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Effect of Sulfur and Potassium Application under Salinity Stress on Productivity and Fruit Quality of Swelling Peach Cultivar

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ABSTRACT

This study was conducted during two successive seasons (2016 and 2017) at El-Sheikh Zwayed, North Sinai Governorate, Egypt. The aim of this research was to investigate the effect of three anti-salt stress materials (Nile fertile, elemental sulfur and potassium sulfate) on Swelling peach cultivar under irrigation water saline stress. In this experiment Nile fertile was applied at (0, 500 and 1000 gm/ tree), elemental sulfur (95% S) as soil application at three levels (0, 500 and 750 g / tree) and potassium sulphate as foliar application on three concentrations (0, 2, and 4 g/l.) and combination of them. The obtained results revealed that all anti-salt stress substances have a positive effect on vegetative growth parameters, fruit set, and yield/tree. The highest significant value of the final fruit set, yield/tree was obtained with Nile fertile treatment followed by elemental sulfur and potassium sulphate in both seasons of this study. On the other hand, there was no significant differences between the three materials on fruit length, fruit diameter, flesh and pit fruit weight, total soluble solids, total acidity and leaf content of N%, P% and k% during both seasons of the study and leaf content of Fe (ppm) in the 1st season. While the interaction effect between the three investigated factors shows clearly significant effects in improving vegetative growth, final fruit set no. of fruits /tree, fruit weight, crop yield, fruit physical and chemical parameters. Thus, the combination between Nile fertile 1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (4g/L) gave the best results on shoot length, leaf area, initial, final fruit set %, fruit length and diameter, flesh weight (g), pit weight (g), maximum yield/tree, TSS, lowest acidity%. In addition to N, P, K, Fe, Zn and Mn in leaves in both seasons. On the other hand, untreated trees recorded the lowest values in previous studied parameters in this respect.

Keywords: Sulfur, Potassium, Swelling Peach Cultivar, Productivity, fruit quality, Salinity.

INTRODUCTION

Peach (*Prunus persica L.*) were recently cultured in China nearly 4000 years ago. It appertains to the family Rosaceae. They have moved along quickly universally outside of it. The availability of unalleviated chilling cultivars high because of their foremost harvest with small water need, immense commercial value and acceptable potential for trade abroad are the consequence of this very quick spreading. They are one of the best valuable deciduous fruit trees developed in Egypt. One of the main sights of developing peach tree in North Sinai governorate (Abed El-Hamied and Ghieth, 2017). Peach is one of the leading fruit crop grown in commercial orchards that include many variable cultivars in North Sinai governorate especially Swelling Peach cultivars. The demands for high quality locally produced peach remain good and the future appears high for the industry of this cultivar.

Salinity is a dominant abiotic stress aspect that is correlate with ionic/osmotic consequences, nutritional disproportion or oxidative stress. It influences plant growth, advancement, and mass production all over the world by minimization in photosynthesis and growth features of plants, which established various mechanisms to conquer and tolerate salinity outcome. Handling of mineral nutrients situation of plants is one of the diverse available mechanisms to cut down the reactions of salinity stress and to establish an adequate protection system (Nazar *et al.*, 2011).

Underground water as a possible source of saline water used in irrigation is still very restricted source until today. It recognized as a restricting factor for the achievement of the projects of new land reclamation where several difficulties predicte to appear due to the extreme accumulation of noticeable salts in the soil (Maghoury, 2017).

Potassium (K) as a synthetic fertilizer, has been handled on crop field since the 19th Cakmak (2005) Potassium is one of the greatest valuable macronutrients, together with nitrogen(N) and phosphorous (P) Fageria (2016) Potassium is involved in diverse biochemical operations like protein synthesis, carbohydrate metabolism, and enzyme stimulation. It has an alleviating role in different abiotic stresses like drought, salinity, metal toxicity, increase or decrease temperatures, etc. Also, it is required to assist in many physiological mechanisms including the cation-anion harmony, osmoregulation, water movement and energy transmission (Wang *et al.,* 2013).

Potassium is connected with natural plant growth and development increases tolerance/resistance facing various stress status. Satisfactorily provided k to the plants all along stress condition can decrease the production of ROS and recover the plant condition. It is involved in plant signaling systems, which supports to resist few stresses by triggering antioxidant defense systems. So good application of K with different nutrients aids to achieve viable yield and trait of crops (Borhannuddin *et al.,* 2018).

Sulfur (S) is ranked in 4th place in priority after nitrogen, phosphorus, and potassium. It is a necessary plant nutrient used in plant growth and development. It is an essential part of several valuable compositions that clarify growth and vigor of plants under excellent and stress statuses such as vitamins, co-enzymes, phytohormones, and reduced sulfur compositions (Nazar *et al.*, 2011).

The Nile fertile (NF) is one of the hopeful soil improvement which includes 38% S, some vital elements, (N 2.7%, P 3.5%, K 1.2%, Ca 5%, Mg 2.7%, and Fe 1%) and Sulfur bacteria (*Thiobacillus ferroxidase*) (10^6 CFU/gm) (Kassem *et al.,* 1995). Acid bacteria involved in (NF) constitution adhere to the (S) particles. The proportion of generation of moderately simple oxidized sulfur compositions is raised when the bacteria begin to oxidize (S) and increased in number with advanced time. Generated oxidized sulfur composition is absorbed by plants then involved in its growth and production. Furthermore, NF raised the possibility of nearly all nutrients by lessening pH and raising the organic matter. For this reason, it is well advised as a soil modifier (Bhavaraju *et al.,* 1993).

The present study aimed to minimize the adverse effects of irrigation water salinity on tree growth and productivity of swelling peach trees through manipulation with some anti-salt stress substances (potassium sulfate, Nile fertile and elemental sulfur).

MATERIALS AND METHODS

This study was carried out during the two successive experimental seasons 2016 and 2017 on Swelling peach cultivar grafted on bitter almond rootstock grown in a private orchard, which is located at El-Sheikh Zuwayid, North Sinai Governorate, Egypt. All trees were seven years old, grown in sandy soil under drip irrigation system. The trees were planted at 5 × 5 m apart and all trees are almost uniform in shape and received regularly the annual horticultural practices.

The soil and irrigation water analysis was done and listed in Table (1)

Table 1. Some physical and chemical properties of the experimental soil and irrigation water

characteristics	Soil	water
Particle size distribution %		
sand	93.3	
silt	4.9	
clay	2.1	
Texture calls	sandy soil	
SP	19.5	6.6
EC (dsm^{-1})	4.29	2.13
pH	8.00	8.0
Soluble cations meq/l		
Ca^{+2}	20.0	6
Mg^{+2}	7.8	1.3
Na^{+}	14.1	13.6
K^{+}	1.0	0.4
Soluble anions meq/l		
CO_3^{-2}	---	--
HCO_3^{-}	3.1	1.6
Cl^{-}	25.6	16.3
SO_4^{-2}	14.2	3.4
Available micronutrients in soil (ppm)		
Fe	2.8	1.5
Zn	3.6	1.5
Cu	0.7	0.2
Mn	5.4	0.1

Treatments and experimental design:

Three kinds of anti-salt stress substances (Nile fertile, elemental sulfur and potassium sulphate) studied during the present investigation as follows:

First factor: Nile fertile (NF) contains 38% S, some essential elements, (2.7 % N, 3.5% P, 1.2% K, 5% Ca, 2.7% Mg and 1% Fe) and sulfur bacteria (*Thiobacillus ferrioxidans.*) (106 CFU/gm). Bacteria, which consider as the most important microorganisms involved in the bioleaching of sulfide compounds to sulfuric acid in amount enough to decrease soil pH, improve availability of most soil nutrients and uptake by plant, enhancing root development and increasing the activity of soil microorganisms (Kassem *et al*., 1995). Nile fertile was applied as a single dose at three levels (0, 500, 1000 gm/ tree) during winter agricultural management by mixing with soil in wetting zone adhesive to the roots.

Second factor: Soil application of agricultural sulfur (95% S) at three levels of (0, 500 and 750 g / tree). The sulfur was applied around the trunk of trees at the first week of January for the two seasons.

Third factor: Foliar application of potassium sulphate at three concentrations (0, 2, and 4 g/l.). They were sprayed three times, the first spray at vegetative buds burst and the second spray after full bloom stage and the final spray particularly after the fruit set during the two seasons.

Measurements

Vegetative Growth:

At the end of each season (first week of October), the selected shoots were measured for the average of shoot length (cm) and leaf area cm^2.

Fruit Set %:

Ten shoots on each tree were labeled for determined the number of flowers at full bloom. Number of fruits was recorded at fruit stage and Final fruit set (%) at harvest time. They were calculated by equations

Initial fruit set (%) = no. of fruitlets / total No. of flowers at full bloom ×100

Final fruit set (%) = no. of fruits at harvest time / no. of fruitlets at fruit set stage×100

Yield / Tree:

Yield was pressed in weight kg and number of fruits per tree was recorded at harvest time (3rd week of May).

Fruit quality:

Twenty fruits were randomly taken at harvest time from each replicate for measuring the following; average fruit weight (g), length (cm) and fruit diameter (cm), weight of pit (g) and flesh (g), total soluble solids% (TSS%) and total acidity (%) according to A.O.A.C. (1985).

Macro and micro-nutrients:

Macro and micro-nutrients were determined in dry leaves samples which collected randomly from the middle part of the shoots at the end of June in both seasons. Total nitrogen was determined by micro-Kjeldahl method described by Pregl (1945). Phosphorus content was determined using spectrophotometer according to Watanabe and Olsen (1965).

Potassium was measured using flame photometer according to Page *et al.* (1982). Total Iron, zinc and manganese were determined by using Atomic Absorption Spectrophotometer (Pye unican SP1900) according to Brandifeld and Spincer (1965).

The obtained data were exposed to proper statistical analysis of variance for a split split plot design (three factors) using MSTATC computer program with three replicas and each replicate was represented by two trees. The differences between various treatment means were tested with Duncun Multiple range test at 0.05 (Duncan, 1955).

RESULTS AND DISCUSSION

Results

Data presented in Table (2) revealed that the significal values of shoot length, leaf area and initial fruit set % were recorded with Nile fertile and elemental sulfur applications in the 1st &2nd season with insignificant effect between them.

As for the interaction effect among Nile fertile, elemental sulfur and potassium sulphate, data in table (2) cleared that shoot length, leaf area and initial fruit set % recorded the highest values when applied the high concentration of all tested treatments (4g/L of potassium sulphate, 750 g/tree of elemental sulfur and 1000g/tree of Nile fertile) 34.22, 20.17 and 85.49 in the first season while in the second season 43.24, 22.44 and 91.06, respectively. On the other hand, untreated trees recorded the lowest values of shoot length (25.64 &26.81 cm), leaf area (17.69 & 17.68cm) and Initial fruit set (64.20 & 69.44%) in the 1st and 2nd season, respectively. The other interactions were in between those values.

Table 2. The effect of Nile fertile, Sulfur and Potassium sulphate on shoot length, leaf area and initial fruit set percentage of peach trees under North Sinai conditions during 2016 and 2017 seasons.

The specific effect of Nile fertile, Sulfur and Potassium								
Treatments			**Shoot Length(cm)**		**Leaf Area (cm^2)**		**Initial fruit set%**	
			2016	**2017**	**2016**	**2017**	**2016**	**2017**
Specific effect of Nile fertile			31.29a	36.50a	19.43a	21.24a	79.03a	85.62a
Sulfur Specific effect of			31.21a	36.61a	19.16a	21.17a	79.22a	85.14a
Potassium Specific effect of			29.39b	33.87b	18.74b	20.26b	76.22b	81.41b
The interaction effect between Nile fertile, Sulfur and Potassium								
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017	2016	2017
Control	Control	Control	25.64h-i	26.81 l	17.69g-i	17.68l	64.20h	69.44h
		2 g/L	26.45g-l	28.96j-l	17.62hi	18.30kl	67.83g-h	70.11h
		4 g/L	27.17f-j	28.56kl	17.88f-i	18.45j-l	71.33d-h	75.19f-h
	500g/tree	Control	25.34h-i	29.78i-l	18.10e-i	18.67i-l	69.48e-h	76.45e-h
		2 g/L	27.34f-i	32.74e-k	18.27d-i	19.95d-k	75.58c-g	78.64c-h
		4 g/L	30.34c-i	33.64d-j	18.65c-i	20.11d-j	78.70a-d	85.13a-f
	750g/tree	Control	28.38e-i	30.11h-l	18.43d-i	18.94h-l	71.82d-h	75.00f-h
		2 g/L	30.90c-f	32.74e-k	18.73c-h	20.70a-h	76.19b-h	84.46a-g
		4 g/L	32.19bc	36.99b-f	18.89b-g	20.90a-g	81.50a	86.41a-e
500g/tree	Control	Control	26.31g-i	30.10h-l	17.46i	18.23kl	68.32f-h	74.51gh
		2 g/L	26.89g-k	32.03f-k	18.06e-i	19.13g-l	71.06d-h	77.33d-h
		4 g/L	28.17e-k	32.16f-k	18.50c-i	20.70a-h	78.24a-e	81.62a-g
	500g/tree	Control	27.51f-h	30.37h-l	18.06e-i	19.36f-l	74.38e-g	77.46d-h
		2 g/L	29.08d-i	35.86b-g	18.77c-h	20.57b-h	77.46a-e	82.70a-g
		4 g/L	30.41c-h	36.65b-f	19.13a-e	20.75a-g	81.22a-c	87.48a-d
	750g/tree	Control	28.54e-h	33.60d-j	18.67c-h	21.08a-f	74.96c-g	80.44b-g
		2 g/L	31.63b-d	36.78b-f	18.78c-h	21.05a-f	81.23a-c	86.70a-e
		4 g/L	31.36b-e	38.04b-d	19.25a-e	21.22a-e	83.23a-c	87.34a-d
1000g/tree	Control	Control	27.73f-g	29.07j-l	18.96b-f	19.48e-k	71.37d-h	75.35f-h
		2 g/L	28.76e-g	31.47g-l	19.00a-f	20.52b-h	74.48c-g	78.55c-h
		4 g/L	31.09b-f	34.95c-h	19.18a-e	20.59b-h	81.08a-c	83.38a-g
	500g/tree	Control	30.41c-h	34.10d-i	18.94b-f	20.41c-i	75.79c-g	80.86a-g
		2 g/L	31.63b-d	38.44b-d	19.43a-d	21.38a-d	79.79a-d	89.14ab
		4 g/L	32.3ab	39.31a-c	19.69a-c	22.11a-c	84.73ab	88.41a-c
	750g/tree	Control	30.41c-h	37.63b-e	19.45a-d	21.96a-c	76.89a-f	84.30a-g
		2 g/L	33.24ab	40.33ab	20.06ab	22.25ab	81.67a-c	90.57ab
		4 g/L	34.22a	43.24a	20.17a	22.44a	85.49a	91.06a

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Data presented in Table (3) showed that the highest significant value of final fruit set% was obtained with Nile fertile treatment (69.57 and 74.75) followed by elemental sulfur and potassium sulphate in both seasons. On the other side, it was observed that Nile fertile and elemental sulfur treatments recorded the best results of No. of fruits /trees and fruit weight (g) parameters with insignificant effect between them when compared with spraying potassium sulphate which recorded (130.20 &142.19) and (98.85 &100.25), respectively, in both seasons.

As for the interaction effect between of studied factors, data cleared that all the combined treatments gave significant improving of final fruit set%, no. of fruits /tree and fruit weight. While the combination between Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (4g/L) recorded the best final fruit set% in the first and second season with slight significant increase (82.75 and 84.62%) when used Nile fertile1000g/tree + elemental sulfur 750g/tree +potassium sulphate at (2g/L) applications (80.13and 84.28%).

Also, it was found that no. of fruits/trees and fruit weight results were approved positively by the same previous order of the three combined anti salt stress substances concentrations which recorded the highest values of the studied parameters. Meanwhile, the lowest values were obtained by the control trees in both seasons. The other interactions were in between.

Table 3. The effect of Nile fertile, Sulfur and Potassium on final fruit set, No. of fruits/tree and fruit weight of peach trees under North Sinai conditions during 2016 and 2017 seasons.

Treatments			**Final fruit set%**		**No. of fruits/tree**		**Fruit weight(g)**	
The specific effect of Nile fertile, Sulfur and Potassium								
			2016	**2017**	**2016**	**2017**	**2016**	**2017**
Specific effect of Nile fertile			69.57a	74.75a	132.93a	145.17a	100.94a	102.91a
Sulfur Specific effect of			68.37b	72.65b	132.74a	144.20a	100.92a	102.80a
Potassium Specific effect of			67.10c	71.05c	130.20b	142.19b	98.85b	100.25b
The interaction effect between Nile fertile, Sulfur and Potassium								
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017	2016	2017
Control	Control	Control	59.56i	60.11k	111.64k	155.04l	88.86h	90.99h
		2 g/L	69.49hi	64.36jk	115.58j-k	121.81kl	90.44gh	93.45f-h
		4 g/L	66.84d-i	71.21g-j	116.80j-k	125.30j-l	90.70f-h	98.76b-h
	500g/tree	Control	61.40h-i	64.13jk	118.70i-k	122.10kl	92.17e-h	95.48e-h
		2 g/L	63.62f-i	70.36h-j	118.80i-k	131.49h-l	95.28c-h	100.93a-f
		4 g/L	68.55c-i	77.66a-h	123.26f-k	136.29f-k	97.28b-h	104.35a-d
	750g/tree	Control	63.07g-i	68.65i-k	122.37g-k	129.17i-l	92.85e-h	99.54b-g
		2 g/L	66.57d-i	75.49b-i	128.60d-j	140.54e-j	96.57b-h	100.35a-g
		4 g/L	71.13c-g	78.45a-h	132.86c-h	144.76d-i	98.10a-h	106.19ab
500g/tree	Control	Control	63.97f-i	65.42jk	116.21j-k	121.31kl	89.27g-h	92.36gh
		2 g/L	64.03f-i	68.23i-k	120.08h-k	131.52h-l	95.27c-h	99.21b-g
		4 g/L	67.28d-i	75.13c-i	122.78f-k	138.08f-k	95.66c-h	100.32a-g
	500g/tree	Control	65.54e-i	70.72g-j	125.07e-j	134.54g-k	95.80c-h	97.75c-h
		2 g/L	70.62c-h	75.51b-i	133.30c-g	143.73d-i	98.09a-h	104.48a-d
		4 g/L	77.40a-c	80.35a-e	135.68c-f	155.62b-e	100.22a-e	105.12a-c
	750g/tree	Control	66.42d-i	72.19e-j	127.88d-j	138.08f-k	95.52c-h	97.55c-h
		2 g/L	72.62b-f	76.64a-i	136.32b-e	153.32b-f	100.13a-f	104.81a-c
		4 g/L	77.47a-c	80.22a-f	139.38a-d	159.09b-d	104.23a-c	107.80a
1000g/tree	Control	Control	65.73e-i	68.67i-k	131.01c-i	143.48d-i	95.23c-h	96.41d-h
		2 g/L	68.07d-i	71.41f-j	136.78b-e	147.55d-h	97.52b-h	100.49a-f
		4 g/L	75.43a-d	79.55a-g	139.39a-d	152.07b-f	98.48a-g	103.55a-e
	500g/tree	Control	67.28d-i	72.67d-j	137.20b-e	151.08c-g	93.91d-h	100.00a-g
		2 g/L	72.47b-f	81.34a-d	139.79a-d	164.72a-c	102.94a-d	103.2a-e
		4 g/L	74.47a-e	82.33a-c	143.36a-c	166.02a-c	105.83a-b	106.7ab
	750g/tree	Control	73.71b-e	79.58a-g	140.80a-d	153.27b-f	95.87c-h	102.60a-e
		2 g/L	80.13ab	84.28ab	149.16ab	168.42ab	104.31a-c	108.12a
		4 g/L	82.75a	84.62a	152.07a	177.47a	107.06a	106.28ab

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Data in Table (4) showed that all anti-salt stress substances had positive effect on yield/tree. Meanwhile, Nile fertile application recorded the highest significant effect on yield/tree (15.06 and17.30 kg/tree) in the 1st and 2nd season respectively. On the other hand, there are no significant differences between the three materials on fruit length and fruit diameter during both seasons of the study. This is not consistent with slight differences between treatments.

Concerning the interaction effect between soil additions of Nile Fertile, elemental sulfur and potassium sulphate foliar spray, all the combinations between the three substances affect the crop yield and fruit parameters. The maximum yield/tree was obtained from Nile Fertile 1000g/tree + elemental sulfur 750g/tree + Potassium sulphate 4g/L in both seasons (17.94 and 19.99 kg/tree), respectively. On the other hand, the best fruit length was with Nile Fertile 1000g/tree + elemental sulfur 750g/tree + Potassium sulphate 4g/L in 1st & in2nd season respectively (4.82 & 5.30cm). Similar results were obtained from Nile Fertile 1000g/tree + elemental sulfur 750g/tree + Potassium sulphate 2g/L in the 2nd season (5.32 cm). As for, fruit diameter, the highest value was recorded with the interaction between Nile Fertile 1000g/tree + elemental sulfur + Potassium sulphate 4g/L in both seasons (5.18 & 5.71) and Nile Fertile 1000g/tree + elemental sulfur 750g/tree + Potassium sulphate 2g/L in 2nd season (5,72cm). On the contrary, untreated trees recorded the lowest values of yield/tree (10, 26 &11, 09 kg/tree), fruit length (4.01& 4.08cm) and fruit diameter (4.30 & 4.55 cm) in the 1st and 2nd season respectively. The other interactions came in between aforesaid treatments in both seasons.

Data presented in Table (5) revealed that there were no significant effects between all treated substances on flesh and pit fruit weight in both studied seasons.

In respect with the interaction effect between anti-salt stress substances on weight of flesh and pit fruit, data indicated that all combinations have positive effect on these parameters. The maximum flesh weight (g) was recorded with the combination between (Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (4g/L) (100.30g) in 1st season and Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (2g/L) (102.30 g) in the 2nd season.

However, maximum pit weight was recorded with Nile fertile1000g/tree + elemental sulphur 750g/tree + potassium sulphate at (4g/L) (5.26g) in 1st season and with Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (2g/L) (5.34g) in the 2nd season. On the contrary, the lowest values were exhibited with control trees for flesh weight (83.12 and 85.71g) and pit weight (4.31 and 4.49g) in both successive seasons. The other interaction came in between.

Table 4. The effect of Nile fertile, Sulfur and Potassium sulphate on peach trees yield, fruit length and fruit diameter under North Sinai conditions during 2016 and 2017 seasons.

Treatments			**Yield/tree**		**Fruit length**		**Fruit diameter**	
			2016	**2017**	**2016**	**2017**	**2016**	**2017**
The specific effect of Nile fertile, Sulfur and Potassium								
Specific effect of Nile fertile			15.06a	17.30a	4.65a	5.20a	4.98a	5.58a
Specific effect of Sulfur			14.50ab	16.69ab	4.56a	5.09a	4.92a	5.47a
Specific effect of Potassium			14.22ab	16.66ab	4.56a	5.09a	4.89a	5.40a
The interaction effect between Nile fertile, Sulfur and Potassium								
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017	2016	2017
Control	Control	Control	10.26k	11.09o	4.01q	4.08o	4.30o	4.55m
		2 g/L	10.96j-k	12.06no	4.11pq	4.34n	4.43n	4.67l
		4 g/L	11.22i-k	13.09l-o	4.15op	4.38n	4.45n	4.70l
	500g/tree	Control	11.58h-k	12.37m-o	4.17n-p	4.75l	4.48mn	5.06jk
		2 g/L	11.97g-k	14.02j-n	4.36j-l	4.82kl	4.68i-k	5.18h-j
		4 g/L	12.09g-k	15.04g-l	4.44g-h	4.89jk	4.75g-i	5.26g-i
	750g/tree	Control	12.03g-k	13.62k-n	4.24m-o	4.81l	4.56lm	5.14ij
		2 g/L	13.16e-i	14.94g-l	4.39h-k	5.01gh	4.72g-j	5.37e-g
		4 g/L	13.82d-g	16.28d-i	4.48f-i	5.05f-h	4.81e-g	5.42d-f
500g/tree	Control	Control	11.00jk	11.88no	4.27l-n	4.62m	4.63j-l	4.98k
		2 g/L	12.10g-h	13.80j-n	4.29k-m	4.79l	4.60kl	5.15ij
		4 g/L	12.45f-j	14.68h-l	4.45gh	4.82kl	4.79f-h	5.18h-j
	500g/tree	Control	12.70e-j	13.90j-n	4.37i-l	4.83kl	4.70h-k	5.11j
		2 g/L	13.82d-g	15.89e-j	4.55e-g	4.98hi	4.91de	5.34fg
		4 g/L	14.41c-f	17.31b-f	4.63de	5.09ef	4.97cd	5.47de
	750g/tree	Control	12.92e-j	14.31i-m	4.49f-i	4.80l	4.91de	5.17h-j
		2 g/L	14.43c-e	17.03c-g	4.66c-e	5.08e-g	5.01c	5.47de
		4 g/L	15.42b-d	18.14a-d	4.62de	5.21b-d	4.98cd	5.60a-c
1000g/tree	Control	Control	13.21e-h	14.65h-l	4.29k-m	4.92ij	4.61kl	5.29gh
		2 g/L	14.14d- g	15.73f-k	4.51f-h	5.16de	4.85ef	5.53b-d
		4 g/L	14.54c-e	16.69c-h	4.66c-e	5.19cd	5.02c	5.60a-c
	500g/tree	Control	13.62d-g	16.00d-j	4.58ef	5.14de	4.90de	5.50cd
		2 g/L	15.25b-d	18.01a-e	4.70b-d	5.25a-c	5.05bc	5.62ab
		4 g/L	16.07b-c	18.76a-c	4.78a-b	5.28ab	5.13ab	5.67a
	750g/tree	Control	14.32c-f	16.62d-h	4.71a-d	5.25a-c	4.99cd	5.61a-c
		2 g/L	16.46ab	19.27ab	4.77a-c	5.32a	5.13ab	5.72a
		4 g/L	17.94a	19.99a	4.82a	5.30a	5.18a	5.71a

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Table 5. The effect of Nile fertile, Sulfur and Potassium sulphate on fruit parameters of peach trees under North Sinai conditions during 2016 and 2017 seasons.

Treatment			**Flesh weight (g)**		**Pit weight (g)**	
			2016	**2017**	**2016**	**2017**
The specific effect of Nile fertile, Sulfur and Potassium						
Specific effect of Nile fertile			92.73a	96.83a	4.89a	5.15a
Sulfur Specific effect of			92.96a	96.73a	4.84a	5.10a
Potassium Specific effect of			92.19a	96.61a	4.80a	5.07a
The interaction effect between Nile fertile, Sulfur and Potassium						
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017
Control	Control	Control	83.12h	85.71h	4.31n	4.49k
		2 g/L	86.25gh	90.66f-h	4.55m	4.79j
		4 g/L	87.65f-h	93.27d-g	4.73i-l	4.87ij
	500g/tree	Control	85.54gh	90.15gh	4.62lm	4.98f-j
		2 g/L	89.95e-h	96.08a-g	4.73i-l	5.02e-i
		4 g/L	91.15c-g	98.26a-f	4.81h-k	5.16a-f
	750g/tree	Control	86.07gh	90.52f-h	4.68k-m	4.93h-j
		2 g/L	91.30c-g	97.93a-g	4.77h-k	5.11b-h
		4 g/L	92.62b-g	100.1a-d	4.84g-j	5.24a-c
500g/tree	Control	Control	86.07gh	91.89e-h	4.57m	4.79j
		2 g/L	89.92e-h	93.92c-g	4.71j-l	4.91h-j
		4 g/L	92.19c-g	94.98a-g	4.82h-j	4.95g-j
	500g/tree	Control	87.42f-h	92.82d-h	4.73i-l	4.98f-j
		2 g/L	92.58b-g	98.28a-f	4.83g-j	5.15a-g
		4 g/L	94.65a-f	99.40a-e	4.97d-f	5.22a-e
	750g/tree	Control	90.68d-h	97.93a-g	4.85f-i	5.02e-i
		2 g/L	96.45a-e	98.84a-e	5.04c-e	5.18a-f
		4 g/L	98.29a-d	101.63a-c	5.13bc	5.21a-e
1000g/tree	Control	Control	86.07gh	94.18b-g	4.70j-l	4.92h-j
		2 g/L	92.02c-g	96.82a-g	4.81h-j	5.06c-i
		4 g/L	92.62b-g	97.88a-g	4.87f-h	5.11b-h
	500g/tree	Control	91.15c-g	98.88a-e	4.95e-g	5.05d-i
		2 g/L	97.12a-e	97.32a-g	5.08cd	5.09c-h
		4 g/L	99.84ab	100.34a-d	5.22ab	5.26a-c
	750g/tree	Control	94.55a-f	99.55a-e	5.09cd	5.19a-e
		2 g/L	98.59a-c	102.30a	5.14bc	5.34a
		4 g/L	100.30a	101.80ab	5.26a	5.30ab

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Data in Table (6) revealed that the three treatments had no significant effect between those three chemicals on total soluble solids and total acidity content of peach swelling fruits.

As for the interaction effect between Nile fertile, elemental sulfur and potassium sulphate on TSS%, data in table (6) indicated that the combinations (Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (4g/L) had the highest value (14.81%) in 1st season and Nile fertile1000g/tree + elemental sculpture 750g/tree +potassium sulphate at (2g/L) gave the highest value (14.80%) in the 2nd season. On the contrary, untreated trees recorded the lowest TSS% (13.81% and 13.85%) in both seasons. On contrast, acidity% recorded the highest value with untreated trees (0.33% and 0.34%) in both seasons, respectively. On the other hand, the lowest acidity% level was obtained from the treatment of Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (4g/L) (0.18% and 0.18%) in both seasons, respectively.

Table 6. The effect of Nile fertile, Sulfur and Potassium sulphate on total soluble solids and total acidity content of peach tree under North Sinai conditions during 2016 and 2017 seasons.

The specific effect of Nile fertile, Sulfur and Potassium						
Treatment			**T.S.S. (%)**		**Acidity (%)**	
			2016	**2017**	**2016**	**2017**
Specific effect of Nile fertile			14.31a	14.45a	0.24a	0.21a
Sulfur Specific effect of			14.25a	14.41a	0.23a	0.22a
Potassium Specific effect of			14.29a	14.38a	0.23a	0.22a
The interaction effect between Nile fertile, Sulfur and Potassium						
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017
Control	Control	Control	13.81k	13.85m	0.33a	0.34a
		2 g/L	13.87i-k	13.94k-m	0.33a	0.30bc
		4 g/L	13.90i-k	14.13ij	0.29b-d	0.27de
	500g/tree	Control	13.84g-k	13.87lm	0.32a	0.30b
		2 g/L	13.94h-k	14.00j-l	0.30b	0.25e-h
		4 g/L	13.98h-j	14.12ij	0.28d-f	0.26ef
	750g/tree	Control	13.91i-k	13.95k-m	0.30bc	0.27de
		2 g/L	13.99h-j	14.12ij	0.24ij	0.22ij
		4 g/L	14.06h	14.25hi	0.22k	0.22jk
500g/tree	Control	Control	13.81k	14.05jk	0.29b-d	0.28cd
		2 g/L	13.96h-j	14.29gh	0.28c-f	0.26e-g
		4 g/L	14.00hi	14.46ef	0.27e-g	0.24hi
	500g/tree	Control	13. 90i-k	14.28gh	0.29b-e	0.25f-h
		2 g/L	14.44f	14.58de	0.24i	0.24hi
		4 g/L	14.53d-f	14.65b-d	0.24ij	0.22j-l
	750g/tree	Control	13.93h-k	14.36f-h	0.29b-d	0.29b-d
		2 g/L	14.48ef	14.63b-d	0.22k	0.21j-m
		4 g/L	14.66b-d	14.76a-c	0.20l	0.20m-p
1000g/tree	Control	Control	14.25g	14.35 g-i	0.29b-d	0.25f-h
		2 g/L	14.58c-e	14.71a-d	0.22f-h	0.20l-o
		4 g/L	14.69a-c	14.77ab	0.25g-i	0.20k-n
	500g/tree	Control	14.28g	14.41fg	0.27f-h	0.24hi
		2 g/L	14.57c-f	14.66a-d	0.23jk	0.22ij
		4 g/L	14.78ab	14.76a-c	0.20l	0.18op
	750g/tree	Control	14.46ef	14.61cd	0.25hi	0.24gh
		2 g/L	14.77ab	14.80a	0.22k	0.19n-p
		4 g/L	14.81a	14.75a-c	0.18m	0.18p

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Data in Table (7) indicated that all substances have no significant effect on these parameters.

Referring to the interaction effect between the combinations treatment, data in Table (7) indicated that Nile fertile 1000g/tree + elemental sulfur 750g/tree + potassium sulphate at (4g/L) recorded the highest content of N% (2.43% and 2.66%), P% (0.218% and 0.234%) and K% (1.59% and 1.78%) in leaves in the first and the second season, respectively. On the other hand, the lowest N%, P% and K% leaf content had the lowest values with untreated trees (1.89% and 2.01%), (0.194% and 0.199%) and (1.13% and 1.17%) in both seasons, respectively. The other interaction came in between them.

With respect to the specific effect of the three investigated factors (Nile Fertile, elemental sulfur and Potassium sulphate) on Fe, Zn and Mn leaf content of peach trees, data tabulated in Table (8) showed that individual applications had no significant differences in Fe (ppm) leaf content in the 1st season .However, there was high values of Fe (ppm) when received Nile fertile (49.83ppm) and elemental sulfur (49.28ppm) in the second season .As for zinc (ppm) leaf content Nile fertile and elemental sulfur enhanced Zn (ppm) content in both seasons compared with potassium sulphate treatments. On the other hand, Nile fertile and elemental sulfur ameliorate Mn (ppm) content in the first season .while, Mn (ppm) content was enhanced with Nile fertile (39.48ppm) and Potassium sulphate (39.45ppm) in the 2nd season.

Concerning the interaction effect between three anti salinity stress treatments, all different combinations ameliorate Fe, Zn and Mn (leaf content). In addition, Nile fertile1000g/tree + elemental sulfur 750g/tree +potassium sulphate at(4g/L) recorded the highest values of Fe(ppm) (55.67 ppm and 64.67ppm) while Zn recorded (46.00 ppm and 60.19 ppm) .In addition Mn recorded (53.31ppm and 41.67ppm) in both studied seasons also, the combination of Nile fertile1000g/tree + elemental sulfur 750g/tree + potassium sulphate (2g/L) with Zn (ppm) recorded (59.23ppm) in the 2nd season exhibited the same level. On contrary, untreated trees have the lowest values of Fe (ppm), Zn (ppm) and Mn (ppm) leaf content in both seasons. The other interaction came in between them.

Table 7. The effect of Nile fertile, Sulfur and Potassium sulphate on leaves content of nitrogen, phosphorus and potassium of peach tree under North Sinai conditions during 2016 and 2017 seasons.

The specific effect of Nile fertile, Sulfur and Potassium								
Treatments			**N (%)**		**P (%)**		**K (%)**	
			2016	**2017**	**2016**	**2017**	**2016**	**2017**
Specific effect of Nile fertile			2.225a	2.433a	0.202a	0.216a	1.317a	1.459a
Sulfur Specific effect of			2.228a	2.453a	0.204a	0.219a	1.339a	1.464a
Potassium Specific effect of			2.216a	2.417a	0.203a	0.215a	1.343a	1.491a
The interaction effect between Nile fertile, Sulfur and Potassium								
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017	2016	2017
Control	Control	Control	1.89j	2.01l	0.194c	0.199g	1.13j	1.17k
		2 g/L	1.86j	2.05kl	0.194c	0.203e-g	1.17ij	1.22jk
		4 g/L	2.01i	2.10k	0.195bc	0.211c-g	1.19h-j	1.29h-k
	500g/tree	Control	2.05i	2.25j	0.195bc	0.206d-g	1.16j	1.33g-k
		2 g/L	2.20e-h	2.31ij	0.197bc	0.211c-g	1.30e-i	1.38f-j
		4 g/L	2.23d-h	2.37g-i	0.202a-c	0.212b-g	1.32e-h	1.46e-i
	750g/tree	Control	2.18f-h	2.29ij	0.195bc	0.207d-g	1.17ij	1.28i-k
		2 g/L	2.22e-h	2.40f-h	0.200a-c	0.211c-g	1.33d-h	1.35g-k
		4 g/L	2.24d-h	2.44e-h	0.202a-c	0.220a-f	1.38c-g	1.44e-i
500g/tree	Control	Control	2.16h	2.31ij	0.195bc	0.201fg	1.21h-j	1.22jk
		2 g/L	2.20e-h	2.35hi	0.197bc	0.207d-g	1.20h-j	1.34g-k
		4 g/L	2.18gh	2.35hi	0.200a-c	0.211c-g	1.29f-i	1.44e-i
	500g/tree	Control	2.21e-h	2.40f-h	0.198a-c	0.212b-g	1.25g-j	1.33g-k
		2 g/L	2.24d-h	2.47d-f	0.203a-c	0.224a-d	1.36c-g	1.51d-g
		4 g/L	2.27cd	2.51c-e	0.208a-c	0.227a-c	1.42c-f	1.56c-f
	750g/tree	Control	2.25d-g	2.42f-h	0.197bc	0.211c-g	1.29f-i	1.45e-i
		2 g/L	2.26c-g	2.53cd	0.205a-c	0.220a-f	1.38c-g	1.61a-e
		4 g/L	2.29c-e	2.55bc	0.213a-c	0.231ab	1.44b-e	1.69a-d
1000g/tree	Control	Control	2.20e-h	2.42f-h	0.203a-c	0.207d-g	1.32e-h	1.33g-k
		2 g/L	2.21e-h	2.43f-h	0.206a-c	0.216a-g	1.39c-g	1.44e-i
		4 g/L	2.25c-g	2.45d-g	0.209a-c	0.222a-e	1.47a-d	1.51e-g
	500g/tree	Control	2.27c-f	2.53cd	0.203a-c	0.221a-f	1.35c-g	1.47e-h
		2 g/L	2.28c-e	2.59a-c	0.213a-c	0.224a-d	1.41c-f	1.58b-e
		4 g/L	2.31b-d	2.65a	0.214ab	0.229a-c	1.49a-c	1.74ab
	750g/tree	Control	2.34bc	2.61ab	0.208a-c	0.224a-d	1.47a-d	1.61a-e
		2 g/L	2.38ab	2.63ab	0.211a-c	0.232ab	1.56ab	1.72a-c
		4 g/L	2.43a	2.66a	0.218a	0.234a	1.59a	1.78a

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Table 8. The effect of Nile fertile, Sulfur and Potassium sulphate on peach leaves content of iron, zinc and manganese under North Sinai conditions during 2016 and 2017 seasons.

The specific effect of Nile fertile, Sulfur and Potassium								
Treatments			**Fe (ppm)**		**Mn (ppm)**		**Zn (ppm)**	
			2016	**2017**	**2016**	**2017**	**2016**	**2017**
Specific effect of Nile fertile			43.52a	49.83a	38.09a	43.37a	32.62a	39.48a
Sulfur Specific effect of			43.61a	49.28a	38.00a	43.23a	32.50a	38.56b
Potassium Specific effect of			43.51a	47.41b	37.24b	42.71b	31.12b	39.45a
The interaction effect between Nile fertile, Sulfur and Potassium								
Nile fertile	Sulfur	Potassium	2016	2017	2016	2017	2016	2017
Control	Control	Control	37.67m	39.67l	32.05l	30.10m	28.78l	21.01m
		2 g/L	38.67lm	40.33l	32.47kl	31.67lm	28.57l	23.00lm
		4 g/L	39.83j-m	41.83kl	34.68h-l	32.24lm	20.60kl	23.67k-m
	500g/tree	Control	39.33k-m	41.83kl	32.18l	35.00kl	33.44i-k	25.67j-l
		2 g/L	41.83f-l	46.00h-j	34.39i-l	36.10j-l	35.14ij	29.00f-j
		4 g/L	44.50c-h	47.83f-i	36.38e-j	41.47g-i	37.22g-i	30.33f-i
	750g/tree	Control	43.83d-i	43.83jk	34.42i-l	38.46i-k	34.00i-k	28.33g-j
		2 g/L	45.17c-g	47.83f-i	35.29h-k	39.32h-k	36.20h-j	29.67f-i
		4 g/L	46.17c-e	48.83e-h	38.86c-f	42.42f-i	41.18e-g	32.00d-g
500g/tree	Control	Control	38.67lm	40.00l	32.48kl	36.01j-l	29.99kl	23.67k-m
		2 g/L	40.33i-m	45.00ij	33.33kl	37.47i-k	32.10j-l	27.67h-j
		4 g/L	43.50e-l	46.33g-j	34.33i-l	40.24g-j	33.28i-k	30.01f-i
	500g/tree	Control	41.50g-l	45.50ij	35.33h-k	39.28h-k	35.47ij	27.67h-j
		2 g/L	44.00d-i	49.33d-g	38.33c-g	41.08g-j	40.41e-g	31.33f-h
		4 g/L	45.50c-f	50.50d-f	40.00bc	48.08c-e	42.17d-f	36.00bc
	750g/tree	Control	42.67e-k	46.83g-j	36.00f-j	38.14i-k	36.12h-j	31.33f-h
		2 g/L	45.00c-g	52.03d	40.33b-d	47.02d-f	43.60c-f	31.67e-g
		4 g/L	48.17bc	55.00c	42.67b	53.07bc	45.42b-d	37.00b
1000g/tree	Control	Control	40.83h-m	45.83h-j	35.67g-j	40.74g-j	37.11.g-i	27.00i-k
		2 g/L	43.33e-j	47.83f-i	37.33e-i	45.16e-g	43.74c-f	30.00f-i
		4 g/L	45.50c-f	50.00de	39.33c-e	50.83cd	46.89bc	32.67c-f
	500g/tree	Control	43.00e-j	46.67g-j	37.67d-h	44.20e-h	39.83f-h	30.00f-i
		2 g/L	45.83c-e	55.17c	40.67bc	47.08d-f	44.23b-e	35.33b-d
		4 g/L	49.67b	60.67b	46.00a	56.07ab	47.61bc	38.67ab
	750g/tree	Control	45.17c-g	50.17d-f	38.67c-f	46.46d-f	41.19e-g	35.00b-e
		2 g/L	47.50b-d	61.17b	43.00b	59.23a	48.07b	36.67b
		4 g/L	55.67a	64.67a	46.00a	60.19a	53.31a	41.67a

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test

Discussions

Acid bacteria involved in (NF) constitution adhere to the (S) particles. The proportion of generation of moderately simple oxidized sulfur compositions is raised when the bacteria begin to oxidize (S) and increased in number with advanced time. Generated oxidized sulfur compositions are absorbed by plants then involved in its growth and production. Furthermore, NF raised the possibility of nearly all nutrients by lessening pH and raising the organic matter. For this reason, it is well advised as a soil modifier (Bhavaraju *et al.,* 1993). Also lessening pH and improving organic matter improved the availability of nearly all nutrients (Ibrahiem 2003). Rizk-Alla *et al.,* (2006) reported the utmost values of vegetative growth were achieved by the application of Nile fertile.

The present results explained that the root formation is enhanced by the beneficial outcome of Nile fertile. Mankolah (2017), noted that Nile Fertile at 750g /tree and sulfur at 1.0 kg /tree were much practical in augmenting the growth parameters of orange trees. Identical outputs were attained by Ibrahiem (2003), Rizk-Alla *et al.,* (2006) and Ashour *et al.,* (2009) on orange trees & Rizk-Alla and Tolba (2010) on grapevines. They noted that impeding the adverse effect of saline irrigation water on vegetable growth parameters attained a good outcome with Nile fertile application. It is apparent that the uppermost value of average leaf area is exhibited by the conjoining of K-Silicate at 10 ml/L to Nile Fertile at (250 or 500 g/tree) treatments (Atawia *et al,* 2017).

Sulfur is a part of every living cell and involved in the synthesis of certain amino acids. The good influence of Nile fertile application to soil on vegetative growth parameters may be due to containing elemental sulfur (acidulous material) which is oxidized gently to sulfuric acid. Also, it contains different S- Oxidizing bacteria so it diminished soil pH and approved element accessibility (Abd-Ella, 2011). As for the effect of Nile fertile Ibrahiem, (2003) found that physical and chemical traits of grapevines berries were improved by NF.

The humic acid, NF and AM fungi applications on grapevines have a good effect on creating a valuable balance among growths and fruiting by way of elements accessible in the soil. These elements raise the accretion of total carbohydrate and occurring the hastening of ripening and chemical traits of (Rizk-Alla and Tolba 2010).

Raising the combination of NF and K_2SO_4 up to 2kg /tree and 500gm /tree respectively directed the count of flowers /shoot, fruit set % and yield mean values to be sufficiently immense in order to be significant (Abd-Ella, 2011). Appliance of K2SO4 in the uppermost level of combinations prompted more enzyme systems, assists in photosynthesis, encourage water uptake, adjusts nutrients transfer in plant, approves carbohydrate transfer and raises crop production (Marschner, 1995). Identical outputs were illustrated by El-Iraqy *et al.,* (2006) on guava & (El-Shenawi and Moursy, 2010) on Apple. The good effect of Nile fertile utilization on fruit set and yield could be associated to the critical function of a combination of ground rocks and minerals (45%) in approving the opportunity of nutrient supply, enriching the performance of macro-elements along with its capability to meet some micro-elements demands of crop, which in turn, should be reversed on bearing of immense yield. Furthermore, NF soil application under the drip irrigation system includes elemental sulfur which is oxidized gently to sulfuric acid that inhibited salt accumulation in the roots area and sustained the crop production (Abd-Ella (2011). The outputs are in line with those of Wael (2005) who illustrated that olive fruit set and yield is raised significantly by augmenting Nile fertile level. El-Iraqy *et al.,* (2006) on guava & (El-Shenawi and Moursy, 2010) on *Apple* noted that K fertilization certainly altered fruit chemical composition.

As for elemental sulfur in relation with vegetative growth and fruiting, results go in the same trend of Nile fertile, because of that the low components have the same mechanism in action, which depend on sulfur. Sulfur (S) is ranked in 4 th place in priority after nitrogen, phosphorus, and potassium. It is a necessary plant nutrient used in plant growth and development. It is an essential part of several valuable compositions that clarify growth and vigor of plants under excellent and stress statuses such as vitamins, co-enzymes, phytohormones, and reduced sulfur compositions (Nazar *et al.,* 2011).

The profitable effect of adding (S) is mainly due to raising the oxidation rate and occurring in improving some physical and chemical aspects of soil and augmenting nutrient use. Leaf area is about the most significantly noted data announcing the growth and vigor of the vines by using sulfur ground application which illustrates the certain response to the various S ground applications (Mostafa, 2008). It was observed that by the application of S, the absorption N, P and P which are rarely used to the plants raised on alkaline soils as a result of a decrease in soil pH is approved (Muhammad *et al*., 2007). All (S) treatments significantly increased total soluble solids and reduced the total acidity (as tartaric acid) in grapevines berries (Mostafa, 2008).

As for the effect of Potassium on shoot length, leaf area, and initial fruit set results go in line with the findings of Baligar *et al*., (2001) who noted that k plays a basic function on plant growth and continual crop production as an essential element. On the other hand, leaf area, nutrients content, tree production, and fruit physical and chemical traits were certainly enhanced by using of various k fertilizer patterns on mango trees as compared with untreated trees (Taha *et al.,* 2014).

According to our results, the foliar application of potassium sulphate ameliorated obviously vegetative growth, fruit set, fruit physical and chemical traits and tree production in comparison with untreated trees, these results agree with Mosa *et al*., (2015) on apple trees. On the other hand, raising the crop production and ameliorating the grain trait is achieved by a critical action of potassium (k) in photosynthesis operation and the consequent carbohydrate transfer and metabolism (Pettigrew, 2008 and Lu, *et al*., 2016).

Considerable increments in the tree production, fruit set %, average fruit weight and declined the percentages of fruit drop were allowed by the exogenous utilization of potassium sulphate and humic acid independently or in combination between them_ (Mosa *et al*., 2015). The best tree bearing, fruit physical traits, vitamin C, and total soluble solids % were observed with

Calcium chloride and zinc sulphate at 0.5, 1 and 1.5% and potassium sulphate at 1, 2 and 3% in comparison with untreated trees (Aly *et al*., 2015).

The transport of elements inside storage tissues further counts on firmly on the K (and Mg) condition of source leaves. It was mentioned that K and Mg in origin leaves play a basic function in assuring an admissible amount of sucrose as well as in providing K, Mg, N, S, and P to the dressing of grains fruits and tubers during the reproductive stages of crop plants. Also, micronutrient needs (Zn, B, and Cu) can also be notable high all along the initially reproductive growth (Kirkby and Römheld, 2004).

As suggested by Cakmak (2005), exogenous foliar spray of K and Mg independently is necessary to alleviate against this chlorotic symptoms all along reproductive growth. So growers should assure that leaf proportions of both K and Mg are enough and required. Also, it was found that average fruit weight, fruit diameter, medium and large fruits%, and tree bearing of sweet orange cv. Jaffa was enhanced significantly above untreated trees when treated with Potassium sulphate at 1.5 and 3.0 % (Vijay *et al* ., 2017).

Taha *et al* ., (2014) noted that high increment in the bear tree, fruit set %, average fruit weight and diminished of proportions of fruit drop are committed by the exogenous foliar spray of potassium sulphate and humic acid independently or by mixing the two materials. Also, diminishing the absorbance of harmful elements, approving resistance to abiotic stress and encouraging the fruit-bearing and its related traits returned to the exogenous application of potassium at tremendous growth stages (Ganie *et al*., 2017).

Potassium adjusts the biosynthesis, changeover, and distribution of metabolites that eventually raises the crop production (Borhannuddin *et al*., 2018). Extreme potassium use raises the TSS content and diminished acidity % of berries (Martín *et al*., 2004). An assured consequence of leaf area, element content, yield, fruit physical and chemical traits were noted by the use of various potassium fertilizer forms on mango trees in comparison with untreated trees (Taha *et al.,* 2014). Exogenous potassium was very practical in ameliorating, nutritional condition, crop production and quality of pear and apple trees (Gobara *et al.,* 2001). The observed topmost concentrations of potassium in young growing tissues and generating organs assured its high activity in cell metabolism and growth. Potassium triggers various enzymes containing those including energy metabolism, protein synthesis, and solute transfer (Mengel and Kirkby, 2001 & Amtmann *et al.,* 2008).

Yang *et al.,* (2004) noted that the use of a uniform N–P–K fertilizer recorded a great increase in the protein % in maize (*Zea mays L.*) grain. Nevertheless, the protein % beside the grain trait was diminished when only N–P fertilizer was used. Also, fruit yield traits (weight, size, color, rind thickness, juice content, maturity index, acidity, and total soluble sugars) were enhanced marginally by the exogenous spray of K (Hamza *et al.* 2012).

The increment of the TSS content and lessening the total acidity of berries were recorded by the use of higher potassium amount Martín P *et al.,* (2004). K and N% were approved significantly by the application of potassium sulphate independently or mixed with humic acid, while P and Ca % were not altered (Mosa *et al*., 2015).

Abd El-Razek *et al.,* (2011) discovered that K fertilization diminished the acid content in grape berries. On the other hand, Nutritional status, tree bearing and traits of pear and apple trees were ameliorated by the well efficient exogenous foliar spray of potassium Gobara *et al*., (2001). K_2so_4 ameliorated significantly Zn, Mn and Fe leaf contents (Mosa *et al*., 2015).

The utmost mean values of vegetative growth, fruit set, tree bearing along with leaf NPK content and fruit traits (fruit weight, diameter, length, TSS were approved significantly by the Association of (NF + K2SO4) at uppermost proportion (2Kg + 500gm) while fruit acidity and tannins content were diminished (Abd-Ella, 2011).

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أثر اضافة الكبريت والرش بالبوتاسيوم على انتاجية وجودة ثمار الخوخ صنف سويلنج تحت الاجهاد الملحي

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اجريت هذه الدراسة خلال الموسمين المتتاليين (٢٠١٦-٢٠١٧) بمنطقة الشيخ زويد، محافظة شمال سيناء بجمهورية مصر العربية والهدف من هذا البحث هو دراسة تأثير ثلاث مواد مضادة لتأثير الملوحة (نايل فرتيل، الكبريت الزراعي، سلفات البوتاسيوم) على أشجار الخوخ صنف سويلنج التي تقع تحت اجهاد ملوحة مياة الري المرتفعة. وفي هذه التجربة تم اضافة النيل فرتيل اضافة ارضية تحت ثلاث مستويات (صفر،٥٠٠ و١٠٠٠ جم/ شجرة) واضافة الكبريت الزراعي (٩٥%كبريت) اضافة ارضية تحت ثلاث مستويات (صفر،٥٠٠ و٧٥٠ جم/ شجرة) في حين تم رش المجموع الخضري للأشجار بسلفات البوتاسيوم باستخدام ثلاثة تركيزات (صفر، ٢، ٤ جم/لتر). أظهرت النتائج المتحصل عليها ان كل المواد المستخدمة لها تأثيرات إيجابيه على الصفات الخضرية للشجرة، عقد الثمار، محصول الشجرة. وقد تم تسجيل أعلي قيمة معنوية من الثمار العاقدة عند الجمع وكذلك محصول الشجرة عند استخدام النايل فرتيل يليه الكبريت ثم سلفات البوتاسيوم في كلا موسمى الدراسة. وقد أظهرت النتائج أيضا عدم وجود اي فروق معنوية بين الثلاث مواد محل الدراسة بالنسبة لصفات طول الثمرة، عرض الثمرة، وزن اللحم، وزن البذرة، المواد الصلبة الذائبة، الحموضة الكلية ومحتوي الاوراق من عناصر النتروجين، الفوسفور والبوتاسيوم في كلا موسمي الدراسة ومحتوي الاوراق من الحديد في الموسم الاول.من ناحية اخري أظهر التفاعل بين الثلاث مواد محل الدراسة تأثيرات معنوية في تحسين النمو الخضري، العقد النهائي للثمار، عدد الثمار للشجرة، وزن الثمرة، المحصول، الصفات الطبيعية والكيماوية للثمار. واشارت الدراسة ان المعاملة المتمثلة فى نايل فرتيل بمعدل١٠٠٠جم/شجرة+الكبريت٧٥٠جم/شجرة+ سلفات بوتاسيوم بتركيز ٤ جم/لتر قد سجلت أفضل استطالة للافرع، المساحة الورقة، نسبة الثمار العاقدة الأولية والنهائية عند جمع المحصول وكذلك محصول الشجرة، طول الثمرة، عرض الثمرة مع اقل نسبة حموضة لعصير الثمار. بالإضافة الى اعلي نسبة مئوية لمحتوى النتروجين، الفوسفور، البوتاسيوم وكذلك الحديد (جزء في المليون)، الزنك (جزء في المليون) والمنجنيز(جزء في المليون) بالأوراق وأيضا وزن اللحم (جم)، وزن البذرة (جم) وكذلك المواد الصلبة الذائبة في الموسم الأول ومن ناحية أخري، سجلت الاشجار غير المعاملة اقل قيم للصفات محل الدراسة.ولذلك نوصى من خلال هذه الدراسة باستخدام نايل فرتيل بمعدل ١٠٠ جم/ شجرة+ الكبريت الزارعى بمعدل ٧٥٠جم/شجرة+ سلفات بوتلسيوم بتركيز ٤جم/لتر/شجرة في حالة رى أشجار الخوخ المروية بمياه ذات ملوحة عالية لتحسين النمو والعقد والمحصول وصفاته.