irrigation water.

	Salt content ppm				
Treatment	0	2,500	5,000	Total	Mean
Control	28.00	28.12	28.72	84.84	28.28
Sprayed	28.46	36.72	28.26	93.44	31.15
Total	56.46	64.84	56.98	178.28	
Mean	28.23	32.42	28.49		

L.S.D. (0.05) for salt content = 3.74
L.S.D. (0.05) for interaction = 5.29
L.S.D. (0.01) for interaction = 7.16

Table 6 The average boll weight (gm) as affected by spraying with trace elements and salt content of irrigation water.

	Salt content ppm				
Treatment	0	2,500	5,000	Total	Mean
Control	2.077	2.276	2.249	6.602	2.201
Sprayed	2.024	2.238	2.286	6.548	2.183
Total	4.101	4.514	4.535	13.150	
Mean	2.050	2.257	2.267		

the 2,500 ppm salinity level. On the other hand, no differences in yield of the unsprayed and sprayed plants under salinity control and the 5,000 ppm treatments were observed.

Table 6 shows that boll size was neither affected by salinity treatment nor by spraying with trace elements. Sorour and Abou Elleil (4) obtained similar results when cotton seeds were soaked before planting in solutions of trace elements. In another study Sorour *et al.* (3) reported a reduction in boll size with the increase of salt concentration in irrigation water, since the average boll weight was not significantly affected by either spraying or by salt concentration in irrigation water; the increase in yield could be attributed to the increase in boll setting percentage. Similar results were obtained by Sorour and Abou Elleil (4).

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