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# ROLE OF SOME PLANT ANTIOXIDANTS IN ALLEVIATING SOIL SALINITY STRESS IN WHEAT PLANT .

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## ABSTRACT

A field experiment was carried out to investigate the role of some plant antioxidant materials such as Ascorbic, Glutathion, α-Tocopherol, Spermine in alleviating the harmful effects caused by soil salinity levels (2000,3000 and 5000mg/l) in wheat plant. The grain were pre-soaked then the plants sprayed with any of antioxidants used. It could be concluded that soil salinity stress especially high levels depressed all of growth parameters and yield coponents. The data also concluded that the different applied antioxidants could partially alleviate the harmful effect of salinity stress on growth and yield of wheat plant.

## INTRODUCTION

Soil salinity is one of the major abiotic stresses affecting germination, crop growth and productivity. Crop yields start declining when pH of the soil solution exceeds 8.5 or ECe value goes above 4 dS $m^{-1}$. At higher ECe values the crop yields are reduced so drastically that crop cultivation is not economical without soil amendments. Addition of salts to water lowers its osmotic potential, resulting in decreased availability of water to root cells. Salt stress thus exposes the plant to secondary osmotic stress, which implies that all the physiological responses, which are invoked by drought stress, can also be observed in salt stress.

Sakr, (1996), indicated that salinity suppressed both cell division and cell enlargement proportionally in wheat plants. The reduction in plant growth under salinization may be also due to regulation between the endogenous Phytohormones present in the plants. ( Ozdemir *et al.* 2004).

In addition, the inhibitory effect of salinity on growth may be due to decrease in water absorption, metabolic processes, merestematic activity and/or cell enlargement (Khadr, *et al,* 1994). Moreover the decrease in growth due to salinity may be attributed to an increase in respiration rate resulting from higher energy requirements ( Yang, *et al.* (1990) reported that there are two ways that salinity could retard growth( a) by damaging growth cells so that they can not perform their functions or ( b-) by limiting their supply of essential metabolites, the reduction in plant growth under salinization may be also due to the regulation between the endogenous growth substances presented in the seedlings( Sakr, (1996). Regarding seedling fresh weight El-Bahrany, (1994) attributed the depressing effects of salinity on plant growth to an inhibition on protein turnover and nucleic acid synthesis in plants.

Regarding the effect of antioxidant on wheat under salinity stress ;it could be mention that, exogenous ascorbic acid had an inhibitory effect on lipid peroxidation in some plants seedlings exposed to osmotically induced

water-stress . Ascorbate may also be involved in regulation the cell cycle (Kerk and Feldman 1995).

(Noctor and Foyer (1998), found that ascorbic acid acts directly to neutralize superoxide radicals, singlet oxygen or superoxide and as a secondary anti-oxidant during reductive recycling of the oxidized form of α-tocopherol, another lipophilic anti-oxidant molecule . There appear to have been no quantitative investigations of the effects of an additional supply of ascorbic acid on plant resistance to severe salt stress.

As for polyamines ;Smith, (1975), have established that specific role of polyamines in maintaining a cation-anion balance in plant tissues. The reported data suggest that polyamines may contribute to the osmotic and excess ion adaptation by maintaining a proper cation-anion balance and by stabilizing membranes at high external salinity.

Broetto *et al.* (1999), suggested that polyamines play an important role in the growth and development of the cells. They also concluded that polyamine metabolism appear to be an important biochemical marker of tolerance to salinity in several plant species. Among the early markers, polyamines have an essential role in the control of cell division and elongation, cell differentiation and morphogenesis(Cvikrova *et al.* 1999). This investigation aimed to study the role of some plant antioxidants in alleviating the harmfull effect of salinity stress levels on wheat plant.

## MATERIALS AND METHODS

Field experiments were conducted during 2006/2007 winter season at Tag El-Ezz research station, Dakahlia Governorate, Egypt. The field experiments aimed to study the effect of plant antioxidant materials on growth and yield of wheat plant under soil salinity stress levels. We selected three field areas differ in its salinity level in three selective different positions:

First field area had low salinity level (4.1 m mohs = 2624 mg/l). Second field area had moderate salinity level (5.2 m mohs = 3328 mg/l).

Field area had high salinity level (7.2 m mohs = 4608 mg/l).

Wheat plant grains were soaked for 6 hours and the plants were sprayed three times with either of antioxidant materials (which used in presoaking) at 30, 60 and 90 days after sawing.

**Antioxidant materials used were:**Tap water., Ascorbic acid (100 mg/l), Glutathione (reduced) (100 mg/l).,α–Tocopherol (50 mg/l).,spermine(10 mg/l).

This experiment contains 3 salinity levels and 5 antioxidant materials. Each treatment replicated 3 times. The nursery seed bed was well prepared. Phosphorus in the form of calcium superphosphate (15.5% $P_2O_5$) at the rate 100 kg/fed was applied on the air dried soil before ploughing then nursery was fertilized with nitrogen in the form of urea (46.5% N) at the rate of 150 kg/fed as documented. All the normal culture practices of growing wheat plants were applied as usual manner followed by the farmer in the distinct.

Mechanical and chemical analysis as well as salinity level of the experiment field was determined. Three samples were taken through the experimental period at the different physiological stages (45,75 and 105 days

after sowing) to investigate growth parameters. Yield and its components were also determined.

**Statistical analysis:**

The dates of all experiments were statistically analyzed as technique of the analysis of variance (ANOVA) according to Gomez and Gomez (1984). The treatment means were compared using the least significant differences (LSD).

## RESULTS

**Growth :**

Data in tables (1,2,3,4,5,6 and 7 ) show the effect of salinity levels and antioxidants as well as their combinations on plant height, stem fresh weight, leaves fresh weight, stem dry weight, leaves dry weight, tillers number and flag leaf area.

**Table (1):- Effect of soil salinity levels and antioxidant materials as well as their combinations on plant height (cm/plant) of wheat plant through out the different physiological stages (45, 75,105 days from sowing for season 2006/2007).**

| Treatments | 1st sampling date (45 days from sowing) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 34.0 | 33.0 | 28.0 | 31.7 |
| Ascorbic (100) | 35.0 | 34.7 | 29.3 | 33.0 |
| Glutathion (100) | 36.3 | 33.0 | 30.0 | 33.7 |
| Tocopherol ( 50) | 38.7 | 36.7 | 35.3 | 36.9 |
| Spermine ( 10) | 34.7 | 33.3 | 29.3 | 32.4 |
| Mean | 35.7 | 34.5 | 30.4 | 33.5 |
| LSD 5% | Salinity = 1.25 &antioxidant = 1.62&combinatio=2.80 | | | |
| | 2nd sampling date (75 days from sowing) | | | |
| Control (0.00) | 47.7 | 40.7 | 38.3 | 42.2 |
| Ascorbic (100) | 51.3 | 46.0 | 41.0 | 46.1 |
| Glutathion (100) | 49.3 | 45.3 | 40.0 | 44.9 |
| Tocopherol ( 50) | 48.3 | 43.3 | 39.3 | 43.6 |
| Spermine ( 10) | 55.7 | 55.3 | 43.0 | 51.3 |
| Mean | 50.5 | 46.1 | 40.3 | 45.6 |
| LSD 5% | Salinity = 1.15 &antioxidant = 1.49 &combinatio=2.57 | | | |
| | 3rd sampling date (105 days from sowing) | | | |
| Control (0.00) | 105.0 | 90.3 | 86.0 | 93.8 |
| Ascorbic (100) | 105.3 | 95.0 | 90.3 | 96.9 |
| Glutathion (100) | 112.0 | 99.0 | 87.0 | 99.3 |
| Tocopherol ( 50) | 109.0 | 94.0 | 90.0 | 97.7 |
| Spermine ( 10) | 108.0 | 92.0 | 88.0 | 96.0 |
| Mean | 107.9 | 94.1 | 88.3 | 96.7 |
| LSD 5% | Salinity =0.87 &antioxidant = 1.12 &combinatio=1.93 | | | |

The data in tables (1--7) show that any antioxidants used ( Ascorbic, Glutathion, Tocopherol or Spermine ) increased plant height ,stem and leaves

fresh and dry weights ( at the different physiological stages (45,75 and 105days from sowing).

**Table (2):- Effect of soil salinity levels and antioxidant materials as well as their combinations on stem fresh weight(gm/ plant ) of wheat plant through out the different physiological stages (45, 75,105 days from sowing for season 2006/2007).**

| Treatments | 1st sampling date (45 days from sowing) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 0.9 | 0.8 | 0.6 | 0.7 |
| Ascorbic (100) | 1.1 | 0.8 | 0.6 | 0.8 |
| Glutathion (100) | 2.5 | 0.9 | 0.6 | 1.0 |
| Tocopherol ( 50) | 1.1 | 1.0 | 0.9 | 1.0 |
| Spermine ( 10) | 2.0 | 0.9 | 0.7 | 0.9 |
| Mean | 1.1 | 0.8 | 0.7 | 0.9 |
| LSD 5% | Salinity = 0.07&antioxidant = 0.09&combination=0.15 | | | |
| | 2nd sampling date (75 days from sowing) | | | |
| Control (0.00) | 32.4 | 22.5 | 16.0 | 23.6 |
| Ascorbic (100) | 37.0 | 24.7 | 17.7 | 26.5 |
| Glutathion (100) | 33.1 | 26.1 | 19.8 | 26.3 |
| Tocopherol ( 50) | 41.4 | 25.8 | 17.0 | 28.1 |
| Spermine ( 10) | 49.3 | 25.3 | 18.3 | 31.0 |
| Mean | 38.6 | 24.9 | 17.8 | 27.1 |
| LSD 5% | Salinity =0.51 &antioxidant =0.66 &combination=1.15 | | | |
| | 3rd sampling date (105 days from sowing) | | | |
| Control (0.00) | 41.4 | 36.6 | 28.2 | 35.4 |
| Ascorbic (100) | 51.2 | 36.8 | 34.3 | 40.8 |
| Glutathion (100) | 52.8 | 40.2 | 30.0 | 41.0 |
| Tocopherol ( 50) | 56.0 | 36.9 | 31.4 | 41.4 |
| Spermine ( 10) | 53.1 | 38.4 | 30.0 | 40.5 |
| Mean | 50.9 | 37.8 | 30.8 | 39.8 |
| LSD 5% | Salinity =0.79&antioxidant =1.02 &combination =1.77 | | | |

In addition, tillers number as well as flag leaf area were also increased (at the age of 105 days from sowing ) .

In contrast high soil salinity levels 3300 and 4600 mg/l decreased all previous growth parameters compared with the low soil salinity stress level (2600 mg/l) .

Data in tables (1---7) also show that any of anti -oxidants used combined with high soil salinity 3300 mg/l or 4600 mg/l decreased plant height especially in last sampling date .

These treatments also decreased stem and leaves fresh weight in the last two sampling dates as well as tillers number and flag leaf area in age of 105 days from sowing .In addition the combination of any antioxidant with the soil salinity level (4600 mg/l) decreased stem and leaves dry matter in the different physiological stages .

It could by mention that the different antioxidants can partially alleviate the harmful effect of high soil salinity on growth parameters of wheat plant .

**Yield and its components :**

Data in tables (8--12) showed the effect of soil salinity levels and antioxidant used (Ascorbic ,Glutathion ,Tocopherol or Spermine) as well as their combinations on yield and its components of wheat plant such as spike length, spikes number/$m^2$, spikelets number/spike, spike weight, number of grains/spike, spike weight, grain yield (ton/fed), 1000 grain weight and straw yield (ton/fed).

**Table (3):- Effect of soil salinity levels and antioxidant materials as well as their combinations on leaves fresh weight(gm/plant) of wheat plant through out the different physiological stages (45, 75,105 days from sowing for season 2006/2007).**

| Treatments | 1st sampling date (45 days from sowing) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 1.9 | 1.3 | 1.1 | 1.4 |
| Ascorbic (100) | 2.5 | 1.3 | 1.1 | 1.6 |
| Glutathion (100) | 2.4 | 1.7 | 1.5 | 1.9 |
| Tocopherol ( 50) | 2.5 | 1.8 | 1.6 | 2.0 |
| Spermine ( 10) | 2.0 | 1.6 | 1.5 | 1.7 |
| Mean | 2.3 | 1.5 | 1.4 | 1.7 |
| LSD 5% | Salinity =0.09 &antioxidant = 0.11&combination=0.19 | | | |
| | 2nd sampling date (75 days from sowing) | | | |
| Control (0.00) | 16.9 | 12.9 | 10.1 | 13.3 |
| Ascorbic (100) | 23.8 | 19.7 | 18.3 | 20.6 |
| Glutathion (100) | 19.3 | 14.8 | 12.6 | 15.6 |
| Tocopherol ( 50) | 27.3 | 19.3 | 15.8 | 20.8 |
| Spermine ( 10) | 25.5 | 22.8 | 15.0 | 21.1 |
| Mean | 22.6 | 17.9 | 14.4 | 18.3 |
| LSD 5% | Salinity =0.37 &antioxidant =0.46&combination=0.80 | | | |
| | 3rd sampling date (105 days from sowing) | | | |
| Control (0.00) | 34.4 | 23.1 | 18.5 | 25.3 |
| Ascorbic (100) | 36.4 | 24.5 | 22.8 | 27.9 |
| Glutathion (100) | 40.7 | 26.7 | 24.1 | 30.5 |
| Tocopherol ( 50) | 40.1 | 29.4 | 25.9 | 31.8 |
| Spermine ( 10) | 40.1 | 26.5 | 23.0 | 29.9 |
| Mean | 38.3 | 26.0 | 22.9 | 29.1 |
| LSD 5% | Salinity =0.48 &antioxidant =0.62&combination=1.07 | | | |

The data in tables (8---12) of the experimental field show tat all of antioxidants used increased the different yield and its components parameters. In contrast, soil salinity stress decreased yield and its components compared with the low soil salinity level (2600 mg/l).

Any of antioxidant used combined with the highest soil salinity stress decreased parameters of yield and its components except for grain yield/fed. compared with the low soil salinity level.

In addition the different antioxidants used combined with the moderate soil salinity level caused an increasing effect on grain yield/fed. when compared with the low soil salinity level.

It could be noticed that the different antioxidants used enhanced yield of wheat plant grown under soil salinity level. Also it could be concluded that the antioxidants can partially mitigate the harmful effect of soil salinity stress levels on yield and its components of wheat plant.

**Table (4):- Effect of soil salinity levels and antioxidant materials as well as their combinations on stem dry weight (gm/plant) of wheat plant through out the different physiological stages (45, 75,105 days from sowing for season 2006/2007).**

| **Treatments** | **1st sampling date (45 days from sowing)** | | | |
|---|---|---|---|---|
| **Salinity(mg/L)** / **Antioxidant (mg/L)** | **2600** | **3300** | **4600** | **Mean** |
| Control (0.00) | 0.23 | 0.19 | 0.12 | 0.18 |
| Ascorbic (100) | 0.31 | 0.23 | 0.16 | 0.23 |
| Glutathion (100) | 0.31 | 0.28 | 0.16 | 0.25 |
| Tocopherol ( 50) | 0.30 | 0.24 | 0.18 | 0.24 |
| Spermine ( 10) | 0.31 | 0.23 | 0.21 | 0.26 |
| Mean | 0.29 | 0.23 | 0.17 | 0.23 |
| LSD 5% | Salinity =0.02 &antioxidant =0.03&combination=0.05 | | | |
| | 2nd sampling date (75 days from sowing) | | | |
| Control (0.00) | 1.23 | 0.98 | 0.73 | 0.98 |
| Ascorbic (100) | 1.47 | 1.26 | 1.08 | 1.27 |
| Glutathion (100) | 1.31 | 1.21 | 1.08 | 1.20 |
| Tocopherol ( 50) | 1.56 | 1.11 | 1.08 | 1.25 |
| Spermine ( 10) | 1.60 | 1.33 | 1.06 | 1.33 |
| Mean | 1.97 | 1.16 | 0.89 | 1.21 |
| LSD 5% | Salinity =0.09 &antioxidant =0.11&combination=0.20 | | | |
| | 3rd sampling date (105 days from sowing) | | | |
| Control (0.00) | 3.63 | 2.37 | 2.04 | 2.68 |
| Ascorbic (100) | 4.34 | 3.53 | 2.37 | 3.41 |
| Glutathion (100) | 3.78 | 2.47 | 2.41 | 2.89 |
| Tocopherol ( 50) | 3.63 | 2.78 | 2.96 | 3.12 |
| Spermine ( 10) | 4.29 | 3.29 | 2.90 | 3.49 |
| Mean | 3.93 | 2.89 | 2.54 | 3.12 |
| LSD 5% | Salinity =0.10 &antioxidant =0.13&combination=0.23 | | | |

**Table (5):- Effect of soil salinity levels and antioxidant materials as well as their combinations on leaves dry weight (gm/ plant) of wheat plant through out the different physiological stages (45, 75,105 days from sowing for season 2006/2007).**

| Treatments | 1st sampling date (45 days from sowing) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 0.54 | 0.43 | 0.32 | 0.43 |
| Ascorbic (100) | 0.56 | 0.48 | 0.34 | 0.46 |
| Glutathion (100) | 0.69 | 0.49 | 0.37 | 0.52 |
| Tocopherol ( 50) | 0.56 | 0.48 | 0.36 | 0.47 |
| Spermine ( 10) | 0.64 | 0.47 | 0.30 | 0.50 |
| Mean | 0.60 | 0.47 | 0.36 | 0.48 |
| LSD 5% | Salinity = 0.02 &antioxidant=0.03&combination=0.05 | | | |
| | 2nd sampling date (75 days from sowing) | | | |
| Control (0.00) | 1.94 | 1.59 | 1.06 | 1.53 |
| Ascorbic (100) | 2.58 | 1.89 | 1.23 | 1.90 |
| Glutathion (100) | 2.90 | 1.80 | 1.21 | 1.97 |
| Tocopherol ( 50) | 2.13 | 1.76 | 1.40 | 1.76 |
| Spermine ( 10) | 2.38 | 1.73 | 1.28 | 1.80 |
| Mean | 2.39 | 1.75 | 1.24 | 1.79 |
| LSD 5% | Salinity = 0.07 &antioxidant =0.09&combination=0.16 | | | |
| | 3rd sampling date (105 days from sowing) | | | |
| Control (0.00) | 3.03 | 1.95 | 1.38 | 2.12 |
| Ascorbic (100) | 4.75 | 3.36 | 2.62 | 3.58 |
| Glutathion (100) | 3.78 | 2.59 | 2.04 | 2.80 |
| Tocopherol ( 50) | 3.63 | 2.45 | 2.22 | 2.77 |
| Spermine ( 10) | 4.37 | 3.45 | 2.05 | 3.29 |
| Mean | 3.91 | 2.76 | 2.06 | 2.91 |
| LSD 5% | Salinity =0.14 &antioxidant=0.18&combination=0.31 | | | |

**Table (6):- Effect of soil salinity levels and antioxidant materials as well as their combinations on number of tiller/$m^2$ of wheat plant at 105 days from sowing for 2007season.**

| Treatments | Number of tiller | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 383 | 308 | 262 | 318 |
| Ascorbic (100) | 440 | 380 | 286 | 369 |
| Glutathion (100) | 479 | 324 | 300 | 368 |
| Tocopherol ( 50) | 420 | 336 | 312 | 356 |
| Spermine ( 10) | 401 | 316 | 311 | 343 |
| Mean | 425 | 333 | 294 | 351 |
| LSD 5% | Salinity =2.32 &antioxidant =3.00&combination=5.19 | | | |

**Table (7):-Effect of soil salinity levels and antioxidant materials as well as their combinations on Flag leaf area(cm$^2$) of wheat plant during season 2006/2007.**

| Treatments | Flag leaf area(cm2) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 57.1 | 47.4 | 35.0 | 46.5 |
| Ascorbic (100) | 60.2 | 57.9 | 39.6 | 52.6 |
| Glutathion (100) | 60.6 | 51.3 | 40.7 | 50.9 |
| Tocopherol ( 50) | 67.3 | 53.3 | 43.2 | 54.6 |
| Spermine ( 10) | 67.7 | 54.2 | 44.4 | 55.4 |
| Mean | 62.6 | 52.8 | 40.6 | 52.0 |
| LSD 5% | Salinity =1.09 &antioxidant = 1.39&combination=2.41 | | | |

**Table (8):-Effect of soil salinity levels and antioxidant materials as well as their combinations on spike length(cm) of wheat plant during season 2006/2007).**

| Treatments | Spike length(cm) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 10.3 | 9.4 | 8.3 | 9.3 |
| Ascorbic (100) | 11.5 | 10.3 | 9.9 | 10.6 |
| Glutathion (100) | 12.8 | 10.4 | 9.0 | 10.7 |
| Tocopherol ( 50) | 12.2 | 10.0 | 9.5 | 10.6 |
| Spermine ( 10) | 12.5 | 10.9 | 10.0 | 11.1 |
| Mean | 11.9 | 10.2 | 9.3 | 10.5 |
| LSD 5% | Salinity = 0.14 &antioxidant=0.18&combination=0.31 | | | |

**Table (9):- Effect of soil salinity levels and antioxidant materials as well as their combinations on number of spikes/m$^2$ of wheat plant during season 2006/2007).**

| Treatments | Number of spikes/m2 | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 420 | 370 | 299 | 363 |
| Ascorbic (100) | 439 | 399 | 312 | 383 |
| Glutathion (100) | 479 | 383 | 319 | 394 |
| Tocopherol ( 50) | 430 | 384 | 319 | 378 |
| Spermine ( 10) | 399 | 374 | 319 | 364 |
| Mean | 433 | 382 | 314 | 376 |
| LSD 5% | Salinity=8.82&antioxidant=11.39&combination=19.72 | | | |

**Table (10):-Effect of soil salinity levels and antioxidant materials as well as their combinations on spikelets number/ spike, spike weight(gm/ spike) and number of grain/spike of wheat plant during season 2006/2007.**

| Treatments | Spikelets number/ spike | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 20 | 18 | 16 | 18 |
| Ascorbic (100) | 23 | 19 | 17 | 20 |
| Glutathion (100) | 25 | 19 | 18 | 21 |
| Tocopherol ( 50) | 24 | 19 | 18 | 20 |
| Spermine ( 10) | 25 | 21 | 20 | 22 |
| Mean | 23 | 19 | 18 | 20 |
| LSD 5% | Salinity =0.52 &antioxidant =0.67 &combination=1.16 | | | |
| | Spike weight(gm/ spike) | | | |
| Control (0.00) | 3.3 | 2.5 | 2.0 | 2.6 |
| Ascorbic (100) | 4.0 | 3.8 | 2.9 | 3.6 |
| Glutathion (100) | 4.6 | 3.7 | 2.5 | 3.6 |
| Tocopherol ( 50) | 4.3 | 3.4 | 2.7 | 3.5 |
| Spermine ( 10) | 4.0 | 3.5 | 2.4 | 3.3 |
| Mean | 4.0 | 3.4 | 2.5 | 3.3 |
| LSD 5% | Salinity =0.12 &antioxidant = 0.15&combination=0.26 | | | |
| | Number of grain/spike | | | |
| Control (0.00) | 55 | 45 | 38 | 46 |
| Ascorbic (100) | 61 | 55 | 41 | 52 |
| Glutathion (100) | 64 | 50 | 45 | 53 |
| Tocopherol ( 50) | 59 | 54 | 42 | 52 |
| Spermine ( 10) | 58 | 51 | 40 | 50 |
| Mean | 59 | 51 | 41 | 51 |
| LSD 5% | Salinity =0.79 &antioxidant=1.02&combination=1.76 | | | |

**Table (11): Effect of soil salinity levels and antioxidant materials as well as their combinations on grain weight(gm/spike), grain yield (ardab/fed)and 1000 grain weight (gm)of wheat plant during season 2006/2007.**

| Treatments | Grain weight(gm/spike) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 3.0 | 2.9 | 2.6 | 2.8 |
| Ascorbic (100) | 3.2 | 3.0 | 2.9 | 3.0 |
| Glutathion (100) | 3.3 | 3.2 | 3.0 | 3.2 |
| Tocopherol ( 50) | 3.5 | 3.4 | 2.7 | 3.2 |
| Spermine ( 10) | 3.6 | 3.4 | 3.0 | 3.3 |
| Mean | 3.3 | 3.2 | 2.8 | 3.1 |
| LSD 5% | Salinity =0.11 &antioxidant = 0.14&combination=0.25 | | | |
| | Grain yield (ardab/fed) | | | |
| Control (0.00) | 19.0 | 18.1 | 16.9 | 18.0 |
| Ascorbic (100) | 22.9 | 21.9 | 20.2 | 21.7 |
| Glutathion (100) | 22.4 | 21.4 | 19.5 | 21.1 |
| Tocopherol ( 50) | 23.4 | 22.3 | 19.0 | 21.6 |
| Spermine ( 10) | 21.0 | 19.5 | 17.8 | 19.4 |
| Mean | 21.7 | 20.6 | 18.7 | 20.4 |
| **LSD 5%** | **Salinity =0.43&antioxidant = 0.56 &combination=0.97** | | | |
| | **1000 grain weight (gm)** | | | |
| Control (0.00) | 46.3 | 44.0 | 39.7 | 43.3 |
| Ascorbic (100) | 48.0 | 46.3 | 40.0 | 44.8 |
| Glutathion (100) | 50.3 | 46.0 | 40.0 | 45.4 |
| Tocopherol ( 50) | 49.7 | 46.3 | 42.0 | 46.0 |
| Spermine ( 10) | 49.0 | 46.0 | 43.3 | 46.1 |
| Mean | 48.7 | 45.7 | 41.0 | 45.1 |
| LSD 5% | Salinity =0.83 &antioxidant = 1.07&combination=1.85 | | | |

**Table (12):-Effect of soil salinity levels and antioxidant materials as well as their combinations on straw yield (ton/fed) of wheat plant during season 2006/2007.**

| Treatments | Straw yield (ton/fed) | | | |
|---|---|---|---|---|
| Salinity(mg/L) / Antioxidant (mg/L) | 2600 | 3300 | 4600 | Mean |
| Control (0.00) | 2.3 | 2.0 | 1.9 | 2.1 |
| Ascorbic (100) | 2.5 | 2.1 | 2.0 | 2.2 |
| Glutathion (100) | 2.4 | 2.2 | 2.1 | 2.2 |
| Tocopherol ( 50) | 2.5 | 2.2 | 2.1 | 2.3 |
| Spermine ( 10) | 2.6 | 2.2 | 2.0 | 2.3 |
| Mean | 2.5 | 2.1 | 2.0 | 2.2 |
| LSD 5% | Salinity =0.06 antioxidant =0.07 &combination =0.12 | | | |

## DISCUSSION

**Effect of salinity stress on:**
**GROWTH**

The inhibitory effect of salinity on growth of wheat plant in our reaults may be due to decrease in water absorption, metabolic processes, merestematic activity and/or cell enlargement (Khadr, *et al.* 1994 and Sakr,1996). Moreover, the decrease in growth due to salinity may be attributed to an increase in respiration rate resulting from higher energy requirements. Yang, *et al.* 1990, reported that there are two ways that salinity could retard growth (a) by damaging growth cells so that they can not perform their functions or (b) by limiting their supply of essential metabolites.

NaCl has been shown to bring about a reduction in the overall growth and productivity of plants by perturbing the functioning of vital components of photosynthesis like PSI, PSII and Rubisco [Chen & Murata 2002].

**yield and its components:**

Salinity affects all stages of wheat growth and development, as well as yield of plants. The yield is much more depressed by salt than is vegetative growth. The reduction in seed yield is largely due to a decrease in seed set in the fruit, which may be attributed to a decrease in the viability of pollen or in the receptivity of the stigmatic surface or both, (Sakr, *et al.* 2004).

The reduction in seed yield is largely due to (1) a reduction in seed set in the fruit that may be attribute to a decrease in the viability of pollen and/or in the receptivity of the stigmatic surface. The reduction in pollen viability has been related to decreased calcium mobilization from plant leaves treated with sodium chloride, which is important in pollen germination and pollen tube growth. (2) also, the significance reduction in fruit number due to substantial abscission of flowers or young fruit due to ethylene induction by salinity. Factor affecting cell division and cell expansion, such as tissue water status and the concentration of certain plant hormones, i.e. ABA are involved in the regulation fruit of set under stress. (3) moreover, revealed that increasing salinity

levels decreased significantly yield due to the decreasing production pollen grain, mean number of perfect flowers, and fruit set. (4) the depression effect of salinity on yield may be due to decreasing the leaf area and number per plant, resulting reduction in the supply of carbon assimilate due to decreasing the net photosynthetic rate and biomass accumulation. (5) it can be proposed that the several detrimental effects attributed to salinity stress on most of the studies growth characters and yield might be partially due to decreases in nitrogen concentration.

According the data recorded in this investigation it could be, show that salinity stress decreased many parameters such as: tillers numbers, leaf area index, accumulation of dry matter, photosynthetic pigments, nitrogen and phosphorus as well as potassium uptake, carbohydrates and sugars content. This may be reflect on decreasing yield and its components.

As for ,Tocopherol, ascorbic and glutathione,it could be cocluded that, these plant antioxidants can alleviate the harmfull effect of ROS may be through several ways such as :

(1) inhibits the lipid photoperoxidation (Michalski and Kaniuga, 1981). (2) is involved in both electron transport of PS II and antioxidizing system of chloroplasts. ( McKersie, 1994). (3) ), as membrane stabilisers and multifaceted antioxidants, that scavenge oxygen free radicals, lipid peroxy radicals, and singlet oxygen (Diplock *et al*., 1989). (4) can react with peroxyl radicals formed in the bilayer as they diffuse to the aqueous phase. (Hess, 1993). (5) . It scavenges cytotoxic $H_2O_2$, and reacts non-enzymatically with other ROS: singlet oxygen, superoxide radical and hydroxyl radical (Larson, 1988).(6) regenerate another powerful water-soluble antioxidant, ascorbic acid, via the ascorbate–glutathione cycle.

(Blokhina, *et al.* 2002**). (7) stabilize membrane structures (**Blokhina**,** 2002 ). (8) modulates membrane fluidity in a similar manner to cholesterol, and also membrane permeability to small ions and molecules (Foryer, 1992).

Regarding polyamines, It has been suggested that PAs may play role in antioxidative system and protect membrane from peroxidation.

The alleviating effect of polyamines on plants grown under salinity stress may be due to one or more of the following factors:

(1)Through activating antioxidative defense system . (2)Suppressed the level of superoxide and $H_2O_2$ in leaf stressed plants (Hernandes, et al 1993). (3)Suppress $H_2O_2$ level and thereby membrane damage is being evaluated in terms of antioxidative system (Dionisio –Sese and Tobita ,1988). (4)Caused reduction in ROS through quenching of singlet oxygen and excited chlorophyll by elevating level of CAR thereby maintained chloroplastic membrane (Velikova et al. 2000).

(5)Reduce membrane leakage and lipid peroxidation and decreased MDA contents in sugarcane leaves ( Zhang et al 1996). (6)Stabilization of membrane damage may be due to its polycationic nature (Tiburcio, et al ,(1994). (7)Increasing AXP and GR activity as well as CAR and GSH at all salinity levels (Tiburcio et al, 1994) . (8)Stimulation of chlorophylls synthesis and prevent chlorophyll degradation (Krishnamurthy ,1991)

9)Increasing all organic concentrations ,that may be attributed to that polyamines are involved in important biological processes , e. g. ionic balance and DNA , RNA and protein synthesis .

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## دور بعض مضادات الأكسدة النباتية فى التغلب على ملوحة التربة فى نبات القمح

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****مركز البحوث الزراعية**

أجريت تجربة حقلية لدراسة دور بعض مواد مضادات الأكسدة مثل الأسكوربيك، التوكوفيرول ،الأسبرمين للتغلب على الآثار الضارة المتسببة عن ملوحة التربة فى أراضى تختلف فى درجة ملوحتها كالتالى (3000،2000، 5000 ملليجرام/لتر) على نبات القمح . كما تم نقع حبوب القمح فى مضادات الأكسدة المختلفة قبل الزراعة وأيضا رش نباتات القمح بنفس مضادات الأكسدة.

أظهرت النتائج أن المستويات المرتفعة من الأجهاد الملحى فى التربة الحقلية أدت إلى نقص فى كل صفات النمو والمحصول ومكوناتة كما أظهرت النتائج أيضا أن مضادات الأكسدة أدت إلى التغلب جزئيا على الآثار الضارة الناجمة عن الأجهاد الملحى سواء على النمو أو المحصول لنبات القمح.