

Physiological Effect of Some Natural Extracts, Magnetized Water and GA₃ on Four Citrus Rootstocks Seedlings

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ABSTRACT

This investigation was carried out during two successive seasons (2015/2016 and 2016/2017) under green-house conditions at Horticultural Research Institute garden "Giza- Egypt". Four citrus rootstocks : Volkamer lemon "VOL" (*C. volkameriana*), Sour orange "SO" (*C. aurantium*), Troyer citrange "Tr.C" (*C. sinensis* x *P. trifoliata*) and Cleopatra mandarin "CLEO" (*C. reshni*) to study effect of some natural treatments i.e., : Diatoms, Magnetized water, Bread Yeast extract, Moringa leaves extract and GA₃ in seedlings bio- chemical and minerals contents in compared to the untreated one (the control). Results revealed that, most of natural extracts treatments under study positively improved stocks seedlings bio- chemical and minerals contents. Diatoms treatment significantly increased: shoots dry matter %; leaf K, Mg and Mn contents. Magnetized water treatment statistically increased: leaf Chl.a; tot. indoles and Phenols. Yeast extract treatment significantly increased: leaf dry matters % and leaf N contents. Moringa leaves extracts treatment significantly increased: shoots dry matter content; Chl.b; tot. Chls; tot. Carotene; stem tot. Carbohydrates and leaf: P; K; Mg; Fe and Zn contents. Finally, GA₃ treatment statistically increased: Chl.a; Chl.b; tot.Chls and leaf: Mg and Mn. for both seasons of study. As for stock seedlings responsibility: data clear that natural extracts treatments significantly increased: VOL seedlings: leaf: P; K; Zn and Mn content. Also, SO: seedlings leaf: Carotene; P; K and Zn contents. Tr.C. seedlings: leaf and root dry matter content; Chl.a; b and tot. Chls; stem Carbohydrates content; leaf Indoles and Phenols and leaf: P; Mg and Fe contents. Moreover, CLEO. Seedlings: number of leaves; stem dry matter; leaf Carotene; Indoles and Phenols and leaf: N; Fe and Mn contents.

Key words: Diatoms, Magnetized water, Yeast extract, Moringa leaves extract, GA₃

Introduction

Citrus are The most important fruits types in Egypt, it is a great economic importance in compared to the other types of fruit, it is the largest horticultural industry during the last few year and harvested area increased rapidly from year to year and reached 530415 fed. The fruiting acreage of citrus occupies 440706 fed. Produced 4402180 tons (according to ministry of agriculture and land reclamation. Annual report 2014); the first popular fruit and has a high nutritional values. Citrus was long propagated by seed, but some factors made the propagation by the process of uniting a desired fruits quality onto a desired adapted root and stem to the nearly only used propagation methods in the world. Indubitable if the rootstock seedling has a healthy root, it will minimized nutrient leaching, enhance nutrient absorption, stimulating plant growth and increasing resistance to abiotic stress. Therefore, citrus rootstocks are of vital importance in the quality and quantity of production and survival of citrus plants. As well as, Volkamer Lemon (*C. volkameriana*) is a Rangpur type, but exhibits the same horticultural characteristics as Rough Lemon. Fruit quality is slightly better and the rind is of better texture, but fruits commonly not match the quality standards of those produced onto trifoliolate rootstocks or Sour Orange. Volkameriana seems to be the most vigorous rootstock of all. Sour orange (*Citrus aurantium L.*) is a universal rootstock for citrus and widely used in the Mediterranean region (Ibrahim, 2007). Sour orange rootstock is reported to be suitable for heavy moist soil, gives good yield and quality fruits, but with smaller fruit size, thin and smooth skin, high

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TSS and acidity (Hemeda, 2014). Troyer citrange (*C. Sinensis* " navel orange" x *Poncirus trifoliata*). It was Intolerant of high pH soils with high levels of available calcium and also intolerant of saline conditions. Trees on this stock frequently show micronutrient deficiencies (Zn, Fe and Mn) especially in the Spring flush. Troyer citrange is achieved in well drained soils. Cleopatra mandarine (*Citrus reticulata*) is a slow growing rootstock in the nursery. It has been widely distributed and trialled as a rootstock throughout the world. It can be used for shallow alkaline soils.

An interesting trend in foliar nutrition of plants is the enrichment of fertilizers with substances of bio-stimulation activity for plant growth and development as well as selected metabolic processes. It can be foliar applied separately or together with mineral nutrients. They mean inorganic and organic substances (organic acids, vitamins, amino acids, low-molecular-weight polypeptides, extracted phytohormones, phenolic compounds, sugars and many other organic compounds) or its mixtures positively affecting plant development or other physiological processes in plants (Noor Shaila Sarmin(2014). Photosynthetic pigments as chlorophyll a, b and carotenoids were positively responded to the different foliar application with yeast – extract. El-Tohamy and El-Greadly (2007); Mady (2009) and Soha and Ezzat(2010). Magnetizing water increases its solubility and filtering properties; permit more nutrients to dissolve (Faten Dhawi *et al.*,(2009). allows for a deeper and larger root zone and dissolves more nutrients to stimulate plant growth. the use of magnetically treated irrigation water reduced soil pH but increased soil EC and available P (Faten Dhawi and Al-Khayri (2008) Fertilizers dissolve more easily in magnetized water and better penetrate plants (Racuciui *et al.*,(2006) The cultivation of plants under it could be the background of crop improving in the frame of future agricultural techniques. Also, the response of plants to magnetic field depends on plant species. Magnetic field increases nitrogen and ions uptake by, Whereas, shoot N, P and K contents of faba bean plants and leaf chlorophyll was significantly increased by using different magnetized irrigation water qualities compared with the normal or non- magnetized water. Racuciui *et al.*, (2006); Faten Dhawi and Al-Khayri (2008) and Ahmed and Bassem(2013).

Development of a program for crop quality management requires a thorough knowledge on mechanisms and regulation of key physiological and biochemical processes in plants. This is the only basis for a proper selection of bio-stimulators or its combination with growth regulators, the application of which should affect the above-mentioned processes in the most selective way. The efficiency of the strategy so developed should always be verified in vegetation experiments. In addition, the main purpose of the present study was aimed to investigate the effect of some natural treatments on bio- chemical and minerals contents of some *C.* rootstocks seedlings.

Materials and Methods

The present study was carried-out during two successive seasons (2015 and 2016) in green-house for citrus nursery seedlings production at Horticulture Research Institute garden, Giza - Egypt. The main goal of this investigation to study the effect of some natural extracts applications on physiological behaviour and mineral content of Sourorange "SO"; (*C. aurantium*); Volkamerlemon "VOL" (*C. volkameriana*); Cleopatra mandarine "CLEO" (*C. reshni*) and Troyer Citrange "Tr.C" (*C. sinensis* X *Poncirus trifoliata*. L) Seedlings rootstocks during transplanting stage. In both studied seasons, at mid-December, mature fruits of rootstocks under study were carefully selected for seeds extract and preparing for swing.

Transplanting and treatments:

At mid-June 180 uniform and healthy seedlings for each rootstock gained from each treatment and divided into 3 replicates and planted individually in black plastic bags (13x30 cm.) filled with the growing media {(4 parts of sand + 1 part Peat moss + 2 k.gm Super Phosphate 15.5%+1 k.gm Sulfur fine + 1k.gm Ammonium Sulphate 20.6% + 1 k.gm Potassium Sulphate 50%) / M3}. after 30 days from transplanting , seedlings were treated 5 times as a foliar application (every 4 weeks -intervals) as follows: 1- Diatoms at rate 1.50 g./L. 2- Magnetized Water. 3- Yeast Extract at rate 5 g. / L. 4- Leaves of Moringa Extract at rate 1.50 ml./ L.5- GA3 at 100 ppm.6- The control . Fertilization program from seedlings transplanting to budding stage as Agri. Min.Nurseries Sector at the Ministry

of Agriculture in Egypt. The previous treatments were arranged in three replicates with 10 plants per a replicate using complete randomized block design (RCBD).

The following measurements were undertaken:

- *Bio-chemicals and organic contents :*

1-1-Dry matter contents:

At the end of the Growing season, fresh and dry weight of leaves, stem and roots were determined and dry matter as a percentage contents were calculated.

1-2-Leaf Chlorophylls a and b and total carotene :

Disks(2.5 cm.²/ area) from the third leaf at the top of seedling were extracted with dimethyl Formide (D.M.F.) solution [HCON(CH₃)₂] and placed overnight at temperature (5°C). Chl.a and b as well as carotenoids were measured by Spectrophotometer Beckman Du 7400 at wavelengths 663,647 and 470 MU, respect., according to the equation described by Nornai, (1982) and calculated as (mg/100g FW) as follows :

$$\text{Chl. a} = 12.70 A_{663} - 2.79 A_{647}.$$

$$\text{Chl. b} = 20.76 A_{647} - 4.62 A_{663}.$$

$$\text{Total Chloro} = 17.90 A_{647} - 8.08 A_{663}$$

$$\text{Total carotenoids} = 1000 X A_{470} - 3.72 \text{chl.a} - 104 \text{chl.b} / 229.$$

1-3- Shoot Carbohydrates contents:

Total Carbohydrates (%): A known weight (0.1g) of dried sample was placed in a test tube; 1N HCl acid (10 ml.) was added. The tube was sealed and placed for 6 hours in an oven at 100°C. The solution was then filtered and clarified by the leading and de-leading method using lead acetate solution (137 g/l.) and the excess of lead salt was precipitated using potassium oxalate solution. The extract was measured into a measuring flask (50 ml.). The combined filtrate was completed to the mark with distilled water. Total sugars were determined according to the method of Dubois *et al.* (1956).

1-4- Leaf total Phenolic and Indolic compounds:

a) Indolic compounds:

P - dimethyl – amino benzaldehyde test (Erlisch reagent, Larsen *et al.*, (1962) as modified by Selim *et al.*, (1978) to obtain a stable pink color was used .They were estimated in leaves calorimetrically at 530 MU and the concentration of IAA was calculated as mg./g. dry weight.

b) Total Phenolic compounds:

It was determined by using the Folin calorimetric method (A.O.A.C., 1975) at 730 MU wave length . The concentration was calculated from a standard curve of pyrogallol as mg./g. dry weight.

1- Leaf minerals contents:

Leaves samples were taken, cleaned with cotton clothes, fresh weight was recorded, washed with tap water followed by distilled water. Samples were dried in an oven at 70 °C for constant weight and ground. Then, 0.5g. Of dried samples was digested using the H₂SO₄ and H₂O₂ as described by Cottenie, (1980). The extracted samples were used to determine the following minerals content of leaves: N, P, K and Mg as macro-elements and Fe, Zn and Mn as micro-elements as follows:

2- Macro- elements :

- Nitrogen (N) %: was determined with the modified micro-kjeldahl method as described by Plummer (1971).
- Phosphorus (P) %: was measured calorimetrically, using the molybdenum blue method by using Spectrophotometer (Model- Beckman Du 7400) according to Murphy and Riley, (1962).
- Potassium (K) %: were determined against a standard using flame-photometer (Model-JENWAY– pfp7 Flame Photometer) according to Piper, (1950).
- Magnesium (Mg) %: were determined in plant digest by titration with the versenate solution according to Richards (1954).

3-Micro-elements:

Iron (Fe), Zinc (Zn) and Manganese (Mn) were determined as ppm by using Atomic Absorption Spectrophotometer according to Brandifeld and Spincer, (1965).

Statistical analysis:

The statistical analysis of the present data was carried out as indicated by Snedecor and Cochran (1980). Significant differences among the means of various treatments were established by LSD at 5% level of probability. Data were analyzed by M STAT-C.

Table 1: Diatoms analysis :

Elements contents* (%)		Amino-acids* (ppm)		Organic acids* (ppm)		Hormpnes contents Ug/100g**	
SiO2	46.56	L.Alanine	0797.77	Tartaric	000383.39	GAA	---
Tio2	0.35	L.Glycine	0217.83	Citric	114390.25	IAA	---
Al2o2	8.67	L.Glutamine	5097.88	Maleic	000172.62	ABA	---
Fe2o3	1.13	L.Glutamine	1339.33	Oxalic	001251.37	Kinten	---
Mno	0.10	L.Valine	0364.25	Succinic	006941.25	Zeatin	489.88
Mgo	1.64	L.Leucine	0645.35	Fumaric	485839.73		
Cao	16.45	L.Isolucine	0751.70				
Na2o	0.87	L.Cysteine	0214.57				
K2o	0.65	L.Proline	0289.54				
P2o3	0.26	L.Methionine	1496.87				
So3	1.65	L.Aspartic	0609.18				
Cl	0.55	L.Phenylalanine	0675.92				
I.o.i	20.78	L.Arginine	0156.71				
		L.Tyrosine	1599.89				
		L.Threonine	1213.20				
		L.Histidine	0430.24				
		L.Tryptophane	0025.57				
		L.Cysteyn	0008.34				

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Fig. (1): Magnetized Water Apparatus.

Magnetized Water production:

Tap water flow from the left side to the right one through Magnetic field (13000 Gaus).then , sprayed by using air sprayer application.

Table 2: Bread Yeast extract preparation : About (1200g from dry yeast + 300 g sugar + 50g Urea) / 20L water in container 100 L size , covered and left for 12 hours at room temperature.Then , diluted by 600 L. of water for spraying .

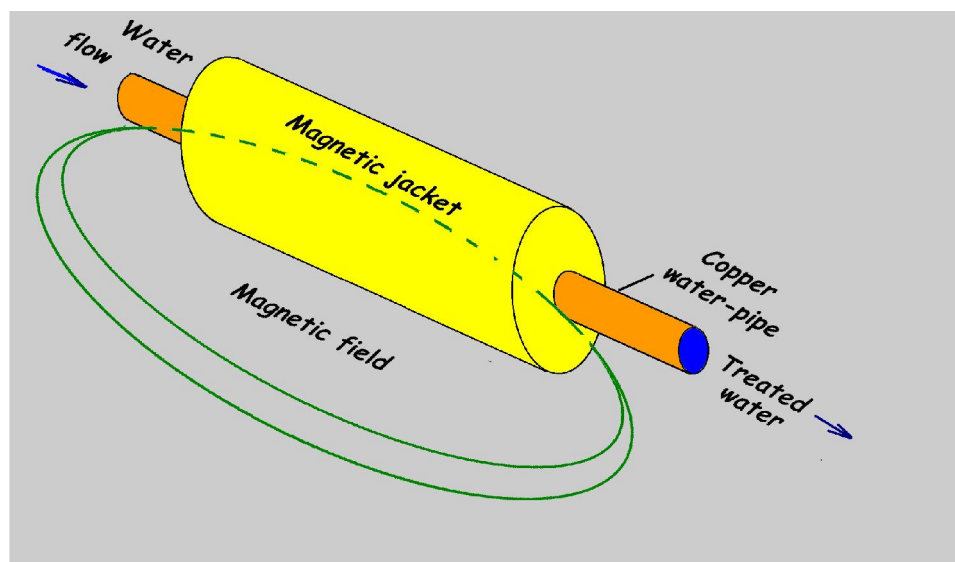


Fig. 1: Magnetized Water apparatus.

Table 2: Bread yeast analysis* :

Mineral %		Vitamins mg ⁻¹ g		Organic cont. %	
Na	00.12	Thiamine	6-100	Protein	47.00
Ca	00.75	Biotin	0001.30	Nucleic acids	08.00
Fe	00.02	Riboflavin	35-50	Carbohydrates	33.00
Mg	01.65	Cholin	4000.00	Lipids	04.00
K	21.00	Niacin	300-500		
Cu	08.00	Folic acid	5-13		
Se	00.10	Pyridoxine ,HCL	28.00		
Mn	00.02	Vit.B12	00.001		
Cr	02.20	Pantothenute	70.00		
Ni	03.00				
P	13.50				
S3	90.00				
Zn	00.17				
Si	00.03				
Va	00.04				
Mo	00.40				
Sn	03.00				
Li	00.17				

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Table 3: Moringa leaves* extracts analysis per 100 grams.

Elements contents		Anti-oxidants		Amino-acids	
Minerals (g)	2.3	Oxalic acid(mg)	101	Araginine(mg)	402
Ca (mg)	440	Vitamina-B carotene(mg)	808	Histidine(mg)	141
Mg(mg)	24	Vitamin B choline(mg)	423	Lysine(mg)	288
P(mg)	70	Vitamin B thiamin(mg)	0.21	Tryptophan(mg)	127
K(mg)	259	Vitamin B riboflavin	0.05	Phenylalanin(mg)	429
Cu(mg)	1.1	Vitamin B nicotinic acid(mg)	0.8	Methionine(mg)	134
Fe(mg)	7	Vitamin cascorbicacid(mg)	220	Threonine(mg)	328
S(mg)	137	Vitamin Etocopherolacetat(mg)	----	Leucine(mg)	623
-----	----	-----	-----	Isoleucine(mg)	422
				valine(mg)	476

*from the miracle tree: edited by Lowell fuglie

Results and Discussion

1- Seedlings organs dry matter % content:

a) Leaves dry matter %:

Referring to the effect of treatments Table (4) reveals that control treatment had significantly the highest leaves dry matter % (49.79) meanwhile magnetized water treatment was the lowest (45.91%) in compared to the other treatments in the 1st season. moreover, moringa treatment statistically was the highest (52.37%) and magnetized water treatment was the lowest (47.3%) in the 2nd season.

Concerning the effect of citrus genotype tabulated data in Table (4) shows that Troyer citrange leaves had statistically the highest dry matter content (56.73 and 58.09 %) and Sour orange (44.33 and 45.31) during the two studied seasons. respectively .

As for the interaction data indicate that a significant effect in stocks leaves dry matter percentage in both seasons. Whereas, Troyer citrange seedlings leaves gave the highest value (62.71%) when treated with moringa leaves extract in the 1st season and (60.30%) under control treatment in the 2nd season. Moreover, Sour orange seedlings leaves was the lowest (43.05 %) with the control treatment in the 1st season and (41.89 %) with magnetized water in the 2nd season.

Table 4: Effect of some treatments on root stocks seedlings leaf dry matter % during the two seasons 2015/2016 & 2016/2017).

R. stocks (A) Treatment (B)	Leaves dry matter%									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	50.00	43.05	61.65	45.2	49.97	46.77	44.03	60.30	46.44	49.38
Diatoms	44.33	47.47	53.47	46.02	47.82	50.20	48.60	59.81	46.61	51.30
M.Water*	44.56	40.83	52.89	45.35	45.91	45.42	41.89	54.91	45.98	47.05
Yeast	42.53	47.07	50.32	45.26	46.30	43.56	47.73	56.18	47.26	48.68
Moringa	44.39	44.84	62.71	45.73	49.42	55.76	45.92	59.71	48.09	52.37
GA ₃	47.96	42.74	59.35	47.00	49.26	44.89	43.69	57.64	46.73	48.24
Mean (A)	45.63	44.33	56.73	45.76		47.76	45.31	58.09	46.85	
L.S.D,0.5	A 0.1956 B 0.2396 AB 0.4792					A 0.1559 B 0.1910 AB 0.3819				

* Magnetized water

b) Stem dry matter % :

Table (5) shows that the stem dry matter percentage significantly increased by moringa leaves extract application (55.56%) in the 1st season or Diatoms treatment (54.90%) in the season. While, the yeast (49.39%) in the 1st season and the control treatment (51.53%) in the 2nd season had statistically the lowest stem dry matter content in this study .

Regarding the effect of the citrus stocks genotype data presented in Table (5) cleared that Cleopatra mandarin stock significantly was the highest shoot dry matter content (58.00 and 56.62 %) in compared to the other stocks in this study for both seasons, respectively.

With respect the interaction between the two investigated factors (treatments and rootstocks) tabulated data in Table (5) show that a significant effect in both studied seasons. Whereas, Cleopatra mandarin stock with magnetized water treatment was the highest value (60.24%) in the 1st season, and Troyer citrange with moringa leaves extract (58.39 %) in the 2nd season. It is interesting to note that, Troyer citrange stock gave the lowest value (42.12 and 41.19 %) with yeast treatment in the two seasons, respectively.

Table 5: Effect of treatments on root stocks seedlings Stem dry matter% during the two seasons (2015/2016 & 2016/2017).

R. stocks (A) Treatment (B)	Stem dry matter%									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	50.48	53.77	46.91	55.87	51.76	51.19	52.18	45.85	56.88	51.53
Diatoms	50.99	51.61	58.35	58.26	54.80	52.00	53.29	57.28	57.03	54.90
M.Water*	46.67	50.48	55.18	60.24	53.14	47.71	49.40	54.14	57.10	52.09
Yeast	47.63	50.25	42.12	57.54	49.39	48.70	51.06	41.19	55.12	49.02
Moringa	51.45	52.44	59.29	59.05	55.56	52.19	49.60	58.39	57.14	54.33
GA ₃	47.67	49.93	57.02	57.06	52.92	48.60	51.19	55.85	56.44	53.02
Mean (A)	49.15	51.41	53.15	58.00		50.06	51.12	52.12	56.62	
L.S.D,0.5	A 0.2275		B 0.2787		AB 0.5573	A 0.1181		B 0.1447		AB 0.2894

* Magnetized water

c) Roots dry matter %:

With regard to the effect of treatments, Table (6) reveals that the control treatment had statistically increased stocks seedlings root dry matter % (46.87 and 46.93). Whereas, yeast treatment had the lowest values (40.92 and 39.04%) in both seasons, respectively.

As for citrus genotype effect , it is quite clear from the Table (6) that Troyer citrange stock had significantly the highest root dry matter content (50.16 and 48.83 %) while Volkamer lemon was the lowest (37.58 and 36.79 %) for the two studied seasons, respectively.

Referring the interaction, data recorded in Table (6) cleared that a significant effect of the two studied factors on seedlings root dry matter contents in both season. Whereas, Troyer citrange stock was the highest value of root dry matter (60.85%) with Diatoms treatment in the 1st season and (61.12%) with the control treatment in the 2nd season. Also, Volkamer lemon was the lowest (32.35%) with Diatoms in the 1st season and Sour orange (33.86%) with GA₃ treatment in the 2nd season.

Table, 6: Effect of some treatments on root stocks seedlings root dry matter% during the two seasons (2015/2016 & 2016/2017).

R. stocks (A) Treatment (B)	Roots dry matter (%)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	38.01	46.29	54.60	48.57	46.87	38.13	43.37	61.12	45.09	46.93
Diatoms	32.35	41.24	60.85	51.62	46.51	38.44	38.63	56.97	43.82	44.46
M.Water*	38.51	38.86	48.23	46.04	42.91	37.41	35.94	50.15	53.74	44.31
Yeast	37.59	43.93	36.30	45.84	40.92	36.88	41.14	34.79	43.35	39.04
Moringa	40.08	38.72	50.89	52.24	45.48	36.62	35.98	40.40	52.86	41.47
GA ₃	38.97	36.61	50.11	45.80	42.87	33.29	33.86	49.54	46.30	40.75
Mean (A)	37.58	40.94	50.16	48.35		36.79	38.16	48.83	47.53	
L.S.D,0.5	A 0.0822		B 0.1006		AB 0.2013	A 0.1968		B 0.2410		AB 0.4820

* Magnetized water

Refer to the analysis Tables (1 ; 2 and 3) of (Diatoms , Yeast and Moringa leaves extract), it could be concluded that these substances contain many elements that stimulate plant grows as plant regulators ,amino acids, organic acide, antioxidant substances, nutrient elements Vitmens....etc. In

additions to the effect of GA₃ and Magnetized water. Therefore, these results were in line with those obtained by Mady, (2009) found that stem and dry weights per plant of faba bean plants were significantly increased by foliar application with yeast extract. Ahmed *et al.*, (2013) found that whole plant dry weight of potato plants were gradually improved by increasing of different yeast extract concentrations. Eman and Abd-Allah, (2008) found that all growth characters of superior grapevines (Leaf area, shoot length and number of leaves/shoot) were positively affected by using algal extract. Nawroz and Hero, (2010) obtained that seedling dry weight compared to unexposed control. Magnetized water have enhanced root and shoot dry weight, Omayma *et al.*, (2011) found that algae extraction treatment exhibited the highest values of stem and roots dry weight of SO (*Citrus aurantium* L.).

2- Seedlings chemical composition:

2.1) Leaves pigments content:

a) Chlorophyll a:

It is quite evident that, all treatments improved stock seedlings leaves chl.a contents. Whereas, GA₃ treatment significantly gave the highest value (0.8443 mg/100gf.w) in the 1st season and magnetized water (0.8440 mg/100gf.w) in the 2nd season in compared to the control treatment for both seasons.

As for the citrus stock genotype effect, data presented in Table (7) shows that Troyer citrange had statistically the highest chl.a leaf contents (0.8498 and 0.8948 mg/100gf.w) in the two studied seasons, respectively.

Regard to the interaction between treatments and citrus stocks, tabulated data in Table (7) cleared that a significant effect in both seasons. Whereas, Cleopatra mandarin treated with magnetized water (0.8563 mg/100gf.w) in the 1st season while GA₃ and moringa (0.8550 mg/100gf.w) in the 2nd season meanwhile Volkamer lemon was the lowest (0.7590 and 0.7500 mg/100gf.w) under control treatment in both seasons, respectively.

Table 7: Effect of some treatments on root-stocks seedlings leaf chlorophyll (a) during the two seasons (2015/2016 & 2016/2017).

R. stocks (A) Treatment (B)	Leaf chlorophyll (a) (mg/100gf.w)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	0.759	0.793	0.851	0.845	0.812	0.750	0.814	0.847	0.830	0.8102
Diatoms	0.852	0.760	0.850	0.839	0.825	0.811	0.848	0.851	0.838	0.8370
M.Water*	0.824	0.788	0.847	0.856	0.829	0.841	0.838	0.854	0.843	0.8440
Yeast	0.840	0.808	0.849	0.843	0.835	0.817	0.797	0.852	0.851	0.8293
Moringa	0.815	0.829	0.854	0.851	0.837	0.823	0.845	0.848	0.855	0.8428
GA ₃	0.849	0.830	0.848	0.850	0.844	0.838	0.799	0.847	0.855	0.8347
Mean (A)	0.8232	0.8014	0.8498	0.8474		0.8133	0.8235	0.8498	0.8453	
L.S.D,0.5	A 0.02225		B 0.02725		AB 0.05451	A 0.02324		B 0.02847		AB 0.05693

* Magnetized water

b) Chlorophyll b:

Table (8) shows that the variance due to effect of natural extracts treatments in this study was significant in both seasons. Where, GA₃ treatment gave the highest leaf chl.b content (0.7368 mg/100gf.w) when compared to other treatments in the 1st season. In contrary, most of treatments

significantly increased chl.b content in leaves but the Moringa leaves extract was the superior treatment (0.7002 mg/100gf.w) during the 2nd season in compared to the control treatment.

Concerning the citrus genotype effect, tabulated data in Table (8) illustrated that Troyer citrange had significant high leaf chl.b contents (0.7834 and 0.8480 mg/100gf.w) respectively when compared to the other treatments for both seasons.

As for the interaction between the treatments and citrus genotype, data presented in Table (8) cleared that variance in leaf chl.b content was significantly in both seasons. Whereas, Troyer citrange was the highest values with GA₃ treatment (0.9450 mg/100gf.w) in the 1st season and under control treatment in the 2nd season. On the other hand Volkamer lemon with control treatment was the lowest (0.3870 and 0.3847 mg/100gf.w) in both studied seasons, respectively.

Table, 8: Effect of some treatments on root-stocks seedlings leaf chlorophyll (b) during the two seasons (2015/2016 & 2016/2017).

R. stocks (A) Treatment (B)	Leaf chlorophyll (b) (mg/100gf.w)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	0.387	0.470	0.738	0.676	0.5677	0.385	0.539	0.895	0.587	0.6013
Diatoms	0.764	0.428	0.862	0.613	0.6668	0.503	0.786	0.842	0.624	0.6888
M.Water*	0.531	0.476	0.669	0.795	0.6179	0.614	0.631	0.836	0.651	0.6829
Yeast	0.602	0.506	0.724	0.662	0.6234	0.504	0.479	0.851	0.716	0.6376
Moringa	0.523	0.597	0.763	0.733	0.6539	0.553	0.678	0.802	0.768	0.7002
GA ₃	0.701	0.602	0.945	0.699	0.7368	0.603	0.501	0.862	0.739	0.6764
Mean (A)	0.5847	0.5131	0.7834	0.6964		0.5269	0.6024	0.8480	0.6808	
L.S.D,0.5	A 0.02419		B 0.02963		AB 0.05926	A 0.02511		B 0.03075		AB 0.06149

* Magnetized water

c) Total chlorophylls:

Referring to the effect of treatments on citrus stocks leaves total chls. content, Table (9) reveals that GA₃ treatment significantly increased leaf total chls. in the 1st season (1.577 mg/100gf.w) and moringa leaves extract in the 2nd season (1.539 mg/100gf.w) when compared to the other treatments .

Regarding the effect of citrus stock genotype , data presented cleared that Troyer citrange seedlings leaves had significant a high values (1.629 and 1.694 mg/100gf.w) in both seasons, respectively.

As for the interaction between the two investigated factors in this study (treatments and citrus stocks) was significant in both seasons Table (9). Whereas, GA₃ treatment with Troyer citrange stock had the highest values (1.789 mg/100gf.w) and control (1.705 mg/100gf.w) for both studied seasons, respectively. While, Sour orange stock with Diatoms treatment in the 1st season (1.185 mg/100gf.w) or Volkamer lemon with control in the 2nd season (1.133 mg/100gf.w) was the lowest values of leaves total chlorophylls.

d) Total carotenoids:

With regard to the effect of treatments on stocks seedlings leaves carotenoids content data in Table (10) displayed that, moringa leaves extract significantly improved stocks seedlings leaves carotenoids content (0.1712 mg/100gf.w) in the 1st season in compared to other treatments in this study. Moreover, all treatments significantly increased seedlings leaves carotenoids content, whereas, the control treatment was the highest value (0.1345 mg/100gf.w) in compared to moringa leaves extract which recorded the lowest values (0.1104 mg/100gf.w) for the 2nd season .

Response of seedlings leaves carotenoids contents to citrus genotype. It is quite clear that both Sour orange and Cleopatra mandarin had statistically the highest values (0.1390 and 0.1366 mg/100gf.w) in the 1st season, respectively and Cleopatra (0.1478 mg/100gf.w) in the 2nd season.

As for the interaction, data tabulated in Table (10) reveal that both treatments and citrus stocks in this study significantly effect on leaves carotenoids content in the two seasons. Whereas, Troyer citrange with moringa leaves extract treatment had the best value (0.2580 mg/100gf.w) and was the lowest with GA₃ treatment (0.0263 mg/100gf.w) in the 1st season. While, in the 2nd season Cleopatra mandarin with Diatoms treatment was the best (0.1920 mg/100gf.w) and Sour orange with the same treatment Diatoms was the lowest (0.1060 mg/100gf.w)

Table 9: Effect of some treatments on root-stocks seedlings leaf total chlorophylls during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf total chlorophylls (mg/100gf.w)											
	First season					Second season						
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)		
Control	1.144	1.260	1.585	1.517	1.377	1.133	1.350	1.738	1.414	1.409		
Diatoms	1.612	1.185	1.707	1.449	1.488	1.311	1.630	1.690	1.459	1.523		
M.Water*	1.353	1.262	1.513	1.648	1.444	1.452	1.466	1.685	1.491	1.524		
Yeast	1.439	1.311	1.569	1.501	1.455	1.319	1.274	1.699	1.563	1.464		
Moringa	1.335	1.422	1.612	1.580	1.487	1.373	1.519	1.646	1.619	1.539		
GA ₃	1.547	1.429	1.789	1.545	1.577	1.438	1.297	1.705	1.591	1.508		
Mean (A)	1.405	1.311	1.629	1.540		1.338	1.423	1.694	1.523			
L.S.D,0.5	A 0.02122		B 0.02599		AB 0.05197		A 0.02122		B 0.02599		AB 0.05197	

* Magnetized water

Table, 10: Effect of some treatments on root-stocks seedlings leaf total carotenoids during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf total carotenoids (mg/100gf.w)											
	First season					Second season						
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)		
Control	0.130	0.160	0.112	0.146	0.1371	0.145	0.135	0.069	0.189	0.1345		
Diatoms	0.102	0.164	0.054	0.130	0.1123	0.131	0.106	0.073	0.192	0.1255		
M.Water*	0.145	0.162	0.123	0.104	0.1335	0.141	0.161	0.085	0.131	0.1295		
Yeast	0.135	0.087	0.122	0.151	0.1236	0.132	0.165	0.069	0.127	0.1233		
Moringa	0.134	0.134	0.258	0.159	0.1712	0.117	0.135	0.076	0.113	0.1104		
GA ₃	0.117	0.127	0.026	0.130	0.1001	0.145	0.153	0.068	0.135	0.1252		
Mean (A)	0.1271	0.1390	0.1158	0.1366		0.1352	0.1426	0.0733	0.1478			
L.S.D,0.5	A 0.00822		B 0.01006		AB 0.02013		A 0.00849		B 0.01039		AB 0.02079	

* Magnetized water

2-2- Stem carbohydrates content:

Data obtained in Table (11) revealed that the control treatment statistically increased citrus stocks shoots carbohydrates content (83.43%) in the 1st season and moringa leaves extract (80.66%) in the 2nd season in compared to the other treatments.

Concerning to the effect of citrus stock genotype, data displayed cleared that Troyer citrange shoots significantly had the highest carbohydrates content (89.43 and 83.75 %) for both seasons, respectively.

Regarding the interaction, data presented in Table (11) illustrated a significant effect in the two studied seasons. Whereas, Troyer citrange stock with magnetized water in the 1st season (95.68 %) and Volkamer lemon with yeast (92.84%) in the 2nd season gave the highest carbohydrates content in shoots.

Table, 11: Effect of some treatments on root-stocks seedlings stems total carbohydrates content during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) treatment(B)	Stem total carbohydrates%											
	First season					Second season						
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)		
Control	89.17	74.38	85.69	84.49	83.43	92.71	68.78	72.21	69.13	75.71		
Diatoms	54.65	85.45	91.80	75.81	76.93	44.21	84.54	92.53	78.50	74.94		
M.Water*	53.69	47.37	95.68	90.69	71.86	71.93	41.73	88.21	85.71	71.90		
Yeast	71.33	85.68	93.03	81.51	82.89	92.84	56.58	90.53	77.43	79.35		
Moringa	93.32	67.89	86.61	74.13	80.49	87.35	69.10	79.56	86.64	80.66		
GA ₃	65.12	57.35	83.74	72.81	69.75	47.85	61.10	79.45	71.62	65.00		
Mean (A)	71.21	69.69	89.43	79.91		72.82	63.64	83.75	78.17			
L.S.D,0.5	A 0.2225		B 0.2725		AB 0.5451		A 0.2419		B 0.2963		AB 0.5926	

*Magnetized water

2-3- Leaf total indoles and phenols content:

a) Total indoles contents:

As for the effect of treatments, data in Table (12) cleared that magnetized water treatment significantly increased indoles components in seedling leaves (1.355 and 1.452mg./100g.d.w) for both seasons, respectively. In addition, moringa leaves extract gave the highest value (1.457 mg./100g.d.w) in the 2nd season.

It is quite evident as shown from Table (12) citrus stock genotype was a significant effect on seedling leaves indoles components ,Whereas, Troyer citrange seedlings leaves was the richest values (1.417 and 1.528 mg./100g.d.w) during the two studied seasons, respectively.

As for the interaction, data presented indicated that a significant effect for both seasons. Moreover, Troyer citrange stock with magnetized water gave the highest indoles components (2.353 and 2.975 mg./100g.d.w) in the first and second season respectively, Sour orange seedlings with moringa leaves extract was the lowest (0.419 mg./100g.d.w) in the 1st season and with yeast extract (0.276 mg./100g.d.w) in the 2nd season.

b) Total phenoles contents:

Referring to the effect of applied treatments on seedlings leaves phenolic components data in Table (13) shows that both magnetized water in the 1st season and GA₃ in the 2nd season significantly increased leaves phenolic contents (1.322 and 1.590 mg./g.d.w), respectively.

Concerning the effect of citrus genotype, obtained data indicate that Cleopatra mandarin had significantly the highest value (1.771 mg./g.d.w) in the 1st season, and Troyer citrange (1.949 mg./g.d.w) in the 2nd season.

As for the interaction, data in Table (13) revealed that both investigated factors had significantly effectiveness on seedlings leaves phenolic components in both seasons. Whereas, Cleopatra mandarin with magnetized water was the highest values (2.857 mg./g.d.w) in the 1st season and with GA₃ (2.929 mg./g.d.w) in the 2nd season. While, Volkamer lemon was the lowest (0.292 mg./g.d.w) in the 1st season with moringa extract and (0.211mg./g.d.w) in the 2nd season with yeast extract.

Table 12: Effect of some treatments on root-stocks seedlings leaf total indoles during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf total indoles											
	First season					Second season						
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)		
Control	0.707	0.510	1.251	1.098	0.892	0.405	0.641	1.557	0.800	0.8507		
Diatoms	1.280	0.467	0.831	0.942	0.880	0.902	1.117	0.824	1.089	0.9830		
M.Water*	1.348	1.123	2.353	0.597	1.355	1.029	1.287	2.975	0.516	1.452		
Yeast	1.278	0.778	0.331	1.971	1.089	1.041	0.276	0.497	1.909	0.9308		
Moringa	1.040	0.419	2.231	0.912	1.150	1.356	0.858	2.399	1.215	1.457		
GA ₃	1.091	1.301	1.503	1.170	1.266	0.993	0.973	0.917	1.655	1.135		
Mean (A)	1.124	0.7663	1.417	1.115		0.9543	0.8587	1.528	1.197			
L.S.D,0.5	A 0.02235		B 0.02738		AB 0.05476		A 0.02245		B 0.02750		AB 0.05500	

* Magnetized water

Table 13: Effect of some treatments on root-stocks seedlings leaf total phenols during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf total phenols											
	First season					Second season						
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)		
Control	0.501	0.490	2.167	1.462	1.155	0.579	0.412	2.596	1.282	1.217		
Diatoms	0.464	0.538	1.577	1.076	0.914	0.429	0.471	1.422	1.183	0.876		
M.Water*	0.508	0.418	1.507	2.857	1.322	0.507	0.543	1.767	1.182	0.9998		
Yeast	0.504	0.359	1.256	2.349	1.117	0.211	0.407	1.523	1.614	0.9387		
Moringa	0.292	0.345	2.080	1.347	1.016	0.287	0.468	1.863	2.213	1.208		
GA ₃	0.307	0.428	1.594	1.536	0.966	0.400	0.507	2.523	2.929	1.590		
Mean (A)	0.4293	0.4297	1.697	1.771		0.4022	0.4680	1.949	1.734			
L.S.D,0.5	A 0.02122		B 0.02599		AB 0.05197		A 0.02419		B 0.02963		AB 0.05926	

* Magnetized water

From the obvious results, It can be conclude that response of citrus stocks seedlings as a chemical composition contents to the natural extracts under study were varied. Whereas :i) GA₃ ; Magnetized water and Moringa leaves extract were positively effect on the photosynthetic pigments contents in citrus stocks .ii) Both Magnetized water and control treatments increased seedlings stem carbohydrates content . iii) All natural applications improved citrus seedlings leaves Indoles contents . Whereas, Magnetized water was the superior effect and Tr.C. was the most responsive . iv) Magnetized water and GA₃ treatments increased both CLEO. or Tr.C. seedlings leaves Phenoles content . These results are in harmony with those obtained by Racuciui *et al.*,(2006) ,El-Tohamyand El-Greadly (2007) , Faten Dhawi, and Al-Khayri (2008) , Mady(2009) Nawroz and Hero (2010) , Hoda *et al.*, (2010), Omayma *et al.*, (2011)and Sheren(2014).

3- Leaf mineral composition:

3-1- Leaf macro - nutrient content:

a) Nitrogen content:

Regarding the effect of treatments, data presented in Table (14) cleared that Yeast extract applications significantly increased leaf nitrogen content (2.447%) in the 1st season when compared to other treatments. On the other hand, the control, Magnetized water, diatoms and moringa leaves

extract treatments statistically had the richest leaf nitrogen content (2.435, 2.398, 2.388 and 2.378 %) in the 2nd season, respectively.

As for the effect of citrus stock genotype, tabulated data in Table (14) displayed obviously that Cleopatra mandarin had a significant leaf nitrogen content (2.487%) in the 1st season. Moreover, in the second season all studied rootstocks gave the highest values of leaf nitrogen content except Sour orange stock was the lowest (2.130%).

Concerning the interaction between the two investigated factors in this study, Data in Table (14) shows a significant effect for both seasons. Whereas, Cleopatra mandarin stock with magnetized water had the highest value (3.82 and 3.27 %) in the two seasons respectively, and it was the lowest with GA₃ (1.57%) in the 1st season or yeast extract (1.52%) in the 2nd season.

Table, 14: Effect of some treatments on root-stocks seedlings leaf nitrogen content% during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf nitrogen content (%)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	1.96	2.11	2.90	2.38	2.338	1.72	2.37	2.70	2.95	2.435
Diatoms	2.29	2.20	2.22	2.96	2.418	2.36	1.90	2.16	3.13	2.388
M.Water*	2.06	1.78	2.02	3.82	2.420	2.08	1.92	2.32	3.27	2.398
Yeast	2.86	1.90	2.44	2.59	2.447	2.51	1.97	2.68	1.52	2.170
Moringa	2.08	2.38	2.13	1.60	2.047	2.86	2.51	2.07	2.07	2.378
GA ₃	2.22	2.48	1.96	1.57	2.058	2.84	2.11	2.36	1.62	2.233
Mean (A)	2.245	2.142	2.278	2.487		2.395	2.130	2.382	2.427	
L.S.D,0.5	A 0.02122		B 0.02599		AB 0.1644	A 0.06710		B 0.08218		AB 0.05197

* Magnetized water

b) Phosphorus content:

Concerning the effect of natural extract on seedlings leaves Phosphorus content, tabulated data in Table (15) disclosed reveal that moringa leaves extract significantly increased P content (0.3175%) in the 1st season. In spite of most treatments improved seedlings leaves phosphorus contents in the 2nd season except the control treatment was statistically the richest P content (0.3225 %).

As for citrus genotype effect, data presented shows that both of Volkamer lemon and Sour orange stocks significantly had the highest values of leaves P content (0.3133 and 0.3117 %) in the 1st season. while, in the second season Volkamer lemon and Troyer citrange gave the highest values (0.3317 and 0.3283 %) respectively.

Data in Table (15) reveal that the interaction between treatments and citrus genotype was significantly in both studied seasons. Whereas, Sour orange stock with Diatoms recorded the highest value (0.440%) in the 1st season and Volkamer lemon stock with control treatment (0.3317%) in the 2nd season. On the other hand, Cleopatra mandarin stock with GA₃ was the lowest (0.190 and 0.170%) in the 1st and 2nd season, respectively.

c) Potassium content:

With regard to the effect of natural extracts on stock seedlings leaves, data in Table(16) reveal that differences during the 1st season were absent from the statistical point of view, except Diatoms treatment which has significantly increased seedlings leaves potassium contents (0.4260%) when compared with control treatment (0.3943%) in the 1st season. In contrary, both control or moringa leaves extracts significantly gave the highest leaf K content (0.4283 and 0.4282 %) respectively, in compared to the other treatments in this study during the 2nd season.

Concerning the effect of citrus genotype, data presented in Table (16) indicated that both Volkamer lemon or Sour orange stocks were significantly the richest in K leaf contents (0.4352 and 0.4527 %) respectively, in the 1st season and (0.4302 and 0.4153%) in the 2nd season in compared to Troyer citrange and Cleopatra mandarin, respectively.

As for the interaction, tabulated data in Table (16) display clear that a significant effect during both seasons. Whereas, Sour orange stock with Diatoms gave the highest value (0.574%) in the 1st season and Volkamer lemon stock with moringa leaves extract (0.496%) in the 2nd season. While, Cleopatra mandarin stock with GA₃ was the lowest (0.333%) in the 1st season and with magnetized water (0.316 %) in the 2nd season.

Table 15: Effect of some treatments on root-stocks seedlings leaf phosphorus content% during the two seasons (2015/2016 & 2016/2017).

R. stocks (A)	Leaf phosphorus content%									
	First season					Second season				
	Treatment (B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.
Control	0.31	0.28	0.22	0.20	0.2525	0.45	0.39	0.23	0.22	0.3225
Diatoms	0.25	0.44	0.31	0.23	0.3075	0.29	0.38	0.30	0.23	0.3000
M. Water*	0.32	0.33	0.21	0.24	0.2750	0.26	0.29	0.36	0.21	0.2800
Yeast	0.36	0.23	0.37	0.20	0.2900	0.38	0.23	0.38	0.22	0.3025
Moringa	0.38	0.28	0.38	0.23	0.3175	0.31	0.27	0.35	0.22	0.2875
GA ₃	0.26	0.31	0.31	0.19	0.2675	0.30	0.25	0.35	0.17	0.2675
Mean (A)	0.3133	0.3117	0.3000	0.2150		0.3317	0.3017	0.3283	0.2117	
L.S.D,0.5	A 0.006710		B 0.008218		AB 0.01644	A 0.02122		B 0.02599		AB 0.05197

* Magnetized water

Table 16: Effect of some treatments on root-stocks seedlings leaf potassium content% during the two seasons (2015/2016 & 2016/2017).

R. stocks(A)	Leaf potassium content%									
	First season					Second season				
	Treatment(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.
Control	0.429	0.435	0.351	0.362	0.3943	0.423	0.429	0.422	0.439	0.4283
Diatoms	0.415	0.574	0.343	0.372	0.4260	0.374	0.404	0.409	0.326	0.3783
M. Water*	0.457	0.384	0.416	0.359	0.4040	0.393	0.459	0.411	0.312	0.3938
Yeast	0.453	0.404	0.397	0.365	0.4047	0.436	0.342	0.363	0.367	0.3770
Moringa	0.434	0.413	0.416	0.418	0.4202	0.496	0.418	0.341	0.458	0.4282
GA ₃	0.423	0.506	0.403	0.333	0.4162	0.459	0.440	0.344	0.316	0.3898
Mean (A)	0.4352	0.4527	0.3877	0.3682		0.4302	0.4153	0.3817	0.3697	
L.S.D,0.5	A 0.02225		B 0.02725		AB 0.05451	A 0.0232		B 0.0285		AB 0.057

* Magnetized water

d) Magnesium content:

Data in Table (17) illustrated that the control treatment significantly increased seedlings leaves Mg content (0.1726%) when compared to yeast (0.1595%); moringa extract (0.1505%) and magnetized water (0.1447%) and insignificant effect with GA₃ (0.1685%) and Diatoms (0.1663%) in the 1st season. Whereas, moringa leaves extract statistically increased it (0.1875%) compared with other treatments in the 2nd season.

As for response of citrus genotype to seedlings leaves Mg content, data in Table (17) pointed to Troyer citrange and Volkamer lemon had a significant values (0.1672 and 0.1620%) respectively, in the 1st season and Volkamer lemon stock (0.1898%) in the 2nd season in this study .

Regarding the interaction, data in Table (17) shows that a significant effect during the two seasons. Whereas, Troyer citrange was the richest stock in Mg leaf content with the yeast extract (0.198%) in the 1st season and with moringa leaves extract (0.213%) in the 2nd season. While, Volkamer lemon with moringa leaves extract (0.127%) and Sour orange with yeast extract (0.137%) in the 2nd season were the lowest values.

Table 17: Effect of some treatments on root-stocks seedlings leaf magnesium content (%) during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf magnesium content (%)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLEO.	Mean(B)	VOL.	SO.	Tr.C	CLEO.	Mean(B)
Control	0.171	0.179	0.176	0.164	0.1725	0.192	0.137	0.149	0.151	0.1573
Diatoms	0.186	0.168	0.139	0.172	0.1663	0.156	0.151	0.148	0.204	0.1647
M.Water*	0.173	0.140	0.135	0.131	0.1447	0.170	0.177	0.111	0.161	0.1548
Yeast	0.164	0.140	0.198	0.136	0.1595	0.221	0.137	0.169	0.149	0.1690
Moringa	0.127	0.158	0.170	0.147	0.1505	0.207	0.168	0.213	0.162	0.1875
GA ₃	0.151	0.175	0.185	0.163	0.1685	0.193	0.177	0.157	0.149	0.1690
Mean (A)	0.1620	0.1600	0.1672	0.1522		0.1898	0.1578	0.1578	0.1627	
L.S.D,0.5	A 0.0070		B 0.0086	AB 0.017		A 0.0074		B 0.0090	AB 0.018	

* Magnetized water

3-2- Micro – elements:

a) Leaf Iron content:

Concerning the effect of treatments, data presented in Table (18) display reveal that Moringa leaves extract had significantly increased seedlings leaves Fe contents (68.71and 75.48 ppm) when compared to other treatments for both seasons.

As for the response of seedlings leaves Fe content to citrus stock genotype, data in Table (18) clear that Cleopatra mandarin stock had significantly had highest value of leaf Fe content (67.10ppm) in the 1st season and Troyer citrange (76.48ppm) in the 2nd season.

With regard to the interaction, tabulated data demonstrated that a significant effect for both seasons, whereas, Sour orange stock was the highest Fe content (81.72ppm) under Diatoms treatment in the 1st season and Troyer citrange (85.68ppm) in the 2nd season. On the other hand, Sour orange stock was lowest (39.06ppm) in the 1st season with yeast treatment and (38.99 ppm) in the 2nd season with magnetized water treatment.

b) Leaf Zinc content:

Data in Table (19) shows that leaf Zn content followed typically the same trend previously detected with leaf Fe content related to the effect of natural extracts, whereas, moringa leaves extract applications significantly increased seedlings leaves Zn contents (19.02 and 19.23 ppm) respectively, in both studied seasons.

Concerning the effect of citrus genotype, both Volkamer lemon stock in the 1st season and Sour orange in the 2nd season significantly gave the highest values (18.90 and 19.24 ppm) respectively.

As for the interaction, data in Table (19) reveal that a significant effect of treatments and citrus stocks genotype on seedlings leaves Zn content during the two seasons. Whereas, Sour orange seedlings was the richest leaf Zn content (21.67 and 21.35ppm) respectively, in the 1st season with

moringa leaves extract and GA₃ treatments and with GA₃ treatment (22.01ppm) in the 2nd season. While, Cleopatra mandarin with GA₃ treatment in the 1st season and Troyer citrange with control treatment in the 2nd season were the lowest Zn contents (12.62 and 12.75 ppm) respectively.

Table 18: Effect of some treatments on root stocks seedlings leaf iron content (ppm) during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	leaf iron content (ppm)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLE0.	Mean (B)	VOL.	SO.	Tr.C	CLE0.	Mean (B)
Control	51.07	66.88	73.92	58.89	62.69	43.91	50.30	85.61	59.90	59.93
Diatoms	54.93	81.72	58.98	61.61	64.31	60.24	74.49	85.68	59.24	69.91
M.Water*	64.66	57.87	62.92	78.43	65.97	79.61	38.99	84.01	78.89	70.38
Yeast	68.01	39.06	57.90	63.47	57.11	60.65	41.95	72.45	65.17	60.05
Moringa	73.61	80.17	61.60	59.47	68.71	84.84	77.40	66.86	72.80	75.48
GA ₃	47.27	53.13	74.72	80.75	63.97	46.68	49.59	64.26	64.31	56.21
Mean (A)	59.93	63.14	65.01	67.10		62.65	55.46	76.48	66.72	
L.S.D,0.5	A 0.2225 B 0.2725 AB 0.5451					A 0.2324 B 0.2847 AB 0.5693				

* Magnetized water

Table 19: Effect of some treatments on root stocks seedlings leaf Zinc content (ppm) during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf Zinc content (ppm)									
	First season					Second season				
	VOL.	SO.	Tr.C	CLE0.	Mean (B)	VOL.	SO.	Tr.C	CLE0.	Mean (B)
Control	20.78	17.76	15.58	17.64	17.94	19.46	21.04	12.75	19.98	18.31
Diatoms	20.76	17.47	15.66	17.97	17.96	19.51	18.00	12.95	15.19	16.41
M.Water*	20.15	14.45	15.39	15.25	16.31	17.65	16.69	16.25	18.35	17.24
Yeast	19.75	17.95	16.46	13.88	17.01	19.05	16.70	17.37	17.16	17.57
Moringa	19.61	21.67	16.90	17.89	19.02	15.05	20.98	19.25	21.64	19.23
GA ₃	12.33	21.35	13.95	12.62	15.06	18.37	22.01	12.76	13.97	16.78
Mean (A)	18.90	18.44	15.65	15.87		18.18	19.24	15.22	17.72	
L.S.D,0.5	A 0.2122 B 0.2599 AB 0.5197					A 0.2419 B 0.2963 AB 0.5926				

* Magnetized water

c) Leaf Manganese content :

With regard to treatments effect on stocks seedlings leaves Mn content, it is quite clear as shown from Table (20) that the GA₃ treatment in the 1st season or Diatoms in the 2nd season significantly increased seedlings leaves Mn contents (36.82 and 36.02 ppm), respectively.

Concerning the responsibility of citrus stocks genotype on seedlings leaves Mn contents, data illustrated that Cleopatra mandarin stock in the 1st season or Volkamer lemon stock in the 2nd season had significantly the highest values (38.74 and 34.22 ppm), respectively. While, Troyer citrange was the lowest (23.67 and 24.14 ppm) in both studied seasons, respectively.

As for the interaction, data in Table (20) shows a statistical effect for both seasons, whereas, Volkamer lemon seedlings leaves gave the highest Mn contents with Diatoms treatment (55.70 and 45.94 ppm) in both season respectively. While, Sour orange seedlings was the lowest with magnetized water treatment (16.63 ppm) in the 1st season and Cleopatra mandarin stock with control (17.33 ppm) in the 2nd season.

Table, 20: Effect of some treatments on root stocks seedlings leaf Manganese content(ppm) during the two seasons (2015/2016 & 2016/2017).

R. stocks(A) Treatment(B)	Leaf Manganese content(ppm)											
	First season					Second season						
	VOL.	SO.	Tr.C	CLE0.	Mean (B)	VOL.	SO.	Tr.C	CLE0.	Mean (B)		
Control	38.13	18.38	22.97	20.74	25.05	31.70	24.74	19.42	17.33	23.30		
Diatoms	55.70	27.39	23.84	39.28	36.55	45.94	33.01	27.02	38.10	36.02		
M.Water*	53.43	16.63	24.05	44.57	34.67	32.15	24.35	24.16	31.46	28.03		
Yeast	27.45	20.59	19.22	33.38	25.16	31.78	21.45	22.71	32.91	27.21		
Moringa	25.23	36.54	24.69	45.03	32.87	30.62	40.42	26.43	41.56	34.76		
GA ₃	22.07	48.53	27.24	49.44	36.82	33.16	31.35	25.08	40.29	32.47		
Mean (A)	37.00	28.01	23.67	38.74		34.22	29.22	24.14	33.61			
L.S.D,0.5	A 0.07037		B 0.08619		AB 0.1724		A 0.07350		B 0.09002		AB 0.1800	

* Magnetized water

In this respect, data Tables (1, 2 and 3) disclosed showed that bio- stimulated substances (Yeast extract and GA₃) may stimulate the organic components (Netc contents) in plant tissues. While, the other organic materials as Diatoms (mining Algae) or Moringa leaves extract has a close relation with elements as(P ; K ; Ca ; Mg ; Fe ; Znetc). These foundations are harmony with those obtained by El-Tohamy and El-Greadly (2007) ; Selim, M. M.(2008); Mady(2009) ; Elham *et al.*, (2010) ; Zakaria(2010) ; Omayma *et al.*, (2011) ; Salwa (2013) whom indicated that : yeast, increased N, P and K content of leaves, algal extract gave favorable effects on chemical properties parameters ; magnetized water induced changes in mobility of nutrient elements in root zone differed greatly from element to another according to element magnetic susceptibility; bio-stimulants as a foliar spray have positive effects on some micro-nutrients (Fe, Zn, Cu and Mn) content of fruits tissues and the algae extraction treatment recorded the highest values of phosphorus.

On the other hand, Hoda *et al.*, (2010) and Hoda *et al.*, (2013) noticed that no significant differences between SO (*C.aurantium*) and VOL (*C.Volkameriana*) leaf N and P contents. In spite of leaf K content was increasing as a result for spray of GA₃, but, leaf Fe content was decreased, and there were significant differences between treatments for leaf Zn and Mn. Also , Hoda *et al.*, (2013) Found that Magnetite, Diatoms and biofertilizer treatments on citrus seedlings .The differences between treatments were low to be significant and the lowest value were obtained by control treatment .Moreover, the results did not show any significant between all treatments for leaf P content (%).

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