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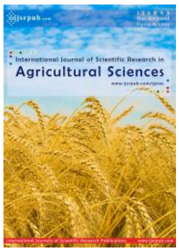

Influence of Magnetic Iron and K-Humate on Productivity of Valencia Orange Trees (*Citrus Sinensis* L.) under Salinity Conditions

Abobatta, W. F.

Citrus Dept., Horticulture Research Institute, A. R. C., Giza, Egypt
Email: wabobatta@yahoo.com

Abstract. This study is to evaluate the effect of magnetic iron (500 and 1000g/tree) and k-humate (50 and 100 g/tree) treatments on growth and productivity of Valencia orange trees under reclaimed conditions (sandy soil and saline water), during two successive seasons (2011-012) and (2012-013) at a private orchard in Abu Shalaby - El Salhia region, Sharkia Governorate. There was significant improve by the different magnetic iron and K-humate treatments on the growth, tree productivity and fruit quality. The analysis of the data collected during the study proved that there were statistically significant increases in vegetative growth, crop yield, fruit quality and some leaf chemical composition with different doses of magnetic iron and K-humate treatments, Whereas, 1000 g magnetic iron plus 50g K-humate was the best results for vegetative growth, yield production and the fruit quality under this study during both seasons.

Keywords: Valencia orange, Magnetic iron, K-humate, Vegetative growth, Tree productivity, Fruit quality.

1. 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 (541723 fed. in 2013 from the total fruit crops area, which estimated to be 1609189 fed.) The fruiting acreage of citrus occupies about 439024 fed. and produced about 4098590 tons with average of 9.336 tons/fed. according to Ministry of Agriculture and Land Reclamation (Annual Report 2013).

Citrus is a salt sensitive crop, salinity significantly limits citrus production in many areas worldwide. Saline irrigation water reduces the yields of citrus.

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,

The reduction in plant growth by salinity stress might be related to adverse effects of excess salt on ion homeostasis, water balance, mineral nutrition and photosynthetic carbon metabolism (Munns, 2002).

Salinity is a major a biotic stress factor reducing the yield of wide varieties of crops all over the world (Tester and Davenport, 2003).

Generally, natural Magnetite (mining 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 plays 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 increased vit. C and soluble sugar content Pinton et al., (1998).

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

2. 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 in sandy-clay loamy soil (Table 1- c) with well drained (water table more than two meters depth).

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

Analysis of the tested soil at two levels (0-30cm and 30-90cm soil depth) and irrigation water used were taken (before starting the experiment in January 2011) carried out according to Wild et al., (1985) and the obtained data are shown in Tables (1&2).

Table 1: Some chemical and physical analysis of the experimental soil

a) Chemical soil properties:

Depth	Cations meq /L				Anions meq/L					
	K	Na	Mg	Ca	Cl	SO_4	HCO_3	CO3	EC	pH
0-30 cm	0.9	41.3	5.6	8.2	49.5	4.00	3.5	0	5.6	8.3
30-90 cm	0.9	43.6	5.0	9.5	52.5	2.70	3.8	0	5.9	8.5

b) Available nutrient of macro and micro elements mg/K soil:

Depth	Cu	Mn	Zn	Fe	K	P	N
0-30 cm	0.18	1.0	0.30	3.5	131.6	2.1	22.1
30-90 cm	0.19	0.6	0.25	2.4	152.0	2.6	20.6

c) Soil mechanical analysis:

Sample depth	Soil density	Clay	Silt	Fine sand	Rough sand
0-30 cm	1.51	12.4	19.1	34.49	32.5
30-90 cm	1.55	13.2	17.3	34.15	33.8

Table 2: Water analysis (some chemical characters of the experimental water)

					Cations meq /L				Anions meq/L		
p H	E C	Mn	Zn	Fe	Na	Mg	Ca	K	Cl	SO_4	HCO_3
7.60	3.12	0.45	.0.04	0.08	12.90	3.00	4.50	0.2	16.0	1.90	2.10

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 9 treatments as follow:

1- Magnetite at 500 gm / tree (**M_1**)
2- Magnetite at 1000 gm / tree (**M_2**).
3- K-humates at 50 gm / tree **(H_1)**.
4- K-humates at 100 gm/ tree **(H_2)**.
5- (M_1+H_1). **6- (M_1+H_2)**.
7- (M_2+H_1). **8- (M_2+H_2)**.
9- Control.

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

The following parameters of the studied treatments were carried out.

2.1. Vegetative growth measurements

Vegetative growth measurements were evaluated through determining Tree canopy (m^3).

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). Leaf micro-nutrients content i.e. Fe, Cl, Na and B were determined by using Atomic absorption.

2.3. Total carbohydrates

Total carbohydrate was determined according to the method of Dubois et al. (1956).

2.4. Proline leaf content

Proline was determined according to Bates et al. (1973).

2.5. Tree yield and yield efficiency

Yield per tree expressed in weight (kg) was recorded at harvesting date.

Yield efficiency as kg/ m^3 of canopy volume was calculated:

$$\text{Yield efficiency (kg/ m}^3\text{)} = \frac{\text{tree yield}}{\text{canopy volume}}$$

2.6. Fruit characteristics

Samples of ten fruits at harvesting time for each replicate were picked and the following fruit characters were determined: percentage of juice (w/w), percentage of fruit juice TSS (%) by hand-refractometer, fruit juice acidity (%) and vitamin C content (mg ascorbic acid/100 g juice) according to (A.O.A.C., 1995).

2.7. Experiment design

A complete randomized block design with three replicates for each treatment and each replicate was represented by one tree.

2.8. 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).

3. RESULTS AND DISCUSSIONS

3.1. Influence of treatments on tree canopy volume

In this concern data in Table (3) and Fig. (1) reveled that, Magnetite; K- humate and combinations treatments were significantly increased tree canopy volume when compared to the control treatments, during both studied seasons. Whereas, M_2 H_1 treatment was highest statistically tree canopy volume (20.59 m^3 and 33.41 m^3) when compared to other treatments respectively in the 1st season and the 2nd season. Also, control treatment was significantly the lowest tree canopy volume (15.43 and 19.29 m^3) in both seasons.

These results are in line with, Abd el-Aziz et al., (2010) Behrouz and Mojtaba (2011) Whom found that**,** humic substances is one of the most important organic matter effecting in tree growth such as improved canopy volume of Valencia orange trees. Moreover, the enhancement of plant growth using potassium humate had been reported to be due to the increase in nutrients uptake (like nitrogen) was the main reason of enhanced vegetation growth and humic acids could be used as growth regulator such as gibberlic acid, to improve plant growth and enhance stress tolerance, The presence of iron in magnetite may be have a positive effect on the growth of various groups of microorganisms which may excrete a range of vitamins, growth substances and antibiotics and these may promote plant growth. Magnetic treatment caused more salts out of the soil and at the same time oxygen concentration was increased by 10% and resulted in a better assimilation of nutrients and fertilizer in plants during the vegetative period.

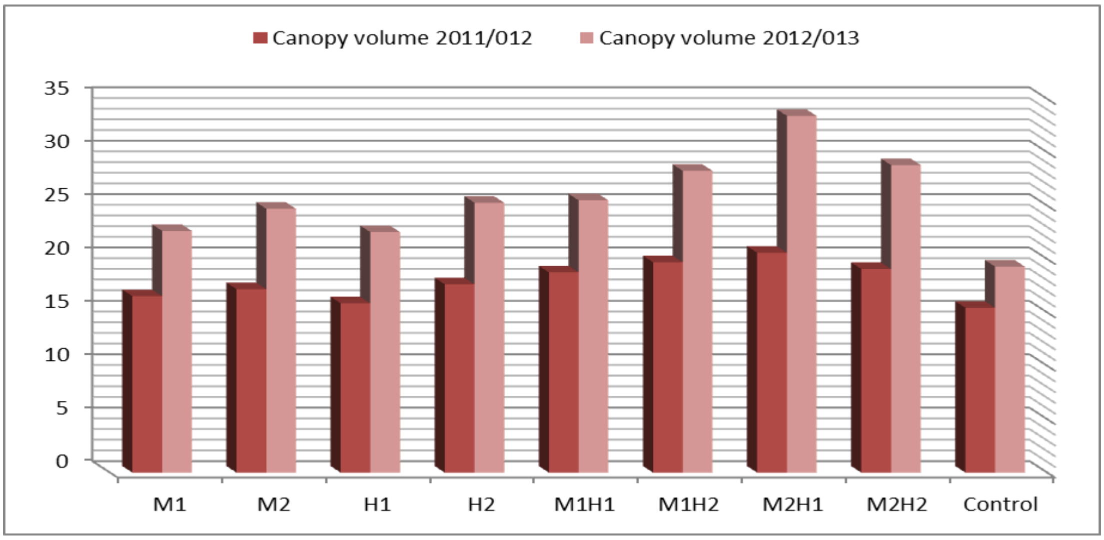

Fig. 1: Effect of Magnetite, K-humate and their combinations on canopy volume of Valencia orange trees

Table 3: Effect of magnetite and K-humate treatments on Canopy volume, yield and yield Efficiency of Valencia orange trees in 2011/012 and 2012/013 seasons

Treat.	**Canopy volume**		**Yield (kg/ tree)**		**Yield efficiency**	
	2011/012	**2012/013**	**2011/012**	**2012/013**	**2011/012**	**2012/013**
M_1	16.52 ef	22.63 e	40.60 cd	53.33 f	2.47 cde	3.24 a
M_2	17.18 de	24.71 d	44.17 bc	56.67 d	2.57 abc	3.30 a
H_1	15.85 fg	22.52 e	42.67 bcd	52.67 g	2.70 a	3.33 a
H_2	17.63 d	25.27 cd	44.50 bc	57.33 c	2.54 bc	3.26 a
M_1H_1	18.75 c	25.50 c	43.67 bc	54.67 e	2.35 e	2.94 b
M_1H_2	19.70 b	28.26 b	47.17 ab	58.33 b	2.40 de	2.96 b
M_2H_1	20.59 a	33.41 a	51.00 a	62.00 a	2.48 cde	3.02b
M_2H_2	19.07 bc	28.80 b	50.00 a	61.67 a	2.63 ab	3.25 a
Control	15.43 g	19.29 f	38.33 d	42.33 h	2.50bcd	2.76 c

3.2. Tree production

3.2.1. Total yield (k g/tree)

Concerning the effect of Magnetite; K-humate and there combinations treatments, the present data in Table (3) and Fig (2) cleared that, high doses of Magnetite and K-humate and there combinations were the highest tree yield values, whereas, M_2H_1 treatments was the highest significant value (51.00&62.00) in both experimental seasons, wherever, the control treatment was the lowest (38.33&42.33) k gm /tree respectively, for both seasons.

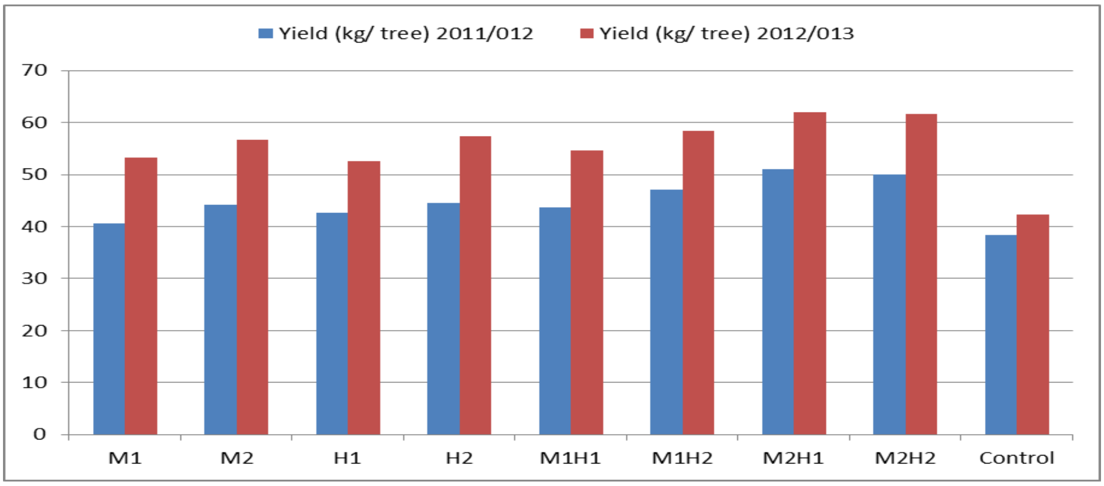

Fig. 2: Effect of Magnetite and K-humate and their combinations on total yield (kg/tree) of Valencia orange trees

3.2.2. Tree yield efficiency (k g/ M^3 tree canopy)

Under the open orchards, there are some variations in the tree canopy volume for many reasons. Therefore, tree yield efficiency measurement considers the best method to correct these variations. Therefore, data in Table (3) and Fig (3) indicated that H_1 treatment was the highest significant effect (2.70 K g/M^3) when compared to the control treatment (2.50 K g/M^3) in the 1st season. Wherever, all magnetite and k-humate treatments were improved yield efficiency compared with control treatments which had lowest value (2.76 K g/M^3) in the 2nd season.

Table 4: Effect of magnetite and K-humate treatments on the percentage of N, P, K and Fe elements in leaves of Valencia orange trees in 2011/012 and 2012/013 seasons

Treat.	**N%**		**P%**		**K%**		**Fe (ppm)**	
	2011/2012	2012/2013	2011/2012	2011/012	2011/012	2012/2013	2011/012	2012/013
M_1	2.05 de	2.12 d	0.117 cd	0.120 c	1.140 c	1.148 h	72.33 f	78.00 f
M_2	2.11 cd	2.17 c	0.114 d	0.119 c	1.160 c	1.177 g	75.33 e	81.22 e
H_1	2.06 cde	2.13cd	0.124 ab	0.127 ab	1.223 b	1.231f	62.59 h	66.58 h
H_2	2.15 c	2.26 b	0.122 ab	0.126 ab	1.237 b	1.254 d	64.08 g	67.43 g
M_1H_1	2.13 cd	2.28 b	0.113 d	0.122 bc	1.223 b	1.243 e	78.85 d	82.58 d
M_1H_2	2.27 b	2.29 b	0.121 bc	0.124 abc	1.253 ab	1.268 c	90.42 c	92.75 c
M_2H_1	2.38 a	2.41 a	0.126 a	0.128 a	1.273 a	1.297a	92.42 b	97.00 b
M_2H_2	2.35 ab	2.42 a	0.121 bc	0.129 a	1.247 ab	1.289b	95.58 a	100.42 a
Control	1.97 e	1.98 e	0.107e	0.113 d	1.070 d	1.125 i	59.60 i	57.58 i

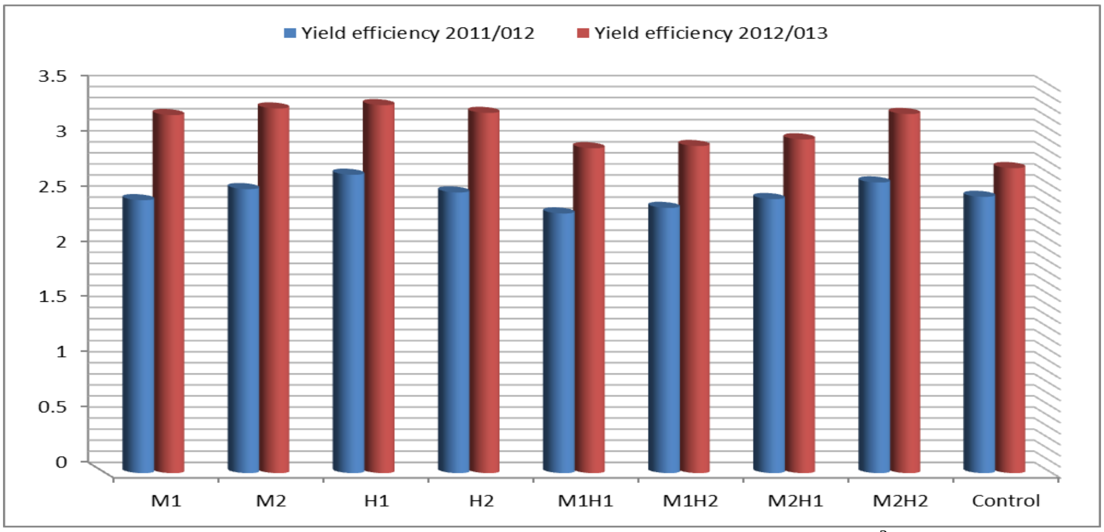

Fig. 3: Effect of Magnetite, K-humate and their combinations on yield efficiency (kg/M^3) of Valencia orange trees

3.3. Leaf chemical composition

3.3.1. Leaf nitrogen content (%)

With regard to the effect of Magnetite; K-humate and their combinations treatments, data in Table (4) and Fig (4) showed that M_2 H_1 treatment was statistically increased leaf nitrogen and recorded the highest leaf nitrogen (2.38 %) percentage content when compared to M_1; M_2; H_1; H_2; M_1H_1; M_1H_2 and control treatments respectively, and was insignificant with M_2H_2 treatment. meanwhile, the control treatment was the lowest value (1.97 %) in the 1st season. While, M_2H_1 and M_2H_2 treatments were significantly increased leaf nitrogen (2.41&2.42%), when compared to other treatments in the 2nd season. Also, control treatment recorded the lowest leaf nitrogen percentage content (1.97&1.98%) in both experimental seasons.

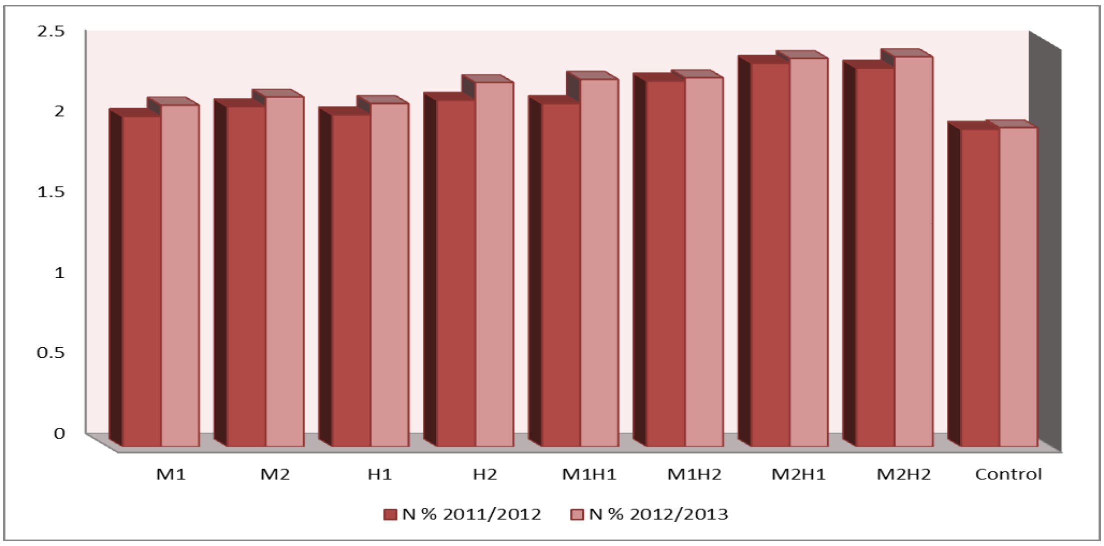

Fig. 4: Effect of Magnetite, K-humate and their combinations on N% leaf content of Valencia orange trees

3.3.2. Leaf phosphorus content (%)

Concerning the effect of Magnetite; K-humate and their combinations Table (4) cleared that, M_2H_1 treatment was significant increased Leaf phosphorus content (0.126%) when compared to M_1; M_2; M_1H_1; M_1H_2 and control treatments. the control was the lowest (0.107%) in the 1st season.

Whereas, M_2H_1 and M_2H_2 treatment were significantly increased leaf P content (0.129 and 0.128%) when compared to M_1; M_2; M_1H_1 and control treatments in the 2nd season.

3.3.3. Leaf potassium content %

Regarding of leaf K content Table (4) and Fig (5) indicated that M_2H_1 treatment was significant increased Leaf potassium content (1.273 %) when compared to M_1; M_2; H_1; H_2; M_1H_1 and control treatments in the 1st season.

Meanwhile, M_2H_1 treatment was significantly statistically increased Leaf potassium content (1.297 %) when compared to other treatments in the 2nd season.

Wherever, the control recorded the lowest values (1.070 and 1.125%) during both studied seasons.

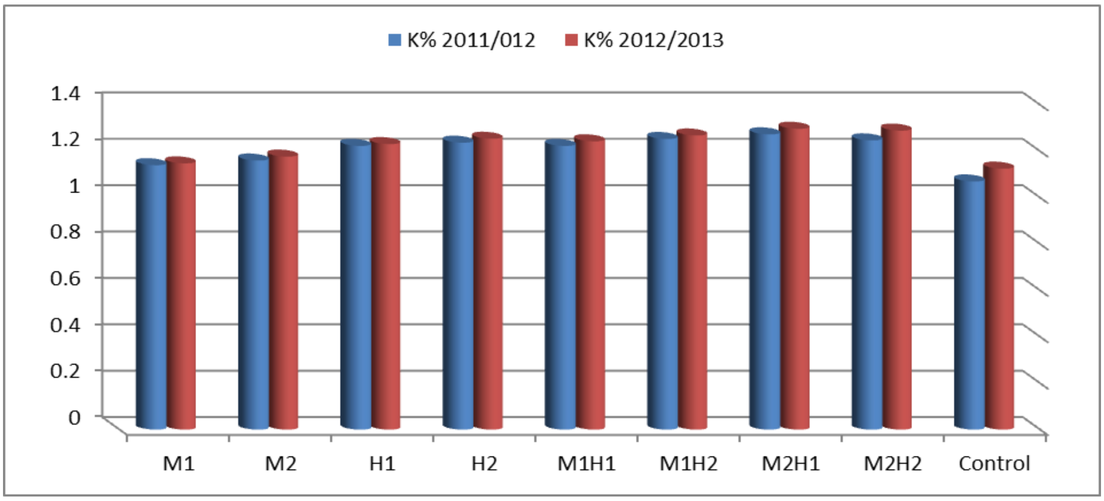

Fig. 5: Effect of Magnetite, K-humate and their combinations on K % leaf content of Valencia orange trees

These results are harmony with those obtained by, 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.

3.3.4. 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.

Data in Table (4) and Fig (6) showed that**,** Magnetite; K-humate and their combination treatments were significantly improved Valencia orange leaves Fe contents during experimental seasons, also, M_2H_2 treatment (95.58& 100.42) ppm respectively, were the highest Fe values when compared to other treatments, the control treatment which was the lowest (59.60 &57.58) ppm in both seasons of this study.

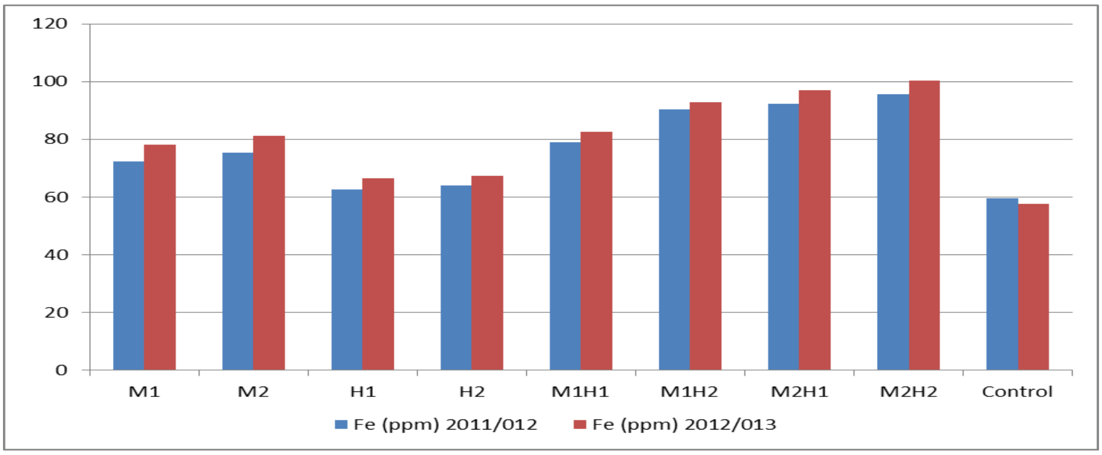

Fig. 6: Effect of Magnetite, K-humate and their combinations on Fe (ppm) leaf content of Valencia orange trees.

3.3.5. Total Carbohydrates Content (g/100g DM)

With regard to the effect of magnetite; K-humate and their combinations Table (5) and Fig (7) indicated that, total carbohydrates content in the leaves were significantly positively affected by different treatments in both seasons, M_2H_1 and M_2H_2 treatments were significantly increased total carbohydrate (20.96 & 21.42%) when compared to other treatments in the 1st season and M_2H_2 (24.09%) in the 2nd season when compared to other treatments.

Also, control treatment was significantly the lowest carbohydrate values (15.13%) in the 1st season, however, M_1, H_1 and control treatments were significantly the lowest values of carbohydrate (15.96, 15.91 and 15.86%) in the 2nd season when compared to other treatments.

The maximum significant values of total carbohydrates content in the leaves were obtained with trees received higher rate of magnetite plus k-humate in the first seasons, meanwhile, the highest value of total carbohydrates content recorded with maximum rate of both magnetite and k-humate in the second season compared to other treatments in the experimental seasons.

Table 5: Effect of magne tite and K-humate treatments on Valencia orange leaf Total carbohydrates; Proline; Na and Cl content in 2011/012 and 2012/013 seasons

Treat.	Leaf Total Carbohydrate (g/100g)		Proline (mg/g)		Na%		Cl %	
	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013	2011/012	2012/013
M_1	16.43 e	15.96 g	65.64 c	64.93 bc	0.31 b	0.320 b	0.69 b	0.67 b
M_2	15.81 ef	16.48 f	69.74 b	65.16 b	0.30 bc	0.31 bc	0.60 e	0.58 d
H_1	15.81 ef	15.91 g	65.62 c	64.43 c	0.30 bc	0.29 cd	0.68 b	0.67 b
H_2	20.14 bc	19.74 d	58.86 d	57.04 e	0.29 c	0.28 de	0.62 d	0.59 d
M_1H_1	18.48 d	18.92 e	58.85 d	61.07 d	0.30 bc	0.28 de	0.66 c	0.63 c
M_1H_2	19.78 c	22.07 b	56.01 e	53.94 f	0.27 d	0.26 ef	0.62 d	0.58 d
M_2H_1	20.96 ab	21.84 c	51.12 g	50.00 g	0.23 f	0.22 g	0.58 f	0.58 d
M_2H_2	21.42 a	24.09 a	52.93 f	49.68 g	0.25 e	0.25 f	0.55 g	0.54 e
Control	15.13 f	15.86 g	86.57 a	88.37 a	0.34 a	0.36 a	0.72 a	0.79 a

The untreated trees showed lower carbohydrates rate due to the increase of hydrolytic enzymes caused by chloride salts and salinity which reduces total carbohydrates, these results is in harmony with those of Kilany et al., (2006) who found that water stress due to salinity in the soil and water effectively depressed the synthesis of carbohydrates.

The increase in carbohydrate content may be due to the activation of photosynthetic machinery as a result of stimulating effect of different nutrients on photosynthetic process.

In the present experiment, there is negative correlation between leaves carbohydrates concentrations and leaf proline concentrations (Table 5), suggests that the increment in leaf carbohydrates in trees under application of magnetite and K-humate could have been due to reduce proline synthesis, meanwhile in control treatment the reduction in leaf carbohydrates could be due to a diversion of sugars to increased proline synthesis (Ennajeh et al., 2006).

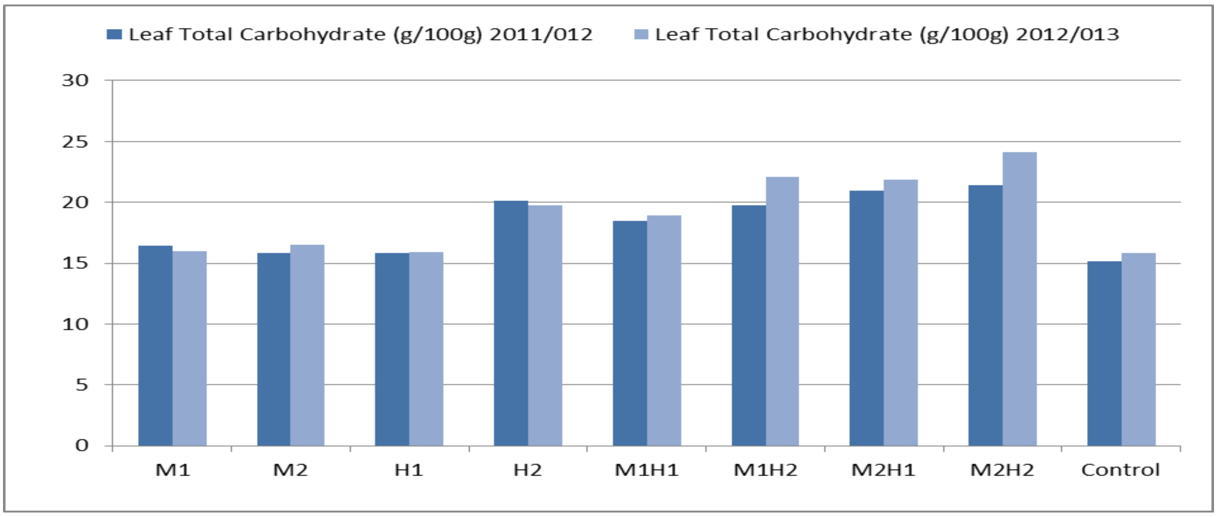

Fig. 7: Effect of Magnetite and K-humate and their combinations on Total Carbohydrates leaf content of Valencia orange trees

3.3.6. Leaf proline content (mg/g D M)

Valencia orange trees leaf proline content was studied under saline water stress during two successive seasons, also, Table (5) and Fig (8) showed that Magnetite; K- humate and combinations treatments were significantly reduced leaf proline content when compared to the control treatments respectively, during both studied seasons. Whereas, M_2H_1 treatment was the highest significant effect with the lowest value (52.93 %) when compared to the control treatment which was the highest value (86.57%) in the 1st season. Whereas, M_2H_1 and M_2H_2 were significantly reduced leaf proline content (50.00 and 49.68%) when compared to other treatments in the 2nd season.

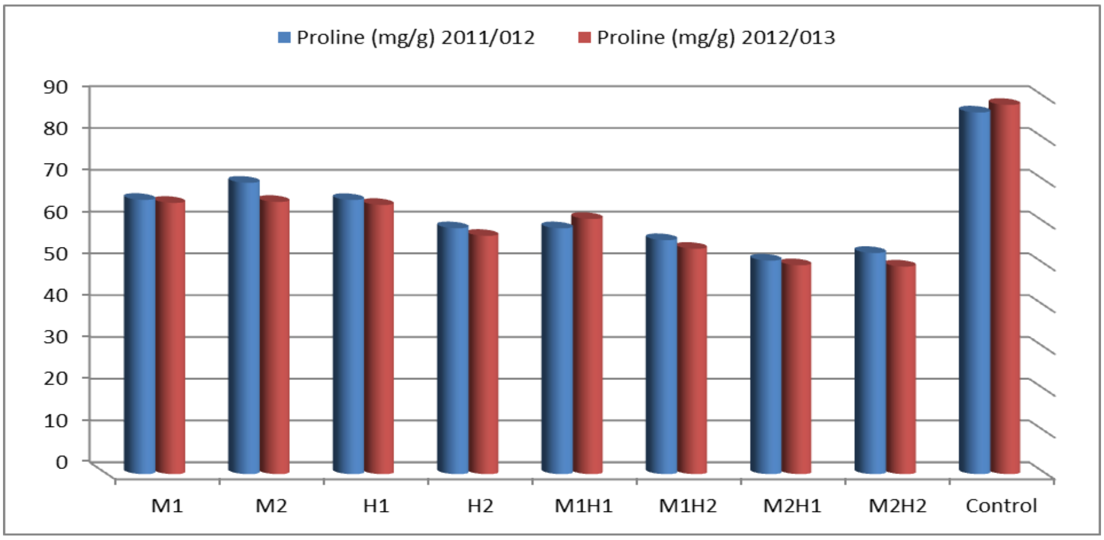

Fig. 8: Effect of Magnetite, K-humate and their combinations on Proline leaf content (mg/g) of Valencia orange trees

3.3.7. Leaf Sodium content (%)

Data in Table (5) and Fig (9) revealed that Magnetite; K- humate and combinations treatments were significantly reduced leaf sodium content when compared to the control treatments respectively, during both studied seasons. Whereas, M_2H_2 treatment was the highest significant effect with the lowest value (0.25 %) when compared to other treatments, also, control treatment was the highest value (0.34%) during 1st season.

Whereas, M_2H_1 treatment was the highest effect with the lowest leaf sodium content (0.22 %) in compared to other treatments, while control treatment was the highest value (0.35%) during the 2nd season of this study.

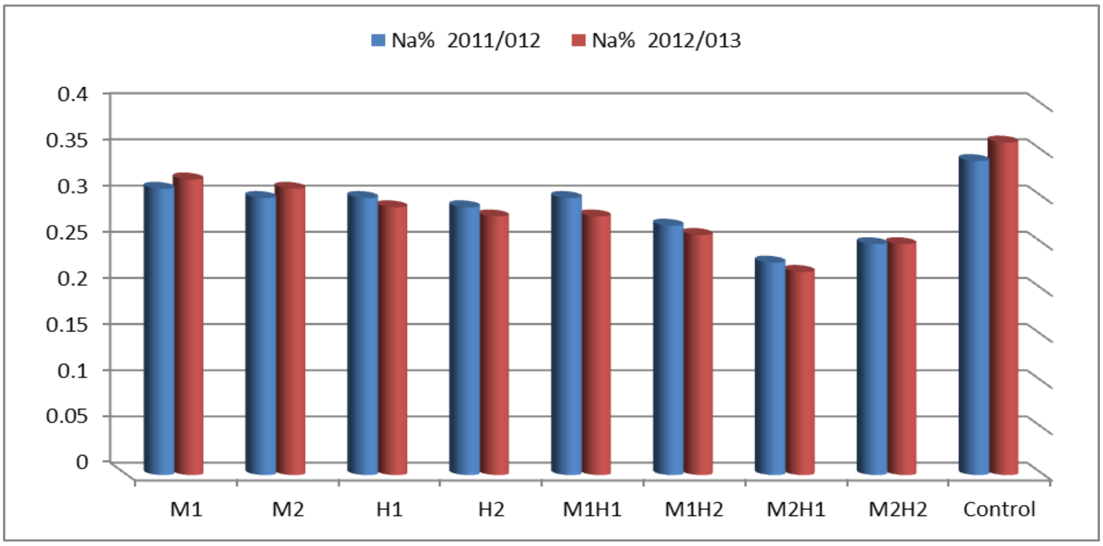

Fig. 9: Effect of Magnetite and K-humate and their combinations on leaf Sodium content of Valencia orange trees

3.3.8. Leaf Chlorine content (%)

Concerning the effect of Magnetite, K-humate and combinations treatments present data in Table (5) and Fig (10) cleared that all the experimental treatments had the trend of their effect on leaf Na content. Whereas, M_2H_2 treatment was significantly reduced leaf Cl content (0.55 and 54 %) in compared to the control treatment (0.72 and 0.79 %) during both seasons.

Whereas, all Magnetite, K-humate and combinations treatments were significantly reduced leaf Na content.

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.

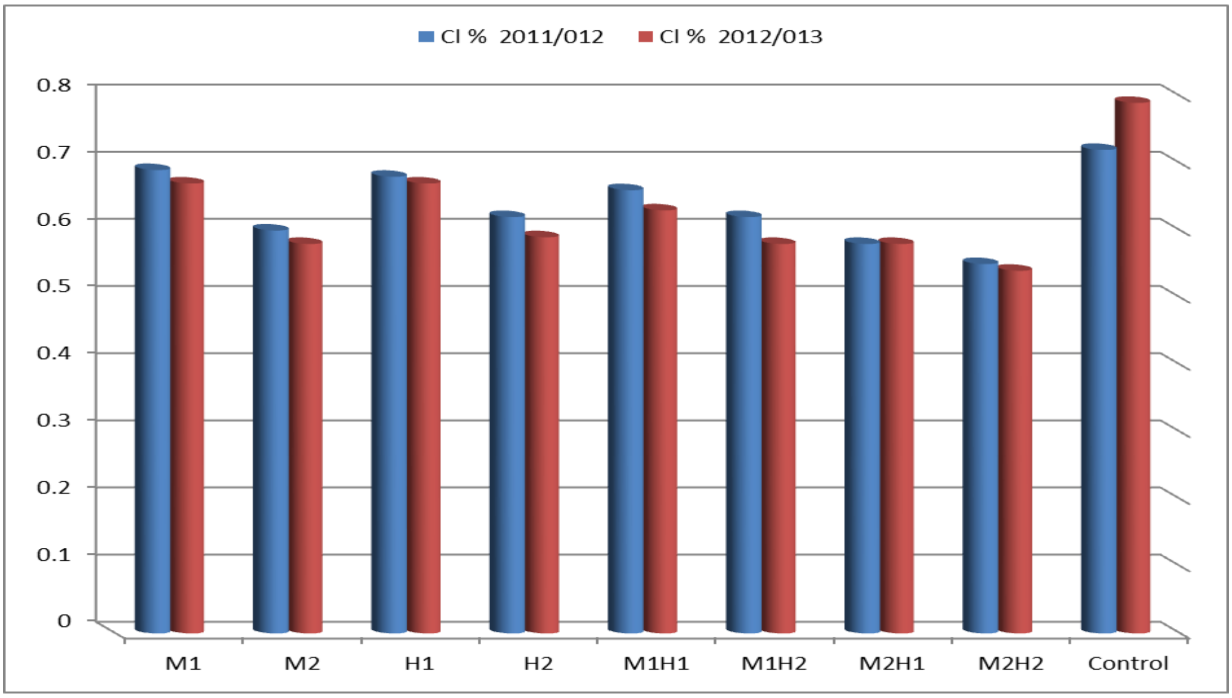

Fig. 10: Effect of Magnetite and K-humate and their combinations on leaf Chlorine content of Valencia orange trees.

These results are in line with those obtained by, Eissa et al., (2007); and Mehanna et al., (2010) whom indicated that Magnetite may be assisting to reduce the Na toxicity at cell level by detoxification of Na, either by restricting the entry of Na at membrane level or by reduced absorption of Na by plant roots. High Na concentration is a limiting factor for plant growth in most crops; also, Salinity not only increased soil ECe, Na+ and Cl-, but also decreased elements conc. It is also interesting to note that the apparently reduced accumulation of Na in plants with magnetite and humate treatments may have helped the trees to continue their growth with less detrimental effects on total yield.

3.4. Fruit quality

3.4.1. Percentage of Juice (w/w)

With this respect, Table (4) and Fig (11) 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. M_1H_2 treatment was the highest significantly value (47.12 %) compared to control (30.17%).

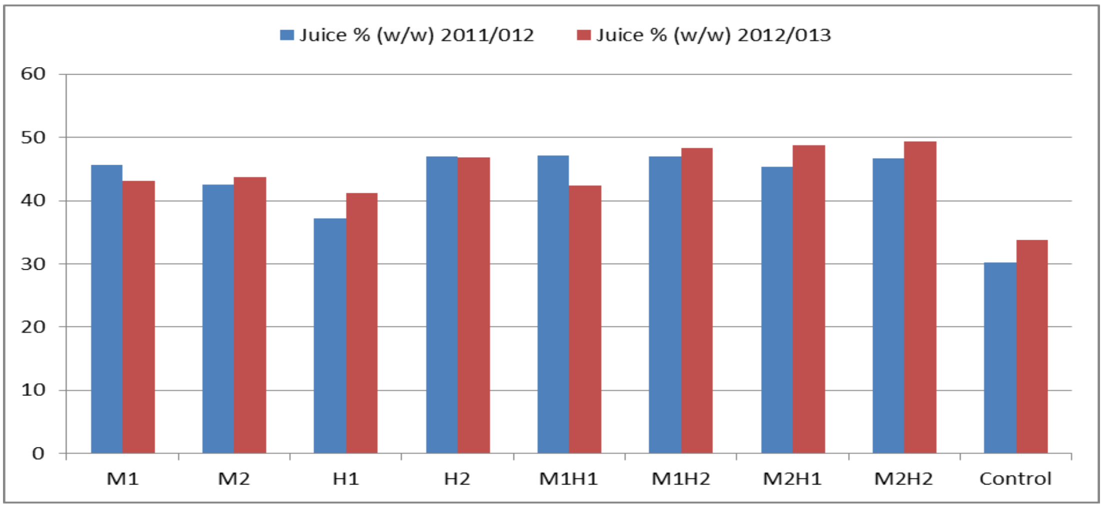

Fig. 11: Effect of Magnetite, K-humate and their combinations on fruit juice ratio of Valencia orange trees

In addition, M_2H_2 treatment was statistically increased Juice percentage (w/w) (49.43%) when compared to other treatments respectively, also, all magnetite, K-humate and their combination 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 2nd season.

3.4.2. TSS/Acid ratio

With regards to the effect of magnetite; K-humate and their combinations data in Table (4) and Fig (12) indicated that, most of the Magnetite and K-humate combinations treatments were significantly increased TSS/acid Ratio when compared to the single Magnetite and K-humate and the control treatments for both seasons. So, M_1H_2 treatment (8.75&8.83) respectively, was the highest values and the control treatment (7.61&8.01) was the lowest for both studied seasons.

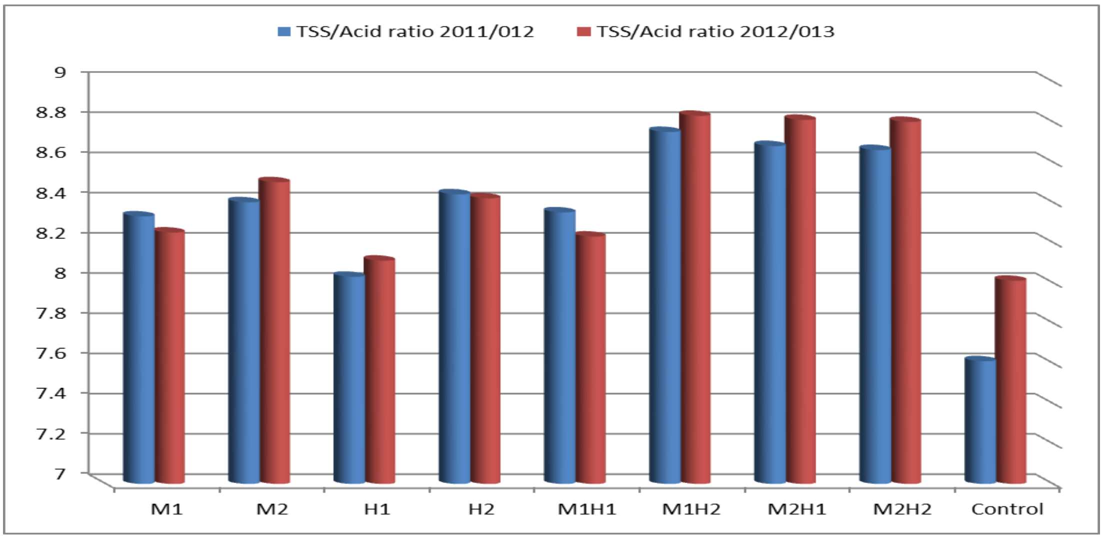

Fig. 12: Effect of Magnetite, K-humate treatments on fruit juice TSS/Acid ratio of Valencia orange

3.4.2. Fruit juice Vitamin C. (mg/100g)

Regarding the effect of Magnetite; K-humate and their combinations treatments, data in Table (4) and Fig (13) indicated that M_2H_1 treatment was significantly increased Valencia orange fruit juice Vit. C (mg/100gm.) content (52.62 and 58.27 mg/100gm.) when compared to other treatments for both seasons. Moreover, control treatment was significantly the lowest values of TSS/acid Ratio (37.19 and 40.23 mg/100gm.) during both seasons.

Table 4: Effect of magnetite and K-humate treatments on the yield, yield effeciency 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
M_1	45.66 c	43.10 f	8.33 b	8.25 bc	39.80 g	49.23 f
M_2	42.60 e	43.70 e	8.40 b	8.50 b	43.97 e	47.30 g
H_1	37.21 f	41.21 h	8.03 c	8.11 c	40.80 f	49.53 e
H_2	47.02 a	46.90 d	8.44 b	8.42 b	47.21 c	50.57 d
M_1H_1	47.08 a	42.42 g	8.35 b	8.23 bc	45.76 d	50.67 d
M_1H_2	47.01 a	48.32 c	8.75 a	8.83 a	51.66 b	54.03 c
M_2H_1	45.36 d	48.79 b	8.68 a	8.81 a	52.62 a	58.27 a
M_2H_2	46.67 b	49.43 a	8.66 a	8.80 a	51.46 b	54.80 b
Control	30.17 g	33.73 i	7.61 d	8.01 c	37.19 h	40.23 h

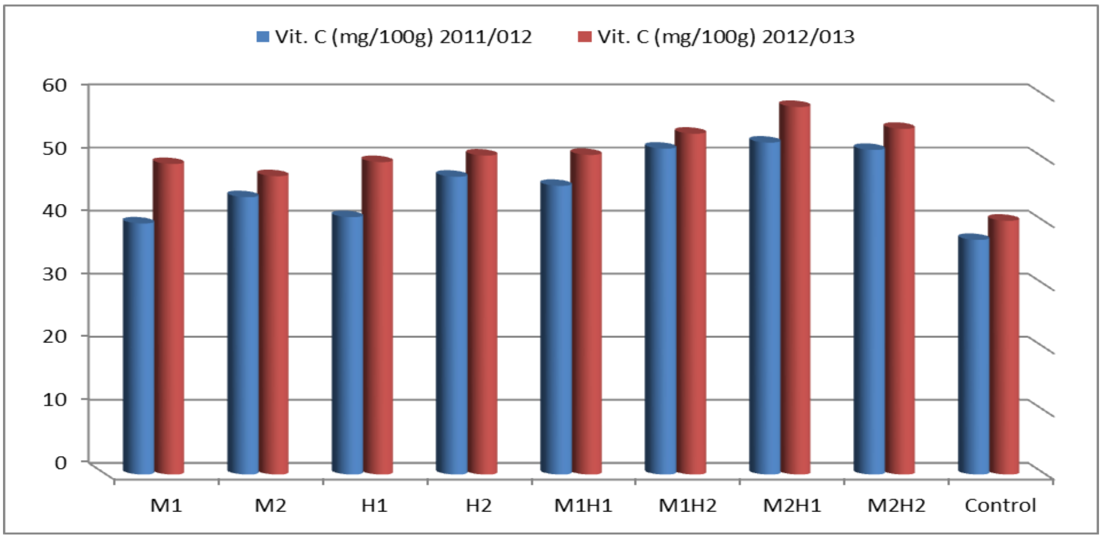

Fig. 13: Effect of Magnetite, and K-humate and their combinations on Fruit juice Vit. C. of Valencia orange

These foundations are in line with those obtained by Abel-Aziz et al. (2010); Abd El-Razek (2012); Ali et al., (2013) and Mohamed et al (2013), Who indicated that, magnetic field and Magnetite treatments increased TSS and enhancing fruit juice weight percentage in Valencia orange fruit juice content. Moreover, humic substances decreased acidity in different fruit and improved fruit juice weight of mandarin. 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.

Generally, Magnetite or humic acid applications will be improved physical fruit quality which gave extra advantage for such fruits to be exported.

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