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ALLEVIATING THE HARMFUL EFFECT OF SALINITY STRESS ON SOYBEAN PLANTS BY USING SOME PROMOTERS

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ABSTRACT

High salinity stress levels decreased while pre- soaked and foliar spray applied antioxidants increased growth parameters such as leaf area , stem dry weights , and leaves dry weights.

Heigh salinity level (9000 mg/l) was more effective in decreasing all growth parameters . while applied antioxidants (pre-soaked and foliar spray) ASA and Yeast extract were more effective in increasing all growth parameters .

Moreover , it could be show that applied antioxidants partially alleviated the harmful effect of salinity stress which enhanced growth parameters .Growth parameters which increased due to applied antioxidants combined with salinity stress levels were still than control .

Salinity stress levels decreased soybean yield, and 9000 mg /l was the most effective in this respect. On the other hand, applied antioxidants (pre-soaked and foliar spray) increased seed yield of soybean plant. The data also show that applied antioxidants enhanced seed yield grown under stress condition comparing with untreated plants. This increase was less than control plant. It could be show that applied antioxidants partially counteracted the harmful effect of salinity stress on seed yield of soybean plant.

INTRODUCTION

Soybean (*Glycine max* [L.] Merrill) is a species of legume native to East Asia, widely grown for its edible bean which has numerous uses. Fat-free (defatted) soybean meal is a significant and cheap source of protein for animal feeds and many prepackaged meals soy vegetable oil is another product of processing the soybean crop.

Azevedo-Neto, *et al*., (2004) and Saied, *et al*., (2005) reported that salinity could reduce the plant growth or damage the plants through: (i) osmotic effect (causing water deficit), (ii) toxic effects of ions, and (iii) imbalance of the uptake of essential nutrients.

Zang, (2006) found that water stress during the grain-filling period induces early senescence, reduces photosynthesis, and shortens the grain-filling period; however, it increases the remobilization of NSC from the vegetative tissues to the grain. If mild soil drying is properly controlled during the later grain-filling period in rice (*Oryza sativa*) and wheat (*Triticum* *aestivum*), it can enhance whole-plant senescence, lead to faster and better remobilization of carbon from vegetative tissues to grains, and accelerate the grain-filling rate. In cases where plant senescence is unfavorably delayed, such as by heavy use of nitrogen and the introduction of hybrids with strong heterosis, the gain from the enhanced remobilization and accelerated grain-filling rate can outweigh the loss of reduced photosynthesis and the shortened grain-filling period, leading to an increased grain yield, better harvest index and higher water-use efficiency.

As for ascorbic acid, Shalata and Tal (1998) found that ascorbic acid is a small, water-soluble anti-oxidant molecule which acts as a primary substrate in the cyclic pathway for enzymatic detoxification of hydrogen peroxide. In addition, it acts directly to neutralize superoxide radicals, singlet oxygen or superoxide and as a secondary anti-oxidant during reductive recycling of the oxidized form of -tocopherol, another lipophilic anti-oxidant molecule (Noctor and Foyer, 1998). 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.

Dehghan, *et al.,* (2011) found that ASC induced enhancement in growth of salt-stressed plants coupled with an increase in catalase and peroxidase activity in seedlings only in soybean cultivar, and an increase in superoxide dismutase activity in both cultivars. These findings led us to conclude that applied ASC counteracts the adverse effects of salt stress on growth of soybean; however, these effects were cultivar specific.

As for Salicylic acid, Borsani *et al.* (2001) reported that (SA) potentiates the generation of reactive oxygen species in photosynthetic tissues during salt and osmotic stresses. Thus convincing data have been obtained concerning the SA-induced increase in the resistance of wheat seedlings to salinity (Shakirova and Bezrukova, 1997), and water deficit (Bezrukova, *et al.*, 2001), of tomato and bean plants to low and high temperature (Senaratna, *et al.*, 2000).

He, *et al.* (2005) found that application of exogenous SA enhanced the drought and salt stress resistance of plants (Senaratna *et al.* 2000; Tari *et al.* 2002).

Arfan, *et al.* (2006)stated that exogenous application of SA promoted growth and yield, and counteracted the salt stress-induced growth inhibition of salt tolerant Presowing treatment with SA prevented the salinity-induced decline centration of IAA and cytokinins in seedlings and reduced the accumulation of ABA.

Regarding Seaweed extract ,It could be concluded that biostimulants (SWE) and HA can alleviate the harmful effect of salinity or drought stress through :1) activate root cells at the same time stimulate biosynthesis of endogenous Cytokinins from roots (Schmidt, 2005). II) enhancing leaf water status, some plant nutrients uptake, shoot growth and root pull strength (Demir, *et al.,* 2004). III) altring hormonal balances and favor Cytokinins and auxins production (Schmidt, 2005). IV) enhancement of antioxidants for protection against adverse environmental conditions (Schmidt, 2005). V)-stimulation the biosynthesis of Tocopherol, ascorbic acid and carotenoids in chloroplast which protectphotosynthetic apparatus of PSII (Zhang and

Schmidt,2000). VI)protictionof plant cells from lipid peroxidation and inactivation of enzymes that occur under stress(Smirnoff,1995). VII)stimulation stem elongation and exhibits auxin-like activity.(Crouch and VanStaden,1993). VIII)reduced uptake of NaCl (Nabati, 1994) while increased K and Ca content in the leaves (Demir, *et al.,* 2004). IX)-stimulation of chlorophyls biosynthesis(Garbay and Churin,1996) and regulation cell membrane components under drought stress (Yan, *et al.,* 1994). X)- inhibits activity of free radical groups which are major elements for chlorophyll degradation (Fletcher, *et al.,*1988). XI)- stimulation the uptake of N, P, K, Mg, Ca, Zn, Fe and Cu by the seedlings. XII)-promoted the accumulation of reducing sugars which increased wilting resistance through enhancing osmotic pressure inside plant. In addition nucleic acids metabolism were stimulated (O,Donnell,1973).

As for Yeast extract, Abdel-Wahid, (2007), showed that using active dry yeast at the rate of 8 g/l increased plant height and stem diameter of potted *Brassaia arboricola*.

Nassar, *et al.*, (2011) revealed that foliar application with the relatively median used concentration of 50 ml active yeast extract / L induced significant promotive effects on all investigated morphological characters (plant height, number of branches/plant, number of leaves/plant, total leaf area/plant and shoot dry weight/plant), yield of green pods/plant, number of pods/plant, number of seeds/plant, seed yield/plant.

The aim of this investigation was to evaluate an attempt to alleviate the harmful effects of salinity on soybean cultivar cv. Giza 111 by using some antioxidants i.e. ascorbic acid, salicylic acid, yeast and seaweed extract on yield and its components and seed quality of soybean under salinity stress conditions.

MATERIALS AND METHODS

pot experiments were carried out to investigate the role of some antioxidant materials (presoaking and foliar spray) in alleviation the harmful effect of different salinity stress levels on soybean plant during 2010 and 2011 seasons.

Seed sowing was carried out on the 15th May in the two growing seasons in pots (60 cm inner diameter) containing 10 Kg of air dried loamy soil at the rate of 6 seeds/pot. Thinning was made three weeks after sowing to leave 4 uniform seedlings/ pot.

The pots were supplied with limit amount of Calcium superphosphate (15.5% P_2O_5) at a rate of 150 kg/fed, then nitrogen in the form of urea (46.5% N) at the rate of 50 kg/fed and potassium sulphate (k_2o) at the rate of 50 kg/fed as recommended.

Salinity stress levels: Six levels of artificial seawater used by dissolving known weight of natural salt crust, in tap water. The natural salt crust was brought directly from the salterns of Rashid, El- Beheira Governorate, Egypt where the Mediterranean Seawater is evaporated, air-dried, thoroughly crushed using porcelain mortar and pestle.

The six salinity levels used:

1- Tap water (320 mg/l). 2- 5000 mg/l. 3- 6000 mg/l. 4- 7000 mg/l. 5- 8000 mg/l. 6- 9000 mg/l.

The amount of salt for each salinity level was calculated, dissolved in the Proper amount of tap water and used for experimental investigation.

Antioxidant materials:

The sterilized seeds were soaked for 3 hours in any of antioxidant used before sowing. The plants of each salinity levels were sprayed with any of antioxidant used (the same antioxidant used in seeds soaking) at two physiological stages (30 and 60 days after sowing).

Antioxidants used:

1- Tap water. 2- Ascorbic acid (250 mg/l). 3- Salicylic acid (250 mg/l).4- Seaweed extract (1000 mg/l). 5- Yeast extract (1000 mg/l).

This experiment contained 6 salinity levels and 5 antioxidant materials. Then the experiment consisted of 30 treatments. Each treatment replicated 3 times.

Sampling dates:

two samples were taken at 2 different physiological stages (45 and 75 day from sowing) to study the following characters:

A- Growth characters:

1- Leaf area (cm^2/plant).
2- Dry weight of leaves (gm/plant).
3- Dry weights of stems (gm/plant).

B- Yield and its components:

Seed weight /plant (gm).

RESULTS

Growth:

In tables (1-3) the data show that high salinity stress levels decreased while pre- soaked and foliar spray applied antioxidants increased growth parameters such as leaf area , stem dry weights , and leaves dry weights

Heigh salinity level (9000 mg/l) was more effective in decreasing all growth parameters . while applied antioxidants (pre-soaked and foliar spray) ASA and Yeast extract were more effective in increasing all growth parameters .

Moreover , it could be show that applied antioxidants partially alleviated the harmful effect of salinity stress which enhanced growth parameters .

It could be mention that pre-soaked and foliar spray of applied antioxidants [Ascorbic acid (ASA) , Salicylic acid (SA) , Seaweed extract (SWE) and Yeast extract] were more effective than pre-soaked of applied antioxidants treatments .This was true in all growth parameter (leaf area , stem dry weights , leaves dry weights) during the two growing seasons (2010 & 2011) . But the two methods of applied antioxidants used [Ascorbic acid (ASA) , Salicylic acid (SA) , Seaweed extract (SWE) and Yeast extract] significantly increased all growth parameters of soybean plant .

Table (1): Effect of salinity stress levels and applied antioxidants as well as their interactions on leaf area (cm^2) of soybean plant during the two growing seasons (2010 & 2011).

Treatment / Antioxidant	Salinity levels (mg/L)													
	320	5000	6000	7000	8000	9000	Mean	320	5000	6000	7000	8000	9000	Mean
	Season 2010							Season 2011						
	1st sample (pre-soaking and foliar spray)													
Tap water	495	272	253	235	227	221	284	504	280	263	242	236	231	293
ASA	556	492	487	484	476	463	493	558	496	491	488	480	471	497
SA	504	327	317	310	297	286	340	513	334	326	313	301	288	346
SWE	513	475	464	457	448	439	466	519	481	474	459	456	447	473
Yeast	532	487	472	460	455	445	475	540	492	483	472	464	453	484
Mean	520	411	399	389	381	371		527	417	407	395	387	378	
LSD at 5%	Salinity: 16 Antioxidant: 13 Interaction: 21							Salinity: 16 Antioxidant: 13 Interaction: 21						
	2nd sample (pre-soaking and foliar spray)													
Tap water	528	283	275	268	258	255	311	540	290	284	275	266	264	320
ASA	572	525	498	482	474	465	503	578	538	520	497	487	474	516
SA	538	336	320	309	303	298	351	545	346	334	315	306	299	358
SWE	546	494	462	454	449	432	473	551	503	476	468	459	452	480
Yeast	556	509	474	460	457	447	484	560	521	485	474	466	457	490
Mean	548	429	406	395	388	379		555	440	420	406	397	389	
LSD at 5%	Salinity:17 Antioxidant: 13 Interaction: 23							Salinity: 17 Antioxidant: 14 Interaction: 23						

ASA : Ascorbic acid (250 mg/l) SWE : seaweeds extract (1000 mg/l)
SA : Salicylic acid (250 mg/l) Yeast : Yeast extract (1000 mg/l)

Table (2): Effect of salinity stress levels and applied antioxidants as well as their interactions on stem dry weight (gm / plant) of soybean plant during the two growing seasons (2010 & 2011).

Treatment / Antioxidant	Salinity levels (mg/L)													
	320	5000	6000	7000	8000	9000	Mean	320	5000	6000	7000	8000	9000	Mean
	Season 2010							Season 2011						
	1st sample (pre-soaking and foliar spray)													
Tap water	3.16	1.49	1.39	1.35	1.24	1.20	1.64	3.32	1.59	1.45	1.39	1.28	1.26	1.72
ASA	4.42	3.00	2.86	2.79	2.68	2.65	3.07	4.50	3.24	3.17	2.98	2.86	2.78	3.26
SA	3.74	2.16	1.98	1.84	1.76	1.66	2.19	3.78	2.18	2.03	1.87	1.79	1.68	2.22
SWE	4.14	2.84	2.64	2.39	2.31	2.23	2.76	4.12	2.93	2.72	2.50	2.37	2.29	2.82
Yeast	4.28	2.92	2.77	2.52	2.43	2.36	2.88	4.20	3.16	2.86	2.63	2.48	2.40	2.96
Mean	3.95	2.48	2.33	2.18	2.08	2.02		3.98	2.62	2.45	2.27	2.16	2.08	
LSD at 5%	Salinity: 0.31 Antioxidant: 0.19 Interaction: 0.75							Salinity: 0.35 Antioxidant: 0.20 Interaction: 0.81						
	2nd sample (pre-soaking and foliar spray)													
Tap water	3.48	1.93	1.69	1.58	1.49	1.42	1.93	3.76	1.98	1.74	1.62	1.47	1.45	2.00
ASA	4.76	3.41	3.68	2.93	2.80	2.76	3.39	5.10	3.72	3.70	3.40	2.96	2.95	3.64
SA	3.84	2.37	2.25	2.19	2.08	2.05	2.46	3.93	2.41	2.33	2.20	2.08	2.00	2.49
SWE	4.43	3.12	2.84	2.66	2.54	2.32	2.99	4.59	3.43	3.29	3.21	2.65	2.48	3.28
Yeast	4.58	3.18	2.92	2.73	2.63	2.54	3.10	4.64	3.49	3.38	3.26	2.84	2.73	3.39
Mean	4.22	2.80	2.68	2.42	2.31	2.22		4.40	3.01	2.89	2.74	2.40	2.32	
LSD at 5%	Salinity: 0.35 Antioxidant: 0.22 Interaction: 0.83							Salinity: 0.37 Antioxidant: 0.22 Interaction: 0.83						

ASA : Ascorbic acid (250 mg/l) SWE : seaweeds extract (1000 mg/l)
SA : Salicylic acid (250 mg/l) Yeast : Yeast extract (1000 mg/l)

Table (3): Effect of salinity stress levels and applied antioxidants as well as their interactions on leaves dry weight (gm / plant) of soybean plant during the two growing seasons (2010 & 2011).

Treatment / Antioxidant	Salinity levels (mg/L)													
	320	5000	6000	7000	8000	9000	Mean	320	5000	6000	7000	8000	9000	Mean
	Season 2010							Season 2011						
	1st sample (pre-soaking and foliar spray)													
Tap water	2.61	1.30	1.21	0.98	0.92	0.80	1.30	2.73	1.45	1.40	1.14	1.10	1.05	1.48
ASA	3.90	2.53	2.42	2.35	2.20	2.15	2.59	3.96	2.57	2.48	2.39	2.25	2.18	2.64
SA	3.15	1.72	1.63	1.58	1.40	1.31	1.80	3.25	1.80	1.69	1.60	1.52	1.43	1.88
SWE	3.72	2.28	2.19	2.10	1.98	1.82	2.35	3.80	2.32	2.29	2.16	2.11	1.95	2.44
Yeast	3.84	2.37	2.27	2.16	2.08	1.90	2.44	3.92	2.43	2.35	2.20	2.14	2.10	2.52
Mean	3.44	2.04	1.94	1.83	1.72	1.60		3.53	2.11	2.04	1.90	1.82	1.74	
LSD at 5%	Salinity:0.03 Antioxidant: 0.01 Interaction: 0.07							Salinity: 0.03 Antioxidant: 0.01 Interaction: 0.07						
	2nd sample (pre-soaking and foliar spray)													
Tap water	3.10	1.48	1.36	1.30	1.22	1.18	1.61	3.24	1.63	1.56	1.46	1.40	1.35	1.77
ASA	4.46	3.00	2.95	2.82	2.68	2.62	3.09	4.50	3.12	3.00	2.87	2.73	2.65	3.15
SA	3.92	2.35	2.26	2.18	1.96	1.80	2.41	3.95	2.39	2.32	2.22	2.16	2.10	2.52
SWE	4.26	2.76	2.63	2.54	2.42	2.28	2.82	4.37	2.82	2.74	2.66	2.54	2.39	2.92
Yeast	4.37	2.82	2.70	2.62	2.50	2.38	2.90	4.43	2.89	2.81	2.74	2.62	2.43	2.99
Mean	4.02	2.48	2.38	2.29	2.16	2.05		4.10	2.57	2.49	2.39	2.29	2.18	
LSD at 5%	Salinity: 0.04 Antioxidant: 0.02 Interaction: 0.08							Salinity: 0.04 Antioxidant: 0.03 Interaction: 0.10						

ASA : Ascorbic acid (250 mg/l) SWE : seaweeds extract (1000 mg/l)
SA : Salicylic acid (250 mg/l) Yeast : Yeast extract (1000 mg/l)

Yield and yield components:

Effect of salinity stress levels , applied antioxidants as well as their combinations on soybean yield (seed weight) during the two growing seasons (2010&2011) are shown in table (4).

The data show that all salinity stress levels decreased soybean yield, and 9000 mg /l was the most effective in this respect.

On the other hand, applied antioxidants (pre-soaked and foliar spray) increased seed yield of soybean plant.

The data also show that applied antioxidants enhanced seed yield grown under stress condition comparing with untreated plants. These increase was less than control plant.

It could be show that applied antioxidants partially counteracted the harmful effect of salinity stress on seed yield of soybean plant.

Table (4): Effect of salinity stress levels and applied antioxidants as well as their interactions on seed weight /plant (gm) of soybean plant during the two growing seasons (2010 & 2011).

Treatment / Antioxidant	Salinity levels (mg/L)													
	320	5000	6000	7000	8000	9000	Mean	320	5000	6000	7000	8000	9000	Mean
	Season 2010							Season 2011						
	soak													
Tap water	12.3	6.8	6.4	5.6	4.0	3.1	6.4	13.2	7.2	6.8	6.1	4.2	3.9	6.9
ASA	19.8	10.7	9.8	9.4	9.1	8.4	11.2	21.1	11.9	10.7	10.4	10.1	9.6	12.3
SA	12.6	8.2	7.8	7.5	7.3	7.0	8.4	13.8	8.4	8.3	7.9	7.6	7.4	8.9
SWE	15.2	8.9	8.3	7.9	7.6	7.3	9.2	16.6	9.2	8.7	8.2	7.9	7.6	9.7
Yeast	17.4	9.4	8.8	8.4	7.9	7.5	9.9	18.8	10.7	10.1	9.5	9.0	8.5	11.1
Mean	15.5	8.8	8.2	7.8	7.2	6.7		16.7	9.5	8.9	8.4	7.8	7.4	
LSD at 5%	Salinity: 1.2 Antioxidant: 0.7 Interaction: 3.0							Salinity:1.2 Antioxidant: 0.7 Interaction: 3.0						
	pre-soaking and foliar spray													
Tap water	13.1	7.6	6.7	6.3	4.6	3.7	7.0	13.9	7.9	7.1	6.7	4.9	4.5	7.5
ASA	21.6	11.4	10.3	9.8	9.5	8.8	11.9	22.5	12.3	11.2	10.9	10.6	9.9	12.9
SA	14.6	9.4	9.1	8.9	8.3	7.9	9.7	15.2	9.6	9.3	9.1	8.6	8.2	10.0
SWE	16.5	9.9	9.4	9.1	8.6	8.3	10.3	17.3	10.9	10.2	9.8	9.2	8.6	11.0
Yeast	19.8	10.8	9.9	9.5	9.3	8.5	11.3	20.7	11.6	10.8	10.1	9.4	9.1	12.0
Mean	17.1	9.8	9.1	8.7	8.1	7.4		17.9	10.5	9.7	9.3	8.6	8.1	
LSD at 5%	Salinity:1.2 Antioxidant: 0.7 Interaction: 3.0							Salinity: 1.3 Antioxidant: 0.7 Interaction: 3.0						

ASA : Ascorbic acid (250 mg/l) SWE : seaweeds extract (1000 mg/l)
SA : Salicylic acid (250 mg/l) Yeast : Yeast extract (1000 mg/l)

DISCUSSION

Effect of salinity stress on:
Growth

The inhibitory effect of salinity on growth of soybean plant in the obtained results may be due to decrease in water absorption, metabolic processes, merestematic activity and/or cell enlargement (Khadr, *et al.* 1994). To control the level of ROS and to protect cells under stress conditions, plant tissues contain several enzymes scavenging ROS (SOD, CAT, peroxidases and glutathione peroxidase), and a network of low molecular mass antioxidants (ascorbate, glutathione, phenolic compounds and tocopherols).

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.

In this study, the severity of salinity antagonism to the normal growth of the plant, as indicated by FW and DW measurements, was higher in the salt sensitive wheat, indicating that NaCl has a negative influence on the growth of wheat seedlings.

The reduction in shoot and root dry weight accumulation was in proportion to the external concentration of salts. This reduction might be attributed to: a decrease in either leaf number and leaf area. and/or a decrease in CO_2 uptake in leaves (Fedina and Popova, 1996) mainly because NaCl treatment, decrease stomatal conductance and consequently less CO_2 is available foı carboxylation reaction in the photosynthesis apparatus (Yadav, *et al.* 1996)

yield and its components:

Salinity affects all stages of soybean growth and development, as well as yield of plants. The yield is much more depressed by salt than vegetative growth. The reduction in seed yield is largely due to a decrease in seed set, 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).

Salinity stress levels affect all stages of soybean growth and development, as well as yield and its components. The yield is much more depressed by salt than is vegetative growth. The highest salinity stress level (9000mg/l) was more effective in this respect. The reduction in grain yield is largely due to a decrease in the fruit set, which may be attributed to a decrease in the viability of pollen or in the receptivity of the stigmatic surface or both, Sakr and EL-Metwally (2009).

The reduction in yield is largely due to (1) a reduction in seed set 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. (Sakr and Gadalla 2009). (2) moreover, revealed that increasing salinity levels decreased significantly yield due to the decreasing production pollen grain, mean number of perfect flowers, and fruit set. (3) 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. (4) The depression effect of salinity on grain 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 (Sakr and EL-Metwally 2009).

Role of antioxidant Ascorbic acid (ASA) on alleviating the harmful effects of salinity stress:

Ascorbic acid can alleviate the harmful effect of ROS may be through several ways such as :

(1) inhibit the lipid photoperoxidation (Michalski and Kaniuga, 1981); (2) involved in both electron transport of PS II and antioxidizing system of chloroplasts. (McKersie *et al.* 1996), (3) as membrane stabilisers and multifaceted antioxidants, that scavenge oxygen free radicals, lipid peroxy radicals, and singlet oxygen (Diplock *et al.* 1989), (4) 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, *et al.* 2002). (8) modulate membrane fluidity

in a similar manner to cholesterol, and also membrane permeability to small ions and molecules (Fryer, 1992). (9) decrease the permeability of digalactosyldiacylglycerol vesicles for glucose and protons (Berglund, *et al.* 1999).

Role of antioxidant salicylic acid (SA) on alleviating the harmful effects of salinity stress:

SA decreased the Na+/K+ ratio in the roots and increased it significantly in the leaves. Na+, accumulated in the leaf tissues, functioned as an inorganic osmolyte, and resulted in an increased water potential and water content. Since SA improved the photosynthetic performance of plants under stress conditions (Ananieva *et al.* 2004), and chlorophyll a fluorescence could give insight into the ability of a plant to tolerate environmental stresses, .these results suggest that SA-pre-treatment may improve the gross rate of carbon assimilation during osmotic stress.

Shakirova, *et al.* (2003) pointed out that (SA)-treatment diminished changes in phytohormones levels in soybean seedlings under salinity. It prevented any decrease in IAA and cytokinin contents and thus reduced stress-induced inhibition of plant growth. A high ABA level was also maintained in SA-treated soybean seedlings providing the development of antistress reactions, for example, maintenance of proline accumulation. These results indicate not only an SA-induced activation of the division of root meristem cells, which contributes to an SA-induced growth of the wheat seedlings, but also a high intensity of mitotic activity in the seedlings under salinity. Such an effect of SA on cell division could be an important mechanism, enabling a reduction in the injurious effect of this stress factor on growth in general and an accelerated resumption of| growth processes during seedling recovery alter salinity.

Role of antioxidant Seaweed Extract (SWE) on alleviating the harmful effects of salinity stress:

The increase of this antioxidant may be triggered by excess production of reactive oxygen species in the photosynthetic apparatus under stress.

Biostimulants (SWE) can alleviate the harmful effect of salinity or drought stress through: I)- activate root cells at the same time stimulate biosynthesis of endogenous cytokinins from roots (Schmidt 2005). II)- enhancing leaf water status, some plant nutrients uptake, shoot growth and root pull strength (Demir *et al.* 2004). III)- altering hormonal balances and favor cytokinins and auxins production (Schmidt 2005). IV)- enhancement of antioxidant enzymes (SOD, GR, ASP) for protection against adverse environmental conditions (Schmidt 2005). V)- stimulation the biosynthesis of Tocopherol, ascorbic acid and carotenoids in chloroplast which protect photosynthetic apparatus of PSII (Zhang and Schmidt 2000). VI)- protection of plant cells from lipid peroxidation and in activation of enzymes that occur under stress (Smirnoff 1995). VII)- stimulation stem elongation and exhibits auxin-like activity. (Crouch and Van-Staden 1993). VIII)- reduced uptake of NaCl (Nabati 1994) while increased K and Ca content in the leaves (Demir *et al.* 2004). IX)- stimulation of chlorophyls biosynthesis (Garbay and Churin 1996) and regulation cell membrane components under drought stress (Yan 1993). X)- inhibits activity of free radical groups which are major elements for chlorophyll degradation (Fletcher *et al.* 1988). XI)- stimulation the uptake of N, P, K, Mg, Ca, Zn, Fe and Cu by the plants that alleviate the inhibitory effect of Na toxicity and restored growth (Nelson and Van-Staden 1984). XII)- promoted the accumulation of reducing sugars which increased wilting resistance through enhancing osmotic pressure inside plant. In addition nucleic acids metabolism were stimulated (O,Donnell 1973). XIII)- Stimulation of chloroplast development and enhancing phloem loading and delay senescence (Demir, *et al.* 2004).

Role of antioxidant Yeast Extract on alleviating the harmful effects of salinity stress:

Yeast is a natural source of cytokinins and has stimulatory effects on bean plants (Amer, 2004). Yeast has also higher contents of different nutrients, higher percentage of proteins, higher values of vitamins as reported by Subba Rao (1984). This may explain the increase of cytokinins and other promoting hormones in response to yeast application. The higher contents of cytokinins and auxins may be attributed to the promoting effects of vitamin E on growth and yield bean plants as El Bassiouny *et al.* (2005) attributed these promoting effects on growth and yield to the fact that it is a low molecular weight lipophilic antioxidant which protect membrane from oxidative damage.

yeasts have been reported to be rich source of phytohormones (especially cytokinins), vitamins, enzymes, amino acids and minerals (Mahmoud, 2001). It was reported about its stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (Kraig and Haber, 1980 and Castelfranco and Beale, 1983). It participates in a beneficial role during stress due to its cytokinins content (Barnett, *et al.,* 1990). Improving growth and productivity of vegetable crops by application of active yeast extract were recorded by El-Tohamy, *et al.,* (2008) on egg plant; El-Ghamriny, *et al.,* (1999) and Fathy, *et al.,* (2000) on tomatoes and Tartoura (2001) and El-Desuki and El-Greadly (2006) on pea.

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تأثير بعض مضادات الأكسدة على مكونات المحصول وجودة تقاوى فول الصويا تحت ظروف الإجهاد الملحى

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أدت المعاملة بالتركيزات المختلفة للملوحة إلى حدوث نقص على العكس من المعاملة بمضادات الأكسدة إلى زيادة فى صفات النمو من المساحة الورقية والأوزان الجافة لكل من الساق والأوراق وكان التركيز المرتفع 9000 mg/l فى الأكثر تأثيرا فى نقص صفات النمو بينما المعاملة بأي من الأسكوربيك أو مستخلص الخميرة كانت الأكثر تأثيرا فى زيادة كل صفات النمو.

يمكن الإشارة إلى أن المعاملة بمضادات الأكسدة أدت إلى التغلب جزئيا على الصفات الضارة للإجهاد الملحى. وكان التأثير المنشط لمضادات الأكسدة أدى إلى زيادة النمو ولكنة مازال أقل من نباتات المقارنة .

أدت المعاملة بالإجهاد الملحى إلى نقص محصول فول الصويا بينما أدت المعاملة بمضادات الأكسدة إلى زيادة المحصول . كما أدت المعاملة بمضادات الأكسدة إلى تحسين المحصول تحت ظروف الإجهاد الملحى ولكن هذه الزيادة مازالت أقل من المقارنة. كما يمكن القول أن مضادات الأكسدة أدت إلى التغلب جزئيا فى إزالة الآثار الضارة للإجهاد الملحى على محصول فول الصويا.

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