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THE ROLE OF GAAND ORGANIC MATTER TO REDUCE THE SALINITY EFFECT ON GROWTH AND LEAVES CONTENTS OF ELEMENTS AND ANTIOXIDANT IN PEPPER

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Abstract

Pepper (*Capsicum annuum* L.) is an important agricultural crop, because of its economic importance and the nutritional value of its fruits; it is an excellent source ofnatural colors, vitamin C and antioxidant compounds worthy for human health ,The salinity of soil is among the most important abiotic stresses which limit agricultural productivity worldwide, effects of salinity on growth. Significant differences in fruit-set, yield, photo synthetic rates, stomatal conductance, total chlorophyll content, proline. In general, salinity affects almost every aspect of the physiology and biochemistry of plants. A field experiment was conducted during the agriculture season in the first of 15th- Oct- 2015 to 15th- Fab- 2016) In agriculture collage fields of Al Qasim Green University (Babylon, Hilla) to study the effect of irrigation water quality and organic fertilization and, gibberellin on growth and yield of pepper , the experiment included 24 treatments as a result of the combination between the factors , salinity of irrigation water (W) was imposed at (1.1 a or 6.5 ds m^{-1}), organic (poultry) litter (O) at (0% or 25%), the gibberellin was applied at (0 or 250 $mg.L^{-1}$) , the water salinity increased electrical conductivity of the soil, peroxidase activity in leaves and sodium and proline contents in leaves, resulting in decreased growth and leaf contents of NPK. The poultry and gibberellins applications alleviated negative effects of saline water by increasing (dry weights of shoots, root fruit weight, and NPK contents in leaves with a slight reduction of peroxidase activity in leaves and greater reduction of sodium and proline contents in leave. Its possibility of mitigated environmental stress like salinity with any exogenous application, the GA_3 and organic matter led to improve pepper growth under salt stress, the GA & poultry application improved the growth and it has alleviated to salt stress, which was exerted by saline irrigation water.

Key words : Pepper, salinity, organic matter, GA, nutrients nutrition, oxidative stress.

Introduction

Pepper is an important agricultural crop not only because of its economic importance, but also due to the nutritional, medicinal value of its fruits as well as being excellent source of natural colors and antioxidant compounds. It is the world's second important vegetable, ranking after tomatoes and it is the most produced type of spice flavouring and coloring for food while providing essential vitamins and minerals like tocopherols (vita-min E), carotenoids (pro vitamin A), capsaicinoids and calcium. Some pepper cultivars contain significant quantities of capsaicinoids, to increased fruit quantity and quality to improve plant resistance to environmental stresses (Jimenez-Garcia *et al*., 2014). Pepper is a moderately sensitive to salt stress (Lee, 2006) and is grown under protected glasshouse conditions in temperate regions and in the open field under temperate and warm Mediterranean climates. It is frequently exposed to saline conditions to saline irrigation water (Kijne, 2003). Studies on vegetables have been mostly conducted to determine best management practices under non-saline conditions. Certain nutrients alleviative effects on salinity (El-Sidding and Ludders, 1994).

Environmental stresses such as salinity and drought reduce the agricultural productivity more than other factors. Higher salinity levels caused significant reduction in growth parameters like leaf area, leaf length and root and shoot dry weight (Al-Taey, 2009; AL-Azawi, 2015; Tayyab *et al*., 2016). Growth and productivity plants are affected by many abiotic stresses (Sana *et al*., 2016) which lead to crop loss (Atkinson and Urwin, 2012). High salt concentration inhibits plant growth by an osmotic or

water- deficit effect and by a salt-specific or ion-excess effect of NaCl. Plants subject to high salinity stress produce cytotoxic activated oxygen that can disrupt normal metabolism, through oxidative damage of lipids, proteins, and nucleic acids (Abbaspour, 2012). Salinization can lead to excess intracellular production of reactive oxygen species (ROS) such as the superoxide radical (O2 •–), the hydroxyl radical (OH•), hydrogen peroxide (H2O2) and singlet oxygen (1O2) 6-, tolerance to salinity is specific for species and cultivars. Vegetables have a high sensitivity to effects of NaCl (Al-Taey and Saadoon, 2014), to defend against oxidants, plants evolved mechanisms, involving antioxidant molecules and enzymes that protect against potentially cytotoxic species of activated oxygen. Adaptation to salt stress requires alterations in genes.

Application of fertilizers in saline soils might result in increased, decreased or unchanged plant salt tolerance, Plant response to fertilizers depends on severity of salt level in the root zone (Faiza and Amin, 2009). There was a positive yield response for pepper at all salinity levels by increasing nutrient N from 2 to 15 mM in a solution culture (Gomez *et al*., 1996). However, the effect of N on relative yield was not clear. The salinity level above the control (25 mM NaCl) had a lower relative yield at lower N and with subsequent increases in salinity, it had a higher relative yield. Phytohormons are the most important endogenous substances for moderating physiological and molecular responses, a critical requirement for plant survival. Phytohormons act at their site of synthesis or elsewhere in plants following their transport (Shabir *et al*., 2016).

Plant growth hormone gibberellins (GAs) are generally involved in growth and development such as seed germination, leaf expansion, photomorphogenesis, stem elongation and flowering (Daviere and Achard, 2013; Ryu and Cho, 2015). It has been reported that bioactive GAs are rapidly reduced when plants are exposed to both biotic and abiotic stresses (Javid *et al*., 2011). It has been long known that there is cross-talking between GA action and other hormones signaling during environmental stresses to control the plant growth and development. Exposure to salt stress induced a reduction in endogenous levels of bioactive GAs, which coincided with higher accumulation of DELLA proteins (Colebrook *et al*., 2014). In tomato (*Lycopersicon esculentum* M.) gas reduced stomata resistance and enhanced plant water use at low salinity. Likewise, grain yield was increased due to the GA_3-priming-induced moderation of ion uptake and partitioning (within shoots and roots) as well as hormone homeostasis under saline conditions. GAs are known to interact with all other phytohormons in numerous developmental and stimulus-response process. The interactions between GA and ET include both negative and positive mutual regulation depending on the tissue and signaling case (Munteanu *et al*., 2014).

Objectives

The aim of this experiment was study the salt tolerance of pepper (*Capsicum annuum* L.) under salinity stress by saline irrigation water, poultry litter and gibberellins applications were used to mitigate the negative effects on growth parameters and yield of pepper under salinity stress.

Materials and Methods

This experiment was conducted under glass house of Horticulture Department, Collage of in AL- Qasim green university at 1-11-2015, the sweet pepper (*Capsicum annuum* L.) of RIDA cultivar from Netherland was used. The seedlings were planted in plastic pots containing 10 kg of soil (six pots for each treatment) physical & chemical characters (table 1). Each one supplied with 0.5 gm of NPK and granular fungicide. Seedlings were irrigated with river water (1.1 $dS.m^{-1}$/cm) for ten days twice a day before salinity treatment, followed by irrigation (half of seedlings) with salted water (6.5 $dS.m^{-1}$/cm) every day until seedlings were reaching 80 days old.

Plants were sprayed twice with of GA (0, 250 mg / L) the first spray was two weeks after germination, the second spray was 4 weeks after the first spray.

Experiment was conducted according to split-split plot design with three factors, The main factor is the water quality (1.1 $dS.m^{-1}$ represented river water (W1) & 6.5 $dS.m^{-1}$ represented saline water (W2) the chemical analysis for water quality (table 2). The second factor (sub-plot) is the poultry fertilization levels with 0% (OM1) & 25% (OM2). The third factor (sub-sub-plot) is gibberellin levels with (0, 250 mg/liter). The Gibberellin 0% (GA1) & the 250 mg/liter (GA2), the data were analyzed statistically with Genstat discovery software. Means were statistically compared by L.S.D test at $p<5\%$ level.

Irrigation requirements was determined according to the weight method, when depleting 75% of the field capacity depend on field capacity, the equation below illustrates the weighted method.

Moisture ratio = water weight /the dry weight of soil × 100

Statistical analysis

Split-split plot experiment included three factors (24 treatments). Each pot was treated as one replicate and all the treatments were repeated three times. The data were analyzed statistically with Genstat discovery 12th software. Means were statistically compared by L.S.D test at p<5% level.

Fig. 1 shows the experiment planer, included 24 treatments.

Three plants were harvested randomly from 4 replicates at maturity (90 days after sowing). Plant height, root length, number of leaves, leaf area, number of fruit, fresh and dry biomass were recorded Na and K contents of leaves, stem and roots determined samples were dried and 0.5g of dry samples were used to determine ash contents. The was placed in 50 ml of de-ionized water, and dilutions made in de-ionized water for mineral analysis. Concentration of cations were measured using a PFP Flame Photometer (Wiessmann and Nehring, 1960), nitrogen determination according to Jackson (1958) determination of phosphorus in leaves measured according to Page *et al*. (1982).

Peroxidase was determined by measuring the increase in absorbance at 510 nm resulting from the decomposition of hydrogen peroxide (Trinder, 1966). The Lambda 25 UV/Vis spectrometer (Perkin Elmer Germany) was adjusted to 510 nm. The blank was a mix of 1.4 mL of phosphate buffer and 1.4 ml of H_2O_2 in cuvette. The assay mixt contained 1.4 mL of phosphate buffer, 1.4 mL of H_2O_2 and 0.2 mL of the extract. The increase in absorbance at 510 nm was recorded for 4 min. The ΔA240/min was calculated from the initial (45 sec) linear portion of the curve.

Enzymatic assays (SOD&CAT) : To determine catalase activity and superoxide dismutase activity, 0.1 gm of frozen leaves and roots were homogenized in 1 ml of phosphate buffer 0.5M, PH 7 and 0.03gm of polyvenile pyrollidone (PVP) with a warring blender, the homogenate were centrifuged at 6000 rpm for 10 minutes at c. The clear supernatant was used for measurement of enzyme activities with three replicates done for each assay.

SOD activity was assayed according to Marclund and Marclund (1974). This method monitored the ability of SOD to inhibit photochemical reduction of pyrogallol at 420 nm.

One unit of SOD activity was defined as the amount of enzyme that caused 50% inhibition. The activity of CAT was assayed by using the method of Wettaker (1992) for chemicals preparation and Aeibi (1984) for cat assay.

The equations used for activity determination were:

$$\text{SOD activity (units)} = \frac{\%inhibition / 50\% \times reactionvolume}{total\,test\,period}$$

$$\text{SOD activity (units)} = \frac{\Delta Abs / \min \times reactionvolume}{0.001}$$

Proline

Proline content was determine calorimetrically according to Bates *et al*. (1973), Marin *et al*. (2010) based on proline's reaction with ninhydrin ratio in a 1:1:1 solution of proline, ninhydrin acid and glacial acetic acid incubated at 100ºC for 1 hr. The reaction was arrested in an iced bath and the chromophore was extracted with 1 mL toluene and its absorbance at 520 nm determined spectrophotometerically A 0.1 g of shoot and root tissues was suspended with 1 mL of 3% sulfosalicylic acid and after centrifugation (10 min at 12,000 rpm) mixed in a 1:1:1 ratio with ninhydrin acid and glacial acetic acid. The reaction and determination of proline were carried out similarly, to that described above. Concentrations of proline in tissues were determined depending on standard curve of pure proline.

Results

The figures 1, 2, 3, 4, 5, 6, 7, 9 shows a significant effect of water quality, the W2 (saline water) led to reduction on dry weight of shoot and root, fruit weight and chlorophyll content N, P, K and K/Na of leaves with dropping rate was 31%, 26%, 60%, 20%, 21%, 36%, 18% and 60%), respectively compared to W1 (river water) significantly, while the saline water due to increase the Na and proline contents in leaves, the activity of POX, CAT and SOD in leaves at an boosting rate was 55%, 44%, 32%, 23% and 17%, respectively these results agreed with AL-Taey (2009), AL-Taey *et al*. (2010), AL-Azawi (2015).

There was an effect due to 25% poultry manure and 250 mg/L gibberellins application on dry weight of shoot and root, fruit weight and chlorophyll content compare to control treatments. Its was increased the dry weight of shoot and root, fruit weight, chlorophyll content by 131%, 93%, 199% and 16% for poultry manure and 31%, 42%, 84% & 14% for GA application, respectively compare to control treatments (figs. 1, 2, 3 and 4). The treatments (W1OM**2**GA2) produced the highest shoot and root dry weight, fruit weight and chlorophyll content, the lowest values for dry weight of shoot, fruit weight, chlorophyll content was due to treatment (W2OM1GA1) (table 3).

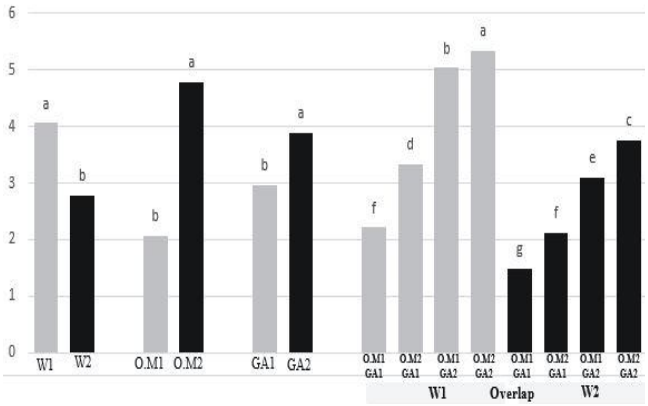

Fig. 1 : Dry weight of shoot (g) W = Water quality, O.M. = Poultry litter, GA = gibberellins.

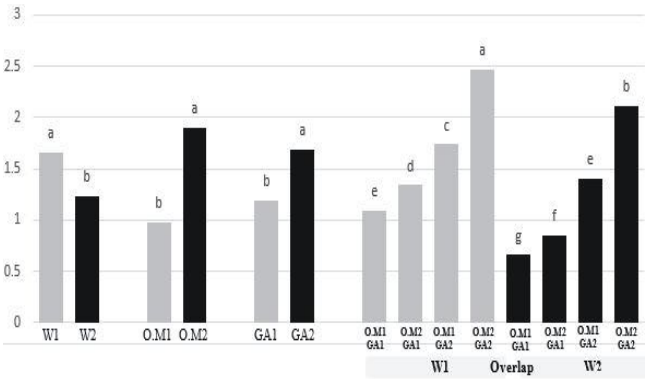

Fig. 2 : Dry weight of root, W = Water quality, O.M. = Poultry litter, GA = gibberellins.

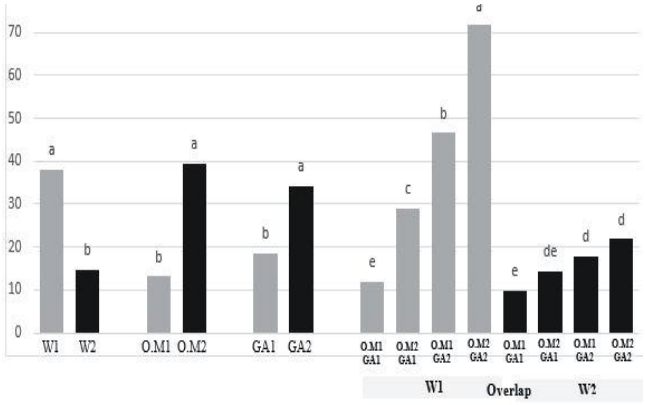

Fig. 3 : Fruit weight (g), W = Water quality, O.M. = Poultry litter, GA = gibberellins.

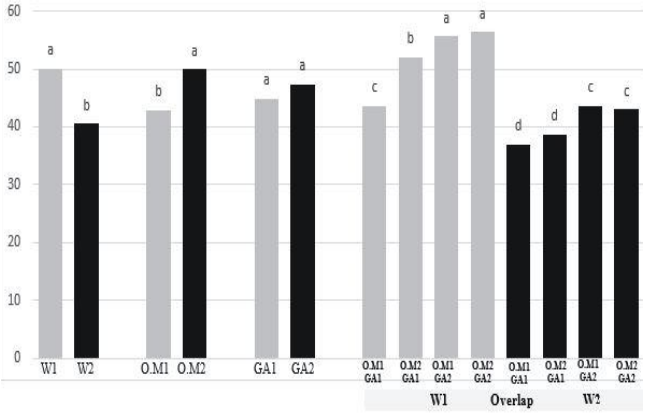

Fig. 4 : Chlorophyll contents in leaves (spad unit), W = Water quality, O.M. = Organic litter, GA = gibberellins.

Table 1 : The chemical analysis for water quality.

Ec	pH	Ca^{++} mmol /L	Mg^{++} mmol /L	Na^{+} mmol /L	K^{+} mmol /L	$CO_3^{=}$ mmol /L	HCO_3^{-} mmol /L	Cl^{-} mmol /L	$SO_4^{=}$ mmol /L
6.5	6.72	35.54	26.6	25.75	0. 43	–	0. 82	37. 69	41. 46
1.1	6.81	4.81	3.65	3.30	0.24	–	2.70	4.21	5.57

Poultry manure at 25% increased concentration of nitrogen, phosphorus, potassium and the K/Na ratio in leaves compare to 0% poultry litter, the poultry litter reduced sodium uptake in root. Fig. 8 compared with 0% poultry litter. Application of gibberellin of 250 $mg.L^{-1}$ increased contents of nitrogen (fig. 5), phosphorus (fig. 6), potassium (fig. 7) and K/Na (fig. 9) compared to 0% gibberellin. Application of gibberellin caused reduction sodium content in leaves (fig. 9).

The saline water led to reduction in nitrogen, phosphorus, potassium and K/Na ratio in the leaves compare to river water (figs. 5, 6, 7 and 9). There was an increase differences in sodium content in leaves when saline water was applied (fig. 8). The interaction of water quality, poultry litter and gibberellin (W1OM2G2) affected in nitrogen, phosphorus, potassium, content and the K/Na ratio compared with (W1OM1GA1). Treatment (W1OM2GA2) produced lowest sodium content compared with treatment (W2O1G1) (figs. 5, 6, 7, 8 and 9) and (table 4). These results agreed with AL-Taey and Saadoon (2012a), ALTaey and Saadoon (2014).

The saline water was increase the proline contents, the activity of POX,CAT and SOD in leaves significantly (figs. 10, 11, 12 and 13). Poultry litter affected in proline contents, POX, CAT and SOD activity in leaves (figs. 10, 11, 12 and 13). The higher poultry manure 25% decreased the values of proline and POX and CAT activity in leaves significantly, compared to 0%. While the poultry application increase the SOD activity in leaves but these elevation not reached to significant level, application of GA 250 $mg.L^{-1}$ didn't gave significant effect in proline content and SOD activity in leaves while, it was

Table 2 : some physical and chemical characters of study soil.

Soil component	Texture	The percent
Sand		24.6
Silt		.3 37
Clay		38.1
Chemical characters	Units	
Ec	$ds.m^{-1}$	2.51
pH	–	7.3
Soluble ions		
Ca^{++}	mmol /L	31
Mg^{++}	mmol /L	7
Na^{+}	mmol /L	15.21
K^{+}	mmol /L	4.35
$CO_3^{=}$	mmol /L	–
HCO_3^{-}	mmol /L	5
Cl^{-}	mmol /L	21.15
$SO_4^{=}$	mmol /L	31.41

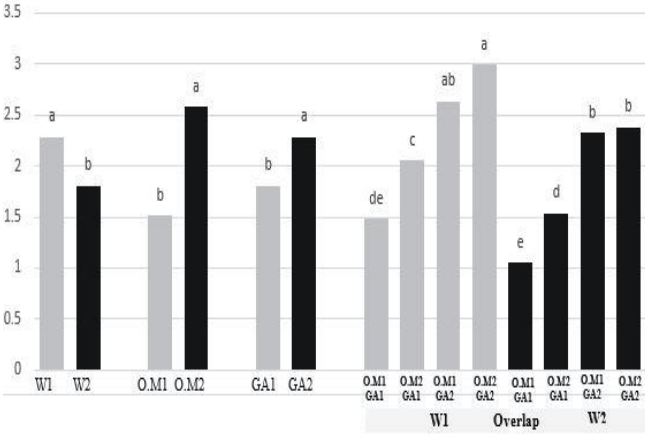

Fig. 5 : Nitrogen contents %, W = Water quality, O.M. = Ooultry litter, GA = gibberellins.

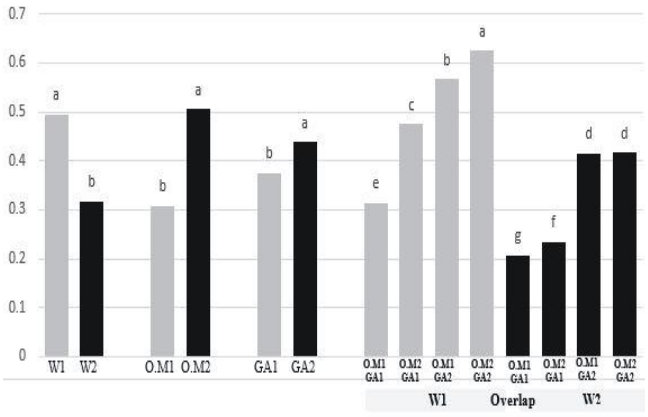

Fig. 6 : Phosphorus contents %, W = Poultry quality, GA = gibberellins.

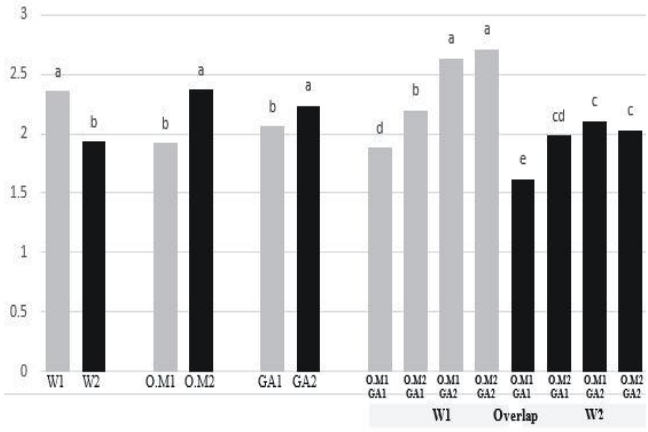

Fig. 7 : Potassium contents, W = Poultry quality, OM = Poultry litter, GA = gibberellins.

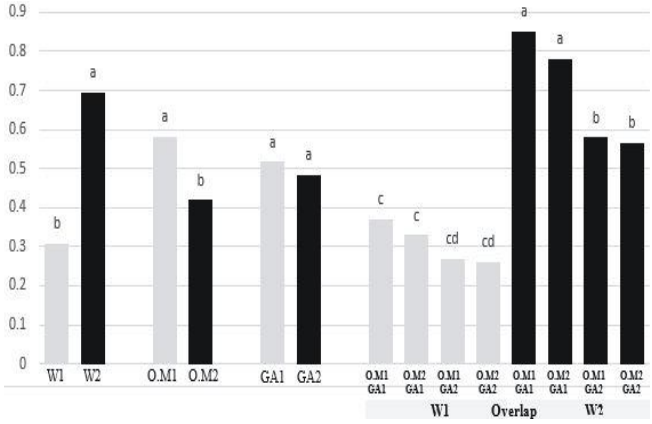

Fig. 8 : Sodium contents, W = Water quality, O.M. = Ooultry litter, GA = gibberellins.

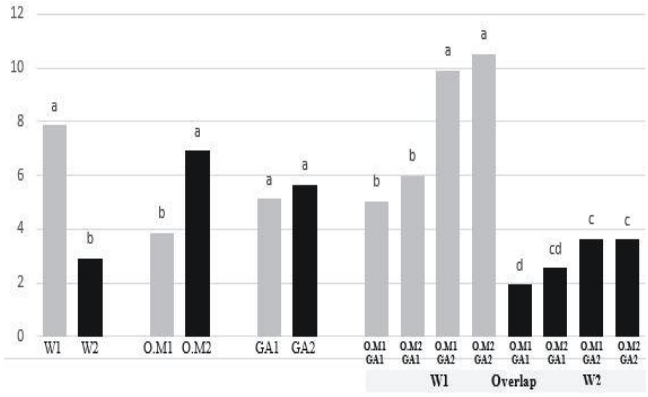

Fig. 9 : K/NA ratio, W = water quality, OM = poultry litter, GA = Gibberellines.

increased the CAT activity in leaves, significantly while the GA application decreased the activity of POX significantly (figs. 10, 11, 12 and 13).

The most complex interaction shows a significant affect among treatment on proline contents in leaves, POX, CAT and SOD, the high value were for (W2O.M2GA1) and (W2 OM1GA1) while the lowest results were for (W1OM1GA2) and (W1 OM2GA2) as

Table 3 : Some vegetative parameters.

			Dry weight of shoot	Dry weight of root	Fruit weight	Chlorophyll contents
1.1 ds.m^{-1}	O.M1	GA1	2.213	1.093	11.9	43.7
		GA2	3.34	1.34	29	52.1
	O.M2	GA1	5.033	1.737	46.6	55.6
		GA2	5.343	2.473	71.6	56.4
6.5 ds.m^{-1}	O.M1	GA1	1.483	0.657	9.8	36.9
		GA2	2.127	0.847	14.3	38.7
	O.M2	GA1	3.103	1.403	17.9	43.7
		GA2	3.764	2.117	21.9	42.97
Dry weight of shoot L.S.D (0.05)		W.Q, = 0.196 ; O.M =0.182 ; GA =0.204 ; WQ× O.M × GA = 0.588				
Dry weight of root L.S.D (0.05)		W.Q, = 0.156 ; O.M =0.166; GA = 0.223; WQ× O.M × GA = 0.354				
Fruit weight L.S.D (0.05)		W.Q, =12.9. ; O.M =11.45 ; GA =11.14 ; WQ× O.M × GA =3.99				
Chlorophyll contents L.S.D (0.05)		W.Q, =2.14. ; O.M =3.02 ; GA =2.11 ; WQ× O.M × GA =5.89				

Table 4 : Some elements contents in leaves.

			N	P	K	Na	K/Na
1.1 ds.m^{-1}	O.M1	GA1	1.48	0.315	1.883	0.37	5.05
		GA2	2.05	0.475	2.2	0.33	5.967
	O.M2	GA1	2.63	0.566	2.637	0.27	9.9
		GA2	2.99	0.625	2.71	0.26	10.51
6.5 ds.m^{-1}	O.M1	GA1	1.05	0.206	1.617	0.85	1.92
		GA2	1.54	0.235	1.983	0.78	2.54
	O.M2	GA1	2.32	0.415	2.103	0.58	3.63
		GA2	2.38	0.417	2.033	0.56	3.6
N L.S.D(0.05)		W.Q, = 0.0 44 ; O.M = 0.029; GA =0.055 ; WQ× O.M × GA = 0.552					
P L.S.D (0.05)		W.Q, = 0.06 ; O.M =0.019; GA =0.025 ; WQ× O.M × GA = 0.046					
K L.S.D (0.05)		W.Q, =0.037 ; O.M =0.043; GA =0.055 ; WQ× O.M × GA =0.073					
Na L.S.D (0.05)		W.Q, = 0.031 ; O.M = 0.027; GA =0.0174 ; WQ× O.M × GA = 0.032					
K/Na L.S.D (0.05)		W.Q, = 0.071 ; O.M = 0.088; GA =0.092 ; WQ× O.M × GA = 0.101					

for Proline and POX, CAT, whereas the overlap treatment (W1 OM1GA1) was give the lowest With regard to SOD (figs. 10, 11, 12 and 13). The application of poultry litter plus gibberellins deleterious the salinity effect on growth (W2 OM1GA1) having a highest value for proline and peroxidase activity compared with W1OM2GA2. These results agreed with AL-Taey and Majid (2017).

Discussion

The salinity of irrigation water was affected water on the growth, elements contents and antioxidants enzymes and components in pepper. The inhibitory effects of salinity on growth of pepper are probably due to decreased water absorption and disturbed metabolic processes leading to decreased meristematic activity or cell enlargement (Kaydan and Okut, 2007). There are two ways, which salinity retards growth, by damaging growth cells so that they cannot perform their functions or by limiting their supply of essential metabolites (Hussein *et al*. 2007; Al-Taey, 2018). Salt stress causes inhibition of growth and development, reduction the photosynthesis, respiration and protein synthesis and disturbs nucleic acid metabolism, that salinity suppressed both of cell diffusion and cell enlargement (Saker and El-Metwally, 2009; Al-Taey, 2009). This reflects negatively on the quantity and quantity of yield and nutrient

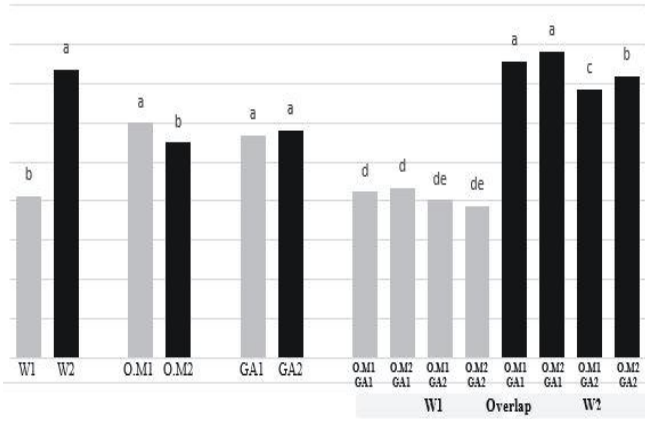

Fig. 10 : Proline contents in leaves, W = water quality, OM = poultry litter, GA = Gibberellines.

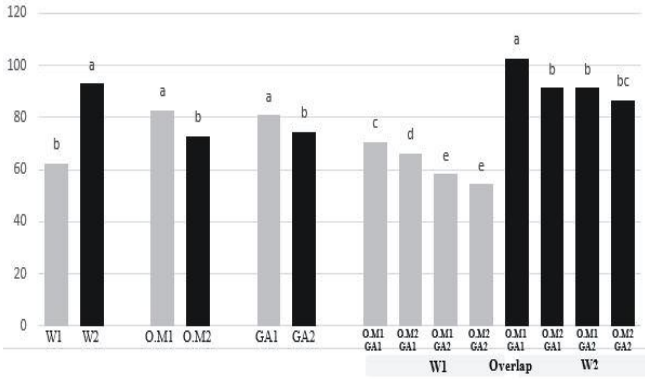

Fig. 11 : POX activity in leaves, W = water quality, OM = poultry litter, GA = Gibberellines.

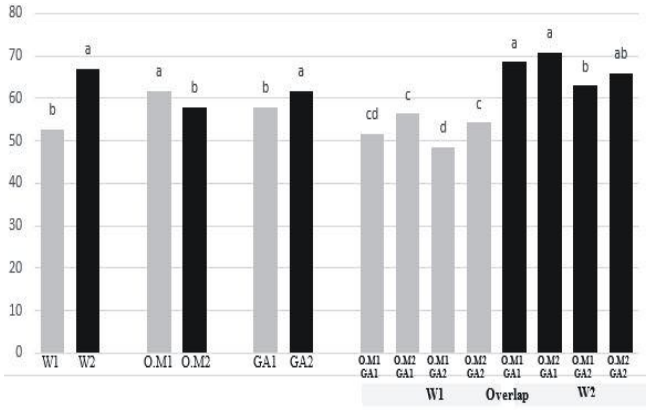

Fig. 12 : CAT activity in leaves, W = water quality, OM = poultry litter, GA = Gibberellines.

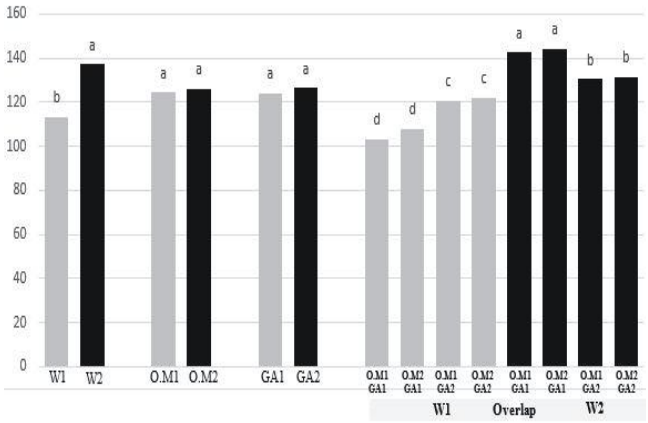

Fig. 13 : SOD activity in leaves, W = water quality, OM = poultry litter, GA = Gibberellines.

Table 5 : Proline contents and some antioxidants enzymes in leaves.

			Proline	POX	CAT	SOD
1.1 ds.m^{-1}	O.M1	GA1	4.24	70.67	51.67	103.23
		GA2	4.337	66.33	56.37	107.91
	O.M2	GA1	4.03	58.33	48.63	120.67
		GA2	3.88	54.33	54.23	122.13
6.5 ds.m^{-1}	O.M1	GA1	7.58	102.67	68.47	142.57
		GA2	7.81	91.33	70.83	144.03
	O.M2	GA1	6.85	90.33	63.54	130.33
		GA2	7.187	86.67	65.83	131.57
Proline L.S.D(0.05)		W.Q. = 0.172 ; O.M = 0.143; GA = 0.211 ; WQ× O.M × GA = 0.282				
POX L.S.D (0.05)		W.Q. = 9.33 ; O.M = 5.74 ; GA =3.55 ; WQ× O.M × GA = 10.23				
CAT L.S.D (0.05)		W.Q. =1.89 ; O.M = 1.65; GA =2.65 ; WQ× O.M × GA = 3.84				
SOD L.S.D (0.05)		W.Q. =3.159 ; O.M = 6.78; GA =8.76 ; WQ× O.M × GA =12.87				

uptake, protein and nucleic acid synthesis, photosynthesis (Zaibunnisa *et al*., 2012), organic solute accumulation, enzyme activity, hormonal balance and reduced water availability at the cell level all of which result in reduced plant growth and ultimately reduced yield. Increased salt content in irrigation water may cause direct and indirect effects on leaf water relations and stomata closure which influence CO_2 exchange and photosynthetic rate. Increased salt content in irrigation water may be directly toxic, which in turn, lower carbohydrate accumulation

plants (Morales *et al*., 2008; AlTaey and Saadoon, 2012b).

The proline contents, POX, CAT and SOD were increased with elevation of water salinity, these results agreed with Al-Azawi, 2015; Younes *et al*., 2016; Al-Taey, 2018), which find that salinity stress reduced chlorophyll content of the plants. But antioxidant enzymes activity, soluble sugars and proline increased, the one mechanism used by plants to scavenge the reactive oxygen species. High salt levels on plant growth increases reactive oxygen species which damage all classes of biologically important macromolecules including DNA and the generation of H_2O_2 and lipid hydro-peroxides, which cause membrane changes. To mitigate, and repair, damage initiated by reactive oxygen, plants developed a complex antioxidant system include peroxidase (POX), catalase (CAT) super oxidase dismutase (SOD) and proline (Amira and Abdul, 2015). Increase in POX and CAT activity with increase salt stress is supposed to be in adaptive trait possibly helping overcome the damage to the tissue metabolism by reducing toxic levels of H_2O_2 produced during cell metabolism and protection against oxidative stress (Bor *et al*., 2003; Sozharajan and Natarajan, 2013).

The plant under salinity stress increased the antioxidant enzymes such as POX, CAT, SOD, MDA for decreasing the oxidative damage in plants, due to salt stress, CAT and POX complement the role of SOD in reducing toxicity caused by salinity (Esfandiari *et al*., 2007; ALTaey, 2014). SOD catalyses the dismutation of superoxide radical anions to hydrogen peroxide and oxygen (Ashraf and Foolad, 2007). Younes *et al*. (2016) have reported significant increasing in activity of POX & CAT in Triticale leaves with the increase of salinity stress, salt stress induces an increase the SOD ,CAT , POX activity, frequently been correlated with salt tolerance.

The poultry applications alleviated negative effects of saline water. Organic fertilizer, apart from releasing nutrient elements to the soil, has been shown to improve other soil chemical and physical properties which enhance crop growth and development (Ikeh *et al*., 2012; AlTaey *et al*., 2015). Poultry litter has been reported to increase soil pH, the acidic soil of the experimental site which could have caused unavailability of nutrients to crops was checked by the limiting potential of organic manure (Ogbonna, 2008). The organic compostes increased the soil fertility and nutrients availability to plants (Husien and Abass, 2016). Moreover, poultry litter contains essential nutrient elements associated with high photosynthetic activities and promoted roots and vegetative growths (John *et al*., 2004).

GA_3 led to improve the growth of pepper, increased the dry weight of shoot and root, fruit weight, chlorophyll contents in leaves, NPK contents in leaves these results may due to that GA_3 regulated developmental processes within plant its helps in cell growth by causing cell elongation, and increases in intermodal length. Higher concentration of gibberellins increases plant growth (Bora and Sarma, 2007). GA_3 counteracts salinity by improving membrane permeability and nutrient levels in leaves which ultimately leads to better growth and GA3 induces physiochemical changes responsible for induction of salt tolerance (Amal *et al*., 2014). In other hand, the effect of organic matter was very distinct under salinity stress, the organic matter can function as salt ion binding agents who detoxify the toxic ions, particularly Na^+ and Cl^- (Eletr *et al*., 2013). Another study showed that OM application to saline paddy soil is an useful remediation method, in terms of the physical, chemical and biological properties of the soil (Wong *et al*., 2009). Badar *et al*. (2015) concluded that physical, chemical and biological properties of soil in salt affected areas are enhanced by the use of organic manure leading to improved plant growth and development, especially under salt stress.

Conclusion

Its possibility of mitigated environmental stress like salinity with any exogenous application, the GA_3 and organic matter led to improve pepper growth under salt stress, the poultry application was decreasing the proline contents and some antioxidant enzymes in leaves while the GA_3 application was decrease the POX and CAT significantly, whereas the proline contents and SOD have a stable value.

Acknowledgment

More work concerning to study the pepper growth and yield under different salinity levels by using many exogenous applications in arid and semi- arid zones is needed.

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