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EFFECT OF IRRIGATION WITH SALINE WATER ON SOME COTTON CULTIVARS

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ABSTRACT

Two pot experiments were conducted at the Agricultural experimental station of ARC in Giza to study the effect of irrigation with saline water on growth, yield as well as pigments, total soluble sugars, reducing sugars and proline contents in leaves, oil and protein percentage in seeds. This study comprised some Egyptian cotton cultivars ie., Giza 80, Giza 83, Giza 90 and Giza 91 (belong to Upper Egypt cultivars) and Giza 45, Giza 70, Giza 85 Giza 88, Giza 86 and Giza 89 (belong to Lower Egypt cultivars) during 2005 and 2006 seasons. Plants were irrigated with saline solution of NaCl at concentrations of 4000, 8000 and 12000 ppm. After 50 days from sowing alternately with tap water up to the end of the growing season. The control plants were irrigated regularly with tap water during the whole season.

The results obtained could be summarized as follows:

1. Cultivars responded differently to irrigation with saline water.
2. Salinity tended to reduce leaf area and dry weight of stem, roots and leaves. In addition, salinity decreased number of flowers / plant, number of bolls / plant, boll weight, seed index and seed cotton yield per plant in grams.
3. Salinity tended to decrease total soluble sugars and reducing sugars in leaves. On contrary, salinity caused an increase in chloroplast pigments and proline. Salinity caused decrease in oil and protein percentage of cotton\ seeds.
4. The most pronounced increase of chemical constituents was observed in proline content in leaves as a result of water stress caused by (salinity). Giza 80 and Giza 45 had the highest values contents of proline under all salinity concentration, the highest values of proline content in their stressed leaves lead to an increase in their yields and its components under saline conditions. For the plant breeder, it is useful to select plants with higher proline contents in leaves to obtain plants more tolerant to salinity.

INTRODUCTION

The problem of salinity received much attention in Egypt in both old cultivated and newly reclaimed areas. In addition any agricultural expansion needs a greet amount of suitable irrigation water which already is not sufficient to need all the expected demand. For that the possibility of using saline water for irrigation, specially underground or drainage water is become a great value, but till now it is still very limited, because this water contains a considerable amount of harmful salts. The applicability of saline water for irrigation is first of all depend upon the concentration, composition of salts dissolved therein and upon the degree at which plants are salt tolerant.

The reduction in growth rate and the economic yield of different plants caused by salinity appears to be caused primarily by the effect of excess ion accumulation, direct osmotic effects acting through reducing water availability for plants, Abd El-Aziz *et al.* (1998), Ronde *et al*. (2000) and Badran (2006).

Ahmed (1994), found that saline water treatments decreased plant height, no. and length of internodes, no. of sympodia / plant and no of flowers per plant.

Kamel *et al*. (1995) found a significant depression in number of leaves and total leaf area, plant height per plant by using saline water (2000 ppm NaCl) in irrigation process.

Badran (2001) studied the effect of varietal response of cotton plants under stress conditions. He reported that fresh, dry weight / plant and leaf area were decreased with increasing salinity level in all genotypes under study.

With regard to the effect of saline water on yield and yield components of cotton plants, Badran (2006) studied the differential response of nine varieties comprised new and old Egyptian cotton germplasm to salinity stress for selecting more salt tolerant, he found that a significant decrease in boll weight, boll no., lint percentage, seed index and seed cotton yield / plant in all genotypes.

With respect to pigments, soluble sugars and proline in leaves, Ahmed *et al*. (1989) found that water stress increased the amount of chlorophyll, which indicated a weaking of its bonding with protein complexes.

Also, Rathert (1983) evaluated the effect of salinity stress on carbohydrate metabolism of two Egyptian cotton varieties after 28 days from sowing of 14 days of salinization and reported that salt stress decreased soluble sugars.

Many plants, including halophytes, accumulated proline to high levels in response to osmotic stress, such as high salinity and water deficit (Szoke *et al*., 1992). Kamel *et al*. (1995) pointed out that, proline concentration was increased comparing to control when cotton plant exposed to salinity stress.

Also, Badran (2006) found that, proline content in cotton leaves, which increased in both seasons when plants were grown at various levels of salinity and significant differences among cotton genotypes under investigation, were considered as evidence that it may act as a cytoplasmic osmoticum.

Ahmed (1994) reported that salinity treatments decreased oil and protein contents of cottonseeds.

The objective of this research was to evaluate yield potential of ten cultivars under salinity conditions to identify salt-tolerant cotton cultivars and determine the variations for various characters, which may help for further selection.

MATERIALS AND METHODS

Two pot experiments were carried out at Giza in the green house of the Cotton Physiology Section, Cotton Research Institute, A.R.C., to study the effect of salinity on growth, yield and some chemical components of cotton plant.

Seeds of ten cotton cultivars (G. 80, G. 83, G. 90 and G. 91, in Upper Egypt) and (G. 45, G. 70, G. 85, G. 88, G. 86 and G. 89, in lower Egypt), were sown on pots of 40 cm. in diameter filled with clay loamy soil, the sowing dates were April 3rd and 1st in 2005 and 2006 through out the two experimental seasons, respectively. All pots received an adequate amount of nitrogen fertilizer at a rate of 60 kg. N. / fed. in split application one after thinning and the other was applied two weeks after the first dose. Watering was carried out with Tap water for 50 days after sowing, hence forward plants were irrigated with saline solutions of 4000. 8000 and 12000 ppm NaCl (followed by Tap water alternately during the whole season). The un-treated pots (control) were irrigated with Tap water continuously.

Each treatments consisted of 5 pots in which were used for daily flower counting.

The studied characters were:

I- Growth parameters (recorded after 90 days from planting):

Final plant height (cm), No. of main stem nodes, inter-node length (cm), No. of fruiting branches / plant, leaf area (cm) by leaf area and dry matter (roots, stems and leaves per gm) were recoded by meter Model L1 – 3100.

II- Yield and yield components:

No. of flowers / plant, No. Of total bolls / plant, boll shedding %, boll weight (gm), seed index (gm) and seed cotton yield / plant (gm) were determined.

III- Chemical constituents:

Pigments concentrations were determined according to (Arnon, 1949), sugars concentration in leaves (A.O.A.C., 1975), proline concentration (Bates *et al*., 1973). Oil and protein in seeds were determined using A.O.A.C., method (1975).

All data were subjected to the statistical analyses outlined by Snedecor and Cochran (1981), using the least significant difference (LSD) for means comparison.

RESULTS AND DISCUSSION

Soil analysis and level of salinity:

The Soil analysis presented in Table (1) show that the value of PH recorded a little decrease at the end of the season associated with the increased salinity level.

Table (1): Chemical analysis of the soil irrigated with saline water.

Time of Sampling	Soil depth cm	NaCL ppm	Anions, meg / L				Cations, meg / L				EC	PH
			CL^-	So_4^{--}	HCO_3^-	CO_3^{--}	Na^+	K^+	Mg^{++}	Ca^{++}		
Before Sowing	0 - 15	0	9.0	15.00	5.-	---	9.16	0.70	5.0	14.90	0.601	8.3
After Harvest	0 - 15	**0**	10.0	15.42	5.-	-	9.56	0.76	5.1	15.2	0.64	8.14
		4000	15.0	2.00	5.20	-	17.65	0.85	4.3	5.2	3.10	7.85
		8000	21.0	6.01	6.0	-	21.2	0.70	2.1	3.01	3.31	7.95
		12000	22.0	8.49	8.00	-	34.66	0.40	1.38	1.05	4.87	7.25

This might be due to the increase in electrical conductivity. On contrary, Ec increased parallel to the increase in salinity, which reached 4.87 (3116 ppm) indicating that the soil tended to be saline.

I.1. Dry matter production:

A- *Cultivars*:

The results in Table (2) revealed that cotton cultivars of Upper Egypt excreted significant differences in dry weight of stem, roots, leaves and total plant weight in all seasons, except stem dry weight in 2006 season. In general, the dry weight of stem, roots and leaves were higher in Giza 80 cultivar in both seasons than other cultivars. The highest values of stem and roots dry weight were observed in Giza 80 cotton cultivar.

On the other hand, the highest dry weight of leaves was recorded in plants of Giza 80 and Giza 83 varieties. For total dry weight of plants, the data show that the value of total dry weight of Giza 80 and Giza 83 plants were higher than the other two varieties, the differences in dry weight of different plant organs (roots or leaves), may be due the interaction between climate factors and varieties.

B- *Salinity:*

Data revealed that salinity of irrigation water treatments exerted a significant effect on all growth parameters under study (stem, root, leaves and total dry weight) in both seasons.

In general, there was a reduction in all plant organs dry weight as salinity concentration increased and the values of dry weight for different plant organs were gradually decreased when the salinity level increased from 4000 ppm up to 12000 ppm. The reduction was more pronounced in leaf dry weight, this means that salinity inhibits the leaf dry matter production and decreases the size of leaves which reducing the photosynthesis activity and consequently reduce carbohydrate formation which requires to build up a new plant organs.

Also, salinity reduced the activity of roots synthesize from of chloroplast and consequently reduce its activity for the formation of new plant metabolites required to the plants.

C- *Interaction*:

Data revealed that the interaction between cotton varieties and irrigation water salinity excreted a significant influence on all growth parameters under study in both seasons except stem dry weight in 2006 season. In general, plants of different varieties have the same behavior under the different salinity concentrations where the reduction in all growth characters was observed as salinity concentration in creased up to 12000 ppm.

With respect to total dry weight, it is clear from these data that the reduction percentage in total dry weight was the lowest in Giza 80 (22.11 %, 49.59 % and 66.09 %) as the mean of two seasons, under the salinity concentrations (4000, 8000 and 12000 ppm), respectively. While, the highest values were observed in Giza 90 (50.63 %, 64.87 % and 70.83 %) for the same respective concentrations. These results indicate that Giza 80 more tolerant to salinity at studied concentrations than the other varieties and Giza 90 was more sensibility to salinity even at its lower concentration.

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I.2. Leaf area:

A- *Cultivars*:

It is clear from results that leaf area differed from variety to another in both seasons. The highest value of leaf area / plant in 2005 season was obtained from plants of Giza 80, Giza 83 and Giza 90 and the lowest value was recorded in plants of Giza 91. In 2006 season, the lowest leaf area / plant was obtained from Giza 91 and Giza 90 while Giza 80 and Giza 83 gave the highest value. The differences in leaf area values may be due to the differences in number of leaves / plant and also leaf size, produced from the different varieties.

B- *Salinity*:

Leaf area decreased gradually with increasing salinity concentration from 4000 ppm up to 12000 ppm. The reducing values of leaf area / plant were obtained (28.41 %, 54.53 % and 79.15 %) from salinity level 4000 ppm, 8000 ppm and 12000 ppm, respectively in 2005 season, while in 2006 season the values were (27.11 %, 49.53 % and 70.61 %) for the same respective concentrations.

The reduction in leaf area / plant as a result of increasing salinity may be due to the reduction in leaf number and/or leaf size as a result of the inhibitory effect of salinity on plant photosynthesis activity and consequently the formation of new metabolites required to form a new leaves.

C- *Interaction*:

Data reveal that leaf area / plant was significantly affected by the interaction between varieties and differed salinity concentrations in both seasons.

In general, varieties behave differently to the differed salinity concentrations. It is clear from data that Giza 80 variety was the lowest one in reduction of leaf area under the lowest concentration of salinity 4000 ppm at the mean of two seasons (25.41 %), while the reduction values for Giza 83, Giza 90 and Giza 91 were 26.17 %, 31.97 % and 27.62 %, respectively at the same concentration.

As salinity concentration increased to 8000ppm, the reduction in leaf area in Giza 90 was pronounced as lowest value (47.24 %), while other varieties had higher and similar values.

For 12000 ppm salinity, the reduction in leaf area was higher in all varieties and recorded a high value (74.89 %) in Giza 83, while Giza 80 recorded lower value (73.45 %).

The decrease in leaf area as salinity increased for the different varieties may be due to the differences in leaf size as well as number of leaf produced by plant under salinity concentration.

II.1. Yield and yield components:

A- *Cultivars*:

Data in Table (3) revealed that cotton cultivars of Upper Egypt exerted a significant influence on number of flowers / plant, number of open bolls / plant, seed index and boll weight in both seasons. However, plants of Giza 80 was superior in all treatments under study in both seasons except number of open bolls / plant in 2006 season in which Giza 83 had the highest value. The increase in seed cotton yield / plant may be due to the increase in number of open bolls / plant and/or to boll weight.

Table (3): Effect of different levels of saline irrigation water on yield and yield components of some cotton cultivars planting in Upper Egypt.

Var. (A)	Treat. (B)	N0. of flowers per plant		Shedding %		No. of open bolls / plant		Boll weight (gm)		Seed index (gm)		Seed cotton yield/plant (gm)	
		2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Giza 80	**Cont.**	18.00	17.30	10	11	12.10	11.53	2.60	2.26	10.21	9.67	31.46	26.06
	4000	15.90	14.30	24	26	10.20	8.91	2.16	2.02	9.26	9.09	22.03	18.00
	8000	12.00	12.10	30	33	8.00	7.40	1.89	1.60	8.39	8.08	15.12	11.85
	12000	9.70	8.90	32	35	6.00	6.50	1.37	1.20	7.28	7.20	8.23	7.81
	Mean	**13.90**	**12.11**	**24.0**	**26.3**	**9.07**	**8.56**	**2.00**	**1.77**	**8.79**	**8.51**	**19.21**	**15.92**
Giza 83	**Cont.**	17.75	16.90	15	17	11.90	11.73	2.40	2.23	8.68	8.80	28.60	26.16
	4000	15.60	13.90	25	25	10.00	9.42	1.98	1.72	8.80	8.07	19.82	16.21
	8000	12.60	11.90	26	35	8.10	7.66	1.58	1.44	7.94	7.78	12.80	11.04
	12000	9.60	9.00	30	39	6.20	5.82	1.16	1.20	6.63	6.74	7.20	6.99
	Mean	**13.88**	**12.92**	**24.0**	**29.0**	**9.05**	**8.65**	**1.78**	**1.65**	**7.91**	**7.82**	**17.10**	**14.60**
Giza 90	**Cont.**	19.20	16.80	17	18	13.22	12.80	2.45	2.19	9.16	9.08	32.40	28.04
	4000	12.00	13.00	27	27	8.10	8.00	1.91	1.64	8.68	8.66	15.30	13.20
	8000	11.60	10.60	33	33	6.50	5.59	1.72	1.41	6.71	7.24	11.20	7.89
	12000	9.00	8.80	45	44	5.90	4.60	1.13	1.10	5.91	6.20	6.72	5.06
	Mean	**12.57**	**12.30**	**30.5**	**30.5**	**8.43**	**7.74**	**1.80**	**1.58**	**7.61**	**7.79**	**16.40**	**13.54**
Giza 91	**Cont.**	18.49	15.90	14	17	11.00	10.59	2.40	2.11	9.11	9.12	26.43	22.36
	4000	132.85	11.90	18	22	8.00	7.28	1.71	1.75	8.70	8.52	13.64	12.75
	8000	11.30	10.00	27	34	7.20	5.78	1.47	1.65	6.94	7.14	10.64	9.20
	12000	9.00	8.06	40	39	5.10	4.00	1.18	1.00	7.20	6.42	6.04	4.00
	Mean	**13.08**	**11.82**	**24.7**	**28.0**	**7.82**	**6.91**	**1.69**	**1.62**	**7.99**	**7.80**	**14.19**	**12.07**
(B)	**Cont.**	18.23	16.92	14.0	15.8	12.05	11.66	2.46	2.20	9.29	9.17	29.72	25.65
	4000	14.33	13.27	23.5	25.0	9.07	8.40	1.94	1.78	8.76	8.59	17.70	15.04
	8000	11.88	11.15	29.0	33.8	7.45	6.60	1.67	1.52	7.49	7.56	12.44	10.49
	12000	9.32	8.69	36.8	39.2	5.80	5.23	1.21	1.12	6.65	6.83	7.05	5.96
L.S.D.	(A)	**0.3**	**0.2**	**1.2**	**1.69**	**1.1**	**1.2**	**0.10**	**0.15**	**0.22**	**0.17**	**3.12**	**2.92**
	(B)	**1.8**	**2.0**	**0.9**	**1.32**	**0.8**	**1.8**	**0.13**	**0.19**	**0.22**	**0.39**	**4.32**	**3.32**
	A x B	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**1.9**	**N.S.**	**N.S.**	**0.60**	**0.44**	**0.49**	**N.S.**	**N.S.**

B- *Salinity*:

In general, increasing salinity concentration decreased all characters of cotton plants under study. The reduction in yield / plant was more pronounced when salinity concentration increased, from 4000 up to 12000 ppm. The reduction in such yield was 40.44 %, 58.40 % and 76.27 for the concentrations of 4000, 8000 and 12000 ppm, respectively as compared to control, in 2005 season. These values were 41.36 %, 59.10 % and 76.76 % for the same respective salinity concentrations in 2006 season. Increasing salinity concentration decreased gradually, flower and boll production as a result of inhibition of vegetative growth (plant height, number or area of leaves / plant, photosynthesis activity and consequently decrease the metabolites request for producing unhealthy new bolls.

The reduction in flower production was lower when salinity was applied at low concentration and increased gradually where the reduction values were 20.94 %, 34.05 % and 48.44 % for 4000, 8000 and 12000 ppm, respectively, as mean of the two seasons compared to the control. While for number of open bolls / plant, the reduction in boll production as a result of salinity increasing were 26.35 %, 40.78 % and 53.50 % for the same respective concentrations, this mean that the reduction in boll production was higher than flower production, it mean that salinity increased shedding percentage of bolls born on cotton plants. The shedding percentages in 2005 season were 14 %, 23.50 %, 29.0 and 36.8 % for control, 4000, 8000 and 12000 ppm, respectively. While these percentages were 15.8 %, 25.0 %, 33.8 % and 39.2 % for the same respective treatments in 2006 seasons.

C- *Interaction*:

The interaction between cotton cultivars and salinity exerted a significant influence on number of open bolls / plant (2005 season), boll weight (2006 season)and seed index (both seasons).

In general, the reduction in flower production when salinity was applied at 4000 ppm differed from one variety to another for mean of both seasons. Giza 80 and Giza 83 plants had the lowest reductions (14.50 % and 14.93 %) respectively, while Giza 90 and Giza 91 had a higher reductions % (30.05 % and 25.12 %), respectively.

Regard to the salinity concentration of 8000 ppm, the reduction was higher than 4000 ppm for all varieties, also, Giza 80 and Giza 83 had the lowest reductions in flower percentage (31.69 % and 29.29 %) respectively, while the higher percentage was observed in Giza 90 and Giza 91 (36.90 % and 37.94 %), respectively.

For seed cotton yield / plant, increasing salinity reduced seed cotton yield / plant and the reduction in such yield differed from one variety to another as well as from season to another. Generally, the lowest reduction in seed cotton yield was recorded in Giza 80 variety (30.44 %) as a mean of two seasons, followed by Giza 83 (34.18 %) and Giza 91 (45.48 %), while the highest value was obtained from Giza 90 variety (52.84 %). This is true when plants of such varieties were grown under salinity concentration of 4000 ppm. Under 8000 ppm the lowest values were in Giza 80 and Giza 83 (53.22 % and 56.51 %) respectively, followed by Giza 91 (58.85 %) while the highest one was observed for Giza 90 (68.64 %). On the other hand, the highest salinity concentration (12000 ppm) gave the higher yield reduction for all varieties, 71.93 %, 74.04 % and 79.60 % for Giza 80, Giza 83 and Giza 91, respectively however, Giza 90 had the highest reduction (80.35 %). This result indicated that Giza 80 variety was almost tolerant to lower concentration of salinity and it is may be due to that Giza 80 had the higher percentage of proline than the other varieties. Meanwhile, Giza 90 plants were sensitive to salinity at all concentrations as compared to the other varieties.

The reduction in seed cotton yield may be due to the reduction in its components, i,e., number of open bolls / plant, weight of boll and seed index. In general, salinity especially at higher concentration exerts harmful effects on plant metabolites required to form more sound bolls with higher seeds. Also, Salinity decreased the vegetative growth especially leaves number and area.

I.1. Dry matter production:

A- *cultivars*:

Data in Table (4) revealed that varieties exerted a significant influence on all studied characters under salinity except dry weight of stem and leaves in 2006 season. It is clear from data that the highest value of stem dry weight in 2005 season was obtained for Giza 45 plants but in 2006 season, there were insignificant differences among varieties. With respect to root dry weight, the results indicated that the highest root dry weight in both seasons was obtained from Giza 88 plants. In concern to leaves dry weight, data show that the highest dry weight of leaf / plant were obtained from Giza 88 and Giza 45 plants in 2005 and 2006 seasons, respectively. The total dry weight of plant recorded the highest value for Giza 45 plants in both seasons. This may be due to the increase in stem and leaves dry weights.

B- *Salinity*:

The results show that salinity in general, reduced total dry weight of all plants for all varieties grown under study. The reduction may be due to the inhibitory effect of such salinity on growth and degradation of cotton plants. The reductions in total dry weight in 2005 season were 22.08 %, 42.33 % and 54.60 % for 4000, 8000 and 12000 ppm, respectively. In 2006 season, the values were 33.93 %, 55.15 % and 68.48 % for the same concentrations, respectively.

C- *Interaction*:

Data revealed that the interaction between varieties and salinity levels exerted significant influences on all varieties under study in both seasons.

It is clear from these data that Giza 45 plants gave the lowest reduction in total dry weight under 4000 ppm salinity than other varieties (21.30 %) and the highest value was observed in Giza 85 (38 %). Under 8000 and 12000 ppm the lowest values were obtained in Giza 86 and Giza 70 (35.6 % and 55.7 %) respectively, while the highest percentage was recorded in Giza 89 (56.65 % and 67.25 %) as the mean of two seasons.

The reduction in plant dry weight under saline conditions was due to the reduction in growth as a result of decreasing water uptake, toxicity of sodium and chloride in the plant cell as well as reducing photosynthesis (Brugnoli and Lauter, 1991).

Osmotic pressure resulting from salinity stress utilizes much of carbon and reduce metabolites synthesis and thus ultimately biomass production is decreased (Javaid *et al*., 2005).

I.2. Leaf area / plant:

A- *Cultivars*:

Data revealed that leaf area differed from one variety to another in both seasons. The highest leaf area / plant was obtained from plants of Giza 88 followed by Giza 45 and the lowest values were recorded in plants of Giza 70 in both seasons. Several authors reported that leaf area was differed from genotypes tested under salinity levels, (Kamel *et al*., 1995, Badran 2001 and Badran 2006).

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B- *Salinity*:

Leaf area / plant was significantly reduced by different levels of salinity concentration from 4000 ppm up to 12000 ppm. The lowest values (25.27 %, 44.02 % and 66.04 %) were obtained from 4000 ppm, 8000 ppm and 12000 ppm, respectively in 2005 season, while in 2006 season the reduction percentages were (31.51 %, 53.43 % and 69.55 %), for the same respective concentration.

Similarly, Badran (2006) pointed out that, leaf area was decreased with increasing the concentration of the salts. Also, such results are corresponded with the findings of Kamel *et al*. (1995) who reported that data obtained from cotton plant exposed to salinity stress were decreased in leaf area / plant comparing to control, and this might be due to stunted growth by salination because of fewer cells, judged by DNA content.

C- *Interaction*:

Data revealed that leaf area / plant was significantly affected by the interaction between varieties and differed salinity concentrations in both seasons.

It is clear from these data that the lowest reduction of leaf area / plant as means of two seasons was recorded in Giza 88 (18.77 and 38.42 %) under 4000 ppm and 8000 ppm, respectively while, the highest values were observed in Giza 85 (32.93 % and 52.17 %) in the same concentration.

Regarding to high salinity level (12000 ppm), the reduction in leaf area / plant was higher for all varieties under study and ranged from (60.94 %) to (73.50 %)

The decrease in leaf area or leaf size might be attributed to the reduction in cell number, cell enlargement and the size of inter cellular space per unit area (Strogonov, 1962).

Several authors reported that, leaf area was decreased with increasing the concentration of salt (Kamel *et al*. 1995, Badran 2001 and Badran 2006).

II.2. Yield and yield components:

A- *Cultivars*:

Data in Table (5) revealed that cotton cultivars exerted a significant influence on number of flowers / plant, number of open bolls / plant and seed index in both seasons as well as, boll weight in 2006 season. During the growing seasons, Giza 45 plants were superior as compared with the other genotypes in all treatments under study except number of open bolls in 2006 in which Giza 88 cultivar had the highest value. These results, are in harmony with those obtained by Kamel *et al*. (1995), Badran (2001) and Badran (2006). They concluded that there was a great variation between some cotton varieties under the same treatments.

B- *Salinity*:

It is clear from this data that the salinity resulted in a significant reduction attributed with increasing salinity levels as compared with the control in all treatments under study. The reduction concentration increased from 4000 up to 12000 ppm. The reduction in such yield were 23.88 %, 50.17 % and 73.23 for 4000, 8000 and 12000 ppm, respectively. This was true in 2005 season and these values were 37.07 %, 54.64 % and 67.24 % for the same respective salinity concentrations in 2006 season.

Table (5): Effect of different levels of saline irrigation water on yield and yield components of cotton cultivars planting in Lower Egypt.

Var. (A)	Treat. (B)	N0. of flowers per plant		Shedding %		No. of open bolls / plant		Boll weight (gm)		Seed index (gm)		Seed cotton yield/plant (gm)	
		2005	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**
Giza 45	**Cont.**	20.90	17.90	18	15	13.67	11.26	2.53	2.30	10.20	9.67	34.60	25.92
	4000	19.00	14.60	20	28	12.86	8.18	2.14	2.16	9.14	9.09	27.52	17.67
	8000	14.20	10.60	22	30	10.39	7.51	1.63	1.70	8.01	7.98	16.95	12.77
	12000	10.60	9.60	33	35	6.44	5.01	1.53	1.45	7.26	6.84	9.78	7.26
	Mean	**15.67**	**13.17**	**23.25**	**27.00**	**10.84**	**7.99**	**1.95**	**1.90**	**8.65**	**8.39**	**22.21**	**15.91**
Giza 70	**Cont.**	18.00	15.00	18	20	11.9	10.58	2.40	2.20	9.70	9.80	26.61	23.29
	4000	12.00	11.10	20	30	9.94	4.36	1.74	2.16	8.33	8.07	17.29	12.42
	8000	10.60	7.60	30	35	7.61	4.81	1.47	1.73	7.82	7.78	11.03	8.42
	12000	8.20	7.10	39	40		3.71	1.29	1.47	6.98	6.04	6.52	5.46
	Mean	**12.20**	**10.20**	**26.75**	**31.25**	**8.42**	**5.86**	**1.72**	**1.89**	**8.21**	**7.92**	**15.36**	**12.40**
Giza 85	**Cont.**	16.00	14.60	18	21	12.45	10.34	2.64	1.99	9.53	9.08	32.86	20.58
	4000	12.30	11.30	28	29	8.50	6.97	1.99	1.69	8.30	8.66	16.91	11.79
	8000	11.30	8.00	34	34	8.37	6.07	1.64	1.55	7.72	7.24	13.48	9.29
	12000	8.20	7.30	43	40	4.65	4.47	1.59	1.34	7.06	6.23	7.39	5.99
	Mean	**11.95**	**10.30**	**30.75**	**31.00**	**8.47**	**6.96**	**1.96**	**1.64**	**8.15**	**7.80**	**17.66**	**11.91**
Giza 88	**Cont.**	18.00	15.00	15	16	15.86	12.56	2.32	1.91	10.27	9.12	36.80	24.00
	4000	16.00	12.00	20	25	12.26	9.06	2.14	1.81	9.13	8.52	26.23	16.41
	8000	9.00	9.60	30	30	6.88	6.43	1.78	1.66	7.79	7.14	16.90	10.67
	12000	8.90	8.10	35	39	6.66	4.57	1.50	1.33	7.74	6.42	10.00	6.07
	Mean	**12.97**	**11.18**	**25.00**	**27.50**	**10.41**	**8.15**	**1.93**	**1.68**	**8.73**	**7.80**	**22.48**	**14.29**
Giza 86	**Cont.**	16.00	14.50	20	22	12.58	7.12	2.36	2.32	9.42	9.17	29.20	16.53
	4000	13.00	10.10	24	22	10.36	5.66	1.94	1.93	9.16	8.59	20.09	10.95
	8000	10.70	9.30	32	37	6.87	5.58	1.73	1.61	8.03	7.29	11.90	8.99
	12000	7.70	7.30	36	50	3.97	4.39	1.51	0.91	6.90	6.66	6.00	4.00
	Mean	**11.85**	**10.30**	**28.00**	**34.50**	**8.44**	**5.69**	**1.8**	**1.69**	**8.38**	**7.93**	**16.80**	**10.12**
Giza 89	**Cont.**	20.00	13.60	19	20	15.21	10.68	2.30	2.02	9.73	9.13	35.00	21.59
	4000	16.00	10.60	25	30	14.07	7.03	1.79	1.96	8.97	8.52	25.20	13.77
	8000	10.00	8.90	30	35	11.33	5.20	1.50	1.86	7.70	7.14	17.00	9.67
	12000	7.00	7.10	40	45	2.91	3.67	1.26	1.22	7.00	6.42	7.20	4.48
	Mean	**13.25**	**10.05**	**28.50**	**32.50**	**10.88**	**6.64**	**1.71**	**1.76**	**8.35**	**7.80**	**21.10**	**12.38**
A-B	**Cont.**	18.15	15.10	18.00	19.00	13.48	10.42	2.42	2.12	9.81	9.33	29.18	21.98
	4000	14.38	11.62	22.83	28.33	11.33	6.88	1.96	1.95	8.84	8.57	22.21	13.83
	8000	10.97	9.00	29.67	33.50	8.56	5.93	1.62	1.68	7.84	7.43	14.54	9.97
	12000	8.43	7.75	37.67	41.67	4.95	4.30	1.44	1.29	7.16	6.43	7.81	7.20
L.S.D.	(A)	**1.8**	**2.3**	**2.1**	**2.9**	**1.9**	**1.2**	**N.S.**	**0.33**	**0.30**	**0.17**	**4.0**	**3.0**
	(B)	**1.6**	**3.2**	**1.8**	**1.8**	**1.8**	**0.8**	**0.16**	**0.19**	**0.25**	**0.39**	**4.1**	**3.6**
	A x B	**2.3**	**5.6**	**2.9**	**3.9**	**2.9**	**1.9**	**N.S.**	**N.S.**	**N.S.**	**1.33**	**5.0**	**5.9**

The reduction in flower production was lower when salinity was applied at lower concentration (21.94 %, 40.99 % and 51.36 %) for 4000, 8000 and 12000 ppm, respectively, as mean of the two seasons in compare to the control. While for bolls production as a result of salinity application, the values were (24.96 %, 39.76 % and 61.00 %) for the same respective concentrations, this mean that the reduction in boll production was higher than those of flower production, this mean that salinity increased shedding percentage of bolls born on cotton plants. When the shedding percentage in 2005 season were 18 %, 22.83 %, 29.67 and 37.67 % for control, 4000, 8000 and 12000 ppm, respectively. While in 2006 season, the values were 19.00 %, 28.33 %, 33.50 % and 41.67 % for the same respect.

C- *Interaction*:

The interaction between cotton cultivars and salinity levels exerted a significant influence on number of open bolls / plant (both seasons), seed index (2006 season). While, boll weight was not affected significantly (in both seasons).

In general, the reduction in flower production when salinity was applied at 4000 ppm differed from one variety to another at mean of both seasons. Giza 88 plants followed by Giza 45 plants had the lowest reduction percentages (15.56 % and 18.54 %) respectively, compared to other varieties while the highest percentage was observed in Giza 70 (29.67 %). At 8000 ppm the lowest value was recorded in Giza 86 followed by Giza 45 (34.49 % and 36.42 %), respectively. Meanwhile, the highest percentage was recorded by Giza 70 (45.22 %). Under 12000 ppm, the reduction percentage reached higher values compared to the other salinity levels in all cultivars. Giza 45 had the lowest reduction value (47.82 %), while Giza 89 had the higher percentage (56.39 %).

These results are in harmony with results of many investigators such as Ronde *et al*. (2000) and Ahmed (1994), who mentioned that the total number of flowers per plant tented to be reduced with increasing salinity levels which, reduce seed cotton yield / plant and this reduction differed within varieties. In general, Giza 45 plants recorded the lowest reduction (26.14 %) as mean of the two seasons, followed by Giza 88 (30.17 %), while the highest reduction was found in Giza 85 (45.62 %).

Under 8000 ppm the lowest value was obtained in Giza 45 plants (50.92 %) while, Giza 70 had the highest percentage of reduction (61.19 %). All varieties grown under 12000 ppm suffered from high reduction in cotton yield than other salinity level and ranged from 71.80 % in (Giza 45) to 78.00 % in (Giza 89). Therefore, Giza 45 variety considered that the best variety in producing seed cotton yield using saline irrigation water and showed the lowest decrease in seed cotton yield / plant. It is worthily to note that the variation between the studied cotton genotypes tested was more pronounced. It is considered a logical phenomenon due to different genetic make up of the used genotypes. These results are in agreement with those previously obtained by Radwan *et al*. (2002) and Badran (2006).

III. Chemical constituents:

Data in Tables (6 and 7) show that all chemical constituents under studies were significantly affected by salt concentrations, varieties as well as the interaction between them.

1. Pigments concentration:

A- *Cultivars:*

Data revealed that significant differences in the pigments concentration among cotton genotypes grown in upper and Lower Egypt. Giza 83 followed by Giza 80 in Upper Egypt and Giza 45 followed by Giza 88 in Lower Egypt have the highest contents in chlorophyll (a), (b) and total chlorophyll compared to other varieties.

The increase in total chlorophyll contents tended to increase chlorophyll (a) than chlorophyll (b) in cotton leaves under irrigations salinity.

Table (6): Effect of different levels of saline irrigation water on chemical constituents of cotton leaves and seeds (Upper Egypt cultivars).

Var. (A)	Treat. (B)	Chl. A	Chl. B	Total chlorophyll	Carotene	Total soluble sugar mg/gm	Reducing sugar mg/gm	Proline	Oil %	Protein %
Giza 80	**Cont.**	3.77	2.16	5.93	0.27	24.77	17.02	3.87	21.74	25.00
	4000	3.80	2.61	6.41	0.34	20.10	14.90	6.90	20.82	21.88
	8000	4.23	2.77	7.00	0.48	16.33	11.02	20.00	19.86	18.88
	12000	4.74	3.60	8.34	0.69	9.97	6.87	24.37	19.73	18.75
	Mean	**4.14**	**2.79**	**6.92**	**0.44**	**17.79**	**12.45**	**13.78**	**20.53**	**21.13**
Giza 83	**Cont.**	3.76	2.44	6.20	0.37	23.75	17.27	3.58	18.83	25.75
	4000	3.92	2.95	6.87	0.46	20.60	15.00	6.25	18.18	21.13
	8000	4.45	3.71	8.16	0.62	17.30	11.17	18.09	16.68	18.88
	12000	4.68	3.95	8.63	0.65	9.13	5.17	26.03.	16.14	18.75
	Mean	**4.20**	**3.26**	**7.47**	**0.53**	**17.69**	**12.15**	**13.48**	**17.46**	**21.13**
Giza 90	**Cont.**	3.51	1.94	5.45	0.34	22.32	16.96	3.49	20.33	23.67
	4000	3.82	2.82	6.64	0.42	17.90	14.20	5.80	17.25	19.01
	8000	3.94	2.83	6.77	0.49	15.49	9.96	9.74	16.57	18.88
	12000	4.24	3.48	7.72	0.69	5.96	4.30	20.18	15.74	18.67
	Mean	**3.88**	**2.77**	**6.65**	**0.49**	**15.41**	**11.36**	**9.80**	**17.47**	**20.06**
Giza 91	**Cont.**	3.17	2.15	5.32	0.35	21.15	16.09	3.37	20.64	25.00
	4000	3.30	3.26	6.56	0.39	17.03	13.53	5.87	19.01	21.88
	8000	4.02	2.85	6.87	0.54	13.90	9.85	9.24	17.56	18.88
	12000	4.69	3.26	7.95	0.63	6.93	3.10	19.93	17.81	18.29
	Mean	**3.79**	**2.88**	**6.67**	**0.48**	**14.75**	**10.64**	**9.60**	**18.75**	**21.01**
(B)	**Cont.**	3.55	2.17	5.72	0.33	22.99	16.84	3.58	20.39	24.85
	4000	3.71	2.66	6.57	0.40	18.91	14.41	6.22	18.81	20.97
	8000	4.16	3.04	7.20	0.53	15.76	10.50	14.26	17.66	18.88
	12000	4.59	3.57	8.16	0.66	7.99	4.86	22.63	17.36	18.62
L.S.D.	(A)	**0.14**	**0.10**	**0.24**	**0.01**	**0.19**	**0.20**	**1.12**	**2.20**	**0.24**
	(B)	**0.17**	**0.10**	**0.27**	**0.02**	**0.21**	**0.14**	**0.86**	**1.23**	**0.17**
	A x B	**0.25**	**0.14**	**0.39**	**0.03**	**0.42**	**0.28**	**1.72**	**1.74**	**0.24**

B- *Salinity*:

Data revealed that salinity treatments tended to obtain a significant increase in all pigment contents in cotton leaves chlorophyll (a), (b) and total chlorophyll.

In general, total chlorophyll concentration increased with increasing salt concentration (14.94 %, 25.87 % and 42.65 %) in cultivar grown in Upper Egypt and (12.3 %, 28.3 % and 61.6 %) in cultivar grown in Lower Egypt under salinity levels (4000 ppm, 8000 ppm and 12000 ppm, respectively. These results are in agreement with those obtained by Ahmed *et al*. (1989) who found that water stress increased the amount of chlorophyll which indicated a weakening of its bonding with protein complex.

C- *Interaction*:

Data in Tables (6 and 7) show that the interaction between cultivars and salinity exerted a significant effect on pigments contents. Under the low level of salinity 4000 ppm and 8000 ppm, the lowest value of accumulation was observed in Giza 80 (8.07 % and 18.04 %) in Lower Egypt. While under high level of salinity 12000 ppm, the accumulation percentage were increased in all cultivars under study which, ranged from 39.19 % to 49.43 %) for Upper Egypt cultivars and (46.8 % to 67.7 %) for Lower Egypt cultivars.

2. Sugars content:

A- *Cultivars*:

Data in Tables (6 and 7) show that cotton cultivars differed among them in total soluble sugars and reducing sugars when irrigated with saline water. The highest value of total soluble and reducing sugars was observed in Giza 80 (17.79 mg and 12.45 mg) for Upper Egypt cultivar and in Giza 45 (20.49 mg and 14.09 mg) for lower Egypt cultivars. While, the lowest value was obtained from Giza 91 and Giza 70 in the same respect content under normal and stress conditions The differences among cultivars were reported by Salem *et al*. (1993) and Alia (2003), who found differences between Egyptian cotton cultivars in their carbohydrate content.

B- *Salinity*:

Data in Tables (6 and 7) show clearly that the content of total and reducing sugars were decreased with increasing salinity levels for all cultivars. The decreasing percentage in total soluble and reducing sugars under (4000 ppm, 8000 ppm and 12000 ppm) in Upper Egypt cultivars were (13.39 %, 31.45 % and 65.25 %) and (14.45 37.65 % and 52.11 %), respectively while in Lower Egypt cultivars. These percentages were (18.19 %, 37.40 % and 69.50%) and (18.75 %, 40.75 % and 70.25 %) in the same respect.

The reduction in sugars content may be due to the reduction in photosynthesis and increasing photorespiration under water deficit (Zakaria *et al*., 1993). These results are in accordance with those previously reviewed by Ahmed *et al*. (1989) who found that water stress conditions decreased reducing sugarss and total soluble sugars in cotton leaves.

C- *Interaction*:

The interaction between cultivars and salinity exerted a significantly effect on total soluble and reducing sugars in cotton leaves.

Under different levels of salinity, 4000 ppm, 8000 ppm and 12000 ppm, the lowest reduction percentages in total soluble sugars were observed in Giza 83 (13.26 %, 27.16 % and 61.56 %), and in Giza 45 (14.7 %, 29.9 % and 58.6 %).

Otherwise, the lowest value of reducing sugars was observed in Giza 80 cultivar (12.46 %, 35.25 % and 59.64 %) under different salinity levels for cotton plants grown in Upper Egypt. In Lower Egypt, the lowest value was observed in Giza 88 (14.8 %) and (66.8 %) under levels 4000 ppm and 12000 ppm, respectively while under, 8000 oom the lowest value was recorded in Giza 45 (34.4 %).

3. Proline contents:

A- *C*ultivars:

Varietal differences in salt tolerance might be correlated with differences in proline content in cotton leaves as well as with its accumulation into the leaves. The results in Tables (6 and 7) show that proline content differed among cultivars grown under salinity, where the highest value was obtained from Giza 80 (Upper Egypt cultivar) and Giza 45 (Lower Egypt cultivar), while the minimum one was obtained from Giza 91 and Giza 86.

From the previous results, it could be concluded that the differences in salt tolerance occur not only between crop species but also among varieties (Rathert, 1983).

The differences between varieties were reported by Kamel *et al*. (1995) and Badran (2006), where they reported differences between cotton varieties in proline content exposed to salinity stress compared to control.

B- Salinity:

It is evident in Tables (6 and 7) that, proline content significantly was affected by salinity levels for all varieties under study. In general, plants of all varieties have the same behavior under the different salinity concentrations.

It is clear from these results that the content of free proline in untreated plant (control), leaves in all varieties was very low, then it rapidly rises after exposing plants to salinity from low level up to high level. The values of increasing proline were (73.74 %, 298.53 % and 532.12 %) under 4000 ppm, 8000 ppm and 12000 ppm, respectively in Upper Egypt cultivars and (95 %, 189 % and 497 %) in Lower Egypt cultivars, in the same respective.

The increases of proline concentrations in salt-stressed leaves play as osmosis regulatory role as well as a protective function for enzyme in the cytoplasm by binding water to the proteins and thus maintained their hydration (Stewart and Lee, 1974). In addition, proline would be a good storage of nitrogen because of its metabolic proximity having a ready conversion to glutamic acid, which is considered a key compound in nitrogen metabolism. Furthermore, the concentrations of proline to glutamic acid, 2 equivalents of NADPH are produced, making proline a readily available source of energy and reducing power. Proline is the most stable amino acid resisting oxidative acid hydrolysis to toxins and is the least inhibitory of cell growth among all amino acids (Delauney and Verma, 1993), because of these qualities it is accumulated in plants under drought or salinity conditions.

C- *Interaction*:

Data revealed that the interaction among varieties and salinity exerted a significantly effect on proline content in cotton leaves.

The level of proline was higher than the control plants of all tested cultivars under different levels of salinity. The increase percentages of proline concentrations were observed in Giza 80 (78.29 % and 416 %) under 4000 ppm and 8000 ppm respectively and (627 %) in Giza 83 under 12000 ppm for Upper Egypt cultivars, while the lowest values were observed in Giza 90 (66.19 % and 47.8 %) under 4000 ppm and 12000 ppm respectively and under 8000 ppm it was (174 %) in Giza 91 cultivar. With respect to Lower Egypt cultivars, the highest percentages (110 % and 194 %) were recorded in Giza 45 for 4000 ppm and 8000 ppm, respectively while, under 12000 ppm, this value was (520 %) in Giza 88 cultivar. On the other hand, the lowest values were observed in Giza 70 (64.8 %) under 4000 ppm and Giza 86 (171 % and 481 %) under 8000 ppm and 12000 ppm, respectively. Results reviewed by Badran (2006) supported these obtained results.

Table (7): Effect of different levels of saline water irrigation on chemical constituents of cotton leaves and seeds (Lower Egypt cultivars).

Var. (A)	Treat. (B)	Chl. A	Chl. B	Total chlorophyll	Carotene	Total soluble sugar mg/gm	Reducing sugar mg/gm	Proline	Oil %	Protein %
Giza 45	Cont.	3.60	2.12	5.72	0.25	27.62	19.87	3.40	20.77	25.88
	4000	3.82	2.20	6.02	0.29	23.57	16.80	7.17	20.13	25.78
	8000	3.89	3.12	7.01	0.35	19.37	13.04	10.00	18.02	21.88
	12000	5.48	3.94	9.42	0.62	11.43	6.63	20.93	16.80	18.78
	Mean	**4.20**	**2.84**	**7.04**	**0.38**	**20.49**	**14.09**	**10.37**	**18.93**	**23.08**
Giza 70	Cont.	3.47	2.00	5.47	0.24	24.76	18.67	3.10	18.73	25.63
	4000	3.53	2.29	5.82	0.29	20.40	14.33	5.11	17.70	25.00
	8000	4.04	2.66	6.70	0.33	14.10	9.30	9.00	16.58	21.88
	12000	4.78	3.25	8.03	0.68	6.10	4.10	18.40	16.31	18.59
	Mean	**3.96**	**2.55**	**6.50**	**0.38**	**16.34**	**11.60**	**8.90**	**17.33**	**22.78**
Giza 85	Cont.	3.59	1.35	4.94	0.19	26.24	18.94	3.09	21.82	25.88
	4000	3.93	1.63	5.56	0.35	21.20	15.10	5.94	19.41	21.88
	8000	4.03	2.62	6.65	0.48	16.97	12.70	9.03	16.37	19.85
	12000	4.68	3.60	8.28	0.65	6.95	6.10	19.08	15.60	18.00
	Mean	**4.06**	**2.30**	**6.36**	**0.42**	**17.59**	**13.46**	**9.30**	**18.30**	**21.40**
Giza 88	Cont.	3.46	1.83	5.29	0.23	27.08	19.96	3.40	20.40	21.88
	4000	3.93	2.51	6.44	0.31	22.73	17.00	7.07	18.73	21.50
	8000	4.10	2.95	7.05	0.36	18.37	11.87	9.93	16.83	21.21
	12000	4.90	3.69	8.59	0.54	9.00	6.77	19.07	16.48	18.75
	Mean	**4.29**	**2.76**	**6.84**	**0.36**	**19.29**	**13.90**	**9.86**	**18.11**	**20.84**
Giza 86	Cont.	3.59	1.37	4.96	0.22	29.17	19.40	3.17	19.55	25.00
	4000	3.71	1.58	5.29	0.25	23.60	14.97	6.08	18.78	21.28
	8000	3.93	2.82	6.75	0.45	16.70	9.99	8.60	17.81	18.88
	12000	4.70	3.62	8.32	0.52	9.10	4.43	18.43	16.79	18.75
	Mean	**3.98**	**2.35**	**6.33**	**0.36**	**17.14**	**12.20**	**9.07**	**18.23**	**20.98**
Giza 89	Cont.	3.44	1.38	4.82	0.21	2869	19.34	3.14	20.27	25.79
	4000	3.56	2.33	5.89	0.42	22.30	16.23	6.33	19.00	25.00
	8000	3.97	3.20	7.17	0.46	17.30	11.97	9.21	16.63	21.36
	12000	4.39	3.38	7.77	0.64	7.20	6.50	19.11	15.99	18.75
	Mean	**3.84**	**2.57**	**6.41**	**0.43**	**18.87**	**13.51**	**9.44**	**17.97**	**22.73**
A-B	Cont.	3.52	1.68	2.20	0.22	27.26	19.36	3.21	20.26	25.01
	4000	3.84	2.00	5.84	0.32	22.30	15.73	6.28	18.96	23.41
	8000	4.59	2.08	6.67	0.40	17.14	11.97	9.24	17.04	20.84
	12000	4.82	3.58	8.40	0.61	8.29	5.75	19.17	16.33	18.60
L.S.D.	(A)	**0.17**	**0.07**	**0.21**	**0.06**	**0.41**	**0.15**	**0.22**	**1.18**	**0.26**
	(B)	**0.21**	**0.08**	**0.29**	**0.06**	**0.29**	**0.12**	**0.12**	**0.96**	**0.18**
	A x B	**0.35**	**0.15**	**0.50**	**0.10**	**0.70**	**0.29**	**0.30**	**1.40**	**0.27**

4- Oil percentage:

A- *Cultivars*:

Data in tables (6 and 7) indicate that the cultivars differed in their oil contents in cotton seeds. The differences in oil content among cultivars may be due to the differences in morphological and physiological characters and their interactions with the environmental conditions prevailing during their growth. The highest values were observed in Giza 80 and Giza 45 compared to other varieties. The differences among cotton cultivars were reported by

Ahmed (1984), Salem *et al*. (1993) and Alia (1997), who found that varieties differed considerably in oil and protein contents but the variation in oil content was much larger.

B- *Salinity*:

Tables (6 and 7) illustrated that salinity levels tended to have a significant effect on oil content. In general, salinity of irrigation tended to have a slight decrease in oil percentages under the lower level of salinity then the increase of reduction percentage under the high level of salinity 8000 ppm and 12000 ppm compared to the control plants. Under the levels 4000 ppm, 8000 ppm and 12000 ppm the reduction percentages were (7.75 %, 13.39 % and 14.86 %) in Upper Egypt cultivars and (8.09 %, 15.89 % and 19.39 %) in Lower Egypt cultivars. In this respect, Ahmed (1994), recorded that salinity treatments decreased oil contents of cotton seeds.

C- *Interaction*:

It is clear to notice in Tables (6 and 7) that the interactions between cultivars and salinity levels were significantly affected in oil contents in all cultivars of cotton seeds.

Under the low level of salinity 4000 ppm, the lowest values of reduction was observed in Giza 83 (3.45 %) while, under 8000 ppm and 12000 ppm, the lowest values were (8.64 % and 9.25 %) respectively in plants of Giza 80 grown in Upper Egypt. However, in cultivars grown in Lower Egypt, the lowest percentage of reduction was observed in Giza 45 (3.1 %) under 4000 ppm, (8.9 %) in Giza 86 under 8000 ppm and (12.9 %) in Giza 70 under 12000 ppm.

5- Protein percentage:

***A- Cultivars*:**

The previous results in Tables (6 and 7) indicated that the cultivars differed in their protein contents in cotton seeds. The cultivars Giza 80 and Giza 83 had the same trend and highest values (21.13 %) of protein contents in cultivars grown in Upper Egypt, while in Lower Egypt cultivars, the highest percentage was observed in Giza 45 (23.08 %). The differences among cotton cultivars were reported by several investigators, i.e., Ahmed (1984), Salem *et al*. (1993) and Alia (1997).

B- *Salinity*:

Salinity of irrigation water tended to reduce significantly the protein contents in all cultivars under this investigation. The data show that the decrease in protein contents in plants grown in Upper Egypt was more than the reduction in Lower Egypt cultivars especially under lower level of salinity while, this percentage was the same under the high level of salinity, this may be due to the climate factors. Under salinity levels of 4000 ppm, 8000 ppm and 12000 ppm the reduction percentages were (15.5 %, 24 % and 25 %), respectively in plants of Upper Egypt cultivars, while in Lower Egypt cultivars, the reduction percentages were (3 %, 17.7 % and 25 %), in the same respective.

C- *Interaction*:

The interaction between cultivars and salinity in protein contents was significantly observed. The lowest values of reductions were observed in Giza 80 and Giza 91 cultivars (12.48 %) under 4000 ppm, (20.24 % and 21.12 %)

in Giza 90 under 8000 ppm and 12000 ppm in Upper Egypt cultivars. While in Lower Egypt cultivars, these percentage were (0.38 %) in Giza 45 under 4000 ppm, (3.06 % and 14.31 %) in Giza 88 cultivar under 8000 ppm and 12000 ppm, respectively.

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تأثير الرى بالماء المالح على بعض أصناف القطن المصرى.

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أجريت تجربتان فى الأصص بمحطة التجارب الزراعية بمركز البحوث الزراعية بالجيزه وذلك لدراسة أثر الرى بالماء المالح على النمو والمحصول ومكوناته ، بالأضافة إلى محتوى النبات من الصبغات والسكريات والبرولين فى الأوراق ، والنسبة المئوية للزيت والبروتين فى البذرة. وشملت هذه الدراسة على بعض أصناف القطن المصرى وهى جـ ٨٠ ، جـ ٨٣ ، جـ ٩٠ ، جـ ٩١ (من أصناف الوجه القبلى) ، جـ ٤٥ ، جـ ٧٠ ، جـ ٨٥ ، جـ ٨٨ ، جـ ٨٦ وجـ ٨٩ (من أصناف الوجه البحرى) خلال موسمى ٢٠٠٥ – ٢٠٠٦. وتم رى النباتات بمحلول ملحى من كلوريد الصوديوم بتركيزات ٤٠٠٠ ، ٨٠٠٠ ، ١٢٠٠٠ جزء فى المليون بعد مرور ٥٠ يوم من الزراعة بالتبادل مع الرة بالمياة العادية حتى نهاية الموسك ، أما معاملة الكنترول فقد تم ريها بالمياه العادية خلال موسم النمو بأكمله

وقد كانت النتائج المتحصل عليها كالتالى:

1. وجد أختلاف بين الأصناف نتيجة الرى بالماء المالح.
2. أدى الرى بالماء المالح إلى نقص فى مساحة الورق والوزن الجاف للساق والجذر والآوراق ، وأيضاً أدت الملوحة إلى نقص فى عدد الأزهار واللوز ومتوسط وزن اللوزة ، وكذلك وزن ١٠٠ بذرة ومحصول النبات بالجرام.
3. أدت الملوحة إلى نقص محتوى الأوراق من السكريات الذائبة الكلية والسكريات المختزلة فى الأوراق ، وحدث العكس بالنسبة للصبغات النباتية والبرولين. وكذلك أدت الملوحة إلى نقص فالنسبة المئوية لزيت والبروتين فى البذرة.
4. كان أكثر المكونات الكيميائية تأثراً بالملوحة هو نسبة البرولين فى الأوراق ، حيث حدث بها زيادة واضحة وسجلت أغلى نسبة زيادة فى صنفى جيزة ٨٠ و جيزة ٤٥ ، وأدى ذلك إلى زيادة فى كمية المحصول ومكوناته فى هذين الصنفين تحت الظروف الملحية ، ولذلك يجب على المربى إنتخاب السلالات التى تحتوى على نسبة عالية من البرولين ، وذلك للحصول على نباتات أكثر نحملاً للملوحة.

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Table (2) : Effect of different levels of salinity irrigation water on growth parameter of some cotton cultivars planting in Upper Egypt.

Var. (A)	Tre. (B)	Plant height (Cm)		No. of Internodes		Inter-node Length (Cm)		No. of fruiting branches		Leaf area $(Cm)^2$		Dry weight: Stem and branch		Dry weight: Roots		Dry weight: Leaves		Total plant	
		2005	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**
Giza 80	**Cont.**	32.00	31.70	15.33	15.03	2.08	2.11	8.33	8.30	644	631	6.40	5.16	5.74	6.20	7.90	7.93	20.03	19.29
	4000	30.00	27.30	13.00	14.00	2.30	1.95	5.67	5.60	486	465	4.97	4.74	4.41	4.17	6.40	5.95	15.78	14.85
	8000	24.00	21.30	10.00	12.02	2.40	1.77	4.33	4.32	310	304	2.83	2.87	3.12	2.82	3.97	4.21	9.92	9.89
	12000	19.00	14.00	8.67	10.11	2.19	1.61	3.00	3.20	147	191	2.42	1.63	2.60	0.88	3.13	3.23	7.61	5.75
	Mean	**26.25**	**23.60**	**11.75**	**12.79**	**2.24**	**1.86**	**5.33**	**5.11**	**396**	**385**	**3.91**	**3.60**	**3.83**	**4.85**	**5.35**	**5.33**	**12.34**	**12.44**
Giza 83	**Cont.**	45.00	38.00	17.67	15.02	2.54	2.53	8.33	8.04	699	626	3.56	4.29	3.13	3.56	8.61	8.51	19.47	16.36
	4000	26.67	24.00	13.33	12.12	2.00	1.98	3.3	5.04	489	487	3.20	4.16	2.75	2.63	7.13	6.18	14.08	11.97
	8000	21.33	21.30	10.67	11.03	1.99	1.93	3.67	3.40	300	308	2.14	2.02	2.55	2.02	3.51	3.20	8.20	8.91
	12000	15.00	13.00	9.67	10.10	1.55	1.29	3.33	3.22	117	197	2.43	0.78	2.44	0.84	2.13	2.27	7.04	5.12
	Mean	**27.00**	**24.00**	**12.83**	**12.06**	**2.02**	**1.93**	**4.66**	**4.93**	**376**	**405**	**2.83**	**2.81**	**2.72**	**2.26**	**5.34**	**5.04**	**12.14**	**10.59**
Giza 90	**Cont.**	41.00	35.70	16.00	18.00	2.56	1.98	8.33	7.92	600	598	5.02	6.03	4.59	4.27	6.89	7.34	16.50	17.64
	4000	30.67	22.00	13.00	11.70	2.35	1.88	4.00	4.00	415	400	1.78	3.34	3.69	1.91	3.08	3.08	8.55	8.33
	8000	16.67	16.70	9.67	9.09	1.72	1.83	3.67	3.90	334	298	1.76	1.33	2.39	1.53	2.26	2.67	6.42	5.53
	12000	13.33	14.00	8.00	8.08	1.66	1.73	2.33	2.80	149	155	1.44	1.01	1.54	1.09	2.34	2.50	5.32	4.60
	Mean	**25.42**	**22.10**	**11.67**	**11.72**	**2.07**	**1.85**	**4.58**	**4.66**	**374**	**363**	**2.50**	**2.93**	**3.05**	**2.20**	**3.64**	**3.80**	**9.19**	**9.07**
Giza 91	**Cont.**	38.00	37.00	18.00	14.09	2.11	2.62	7.67	7.46	580	534	3.97	3.82	4.88	3.99	6.45	7.92	15.30	15.72
	4000	26.67	29.70	12.00	12.00	2.22	2.47	4.67	5.00	416	390	3.94	3.34	2.09	3.51	5.79	5.12	10.82	10.09
	8000	21.00	27.70	11.00	11.02	1.91	2.51	4.33	4.00	203	296	3.25	2.30	2.00	3.01	2.43	3.59	7.68	7.23
	12000	18.67	15.00	9.67	9.03	1.93	1.66	2.67	2.80	113	158	2.08	0.96	1.45	1.68	2.36	2.48	5.98	3.90
	Mean	**26.08**	**27.30**	**12.67**	**11.54**	**2.04**	**2.31**	**4.83**	**4.82**	**328**	**348**	**3.68**	**2.61**	**2.61**	**3.05**	**4.28**	**4.77**	**9.94**	**9.24**
(B)	**Cont.**	39.00	35.60	16.75	16.01	2.32	2.22	7.42	7.93	630.7	597.5	4.73	4.83	4.59	4.51	7.94	7.92	17.83	17.25
	4000	28.50	25.80	12.83	12.03	2.24	2.14	4.42	4.91	451.5	435.5	3.47	3.14	3.24	3.06	5.59	5.08	12.31	11.31
	8000	20.75	21.80	10.25	11.04	2.02	1.97	4.00	3.90	286.8	302.3	2.49	1.88	2.52	2.35	3.80	3.41	8.06	7.39
	12000	16.50	14.50	9.08	9.09	1.80	1.59	2.83	3.00	131.5	175.6	1.84	0.85	1.87	1.12	2.49	2.62	6.49	4.84
L.S.D.	(A)	**N.s.**	**4.3**	**N.S.**	**1.10**	**0.25**	**3.91**	**0.4**	**0.9**	**46**	**44.1**	**0.8**	**N.S.**	**0.5**	**0.7**	**0.6**	**0.71**		
	(B)	**2.4**	**3.8**	**1.3**	**0.95**	**0.24**	**4.00**	**0.7**	**0.8**	**56**	**59.5**	**0.5**	**0.83**	**0.4**	**0.8**	**0.6**	**1.03**		
	A x B	**N.S**	**5.5**	**N.S.**	**1.09**	**0.35**	**2.88**	**N.S.**	**1.6**	**100**	**93.1**	**1.2**	**N.S.**	**1.2**	**1.5**	**1.2**	**1.47**		

Table (4) : Effect of different levels of saline irrigation water on growth parameter of some cotton cultivars planting in Lower Egypt.

Var. (A)	Tre. (B)	Plant height (Cm)		No. of Internodes		Inter-node Length (Cm)		No. of fruiting branches		Leaf area (Cm)		Dry weight (gm) stem and branchs		Dry weight (gm) Roots		Dry weight (gm) Leaves		Total plant	
		2005	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**
Giza 45	**Cont.**	58.7	50.0	20.6	19.3	2..8	2.6	9.3	7.3	843	897	6.8	5.8	4.9	3.7	8.4	8.2	20.2	17.8
	4000	33.7	30.0	16.7	16.0	2.0	1.9	8.0	4.7	665	525	5.5	3.6	4.3	2.9	6.9	6.8	16.7	13.3
	8000	26.3	28.0	13.1	15.0	2.0	1.9	4.0	3.7	465	380	4.9	2.7	2.9	2.6	3.5	5.1	11.3	10.5
	12000	25.3	24.0	11.0	12.3	2.3	1.9	3.3	3.3	250	201	4.0	1.9	1.3	2.4	3.1	2.1	8.4	6.5
	Mean	**36.0**	**33.0**	**15.2**	**15.6**	**2.3**	**2.1**	**6.2**	**4.8**	**555.7**	**500.7**	**5.3**	**3.5**	**3.4**	**2.9**	**5.5**	**5.6**	**14.2**	**12.2**
Giza 70	**Cont.**	37.3	40.0	16.0	17.7	2.3	2.3	6.0	7.0	587	600	4.4	4.3	2.9	3.6	4.8	6.4	12.2	14.3
	4000	31.7	31.0	18.0	13.7	2.4	2.3	4.7	4.0	391	415	2.6	3.7	2.1	2.7	3.5	4.0	8.1	10.4
	8000	18.3	23.0	10.7	12.0	1.7	1.9	4.0	3.7	352	334	2.1	2.3	1.6	1.3	3.9	2.8	7.6	6.4
	12000	16.7	16.0	10.0	10.7	1.6	1.6	3.3	2.3	232	149	2.0	1.2	2.4	0.9	3.5	1.3	7.9	3.4
	Mean	**26.0**	**28.0**	**12.4**	**13.5**	**2.0**	**2.0**	**4.5**	**4.3**	**390.5**	**374.5**	**2.8**	**2.9**	**2.3**	**2.1**	**3.9**	**3.7**	**8.9**	**8.6**
Giza 85	**Cont.**	44.3	43.0	17.0	15.3	2.6	2.8	2.7	7.0	591	686	5.1	6.8	4.3	5.5	6.4	2.6	15.7	15.0
	4000	28.7	26.0	13.0	10.7	2.7	2.4	5.0	3.7	480	363	2.6	2.2	3.4	2.3	5.7	3.0	11.7	7.4
	8000	19.7	20.0	8.3	10.0	2.3	2.0	3.7	2.7	324	280	2.3	1.7	2.6	2.3	4.1	2.0	9.1	5.9
	12000	17.6	18.0	8.3	9.3	2.1	1.8	2.7	2.3	220	277	1.4	1.3	1.6	1.6	3.0	1.5	6.0	4.5
	Mean	**27.4**	**27.0**	**11.7**	**11.3**	**2.4**	**2.3**	**5.0**	**3.9**	**403.7**	**401.5**	**2.8**	**3.0**	**3.0**	**2.9**	**4.8**	**2.3**	**10.6**	**8.2**
Giza 88	**Cont.**	43.3	42.0	18.0	17.7	2.4	2.4	7.0	8.7	829	785	5.1	7.0	4.4	5.4	7.1	7.7	16.6	20.1
	4000	33.0	28.0	13.3	13.0	2.4	2.2	4.0	4.3	616	692	3.9	3.7	3.9	3.1	6.3	6.1	14.1	12.8
	8000	26.3	23.0	12.3	12.3	2.1	1.9	3.7	3.0	609	390	3.6	2.4	3.3	2.4	5.0	2.2	11.9	6.9
	12000	19.7	17.0	11.3	9.7	1.8	1.7	2.7	2.3	302	280	3.0	1.1	2.5	2.1	4.1	2.3	9.6	5.6
	Mean	**30.6**	**28.0**	**13.7**	**13.2**	**2.2**	**2.1**	**4.3**	**4.6**	**589.0**	**536.7**	**3.9**	**3.6**	**3.5**	**3.3**	**5.6**	**4.6**	**13.1**	**11.4**
Giza 86	**Cont.**	42.0	38.0	18.0	14.0	2.3	2.7	7.3	5.3	823	785	4.8	4.1	4.8	4.9	8.5	4.5	18.0	13.4
	4000	29.7	22.0	13.3	12.0	2.2	1.8	4.0	3.7	558	508	4.1	3.1	3.8	2.9	5.6	4.3	13.6	10.3
	8000	21.0	19.0	12.3	11.3	1.7	1.7	3.3	3.0	441	246	2.3	2.4	2.6	2.4	4.2	3.1	9.1	7.8
	12000	20.0	17.0	11.8	9.7	1.7	1.7	2.3	3.0	205	201	1.9	2.0	2.2	2.2	2.3	2.0	6.5	6.2
	Mean	**28.2**	**24.0**	**13.8**	**11.8**	**1.9**	**1.9**	**4.3**	**3.9**	**506.7**	**435**	**3.3**	**2.9**	**3.3**	**3.1**	**5.2**	**3.5**	**11.8**	**9.4**
Giza 89	**Cont.**	46.0	39.0	15.7	15.0	2.9	2.6	9.7	5.7	683	605	4.9	6.3	4.2	4.4	6.0	7.5	15.1	18.2
	4000	34.7	28.0	13.0	11.3	2.6	2.5	4.7	4.0	552	480	3.2	3.6	2.9	2.8	5.8	4.5	12..0	10.9
	8000	29.3	18.0	11.0	9.3	2.6	2.0	3.3	2.0	323	310	2.3	1.7	2.5	2.4	2.8	2.5	7.6	6.6
	12000	17.7	17.0	8.0	8.7	2.2	1.9	2.7	1.7	250	205	1.8	1.0	1.8	2.2	2.2	1.6	5.8	4.9
	Mean	**31.9**	**26.0**	**11.9**	**11.1**	**2.6**	**2.3**	**5.1**	**3.3**	**452**	**400**	**3.1**	**3.2**	**2.9**	**2.9**	**4.2**	**4.0**	**10.1**	**10.1**
A-B	**Cont.**	45.3	42.0	17.5	16.5	2.6	2.6	8.0	6.8	726.0	726.3	5.2	5.7	4.3	4.6	6.9	5.6	16.3	16.5
	4000	31.9	27.5	13.7	12.8	2.4	2.2	5.1	4.1	543.7	497.2	3.7	3.3	3.4	2.8	5.6	4.8	12.7	10.9
	8000	23.5	21.8	11.3	11.6	2.1	1.9	3.7	3.0	499.0	323.3	2.9	2.2	2.6	2.2	3.9	2.9	9.4	7.4
	12000	19.5	18.2	10.0	10.1	1.9	1.8	2.8	2.5	243.2	218.8	2.4	1.4	2.0	1.9	3.0	1.8	7.4	5.2
L.S.D.	(A)	2.9	4.8	1.1	1.2	N.S.	N.S.	1.1	1.4	44.1	89.2	0.84	N.S.	0.3	0.9	0.5	N.S.		
	(B)	2.6	3.0	0.7	1.0	0.1	0.3	0.6	0.8	59.3	90.2	0.26	0.4	0.3	0.8	0.7	1.0		
	A x B	6.5	N.S.	1.7	2.0	N.S.	N.S.	1.5	2.0	97.3	14.8	0.63	2.3	0.8	1.3	1.1	1.8		