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EFFECT OF HUMATES COMPOUNDS AND MAGNETIC IRON ON GROWTH AND FRUITING OF VALENCIA ORANGE TREES (*Citrus sinensis* L.)

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ABSTRACT : *This investigation was carried out during two successive seasons (2011-012) and (2012-013) on 5- year- old Valencia orange trees. Trees were grown at a private orchard under reclaimed conditions (sandy soil and saline water), to study the effect of humate compounds and magnetic iron soil application on tree vegetative growth, yield and fruit quality were studied. There was significant improve by the different humate compounds and magnetic iron treatments on the vegetative growth, yield and fruit quality.*
Whereas, 1000 g magnetite plus 50g K-humate was the best results for the most vegetative growth parameters, yield production and the fruit quality and economically treatment under this study during both seasons.

Key words: *Valencia orange, Magnetic iron, magnetite, Humate compounds, vegetative growth, yield, fruit quality.*

INTRODUCTION

Citrus consider being one of the most important fruit crops in the world, especially, under warm temperate regions, which occupied the third position between fruit crops after grapes and apples.

Moreover, citrus is a major fruit crop cultivated in Egypt as its acreage, production and exportation potentialities are concerned. It is the largest horticultural industry, during the last few years, and harvested area increased rapidly from year to another (483296 fed. in 2011 from the total fruit crops area, which estimated to be 1388153 fed.) The fruiting acreage of citrus occupies about 395731 fed. and produced about 3730685 tons with average of 9.5 tons/fed. according to Ministry of Agriculture and Land Reclamation (Annual Report 2011).

Extension of the cultivated area is due to: I) fit environmental conditions. II) Increasing demands of local consumption and III) Its highly economic value as a main source for exportation fruit crops. Such extensions in area encourage establishing more studies towards finding out an appropriate management for improving tree production and fruit quality.

Moreover, citrus fruits have high nutritional values because of its own higher amount of sugars, minerals, Vitamins, organic acids and antioxidants. It used in various technological purposes such as canning , making juice , jams and other preserves, Prickles and Chutney are prepared from unripe fruits (Chandler , 1987).

Salinity of soil and irrigation water regimes and drought conditions are considered to be a serious and the major problems that faces citrus growers in the newly reclaimed regions, whereas, alkaline soils and mal-nutrition significantly reduced citrus tree production.

Generally, natural Magnetite (minning product) and humate (organic compounds) can be used as soil improvement products with a superior "residual effect" in the soil and cheaper in compared to other chemical substances which practically used in agricultural systems. Application will help in a lowering cost and give safety product for crops users and increasing benefits as time function than other chemical applications.

Nevertheless, Magnetite play an important role in cation uptake capacity and has a positive effect on immobile plant nutrient uptake (Esitken and Turan, 2003). Also, Magnetic field could be substitution of chemical additives, which can reduce toxins in raw materials and these raise the food safety.

In addition, humic fractions as imboile-Fe led to partial control the leaf chlorosis symptoms with a significant increase in chlorophylls and leaf- Fe content. Humic acids as a fertilizer compounds decreased the NO_3- N content in the fruits; increased vit. C and soluble sugar content Pinton *et al.*, (1998).

Citrus growers used these materials (natural organic fertilizer forms like animal manures or seed meals) for perceived or real improvements in soil physical, chemical, and biological properties, but the main benefits appears to be increases nutrient availability Obreza and Ozores-Hampton (2000); Perg *et al.*, (2001).

Humic compounds of peat, saprobe and preparations based on both these materials on mass transport in the soil-plants systems relating to the protection of soils and water from heavy metal pollution, Abramets and Rovdan (2001).

Generally, humic products in soil systems has been substantiated; many immobilizing materials increased soil pH, humic acid resulted in an increase cation exchange capacity (CEC), and decrease in metal mobility, Oste *et al.,* (2002).

The objective of the present stud may be will added more informations on the effect of magnetite and humate compounds on vegetative growth, fruit quality and yield of Valencia orange trees.

MATERIALS AND METHODS

This investigation was carried out during the two successive seasons (2011-012) and (2012-013) on Valencia orange trees (*Citrus sinensis* L.) grown in a private orchard at El Salhia region - Sharkia Governorate.

The main target of this study was examining the effect of magnetite (magnetic iron) and K-humate (humic acid) doses on vegetative growth, mineral composition, yield and fruit quality of Valencia orange trees under salinity stress.

Selected trees were 5-year-old, healthy, and nearly uniform in growth vigor, planted at 5x5 m apart and received the same cultural practices.

This experiment included 16 treatments as follow:

1- Magnetite at 250 gm / tree (M1). 2- Magnetite at 500 gm / tree (M2).
3- Magnetite at 1000 gm / tree (M3).4- Humates at 25 gm / tree (H1).
5- Humates at 50 gm / tree (H2). 6- Humates at 100 gm / tree (H3).
7- (M1+H1). 8- (M1+H2). 9- (M1+H3). 10- (M2+H1). 11- (M2+H2). 12- (M2+H3). 13- (M3+H1). 14- (M3+H2). 15- (M3+H3). 16- Control.

The chosen trees yearly received applied materials as soil application at 1^{st} week of January in both seasons.

The following parameters of the studied treatments were carried out.

1- Vegetative growth measurements: were evaluated through determining the average shoot length (cm) and Leaf area (cm^2).

2- Leaf mineral content: leaves samples were collected from tested trees in September. Total leaf macro-nutrients content i.e. N ; P and K were determined according to (Piper , 1950).

   Total leaf micro-nutrients content i.e. Fe, Cl and Na were determined by using Atomic absorption.

3- Tree yield was recorded at harvesting date; the average yield per tree in Kg for each treatment.

4- Fruit characteristics: samples of ten fruits at harvesting time for each replicate were picked and the following fruit characters were determined: Fruit physical properties including: the average of fruit weight (gm), fruit dimensions (both fruit length and width), fruit color and percentage of juice.

In addition, fruit chemical properties were also estimated including: percentage of fruit juice TSS (%) by hand- refractometer, fruit juice acidity (%) and vitamine C content (mg ascorbic acid/100 g juice according to (A.O.A.C.,1995).

A complete randomized block design with three replicates was followed.

5- Statistical analysis:

The obtained data for the two seasons were statistically analyzed using the analysis of variance method according to Snedecor and Cochran, (1967), whereas differences between means were compared using Duncan's multiple range test at 5 % level (Duncan, 1955)

RESULTS AND DISCUSSION

1- Growth parameters:

1-1-Shoot length:

Regarding the effect of Magnetite; K-humate and their combinations, it is quite evident that data in (Table 1) cleared that M3H2 treatment was significantly increased shoot length (10.90 cm) in the 1st season (2011- 012) and M3H2 (10.50 cm) and M3H3 (10.13cm) in the 2nd season (2012-013) when compared to other treatments and control. Non significant effect of other treatments on shoot length was recorded during both studied seasons. These results are in agreement with those obtained by Ismail *et al.*, (2010) on grapevine, magnetite application increased shoot length of Superior grapevine cv., and the magnetic treatments led to a remarkable increase in plant root and stem length, these initial effects are very positive since they appear to induce an improved capacity of nutrient and water uptake, providing greater physical support to the developing shoot.

Table (1): Effect of magnetite and K-humate treatments on shoot length and average leaf area of Valencia orange trees in 2011/012 and 2012/013 seasons:

Treat.	Shoot length (cm)		Leaf area (cm^2)	
	(2011/2012)	(2012/2013)	(2011/2012)	(2012/2013)
M1	7.33 b	7.53 b	15.89 ab	15.72 b
M2	6.67 b	7.47 b	16.93 ab	16.62 b
M3	8.50 ab	7.30 b	17.38 ab	17.98 ab
H1	6.83 b	7.80 b	16.91 ab	17.12 ab
H2	7.17 b	7.80 b	17.49 ab	17.64 ab
H3	7.83 b	7.90 b	17.75 ab	17.85 ab
M1H1	7.37 b	7.13 b	16.67 ab	16.18 b
M1H2	7.97 b	7.70 b	16.67 ab	17.03 ab
M1H3	8.70 ab	8.83 b	17.85 ab	17.91 ab
M2H1	7.13 b	7.67 b	16.26 ab	17.37 ab
M2H2	8.00 b	7.97 b	16.94 ab	17.39 ab
M2H3	7.50 b	8.50 b	17.93 ab	18.39 ab
M3H1	7.17 b	7.73 b	16.97 ab	17.49 ab
M3H2	10.90 a	10.50 a	18.83 ab	19.97 a
M3H3	8.67 ab	10.13 a	19.16 a	20.01 a
Control	7.33 b	6.97 b	15.35 b	15.86

1-2- leaf area:

With regard to the effect of Magnetite; K-humate and their combinations, data in Table (1) showed that, M3H3 treatment was significantly the highest increment of leaf area (19.16 cm^2) when compared to other treatments and control in the 1st season (2011- 012). While, M3H3 and M3H2 treatments were significantly increased leaf area (20.01and 19.97cm^2) respect., in compared to M1; M2; M1H1 and control treatments and insignificant effect with other treatments in the 2nd season.

These results confirmed with the previous findings by Sayed *et al*., (2007) and Barakat *et al*., (2012) whom indicated that, humic substances play an important role as a nutrient supplying which raising soil fertility and increase the availability of nutrient elements. In addition, using different magnetic field combination could separately alter the root mass, leaf size and stem.

2. Leaf chemical composition:

2.1. Leaf nitrogen content (%):

With regard to the effect of Magnetite; K-humate and their combinations treatments, data in Table (2) showed that both M3H2 and M3H3 treatments were significantly increased leaf nitrogen (2.38& 2.41%) and (2.35&2.42%) percentage content respectively, when compared to other Magnetite; K-humate and their combinations and the control treatment (1.97&1.98%) in both experimental seasons (2011-012&2012-013). Moreover, Magnetite; K-humate and their combinations treatments were significantly increased leaf nitrogen contents in compared to control treatment in the 2nd season.

Table (2): Effect of magnetite and K-humate treatments on the percentage of N, P and K elements in leaves of Valencia orange trees in 2011/012 and 2012/013 seasons.

Treat.	N%		P%		K%	
	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
M1	2.08 cde	2.11 fg	0.115 a	0.118 bcde	1.137 f	1.169 fgh
M2	2.05 ef	2.12 fg	0.117 a	0.120 bcde	1.140 ef	1.148 gh
M3	2.11 cde	2.17 efg	0.114 a	0.119 bcde	1.160 def	1.177 fgh
H1	2.04 ef	2.10 g	0.120 a	0.123 bcde	1.190 cde	1.217 cdef
H2	2.06 def	2.13 fg	0.124 a	0.127abcd	1.223 abc	1.231 cde
H3	2.15 cd	2.26 bcde	0.122 a	0.126 abcde	1.237 abc	1.254 abcd
M1H1	2.09 cde	2.21 cdef	0.116 a	0.115 cde	1.200 bcd	1.205 def
M1H2	2.12 cde	2.20 cdef	0.119 a	0.117 bcde	1.227 abc	1.238 bcd
M1H3	2.16 c	2.31 b	0.112 a	0.120 bcde	1.233 abc	1.247 abcd
M2H1	2.10 cde	2.19 defg	0.111 a	0.114 de	1.150 def	1.178 efg
M2H2	2.13 cde	2.28 bcd	0.113 a	0.122 bcde	1.223 abc	1.243 bcd
M2H3	2.27 b	2.29 bc	0.121 a	0.124 bcde	1.253 a	1.268 abc
M3H1	2.11 cde	2.24bcde	0.133 a	0.138 a	1.243 ab	1.253 abcd
M3H2	2.38 a	2.41 a	0.126 a	0.128 abc	1.273 a	1.297 a
M3H3	2.35 ab	2.42 a	0.121 a	0.129 ab	1.247 ab	1.289 ab
Control	1.97 f	1.98 h	0.107 a	0.113 e	1.070 g	1.125 h

2.2. Leaf phosphor content (%):

Concerning the effect of Presented data in Table (2) cleared that M3H1 treatment was the highest values (0.133 %) and the control was the lowest (0.107%) in the 1st season (2011-012).

Whereas, M3H1 treatment was significantly increased leaf P % content (0.138) when compared to the most of Magnetite; K-humate and their combinations treatments and the control treatment which was the lowest value (0.113%) in the 2nd season (2012-013). In addition, results in Table (2) indicated that high doses of Magnetite with low doses of K-humate were the best effect on P element uptake which increased Valencia orange leaves P content. While, most of Magnetite; K-humate and their combinations treatments fluctuated in their effect on P uptake under this study.

2.3. Leaf potassium content %:

Regarding of leaf K content Table1 (2) indicated that Magnetite; K-humate and their combinations treatments had the same trend of their effect on P element. Whereas, the high doses of Magnetite with low doses of K-humate were the best effect on K element uptake which increased Valencia orange leaves K content. Meanwhile, M3H2 treatment was significantly improved K element uptake which increased in leaves (1.273&1.297) percentage content respectively, when compared with some Magnetite; K-humate and their combinations treatments and the control treatment (1.070&1.125%) for both seasons (2011-012 & 2012-013).

These results are harmony with those obtained by, Abada (2009); Mohammed *et al.*, (2010) and Abd El-Monem *et al.,* (2011) whom indicated that there are many benefits to crop growth resulted from addition natural mineral product like magnetic iron ore including improved soil structure, increased soil organic matter, improved water properties and become more energy and vigor and this known as "Magneto biology', improving water holding capacity and cation exchange capacity, Improved crop nutrition from macro and micro elements. Moreover, the magnetic process separate all chlorine, toxic and harmful gases from soil, increased salt movement and solubility of nutrients increasing water retention by soil and this help on plant growth, moderation of soil temperature.

Improving plant nutrition by humic acid which stimulating the absorption of mineral elements through stimulating root growth and increases the rate of absorption of mineral ions on root surfaces and their penetration into the cells of the plant tissue, so plants show more active metabolism and increase respiratory activity.

2.4. Leaf Iron content (ppm):

It is well known that Magnetite Ore the mining product which used in agriculture field as soil improvement under alkaline conditions and water logging soil.

So, it is not available for plant feeding as Fe source. For this, data in Table (3) showed that, Magnetite; K-humate and there combination treatments were significantly improved Valencia orange leaves Fe contents during experimental seasons (2011-012 and 2012-013), also, M3H3 treatment (95.58 & 100.42) ppm respectively, were the highest Fe values when compared to the control treatment which was the lowest (59.60 &57.58) ppm in both seasons of this study.

2.5. Leaf Sodium content (%):

Data in Table (3) reveled that M3H2 treatment significantly reduced leaf Na content (0.234%) when compared to control treatment (0.339%). Whereas, most of Magnetite; K-humate and their combinations treatments were no significant effect on Na leaf content during the 1st season (2011-012). In contrast, all Magnetite; K-humate and there combinations treatments were significantly reduced leaf Na percentage and M3H2 treatment was the highest effect with the lowest value (0.22 %)in compared to the control treatment which was the highest value(0.35%) during the 2nd season (2012-013) of this study.

2.6. Leaf Chlorine content (%):

Concerning the effect of Magnetite, K-humate and combinations treatments present data in Table (3) cleared that all the experimental treatments had the trend of their effect on leaf Na content. Whereas, M3H3 treatment was significantly reduced leaf Cl content (0.550 %) in compared to the control treatment (0.717%) during the 1st season (2011-012), with insignificant effect with other treatments under this study. Whereas, all Magnetite, K-humate and combinations treatments were significantly reduced leaf Na content and M3H3 treatment was the highest effect with the lowest value (0.54 %) when compared to the control treatment which was the highest value (0.79 %) during the 2nd season (2012-013).

It is well known that both Na and Cl were undesirable elements in the root absorption area. No doubt, Magnetite, K-humate applications will be significantly reduced its injury effect on plants and other nutrient elements uptake.

These results are in line with those obtained byMunns (2002); Garcia-Sanchez *et al.*, (2006) and Mehanna *et al.*, (2010) whom indicated that Magnetite may be assisting to reduce the Na toxicity at cell by reduced absorption of Na by plant roots. Also interesting to note that the apparently reduced accumulation of Na in plants with magnetite and humate treatments helped the trees to continue their growth with less detrimental effects on total yield.

2.7. Leaf proline content (mg/g):

Valencia orange trees leaf proline content was studied under saline water stress during two successive seasons (2011-012 and 2012-013) and Table (3) showed that Magnetite; K- humate and combinations treatments were significantly reduced leaf proline content when compared to the control treatments (86.570 & 88.374) respectively, during both studied seasons (2011-012 and 2012-013). Moreover, indicated that responsible of leaf proline content fluctuated to Magnetite; K- humate and combinations treatments, whereas, the highest effect was resulted of M3H2 (51.119 & 50.00) in both seasons (2011-012 and 2012-013) of this study.

Table (3): Effect of magnetite and K-humate treatments on Valencia orange leaf Fe; Na ; Cl and Proline content in 2011/012 and 2012/013 seasons.

Treat.	Fe (ppm)		Na%		Cl %		Proline (mg/g)	
	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013
M1	69.25 g	73.58 h	0.31 a	0.30 b	0.69 ab	0.62 b	73.63 b	67.50 c
M2	72.92 fg	78.00 fg	0.30 ab	0.30 b	0.69 ab	0.67 b	65.64 d	64.93 c
M3	75.33 ef	81.22 ef	0.30 ab	0.30 b	0.60 ab	0.58 b	69.74 bc	65.16 c
H1	61.83 hi	63.92 j	0.31 a	0.31 b	0.70 ab	0.68 b	71.97 b	73.01 b
H2	62.59 hi	66.58 ij	0.30 ab	0.29 b	0.68 ab	0.67 b	65.62 d	64.43 c
H3	64.08 h	67.43 i	0.29 ab	0.28 b	0.62 ab	0.59 b	58.86 ef	57.04 de
M1H1	70.73 g	75.00 gh	0.30 ab	0.29 b	0.66 ab	0.64 b	66.62 cd	64.77 c
M1H2	78.08 e	79.42 ef	0.30 ab	0.30 b	0.70 ab	0.65 b	62.82 de	61.41 cd
M1H3	85.50 d	88.00 d	0.28 ab	0.25 bc	0.63 ab	0.57 b	55.82 fg	55.61 de
M2H1	78.83 e	80.17 ef	0.29 ab	0.30 b	0.69 ab	0.62 b	63.13 d	61.66 cd
M2H2	78.85 e	82.58 e	0.30 ab	0.28 b	0.66 ab	0.63 b	58.85 ef	61.07 cd
M2H3	90.42 bc	92.75 c	0.27 ab	0.26 b	0.62 ab	0.58 b	56.01 fg	53.94 ef
M3H1	88.58 cd	90.50 cd	0.29 ab	0.27 b	0.62 ab	0.60 b	62.64 de	57.91 de
M3H2	92.42 ab	97.00 b	0.23 b	0.22 c	0.58 ab	0.58 b	51.12 h	50.00 f
M3H3	95.58 a	100.42 a	0.25 ab	0.25 bc	0.55 b	0.54 b	52.93 gh	49.68 f
Control	59.60 i	57.58 k	0.34 a	0.36 a	0.72 a	0.79 a	86.57 a	88.37 a

3. Yield (k g/tree):

Data in Table (4) cleared that, high doses of Magnetite and K-humate and there combinations were the highest tree yield values, whereas, M3H2 treatment was the highest (51.00&62.00) and the control was the lowest (38.33&42.33) k gm /tree respectively, for both seasons.

4. Fruit quality:

4.1. Fruit weight:

Data in Table (4) quite evident that M1H3 treatment was significantly increased fruit weight (218.67 gm) when compared to M1(178.67gm); M2 (181.00gm); H1 (169.33gm); H2 (183.00gm); M1H1 (183.33gm) and M1H2 (181.00gm) treatments respectively, in the 1st season (2011-012). Whereas, M1H3 treatment was significantly increased Valencia orange fruit weight (211.33 gm) when compared to most of other treatments. Also, fruit weight fluctuated from treatment to another during the 2nd season (2012-013) this may be due to the accumulation effect of Magnetite and K-humate application in compared to the 1st season of this study.

4.2. Fruit shape index:

Data in Table (4) indicated that Magnetite; K-humate and their combinations treatments had a positive effect on Valencia orange fruit shape (from round or semi oval to oval shape) under this experimental condition during both seasons. Whereas, M1H3 treatment had a significant effect on of fruit shape index (1.079 &1.151) when compared to M3H3 (0.968) and control 0.927) treatments respectively, in the 1st season (2011-012) and other treatments in the 2nd season (2012-013) with insignificant effect between all other treatments.

4.3. Fruit peel color:

Hue angle was determined as a criterion for appearance which considered as a significant indicator for fruit quality. The present data in Table (4) and showed that the Valencia orange fruit peel color positively affected by Magnetite, K-humate and combinations treatments. Whereas, M3H3, M1H3 and H1treatments had the best color (67.14, 68.02 and 68.57) respectively, in the 1st season (2011-012) with insignificant difference with control treatments. Moreover, M3H3, M1H3 and H1treatments was significantly had the best values (71.37, 72.04 and 3.09) respectively, in the 2nd season (2012-013). Whereas, the lowest fruit color values were obtained from M1H1 treatment in both seasons. Generally, depending on Hue angle method for measuring the color angle. A decrease of hue angle in Valencia peel color which represent the area from greenish yellow to orange yellow in both seasons respectively.

Also, data in Table (4) illustrated that, during fruit growth development peel color of Valencia orange fruits (A/B Ratio) fluctuated as affected by Magnetite, K-humate and combinations treatments during both seasons (2011-012 and 2012-013). Insignificant differences between all treatments in the 1st season (2011-012), while, in the 2nd season (2012-013) Magnetite, K-humate and combinations treatments significantly improved the (A/B ratio) of fruits, whereas, the H2 treatment was the best value (0.278) when compared to the H3 treatment which the lowest (0.216).

These observations are in line with those obtained by Campbell *et al.*, (2004); and Mohamed *et al.*, (2013) whom cleared that fruit peel color is one of the most important attributes of agrifood products, since consumers associate it with freshness and is critical in the acceptance of a particular product among others Producers strive to prevent products with defective colorations from reaching the market. Magnetite treatments had more lightness and good rind fruit color, so it seems more attractive than other treatments.

4.4. Percentage of Juice (w/w):

With this respect, Table (5) cleared that, Magnetite; K-humate and there combinations treatments were significantly increased Valencia orange fruit juice ratio (w/w) when compared to the control treatment in the 1st season (2011-012). M1H2 treatment was the highest value (47.12).

Table 4

Table (5): Effect of magnetite and K-humate treatments on the fruit juice ratio, TSS/Acid ratio and Vit. C content of Valencia orange trees in 2011/012 and 2012/013 seasons.

Treat.	Juice % (w/w)		TSS/Acid ratio		Vit. C (mg/100g)	
	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013
M1	45.38 a	42.98 ab	7.88 b	8.14 b	42.53 def	43.87 cde
M2	45.66 a	43.10 ab	8.33 ab	8.25 b	39.80 fg	49.23 abcd
M3	42.60 a	43.70 ab	8.40 ab	8.50 b	43.97 cde	47.30 bcde
H1	40.71 a	38.37 ab	7.85 ab	8.14 b	39.61 fg	41.67 de
H2	37.21 a	41.21 ab	8.03 b	8.11 b	40.80 ef	49.53 abcd
H3	47.02 a	46.90 ab	8.44 ab	8.42 b	47.21 bc	50.57 abc
M1H1	46.99 a	46.04 ab	8.32 ab	8.12 b	43.37 def	49.33 abcd
M1H2	47.12 a	45.27 ab	8.15 b	8.28 b	44.09 cde	50.13 abc
M1H3	46.88 a	49.21 ab	9.86 a	10.30 a	49.75 ab	57.83 a
M2H1	46.98 a	44.56a	8.32 ab	8.42 b	42.35 def	51.70 abc
M2H2	47.08 a	42.42 ab	8.35 ab	8.23 b	45.76 cd	50.67 abc
M2H3	47.01 a	48.32ab	8.75 ab	8.83 b	51.66 a	54.03 ab
M3H1	46.39 a	51.68 a	8.28 b	8.44 b	49.75 ab	52.80 abc
M3H2	45.36 a	48.79 ab	8.68 ab	8.81 b	52.62 a	58.27 a
M3H3	46.67 a	49.43a	8.66 ab	8.80 b	51.46 a	54.80 ab
Control	30.17 b	33.73 b	7.61 b	8.01 b	37.19 g	40.23 e

In addition, M2H1 (44.56); M3H1 (51.68) and M3H3 (49.43) respectively, treatments were significantly increased fruit juice ratio as a weight when compared to the control treatment (33.73) , and insignificant differences with other Magnetite ; K-humate and their combination treatments in the 2^{nd} season (2012-2013).

These foundations are in line with those obtained by Sayed *et al*., (2007); Abdel Rahman *et al*., (2009); Abel-Aziz *et al*. (2010) and Mohamed *et al* (2013) .(Who indicated that salinity reduced rind thickness and humic acid applications improved fruit juice weight of mandarin. Also, Magnetite treatments were enhancing Valencia orange fruit juice weight percentage. Generally, Magnetite or humic acid applications will be improved physical fruit quality which gave extra advantage for such fruits to be exported.

4.5. TSS/Acid ratio:

In spite of the control treatment clearly increased both TSS and total acidity in compared to Magnetite; K-humate and their combinations treatments Table (5). Nevertheless, M1H2 (9.86&10.30) was significantly increased TSS/acid Ratio when compared to the control treatment (7.61&8.01) respectively, during both seasons.

4.6. Vitamin C.:

Concerning to the effect of Magnetite; K-humate and their combinations treatments, data in the Table (5) indicated that, most of the Magnetite and K-humate combinations treatments were significantly increased Valencia orange fruit juice Vit. C (mg/100gm.) content when compared to the single Magnetite and K-humate and the control treatments for both seasons,

So, M3H2 treatment (52.62&58.27 mg/ 100gm) Vit. C respectively, was the highest values and the control treatment (37.19&40.23) mg/100gm. Vit. C respectively, was the lowest for both studied seasons.

These results are similar with those obtained by, Francois and Clarck (1980); Dasberg *et al.* (1991); Sayed *et al.*, (2007); Fathy *et al.*, (2010); Abd El-Razek (2012); Ali *et al.*, (2013) and Mansour *et al.,* (2013), Whom indicated that saline conditions and water deficit stress enhanced sugar accumulation of Valencia orange fruit cause an increase TSS and acid concentration in the fruit juice which caused a delay in the ripening of the fruit of Valencia orange. Humic acid improved chemical properties due to increasing soil microorganism activity which enhance nutrient cycling that induce growth and enhance fruit quality. Moreover, humic substances decreased acidity in different fruit. Whereas, Magnetic field and Magnetite treatments increased TSS and reduced acidity in Valencia orange fruit juice content.

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تاثير المركبات الهيوماتية والحديد المغناطيسى على النمو الخضرى والثمرى لاشجار البرتقال الصيفى

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الملخص العربى

أجريت هذه الدراسة على اشجار برتقال صيفى عمر ٥ سنوات مطعوم على اصل النارنج فى احد المزارع الخاصة فى صحراء الصالحية – محافظة الشرقية خلال موسمى (٢٠١١-٢٠١٢) و (٢٠١٢-٢٠١٣) لدراسة تاثير الحديد المغناطيسى وهيومات البوتاسيوم على النمو الخضرى والثمرى لاشجار البرتقال الصيفى تحت ظروف الاراضى الرملية.

كانت المعاملات محل الدراسة ١٦ معاملة عبارة عن ثلاثة معدلات من خام الحديد المغناطيسى (الماجنتيت) هى (٢٥٠، ٥٠٠، ١٠٠٠ جم)/ شجرة. وثلاثة معدلات من هيومات البوتاسيوم (٢٥، ٥٠ ، ١٠٠ جم)/ شجرة والتوليفات الرياضية من الماجنتيت والهيومات بالاضافة الى معاملة الكنترول وتم تحليل النتائج من خلال التصميم الإحصائى " القطاعات كاملة العشوائية".

حيث ان الحديد المغناطيسى والهيومات كلاهما من المواد التي تستخدم لتقليل الضرر الناجم عن زيادة الملوحة في التربة او مياه الري بزيادة تحمل النبات لهذه الملوحة، فان جميع القياسات التي تم الاستعانة بها في هذه الدراسة حدثت لها استجابة معنوية في اغلبها لصالح عملية الانتاج وجودة الثمار، كما حدث بالفعل انخفاض او تحييد للمواد المعيقة للنمو (الصوديوم ،الكلورين والتركيزات العالية للبورون) وهي المركبات الضارة وقد تباينت النتائج تبعا لمعدلات الاضافة للماجنتيت والهيومات.

وقد أظهرت النتائج وجود فروق معنوية واضحة فى كل من الصفات المتعلقة بالنمو الخضرى ومعدلات النمو، محتوى الأوراق من كل من العناصر الغذائية الكبرى والصغرى والبرولين بالإضافة إلى المحصول الكلى للاشجار وصفات جودة الثمارالمختلفة و محتوى العصيرمن فيتامين ج.

وعليه يمكن التوصية بالاتى: اعطت معاملة (١٠٠٠ جم ماجنتيت + ٥٠ جم هيومات)/ شجرة افضل النتائج من الناحية التطبيقية والاقتصادية وعليه يوصي باستخدمها تحت نفس ظروف هذه الدراسة .

Table (4): Effect of magnetite and K-humate treatments on the yield, fruit weight, fruit shape index and fruit peel color of Valencia orange trees in 2011/012 and 2012/013 seasons.

Treat.	Yield (kg/ tree)		Fruit weight (g)		Fruit shape index		Fruit peel color (Hue angle)		Fruit peel color a/b ratio	
	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013
M1	39.83 bc	52.00 d	178.67 b	184.67 bcde	0.996 abc	0.988 b	72.94 ab	78.18 ab	0.283 a	0.211 b
M2	40.60 bc	53.33 d	181.00 b	178.67 cde	0.994 abc	0.994 b	70.88 ab	78.07 ab	0.354 a	0.208 b
M3	44.17 abc	56.67 cd	191.67 ab	193.33 bcd	1.004 abc	0.988 b	73.66 ab	75.89 b	0.299 a	0.254 ab
H1	39.50 bc	52.60 d	169.33 b	179.00 cde	0.981 abc	0.982 b	68.57 b	73.09 c	0.300 a	0.241 b
H2	42.67abc	52.67 d	183.00 b	174.67 de	1.028 ab	1.031 b	73.06 ab	77.04 ab	0.328 a	0.278 a
H3	44.50 abc	57.33 bcd	191.33 ab	186.67 bcde	1.013 abc	1.003 b	72.16 ab	77.68 ab	0.318 a	0.216 c
M1H1	42.67 abc	52.67 d	183.33 b	181.00 bcde	1.040 ab	1.037 b	75.97 a	79.60 a	0.255 a	0.251 ab
M1H2	43.00abc	54.67 cd	181.00 b	185.00 bcde	1.027 ab	1.013 b	77.93 a	78.18 ab	0.222 a	0.217 b
M1H3	47.68 ab	61.00 ab	218.67 a	211.33 a	1.079 a	1.151 a	68.02 b	72.04 c	0.271 a	0.202 b
M2H1	44.17 abc	52.67 d	193.67 ab	180.00 cde	1.032 ab	1.032 b	72.32 ab	76.76 b	0.315 a	0.235 ab
M2H2	43.67 abc	54.67cd	191.33 ab	186.33 bcde	1.030 ab	1.026 b	71.92 ab	78.12 ab	0.312 a	0.210 b
M2H3	47.17 abc	58.33abc	194.00 ab	193.33 bcd	0.987 abc	1.008 b	73.58 ab	77.83 ab	0.285 a	0.217 b
M3H1	45.67 abc	55.33 cd	192.67 ab	183.00 bcde	0.986 abc	1.037 b	74.47 ab	78.42 ab	0.315 a	0.204 b
M3H2	51.00 a	62.00 a	198.67 ab	200.00 abc	0.996 abc	0.995 b	71.11 ab	76.80 b	0.291 a	0.237 ab
M3H3	50.00 a	61.67 a	198.33 ab	201.33 ab	0.968 bc	1.004 b	67.14 b	71.37 c	0.268 a	0.218 b
Control	38.33 c	42.33 e	195.67ab	168.33 e	0.927 c	0.980 b	77.00 a	77.58 ab	0.286 a	0.232 b