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ALLEVIATING THE PROBLEM OF SALINITY IN POMEGRANATE CV. WONDERFUL BY USING SOME COMMERCIAL NUTRIENT COMPOUNDS

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ABSTRACT

During 2015, 2016 and 2017 seasons, 10 years old Wonderfoul pomegranate trees (*Punica granatum* L.) growing in sandy saline soil, at Assiut wastern desert road of Assiut governorate - Egypt, were subjected to five commertial compounds namely: hyper tonic (as a source of Ca and algae extract), root fast (as a source of algae extract and biosak), Cetrona (as a source of K), gibberilic acid (GA_3) and potassium silicate (as a source of K and Si). The study aimed to examine the efficiency of these compounds for alleviating the harmfull effects of salinity on vegetative growth, yield and fruit quality of Wonderful pomegranate *Cv.*

Using all the five examined compounds was very effective in stimulating vegetative growth, leaf chemical contents, yield and fruit quality, relative to the control. Hyper tonic at 2L/fed. exhibited the highest shoot numbers/tree followed by root fast at 2%. However, the trees treated with gibberellic acid gave the highest shoot length and leaf area. The chemical analysis of mature leaves treateted with root fast at 2% showed a significantly highest ratio of N. While, the trees treated with hyper tonic at 2L/fed. exhibited the highest phosphours, chlorophyll a, b and total chlorophyll contents in mature leaves. On the other hand, the trees sprayed with potassium silicate at 2% exhibited the highest potassium contents in mature leaves.

The Yield/tree (kg) was varied significantaly. However, the hyper tonic at 2L/fed. exhibited the highest and significant yield/tree. Remarkable promotion was observied on fruit physical and chimecal propertie due to using hypertonic. All treatments significantly decreased fruit peel thickness (mm), fruit peel weight, cracked fruit % and sunburned fruit %, this decreament was sharp for hyper tonic, potassium silicate and root fast but it was slight for gibberellic acid treatment. Morever, Potassium silicate, cetrona and hyper tonic improved chemical constituents, such as T.S.S%, Reducing sugars%, total anthocyanen and total acidity%. It could be concluded that treating Wonderfuol pomegranate with Hyper tonic, Root fast, Cetrona, GA3 and potassium silicate seems necessary for overcoming the harmful effect of salinity on growth and productivety of Wonderfoul pomegranate.

Key Words: Pomegranates, Punica granatum, Wounderfoul, salinity stress, Cetrona, Root fast, Hyper tonic, gibberllica acid and Potassium silicate.

INTRODUCTION

The Pomegranate trees (*Punica granatum* L.) belongs to family Punicaceae. This family contains only two species, *Punica granatum L*. and *Punica protopunica*. Pomegranates are widely grown in the moderate climate of the Mediterranean region and it is well adapted to arid and semi-arid soils, and its grown successfully under unfavorable climatic and soil conditions. (Holland *et al.,* 2001; Holland *et al.,* 2009 and Saeedi *et al.,* 2012). Pomegranates are native to central Asia, but since the pomegranate tree is highly adaptive to a wide range of climates and soil conditions, it is grown in many different geographical regions including the Mediterranean basin. However, many new orchards are now planted in the reclamation desert regions in Egypt as well as in the western desert in Egypt.

Consequently, pomegranate production has expanded in new regions where the available water is poor quality, including recycled or saline water (Holland *et al.,* 2009). Pomegranate is a highly valuated fruit crop for its health-promoting effects and it is mainly cultivated in semi-arid areas (Catola *et al.,* 2016). Although pomegranate is one of the oldest known edible fruits, its culture has always been restricted and generally is considered as a minor crop. In recent years, pomegranate is increasingly recognized as attractive fruit trees that provide highly valued health beneficial ingredients and a wide range of usages of the fruit and its products. Thus, it is of utmost importance to exploit its potential against salinity.

Among all the Egyptian Governorates, Assiut Governorate ranks the first position according to the total pomegranate production of fruit (72505 tons). This production produced from 8751 feds. The Area of Wonderful pomegranate reached 3900 and the total production was 18126 tons.

Soil salinity is a problem of grave concern, because it adversely affects growth and development of plants, especially in arid and semi-arid regions

(Yooki *et al.,* 2002; Yuncal and Schmidhalter, 2005; Sarafi *et al.*, 2014 and Parihar *et al.*, 2015). Those plants holding a healthy soil have a higher probability to cope up the abiotic stress conditions (Parihar *et al.*, 2015). Salt stress has been found to disrupt several physiological processes leading to reduction in growth and yield (Mizrahi & Pasternak, 1985 ; Parihar *et al.*, 2015). The effects of salinity appear to be dependent on the species and cultivars and on the stage of the plant development (Grattana and Grieve, 1999 Marschner 1995). However, Ibrahim (2016) stated that pomegranate growth did not affect by salinity in the range of 500 – 750 ppm.

Therefore, the present investigation was initiated to explore the effect of some chemical compounds namely: hyper tonic (as a source of Calcium10% Ca^{++} and algae extract 10%), Root fast (as a source of algae extract 10% and biosak 10%), Cetrona (as a source of potassium 55% K_2O), gibberellin (GA_3) and potassium silicate (as a source of silicon 25% SiO_2 and potassium 10% K_2O) in decreasing the harmful effects of soil salinity on vegetative growth, yield and fruit quality of Wonderful pomegranate cultivated in sandy soil under Assiut Governorate conditions.

MATERIALS AND METHODS

The present study was conducted during three successive seasons 2014/2015, 2015/2016 and 2016/2017 on thirty three uniform in vigor Wonderful pomegranate trees, grown in European company group farm (private orchard) located at the Assiut Western desert rod of Western Desert Assuit Governorate, where the soil texture is sandy, since water table depth is not less than two meters. The chosen pomegranate trees are 10 years old and planted at 3 X 5 meters apart. The shape of the chosen trees is multi trunk (3 trunk/tree) an open vase system with 4 to 6 principal branches. Winter pruning was followed at the first week of January. Drip irrigation system was adopted. However, the irrigation used water supply from underground well with pressure and volume controllers. The chosen trees are subjected to regular horticultural practices that were commonly applied in the orchard including fertilization, (namely 60 g/tree nitrogen applied in the form of urea (46% N), 250 kg/fed. calcium mono superphosphate (15.5% P_2O_5) and 200 kg/fed potassium sulphate, as well as irrigation, hoeing and pest management.

Soil and irrigation water analysis:

Soil and well water composite samples were collected and subjected to Physical and chemical analysis according to the procedures outlined by Wilde *et al.,* (1985). The data of soil and water sample analyses are shown in Table (1).

Table (1): Physical and chemical analysis of the experimental soil and the well water used in irrigation.

Soil analysis		Water analysis	
Constituents	Values	Constituents	Values
Sand %	66	E.C (µS/cm)	953
Silt %	20	Hardness	19.7
Clay %	14	pH	7.35
Texture	Sandy Loam	Ca (mg/L)	38.4
EC (1 : 2.5 extract) mmhos / cm / 25 C	3.2	Mg (mg/L)	24.3
Organic matter %	0.55	K (mg/L)	5.07
pH (1 : 2.5 extract)	7.89	Na (mg/L)	95.8
Active lime %	3% ($CaCO_3$)	Sum of Cations (mg/L)	8.16
N (mg/kg)	185	Alkalinity (mg/L)	182
Phosphorus (ppm)	9.80 ppm	Chlorides (mg/L)	121
Available Ca (meq/100g)	17.9	Nitrate (mg/L)	11.0
Available Mg (meq/100g)	2.33	Sulphates (mg/L)	53.1
Available K (meq/100g)	0.56	Sum of anions (mg/L)	7.69
Available Na (meq/100g)	1.21	Boron (ppm)	0.08
C/N Ratio	17.2	SAR	2.97

Experimental work:

This study included the following eleven treatments

1- Control treatment (trees sprayed with water)
2- Hyber Tonic at 1 liter/fed.
3- Root fast at 1%.
4- Cetrona at 2%.
5- Gibberellin at 50 ppm.
6- Potassium silicate at 1%.
7- Hyber Tonic at 2 liter/fed
8- Root fast at 2%.
9- Cetrona at 4%.
10- Gibberellic acid at 100 ppm
11- Potassium silicate at 2%

Each treatment was replicated three times, one tree per each. Triton B (at 0.5 g/liter) as a wetting agent was added to all spraying solutions of Cetrona, gibberellin and Potassium silicate. The hyper Tonic and Root fast were added throw the injection in the drip irrigation system. However, the gibberellic acid, cetrona and potassium silicate were sprayed on the shoot system. All the tested compounds were added or sprayed three times during the growing season on April, May and June in the three expermintal seasons. Chemical analyses of the five used compositions are shown in table (2).

Table (2): Chemical composition of the compounds used in this experiment (Produced by Bio Nano Tech for fertilizers Development Company).

Compound	Chemical composition
Hyper Tonic	Calcium 10%; Algae extract 10%; Biosak 5%; Carboxylic acids 15%
Root Fast	Algae extract 10%; Biosak 10%; Vitamins 5%; Amino acids 3.5%; Tri-carboxylic acid 1%; Catalysts for the growth 0.2% and B & Zn at 0.5%
Cetrona	High source of potassium (55% K_2O)
Gibberellin	Gibberellic acid (GA_3)
Potassium Silicate	K_2O 10% and Si 20%

Experimental design: Treatments were arranged in a randomized complete block design (RCBD) and each treatment was replicated three times, one tree per each.

Different measurements: The following parameters were measured during the three experimental seasons.

1- Vegetative growth characters:

At the first week of May during both seasons, twenty mature leaves from the medium part of the shoot were picked from each replicate **(according to Ibrahim, 2010)**, Leaf area (cm^2) was estimated. Leaf area was measured by using an area meter (Area Meter Cl, 202). The average main shoot length (cm) was recorded as a result of measuring the length of eight shoots/tree for the four main geographic directions of the tree (2 for each direction), and the average shoot length was recorded in September.

2- **Measurements of leaf pigments:** Samples of six mature and fresh leaves from those located at the middle part on each shoot were taken at the middle of June during the three seasons and cut into small pieces and 0. 5 g weight from each sample was taken, homogenized and extracted by 25% acetone in the presence of little amounts of Na_2CO_3 then filtered. The residue was washed several times with acetone until the filtrate became colorless. The extract was completed to a known volume (20 ml) with acetone 85%. A portion of this extract was taken for the determination of chlorophylls A and B calorimetrically (as mg/ 100 g F.W) and acetone (85% V/V) was used as a blank. The optical density of the filtrate was determined at the wave length of 662 and 664 nm to determine chlorophylls A and B, respectively. Concentration of each pigment was calculated by using the following equations according to Ward and Johnston (1962).

$$\textbf{Chlorophyll a} = (\mathbf{9.784}\ \boldsymbol{X}\ \boldsymbol{E}\ \mathbf{662}) - (\mathbf{0.99}\ \boldsymbol{X}\ \boldsymbol{E}\ \mathbf{644}) = \textbf{mg/100g FW}$$

$$\textbf{Chlorophyll b} = (\mathbf{21.426}\ \boldsymbol{X}\ \boldsymbol{E}\ \mathbf{644}) - (\mathbf{4.65}\ \boldsymbol{X}\ \boldsymbol{E}\ \mathbf{622}) = \textbf{mg/100 g FW}$$

Where E= Optical density at a given wavelength.

Total chlorophyll was estimated by summation of chlorophyll a plus chlorophyll b (mg/ 100 g. F.W)
Then, the leaves content of total chlorophyll (mg/199 g F.W.) were calculated.

3- **Determination of N P K contents in leaves, according to (**Martin-Préval *et al.,* 1984): Tweleve leaves were picked from the medium part of eight main shoots for each tree were taken at the middle of June during the three seasons. The blades were separated and discarded and the petioles only were saved for determining different nutrients. The petioles washed with distillated water and dried at air and oven dried and grounded, then 0.5 g weight was digested using H_2SO_4 and H_2O_2 until clear solution was obtained. The digested solution was quantitatively transferred to 100 ml volumetric flask and completed to 100 ml by distilled water. Thereafter, contents of N, P, K for each sample were determined as follows:

Nitrogen was determined by the modified microkejldahl method. Phosphorus was determined by using colorimetric method, described by Wild *et al.,* (1985), by measuring the optical density of phosphor-molibdo-vanadate complex by Spectro-photometrically at wave length 430 nm. Potassium was flam-photometrically determined by using the method outlined by Martin-Préval *et al.,* (1984).

4- **Measurement of yield, fruit physical properties as well as fruit chemical properties:** The fruits were harvested when fruits become fully colored and the T.S.S/Total acidity ratio in the juice of the check treatment reached 3:3.5 in the three experimental seasons respectively (According to Hegazi *et al.,* 2014). The yield per tree was recorded in terms of weight (kg) and number of fruits per tree and fruit yield (kg) per tree was calculated. Also percentage of fruit cracking, sunburned fruits per tree and marketable fruit were recorded as follow:

$$\textbf{cracked fruits}\ \% = \frac{\textbf{Number of creacked fruit}}{\textbf{Total number of fruits}}\ \boldsymbol{X}\ \textbf{100}$$

$$\textbf{Sunburned fruit}\ \% = \frac{\textbf{Number of sunburned fruit}}{\textbf{Total number of fruits}}\ \boldsymbol{X}\ \textbf{100}$$

From each tree, four pomegranates fruits were randomly picked at maturation date (Last week of September).

The following physical and fruit characteristics were recorded:

- Percentages of splitted fruits and sunburned fruits were estimated, as mentioned in the previous equations.
- Average fruit weight (g), by using sensitivity balance with 0.01g accuracy.
- Average fruit length without calyx (cm), by using vernier caliper with 0.01cm accuracy.

- Average fruit diameter (cm), by using vernier caliper with 0.01cm accuracy.
- Fruit shape index was calculated as follows:
  $$\text{shape Index} = \frac{Fruit\ Diameter\ (cm)}{Fruit\ Length\ (cm)}\ X\ 100$$
- Rind weight plus weight of carpellary membranes (g), by using sensitivity balance with 0.01g accuracy.
- Rind thickness (mm), by using vernier caliper with 0.01cm accuracy.

Chemical Characteristics of juice:
After extracting the arils by hand, 100 g of each replicate were randomly chosen from homogenized sample, pressed by Electric Extractor for extracting the juice, the following chemical characteristics were determined:

- Percentage of total soluble solids (T.S.S %) were determined in triplicate with the juice obtained from each replicate with an refractometer at 20 C, and expressed as a percentage (Brix), according to Rangana (1977).
- Percentage of total titratable acidity (TA), expressed as grams citric acid per 100 grams of juice, by titration against with 0.1 N NaOH, using 1 ml diluted juice in 10 ml distilled H_2O, and the results expressed as gram citric acid/100 grams of fresh juice (%) (According to A.O.A.C, 2000).
- Percentage of total and reducing sugars in the juice was determined by using Lane and Eynone volumetric method, according to Rangana (1977).
- However, the T.S.S./T.A. mathematically calculated by dividing total soluble solids% by the total acidity%.
- Total anthocyanins in fruit juice was determined according to Ranganna (1977).

Statistical analysis of data: All the obtained data were tabulated and subjected for the proper statistical analysis; by analysis of variance (ANOVA) using the statistical package MSTATC Program. Comparisons between means are make by the F-test and Least significant differences (New L.S.D) at p = 0.05.

RESULTS AND DISCUSSION:

I- Shoot length and number of new shoots / tree:

Obtained data in figures (1) show that the main shoot lengths of Wonderful pomegranate was remarkably increased due to applied the Hyper tonic, Root fast, Cetrona, GA_3 as well as potassium silicate in the three experimental seasons, in comparison with control treatment. Moreover, such increase was gradually enhanced due to the increase in the concentrations used. Therefore, the average shoot length increased gradually from the first to the third seasons.

Regardless the concentration, among the five compounds used, spraying the trees with gibberellic acid was superior to the other four compounds (hyper tonic, root fast, Cetrona and potassium silicate), the data tack almost similar trend during the three experimental seasons. While, the least values of shoot length were observed in the untreated trees (57, 58 and 58 cm) followed by those treated with root fast at 1% (65, 69 and 75 cm) during the three experimental seasons, respectively.

Gibberellic acid can be improved shoot length (cm) of Wonderful pomegranate by enhancing cell division and cell elongation. It is known to influence shoot length. Gibberellic acid also reported to promote growth by increasing plasticity of the cell wall followed by the hydrolysis of starch into sugars which reduces the cell water potential, resulting in the entry of water into the cell and caused elongation **(**Khalil and Ali 2013; Zhang and Whiting, 2011 and Richard 2006).

Also, Data obtained during the three experimental seasons as shown in Figure (2) displayed that, regardless the compound or the concentration used, non-significant differences were observed in the new shoot numbers/tree in the first experimental season. While, in the second and third seasons, all treatments concerning the five examined compounds caused significant increase in the shoot number/tree than those recorded for the control treatment. Regard the concentration used, trees treated with Hyper tonic 2L/fed followed by root fast 2% gave higher and significant number of new shoots/tree (89 & 99 shoot/tree and 85 & 95 shoot/tree respectively).

Similar results were observed in some pomegranate cultivars by (Yuncal and Schmidhalter, 2005; El-Kawaga *et al.*, 2012; Gozlekci *et al.*, 2012; Ibrahim and Al-Wasfy, 2014; Ibrahim, 2016 and Mastrogiannidou *et al.,* 2016) and on other fruit trees by (Bernstein, 1977; Marschner, 1995; Parihar *et al.,* 2015; Umar *et al* 2011; Kahayyat *et al.,* 2012 and Ismaail 2013). Under most field conditions, osmotic effects of salinity greatly predominate in restricting growth. This harmful effect on growth can be eliminate or reduced by treating the trees with some mineral nutrients such as Calcium, potassium and silicon (Banuls *et al., 1991*; Ebert *et al.,* 2002; Ma & Takashi 2002; Karimi & Hasanpour, 2014 and Masoud 2017). Furthermore, some growth regulators such as GA_3 play an important role in this concern (Khalil & Ali 2013). However, Abd El-Hakim **(2018)** observed a remarkable enhancement of vegetative characteristics as a result of sprayed grapevine by algae extract. On the In the present study all the treatments contained Calcium, potassium, algae extract as well as gibberellic acid caused a remarkable enhancement of shoot lengths, these results are true for the three experimental seasons and number of new shoot/tree in the second and third season.

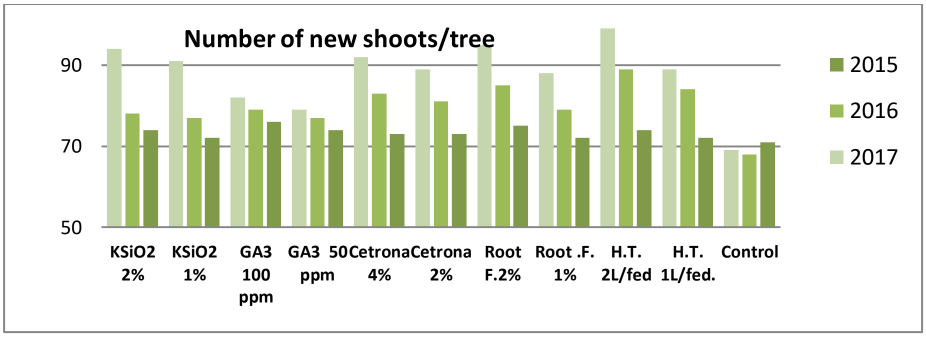

Figure (1): Effect of hyper tonic, Root fast, Cetrona, Gibberellin (GA_3) and Potassium silicate on the number of new shoots/tree of Wonderful pomegranate, during 2015, 2016 and 2017 seasons.

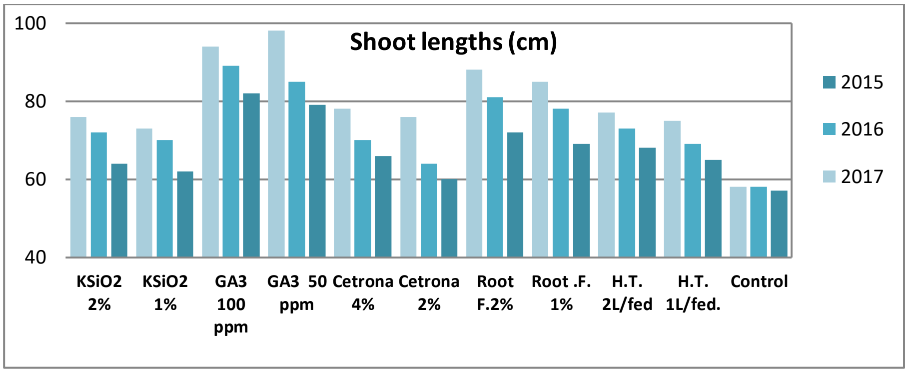

Figure (2): Effect of hyper tonic, Root fast, Cetrona, Gibberellin (GA_3) and Potassium silicate of average shoot lengths/tree of Wonderful pomegranate, during 2015, 2016 and 2017 seasons.

II- Average leaf area (cm^2):

Obtained data in Figure (3) show that the leaf area (cm^2) of Wonderful pomegranate trees was significantly increased due to treating the trees with all the five tested compounds, Hyper Tonic, Root Fast, Cetrona, GA_3 and Potassium silicate in the three experimental seasons. Concerning the five tested compounds, the highest values of leaf area (9.1, 9.5 and 9.9 cm^2), for the three experimental seasons respectively, were resulted from spraying the Wonderful pomegranate trees by AG_3 at 100 ppm. While, the lowest values of leaf area (6.2, 6.3 and 6.1 cm^2), for the three experimental seasons respectively, were resulted from untreated trees followed by those sprayed with potassium silicate alone at 1% (6.4, 6.7 and 7.5 cm^2) in the three experimental seasons respectively. Therefore, the average leaf area increased gradually from the first to the third seasons.

Gibberellin influence plant growth at molecular, cellular, organ, and whole-plant levels. However, Graebe, (1987) and Rodriguez *et al.*, (2006) mentioned that gibberellin counteracted the harmful effect of salinity on the plant growth, dry weight of shoot and yield.

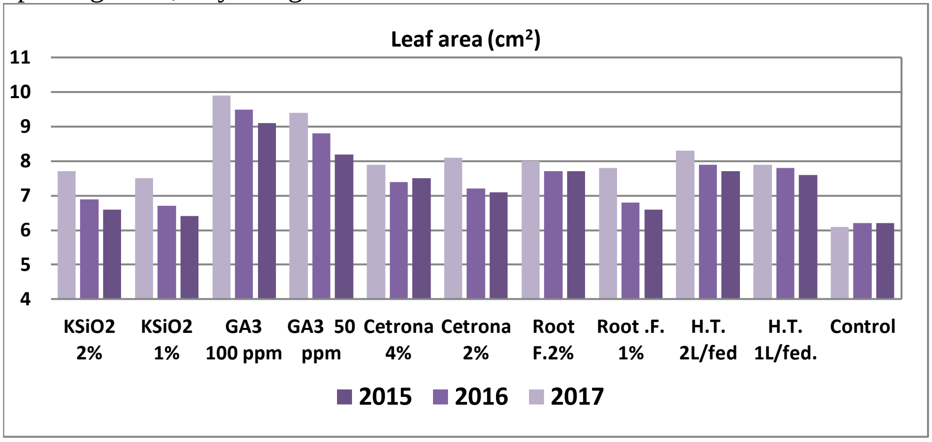

Figure (3): Effect of hyper tonic, Root fast, Cetrona, Gibberellin (GA_3) and Potassium silicate on average leaf area (cm^2) of Wonderful pomegranate, during 2015, 2016 and 2017 seasons.

III- Leaf chemical compostion:

III-1: leaf mineral contents

Obtained data in Table (3) and Figures (4, 5 and 6) show that, regardless the concentrations used, the three nutrients, nitrogen, phosphorus and potassium% in the leaves of Wonderful pomegranate were significantly increased due to treating the trees with the five tested compounds namely: hyper tonic, root fast, Cetrona gibberellic acid and potassium silicate in the three experimental seasons, in comparison with those untreated trees.

Moreover, such increment was gradually increased by increasing the concentrations used. Therefore, the highest values of Nitrogen% (1.79, 1.87 and 1.88%) were obtained from the trees received root fast at 2%. However, the highest phosphorus contents (0.35, 0.37 and 0.38%) were obtained frome the trees received Hyper tonic at 2 L/fed. in the three experimental seasons respectively. While, the maximum values of Wonderful pomegranate potassium contents (1.69, 1.70 & 1.85%) were obtained in the trees received potassium silicate at 2% during the three experimental seasons respectively.

Under salinity stress conditions, These results are in agreement with those obtained by Hu and Schmidhalter (2005); El-Kawaga *et al*., (2012); Gozlekci ***et al*., (**2012); Ibrahim, (2016) and Mastrogiannidou *et al*., (2016) on pomegranate cultivars. Furthermore, Bernstein, (1977); Marschner, (1995); Parihar *et al*., (2015); Grattan & Grieve (1999); Umar *et al* (2011); Kahayyat *et al*., (2012 & 2014) and Ismaail (2013) obtained samilar results on other fruit trees and annual plants.

III-2: Leaf chlorophyll a, b and total chlorophyll contents:

Table (3) shows the effect of hyper tonic, root fast, Cetrona, GA_3 and potassium silicate on chlorophyll a, chlorophylls b and total chlorophyll in the leaves of Wonderful pomegranate trees during 2015, 2016 and 2017 seasons.

One can stated that significant differences on chlorophyll a & b and total chlorophyll in the leaves were observed among the five compounds used levels. Increasing the concentrations of hyper tonic from 1 L/fed to 2 L/fed., root fast from 1% to 2%, Cetrona from 2% to 4%, gibberellic acid from 50 to 100 ppm and potassium silicate from 1% to 2% had significant promotion on leaf chlorophyll contents.

Among the five examined compounds during the three experimental seasons, the trees treated with hyper tonic at 2L/fed present higher and significant values of chlorophyll a (6.99, 7.17 and 7.32 mg/1g F.W. respectively), chlorophyll b (3.21, 3.29 and 3.42 mg/1g F.W. respectively) and total chlorophyll (10.20, 10.46 and 10.74 mg/g F.W respectively) than untreated trees or those treated with the any other compounds. However the lowest values were obtained from untreated trees (5.07, 5.06, 5.11 mg/1g F.W. for chlorophyll a, 2.27, 2.14 and 2.29 mg/g F.W for chlorophyll b, and 7.34, 7.20 and 7.36 mg/g F.W for total chlorophyll, during the three experimental seasons respectively).

Regardless the concentrations used of each compound, the stimulating effect of the five examined compounds on chlorophyll a & b and total chlorophyll contents was related to the increase in the concentrations used.

In agreement with the obtained results, the role of calcium and algae extract (Hyper tonic compound), potassium (citrona), GA_3 and potassium and silicon($KSiO_2$) on the leaf chlorophyll contents of some pomegranate cultivars those obtained by Franck *et al.,* (2012); Salama *et al.,* (2017) and Davarpanah *et al.,* (2017) on Wonderful pomegranate. Also, on the other fruit trees by Bussi *et al.,* **(**2003) on apricot; Gad El-Kareem (2012) on Taimour mango trees; and Abd-El-Hakem (2018) on grapevines. Furthermore, under soilless culture on the three mains pomegranate cultivars in Iran namely Alak, Torsh and Malas Torsh, Naeini et al**.,** (2006**)** reported that vegetative growth and chlorophyll contents were remarkably increased as a result of increasing potassium concentration in the nutrient solution.

Table (3): Effect of hyper tonic, Root fast, cetrona, gibberellin and potassium silicate on leaf chemical composition (N,P,K and Chlorophylls contents) of Wonderful pomegranate trees, during 2015, 2016 and 2017 seasons.

Treatments	Nitrogen %			Phosphorus %			Potassium %			Chlorophyll a mg/1g F.W.			Chlorophyll b mg/1g F.W.			Total Chlorophyll (mg/1g F.W)		
	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017
Control	1.49	1.49	1.48	0.23	0.22	0.22	1.32	1.33	1.31	5.07	5.06	5.11	2.27	2.14	2.25	7.34	7.20	7.36
H. T. 1 L/fed.	1.62	1.66	1.72	0.31	0.33	0.35	1.34	1.35	1.43	6.80	7.01	7.12	3.15	3.24	3.32	9.95	10.25	10.44
H. T. 2 L/fed.	1.69	1.68	1.74	0.32	0.37	0.38	1.39	1.41	1.45	6.99	7.17	7.32	3.21	3.29	3.42	10.20	10.46	10.74
Root Fast 1%	1.64	1.71	1.79	0.25	0.26	0.30	1.41	1.46	1.44	6.72	6.93	7.02	3.01	3.21	3.29	9.73	10.14	10.31
Root Fast 2%	1.72	1.87	1.88	0.27	0.29	0.29	1.41	1.47	1.47	6.89	7.19	7.28	3.09	3.22	3.31	9.98	10.41	10.59
Cetrona 2%	1.66	1.70	1.75	0.33	0.35	0.37	1.59	1.65	1.71	5.91	6.10	6.29	2.89	2.92	2.99	8.80	9.02	9.28
Cetrona 4%	1.68	1.74	1.79	0.32	0.33	0.31	1.62	1.69	1.73	6.17	6.22	6.51	2.82	2.84	2.91	8.99	9.06	9.42
GA_3 50 ppm	1.60	1.72	1.72	0.26	0.27	0.29	1.39	1.44	1.46	5.78	5.78	5.95	2.67	2.65	2.77	8.54	8.52	8.72
GA_3 100 ppm	1.65	1.72	1.75	0.27	0.28	0.30	1.40	1.44	1.47	5.99	6.01	6.19	2.72	2.78	2.81	8.71	8.79	8.99
$KSiO_2$ 1%	1.67	1.74	1.76	0.26	0.26	0.28	1.65	1.71	1.74	5.78	5.82	5.87	2.89	2.91	3.18	8.67	8.73	9.05
$KSiO_2$ 2%	1.71	1.73	1.77	0.27	0.27	0.29	1.69	1.70	1.85	5.94	6.08	6.12	2.98	2.99	3.25	8.92	9.97	9.37
New LSD 5%	0.11	0.13	0.11	0.03	0.04	0.06	0.22	0.24	0.25	0.17	0.13	0.18	0.11	0.11	0.14	0.23	0.22	0.22

IV-1: fruit numbers/tree:

Data concerning the effect of hyper tonic, root fast, cetrona, GA_3 and potassium silicate on yield expressed in weight and number of fruit / tree, of Wonderful pomegranate during 2015, 2016 and 2017 seasons are presented in Tables (4).

It is noticed from the obtained data that, in the second and third experimental seasons, treating the Wonderful pomegranate with hyper tonic, cetrona, GA_3 or potassium silicate (each a two concentrations) significantly improved fruit numbers/tree as well as average fruit weight (g) relative to the control treatment. While, sprayed root fast alone either 1% or 2% not caused any considerable increasing in fruit numbers/tree as compared with untreated trees.

Increasing the concentration of each compound used, although the fruit numbers/tree don't varied significantly, excepted those treated with potassium silicate, which showed a significant increase in the second and third seasons.

Data in Table (4) show also, an enhancement in fruit number/tree form year to year. From the same Table, Regardless the concentrations used, treating Wonderful pomegranate trees by citrona compound (as a source of potassium) presented higher and significant fruit numbers/tree (88 and 90 fruit/tree) in the second and third experimental seasons respectively, as a compared with the other examined compounds.

The positive effect of haypr tonic Hyper tonic, as a compound rich in calcium (10%) and algae extract (10%), can be explained by the effect of calcium on minimizing the harmful effect of soil salinity by obstruct the absorption of Na anions by pomegranate roots (Marchainer 1995). Further, algae extract enhancing growth flowering and fruit setting (Abd El-Hakim, 2018). However, Cetrona (as a source of potassium), and potassium silicate (as a source potassium and of silicon) also showed a significant effect in increasing fruit number/tree during the second and third seasons. This effect can be attributed to the essential roles of potassium in salinity stress and enhancing flowering and fruit setting of pomegranate trees.

IV-2: fruit weight (g):

Data concerning the effect of hyper tonic, root fast, citrona, GA_3, and potassium silicate on fruit weight (g) of Wonderful pomegranate during 2015, 2016 and 2017 seasons are illustrated in Tables (4).

It is noticed from the obtained data that treating the Wonderful pomegranate with the five examined compounds significantly was accompanied with improving fruit weight (kg) relative to the control treatment.

Regardless the concentrations used, during the three experimental seasons treating Wonderful pomegranate trees using hyper tonic, root fast, Cetrona, GA_3 and potassium silicate caused a significant increase in fruit weight (g) than those untreated trees.

Regardless the concentrations used, subjecting Wonderful pomegranate with gibberellic acid present higher and significant fruit weight (551, 559 and 571 g) than the control treatment or than those obtained from the trees received any other examined compound.

Gibberellic acid can be improved Wonderful pomegranate fruit weight (g) by enhancing cell division and cell elongation. It is known to influence fruit size and weight. Gibberellic acid also reported to promote growth by increasing plasticity of the cell wall followed by the hydrolysis of starch into sugars which reduces the cell water potential, resulting in the entry of water into the cell and caused elongation (Richard 2006; Zhang and Whiting (2011); Khalil and Ali 2013 and Omar (2016). However, potassium silicate (as a source of K and Si) positive effect can be explained by the effect of silicon on Powerful fruit growth and the important role of potassium in stimulating cell division and fruit growth (omar, 2016 and Rizc, 2018**)**.

IV-3: Yield (kg/tree):

Data in table (4) showed that, regardless the concentrations used, treating Wonderful pomegranate trees with anyone of the examined compounds: hyper tonic, root fast, Cetrona, gibberellic acid and potassium silicate significantly increased the yield (kg/tree) than those obtained from untreated trees. In the first experimental seasons, although the number of fruits/tree not varied significantly, the yield (kg) increased significantly as a response of the tested compounds, this increment can be attributed to the remarkable increament in the fruit weight.

Regardless the concentrations used, treating Wonderful pomegranate with Hyper tonic at 2L/fed. presented significant promotion on fruit weight in the second and thired seasons (41.2, 46.9 and 49.7 kg/tree) followed by potassium silicate at 2% (42.0, 45.7 and 49.4 kg/tree in the three experimental seasons) over the control treatment.

Fruit physical characteristics:
1: Fruit diameter and fruit length:

Data concerning the effect of hyper tonic, root fast, Cetrona, GA3 as well as potassium silicate on Wonderful pomegranate fruit diameter (cm) and fruit length (cm) during 2015, 2016 and 2017 seasons are illustrated in Table (5).

Data of the first season revealed that, spraying Wonderful pomegranate trees with gibberellic acid at 50 ppm, gibberellic acid at 100 ppm or potassium silicate at 2% significantly increased fruit diameter (cm) than the control treatment. However, treating the trees with hyper tonic, root fast or Cetrona had non-significant promotion on fruit diameter, in the first season, comparison with untreated trees. While, It is noticed from the obtained data that during the second and third experimental seasons fruit diameter of Wonderful pomegranate were improved significantly as a result to application of anyone of the five examined compounds. However, the high concentration, of each examined compound was remarkably effective than that of the lower one.

The same table showed the effect of hyper tonic, root fast, Cetrona, GA3 as well as potassium silicate on Wonderful pomegranate fruit length (cm) during 2015, 2016 and 2017 seasons. It is noticed from the obtained data that, during the three experimental seasons, the fruit length of Wonderful pomegranate not varied significantly, except those treated with GA_3, in the second and third seasons, or those treated with potassium silicate in the third seasons.

The promotion effect of Gibberellic acid on improving Wonderful pomegranate fruit diameter and length can be explained in the light of its increasing effect in cell division and cell elongation. It is known to influence fruit size and weight. Gibberellic acid also reported to promote growth by increasing plasticity of the cell wall followed by the hydrolysis of starch into sugars which reduces the cell water potential, resulting in the entry of water into the cell and caused elongation **(**Khalil and Ali 2013; Zhang and Whiting, 2011 and Richard 2006). These positive effect of GA_3 and potassium silicate on fruit dimensions on pomegranate and other fruit trees were also reported by: (Khalil and Ali 2013; Zhang and Whiting, 2011 and Richard 2006).

Splitted fruits % and sunburned fruits %:

The Data concerning the effect of five examined compounds, each a two concentrations, on cracked fruits % and sunburned fruits % during 2015, 2016 and 2017 seasons given in Table (6) declared that, both cracked fruit % and sunburned fruit % of Wonderful pomegranate were significantly decreased in the three experimental seasons. Such reduction was generally parallel to the increase in the concentrations with the highest values being given due to spraying the trees by water, control treatment, (16.6, 15.9 & 15.3% for fruit cracked % and 16.4, 17.7 & 17.3 % for fruit sunburned %, during the three seasons respectively).

Regardless, the concentrations used, the numerical reduction in cracked fruit percent due to applied the five examined compounds, each one alone, showed that the trees received hyper tonic at 2L/fed. gave the lowest percentage of cracked fruit (6.6, 5.2 and 4.7% in the three experimental season respectively), compared with those picked from the trees received any one of the other four examined compounds.

Furthermore, the same Table showed that, the effect of five examined compounds, each a two concentrations, on sunburned fruits % during 2015, 2016 and 2017 seasons given in Table (6) showed that, all for five examined compounds (Hyper tonic at 1L/fed or at 2L/fed; Root fast at 1% or 2%; Cetrona at 2% or 4%; GA3 at 50 ppm or 100 ppm and $KSiO_2$ at 1% or 2%) caused significant decrease in sunburned fruits % in the three expermintal seasons than control treatment. leasts sunburned fruits %

were obtained from the trees received hyper tonic at 2 L/fed.

In Wounderful pomegranate losses due to fruit cracking and sunburned fruits are quit high. Fruit cracking a problem due to improper water management and deficiency of some mineral nutrients. However, calcium, potassium and silicon nutrition can play an important and clearly role. In the present study, Regardless the concentration used, the numerical reduction in cracked fruits % due to applied the five examined compounds, each one alone, showed that the trees received hyper tonic (as a source of calcium, 10% Ca^{++}) at 2L/fed. gave the lowest percentage of cracked and sunburned fruits fowllowed by those sprayed with potassium silicate at 2%.

Fruit peel thickness:

Obtained data in Table (6) showed that, regardless the examined compounds and the concentrations used, non-significant differences were observed in peel thickness during the first and second seasons.

On other hand, significant decreament in fruit peel thickness were obsereved in the second and third seasons. Regarding the concentrations used, treating the trees with Cetrona at 4% present the lowest fruit peel thickness (32 and 30 mm, in the second and third seasons respectively).

Fruit chemical characteristics:

1- **Effect on juice total soluble solids % and reducing sugars%:**

Data concerning the effect of Hyper tonic, Root fast, Cetrona, GA_3 as well as potassium silicate, each at two concentrations, on Wonderful pomegranate juice total soluble solids and reducing sugars of Wonderful pomegranate juice, during 2015/2016 and 2016/2017 seasons, are illustrated in Table (7). This table shows that, concerning the five examined compounds, both cetrona and potassium silicate were capable of significant promotion in T.S.S% and reducing sugars% in Wonderful pomegranate fruit juice over the control trees during the three experimental seasons season. However, no-significant promotion on T.S.S% and reducing sugars% were attributed to treating the trees with GA3 at 50 or 100 ppm. However, unfavorable effects on fruit T.S.S (12.7, 13.1 and 13.3%) and reducing sugars (10.4, 10.6 and 10.5 %) were recorded on untreated trees. These results were true during the three experimental seasons.

The important roles of potassium concerning increasing total soluble solids and sugars in Wonderful pomegranate fruits can be explained by its effect on enzyme activation, cellular membrane transport processes and translocation of assimilates, anion neutralisation, which is essential in maintenance of membrane potential and osmotic potential regulation, which is one of the important mechanisms in the control of plant water relations (Marshenar 1995). The promotive effect of cetrona (as a source of potassium) or potassium silicate (as a source of silicone and potassium), as well as hyper tonic (as a source of calcium) on Total soluble solids was reported by certain authors such as Mpelasoka *et al.,* (2003); Zhang and Whiting (2011), Gad El-Kareem, 2012 ; Khalil and Ali (2013); Akl *et al.*, (2014); Abd El-Wahab (2015); Omar (2016), Al-Rawi *et al., 2016* and Abd El-Hakem (2018) on pomegranate and other fruit trees.

2- Effect on juice total acidity % and total anthocyanins %:

Data in Table (8) showed that, total acidity was gradually decreased from year to year in the three experimental seasons as a result of treating the trees with the five examined compounds, at both concentrations. However, treating Wonderful pomegranate trees with the five examined compounds was associated with a remarkable redaction in total acidity. On the other hand, the decreament of total acidity was not significant when the trees sprayed with gibberellic acid at 50 or 100 ppm compared with untreated trees. It was clear that such acidity reduction was generally slight when the trees received gibberellic acid at 50 and 100 ppm. While the least total acidity was obtained when the trees received potassium silicate at 2% followed by those received Cetrona at 4%.

Concerning total anthocyanin contents, subjecting the Wonderful pomegranate trees with the five examined compounds enhanced the total anthocyanin contents. This promotion was more remarkable for Cetrona at 4% (103, 106 & 107 mg/100g) and potassium silicate (93, 94 & 98 mg/g) in the three seasons respectively. While, the control treatment given the least total anthocyanin contents (76, 80 & 81 mg/g fresh weight, in the three experimental seasons).

The promotive effect of Hyper tonic on chemical properties of Wonderful pomegranate under salinity stress might be explain by its high content of calcium (one of the most important elements used for reducing the harmful effects of salinity) and algae extract which contanns some of macro and micro nutrients such as potassium and boron, and its content of vitamins such as vitamin C and B, as well as hormones such as cytokinins. The obtained results are in agreement with those obtained by Borochov et al (2014).

CONCLUSION: It could be concluded that treating Wonderfuol pomegranate with Hyper tonic, Root fast, Cetrona, GA3 and potassium silicate seems necessary for overcoming the harmful effect of salinity on growth and productivety of Wonderfoul pomegranate.

Table (4): Effect of hyper tonic or/and Root fast, cetrona, gibberellin and potassium silicate on average fruit numbers/tree, average fruit weight (g) and Yield/tree (kg) of Wonderful pomegranate trees, during 2015, 2016 and 2017 seasons.

Treatments	Fruit No./tree			Fruit weight (g)			Yield/tree (kg)		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Control	65	69	68	426	421	430	27.7	28.9	30.0
H. T. 1 liter / feed	74	86	86	436	521	533	32.3	44.8	45.8
H. T. 2 liter / feed	77	88	91	539	534	542	41.2	46.9	49.7
Root Fast 1%	63	68	72	531	531	538	33.5	36.1	38.7
Root Fast 2%	64	76	78	537	539	545	34.4	40.9	42.5
Cetrona 2%	72	84	86	538	542	546	38.7	45.5	46.9
Cetrona 4%	75	88	90	541	545	549	40.6	47.9	49.4
Gibberellin 50 ppm	58	64	72	549	550	559	31.8	35.2	40.2
Gibberellin 100 ppm	59	67	77	551	559	571	32.5	37.5	44.0
Potassium silicate 1%	76	79	82	531	542	550	40.4	42.8	45.1
Potassium silicate 2%	78	83	88	539	551	565	42.0	45.7	49.4
New LSD 5%	NS	9	10	20	19	19	3.2	3.6	3.5

Table (5): Effect of hyper tonic, Root fast, Cetrona, Gibberellin as well as Potassium Silicate on average equatorial diameter (cm) , average fruit length without calyx (cm) and fruit shape of Wonderful pomegranate trees, during 2015, 2016 and 2017 seasons.

Treatments	Fruit diameter (cm)			Fruit length (cm)			Fruit shape		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Control	7.19	7.14	7.11	6.29	6.48	6.47	1.14	1.10	1.09
H. T. 1 liter / feed	7.30	7.34	7.44	6.45	6.56	6.71	1.13	1.12	1.11
H. T. 2 liter / feed	7.32	7.37	7.48	6.48	6,66	6.83	1.13	1.11	1.09
Root Fast 1%	7.31	7.43	7.59	6.33	6.50	6.69	1.15	1.14	1.13
Root Fast 2%	7.42	7.49	7.63	6.45	6.59	6.78	1.15	1.14	1.13
Cetrona 2%	7.55	7.61	7.68	6.69	6.73	6.80	1.13	1.13	1.13
Cetrona 4%	7.68	7.74	7.79	6.70	6.75	6.88	1.15	1.15	1.13
Gibberellin 50 ppm	8.09	8.36	8.44	6.86	7.02	7.15	1.18	1.19	1.18
Gibberellin 100 ppm	8.01	8.04	8.23	6. 97	6.99	7.05	1.15	1.15	1.17
Potassium silicate 1%	7.89	7.93	8.01	6.68	6.79	6.91	1.18	1.17	1.16
Potassium silicate 2%	7.91	8.05	8.23	6.79	6.91	6.95	1.16	1.16	1.18
New LSD 5%	0.31	0.33	0,32	NS	0.43	0.51	0.07	0.06	0.06

Table (6): Effect of hyper tonic or/and Root fast, Cetrona, gibberellin as well as potassium silicate on average creaking fruit% and sunburned fruit% of Wonderful pomegranate trees, during 2015, 2016 and 2017 seasons.

Treatments	Creaked fruit %			Sunburned fruit %			Fruit peel thickness (cm)		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Control	16.6	15.9	15.3	16.4	17.7	17.3	0.50	0.53	0.51
H. T. 1 liter/feed	6.5	5.8	5.1	7.3	6.4	6.1	0.49	0.45	0.42
H. T. 2 liter/feed	5.6	5.1	3.7	6.3	5.6	5.9	0.46	0.42	0.40
Root Fast 1%	7.3	8.1	9.9	10.2	10.5	9.7	0.45	0.42	0.42
Root Fast 2%	7.7	9.2	8.4	10.3	11.2	9.9	0.45	0.43	0.41
Cetrona 2%	10.5	9.7	9.2	9.9	9.2	9.1	0.47	0.35	0.32
Cetrona 4%	12.2	11.1	9.6	8.9	10.0	8.7	0.46	0.32	0.30
Gibberellin 50 ppm	11.1	8.3	9.0	12.4	12.5	12.6	0.50	0.46	0.44
Gibberellin 100 ppm	9.9	9.2	8.8	12.9	13.1	12.9	0.47	0.45	0.43
Potassium silicate 1%	7.5	6.2	6.1	8.2	8.1	6.6	0.48	0.42	0.42
Potassium silicate 2%	6.0	5.1	4.8	7.4	6.9	6.3	0.46	0.41	0.39
New LSD 5%	2.8	2.1	2.3	3.2	3.3	3.1	NS	0.10	0.09

Table (7): Effect of hyper tonic or/and Root fast, Cetrona, Gibberellin and Potassium Silicate on total soluble solids % (T.S.S. %) and reducing sugars % of Wonderful pomegranate trees, during 2015, 2016 and 2017 seasons.

Treatments	T.S.S. (%)			Reducing Sugars (%)		
	2015	2016	2017	2015	2016	2017
Control	12.7	13.1	13.3	10.4	10.6	10.5
Hyber Tonic 1 liter / feed	14.2	14.6	14.7	11.2	11.6	11.4
Hyber Tonic 2 liter / feed	14.6	14.8	15.1	11.9	11.7	11.9
Root Fast 1%	14.1	14.3	14.6	12.1	12.5	12.7
Root Fast 2%	14.6	14.7	15.1	12.6	12.7	12.9
Cetrona 2%	15.7	15.9	16.1	13.1	13.5	13.7
Cetrona 4%	15.9	16.1	16.8	13.3	13.9	13.7
Gibberellin 50 ppm	13.5	13.4	13.5	11.1	11.4	11.5
Gibberellin 100 ppm	12.9	13.2	12.6	11.7	11.3	11.6
Potassium silicate 1%	15.3	15.8	16.2	12.2	13.0	13.1
Potassium silicate 2%	15.4	15.9	16.4	12.9	13.5	13.9
New LSD 5%	1.2	1.3	1.1	0.99	0.98	1.1

Table (8): Effect of hyper tonic or/and Root fast, Cetrona, Gibberellin and Potassium Silicate on juice total acidity% and total anthocyanins% of Wonderful pomegranate trees, during 2015, 2016 and 2017 seasons.

Treatments	Total acidity (%)			Total anthocyanin (mg/100g)			T.S.S/Acid Ratio		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Control	3.94	3.88	3.90	76	80	81	3.2	3.76	3.41
Hyber Tonic 1 liter / feed	3.18	3.18	3.20	87	92	91	4.5	4.6	4.6
Hyber Tonic 2 liter / feed	3.14	3.12	3.02	90	94	96	4.7	4.7	5.0
Root Fast 1%	3.04	3.11	3.02	89	90	91	4.6	4.6	4.8
Root Fast 2%	3.09	3.08	3.03	89	93	94	4.7	4.8	4.9
Cetrona 2%	3.02	2.82	2.78	99	104	102	5.2	5.5	5.8
Cetrona 4%	2.89	2.81	2.62	103	106	107	5.5	5.7	6.4
Gibberellin 50 ppm	3.58	3.48	3.44	78	82	84	3.8	3.9	3.9
Gibberellin 100 ppm	3.62	3.72	3.66	77	78	81	3.6	3.5	3.4
Potassium silicate 1%	3.02	3.00	2.98	90	92	96	5.1	5.2	5.5
Potassium silicate 2%	2.80	2.72	2.60	93	94	98	5.5	5.8	6.3
New LSD 5%	0.45	0.47	0.52	9	9	11	1.2	1.2	1.5

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التغلب على مشكلة الأجهاد الملحى فى الرمان صنف الوندرفول باستخدام بعض المركبات المغذية التجارية

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خلال اعوام 2015، 2016 و 2017 وعلى أشجار رمان صنف وندرفول عمرها 10سنوات ونامية فى منطقة أسيوط على الطريق الصحراوى الغربى حيث كانت التربة رملية متأثرة بالملوحة، تم أختبار خمس مركبات تجارية هى: الهيبرتونك (10% كالسيوم و10% مستخلص طحالب البحرية) بتركيز 1 & 2 لتر/الفدان، الروت فاست (10% طحالب البحرية و......) بتركيز 1% و 2%، السترونا (كمصدر للبوتاسيوم، 55% P_2O_5) بتركيز 2% و 4%، حامض الجبرليك (GA_3) بتركيز 50 و 100 جزء فى المليون و سليكات البوتاسيوم (25% SiO_2 و 10% K_2O) بتركيز 1% و 2%. وقد هدفت هذه التجربة إلى أختبار كفاءة هذه المركبات فى الحد من الأثر الضار للملوحة على النمو الخضرى والمحصول وكذلك جودة ثمار الرمان صنف الوندرفول.

أظهرت نتائج أستخدام المواد الخمسة محل الدراسة تاثير جيد وملحوظ على النمو الخضرى، التركيب الكيميائى للأوراق البالغة وكذلك على المحصول وجودة الثمار. وكانت نتائج التركيز الأعلى غالباً افضل من التركيز المنخفض. وقد أظهرت المعاملة بمركب الهيبرتونك بتركيز 2لتر/الفدان أعلى عدد من النموات الحديثة/الشجرة متبوعة بتلك التى تم معاملتها بمركب الروت فاست بتركيز 2%. فى حين أن الأشجار التى تمت معاملتها بمركب الجبرلين بتركيز 100 او 50 جزء فى المليون اعطت أعلى معدل لنمو الأفرع الرئيسية وكذلك أعلى معدل لمساحة سطح الورقة. وقد أظهر التحليل الكيميائى للأوراق البالغة أن المعاملة بمركب الروت فاست بتركيز 2% اعطت أفضل نسبة من النيتروجين بالأوراق، بينما سجلت المعاملة بمركب الهيبرتونك أعلى معدل من

الفوسفور وكذلك الكلوروفيل (كلوروفيل أ، ب والكلوروفيل الكلى)، فى حين أن المعاملة بمركب سليكات البوتاسيوم 2% أعطت أعلى نسبة من البوتاسيوم فى الأوراق البالغة.

كما أظهرت نتائج هذه الدراسة حدوث تحسن معنوى فى كمية المحصول، وقد سجلت الأشجار التى تمت معاملتها بمركب الهيبرتونك بمعدل 2لتر/الفدان أعلى كمية محصول/الشجرة. كما أن الصفات الفيزيائية والكيميائية للثمار تحسنت بصورة معنوية خلال سنوات الدراسة. وقد أدت المعاملة بأي من المركبات محل الدراسة الى حدوث تناقص معنوى وملحوظ فى سمك قشرة الثمرة، وزن قشرة الثمرة، نسبة تشقق الثمار ونسبة اصابة الثمار بلفحة الشمس، وقد كان هذا التناقص أكثر وضوحا فى حالة المعاملة بمركب سليكات البوتاسيوم ومركب الروت فاست، بينما كان هذا التناقص أقل وضوحاً عند المعاملة بالجبرلين سواء بتركيز 50 أو 100 جزء فى المليون جزء. وعلاوة على ذلك، أدت المعاملة بسليكات البوتاسيوم، والسترونا والهيبرتونك إلى تحسين الخصائص الكيميائية للعصير، وخاصة نسبة المواد الصلبة الذائبة، نسبة السكريات المختزلة، محتوى العصير من الأنثوسيانينات الكلية، كما أدت إلى خفض نسبة الحموضة بصورة معنوية.

ويمكننا من خلال نتائج هذه الدراسة أن نستخلص التالى: أدت المعاملة بالمركبات الخمسة محل الأختبار إلى تحسين النمو والمحصول وكذلك جودة الثمار وكانت أفضل النتائج المتحصل عليها عند المعاملة بالهيبرتونك أو بسليكات البوتاسيوم. لذلك تعد المعاملة بها ضرورة ملحة للحد من الأثر الضار للملوحة، تحت ظروف التجربة والظروف المماثلة لها.