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EFFECT OF DIFFERENT ANTICHLOROSIS AGENTS ON ANA APPLE AND LE CONTE PEAR TREES GROWN IN CALCAREOUS SOIL

BY

Yehia, M.M.; Samia A. Asaad and Abd El-Meseh, W.M.
Hort. Res. Inst.; Agric. Res. Center

ABSTRACT

The present study was done on "ANNA" apple 5 years old budded on M M 106 root-stock and on 5 years old Le-conte pear trees (*Pyrus communis* L.budded on communis root stock grow on calcaerous soil on nobaria region.
The obtained data cleared that:

Among six antichlorosis agents Fe-EDTA[1] at 0.5g/L; Fe-EDDHA[2] at 0.5g/L; Ferrous sulphate at 5g/L; Ferrous sulphate at 5g/L + Ascobine[3] at 1g/L; Ferrous citrate at 5g/L; Ferrous citrate at 5g/L + Ascobine at 1g/L and water for control were sprayed 3 times/year. First of April, May and June for "Anna" apple and mid April, mid May and mid June for "Le-Conte" pear. Tested trees of apple and pear were 5 years-old grown in calcareous soil and spaced at 4x3.5 meters apart for apple and 5 4 meters pear, were tested for its effects on overcoming Fe deficiency, vegetative growth, fruit quality and yield, of apple and pear trees under study during 2007 and 2008seaons. Fe-EDTA; Fe-EDDHA; Fe-sulphate + Ascobine and Fe-citrate + Ascobine increased shoot number and diameter, leaf area, Fe, Mn, Zn leaf content and total leaf chlorophyll. At the same time, the previous treatments developed the highest yield/tree, fruit total soluble solids, fruit total sugars and the lowest percentage of acidity and fruit starch content. The best treatment was Fe-EDDHA.

INTRODUCTION

Iron is associated with several functions in plants but most importantly with the formation of chlorophyll and plants therefore become pale with its absence. It is relatively immobile in plants and the bleaching symptoms can sometimes arise because of an increase in this immobility although the presence of abundant calcium in the soil induces iron deficiency Granick (1958), Miller *et al.* (1960), Katyae and Randhawa (1983), Buezacki and Harris, (1991). Iron chlorosis is one of the most difficult micronutrients deficiencies to correct in the field. In general, soil applications of ionzable ferrous salts, such as ferrous sulphate, have not been satisfactory because of their rather rapid oxidation to much less soluble ferric iron deficiencies is done mainly with foliar sprays. One dressing of 2-3% ferrous sulphate solution at a rate of 15 to 30 gal/ A is usually sufficient to alleviate mild chlorosis. However, a several sprays 7 to 14 days apart may be needed to remedy more severe iron deficiencies. The most widely used iron sources are the synthetic chelated and natural organic complexes Sillanpaa (1962). Iron in chelated form and in used widely in citrus and grape production where scions with desirable fruit quality are grafted on iron-efficient rootstocks.

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1. Fe-EDTA: Fe-ethylene diamine tetra acetic acid
2. Fe-EDDHA: Fe-ethylene diamine dihydroxy acetic acid
3. Ascobine: Every gm of Ascobine contain 38% (Ascorbic a + Citric a) + 62% activator organic matter for plant growth. The compound was recommended by Agricultural Research Center (ARC

The ability of plants to absorb and translocate iron appears to be genetically controlled adaptive process that responds to iron deficiency or stress. Roots of iron-efficient plants alter their environment to improve the availability and iron uptake. Some of biochemical reactions and changes enabling iron-efficient plants to tolerate and adapt to iron-stress: (1) Eceretion of H^+ ions from roots. (2) Excretion of various reducing compound from roots. (3) Rate of reduction (Fe^{3+} to Fe^{2+}) increases at the root. (4) Organic acids, particularly citrate increase in the root saps. (5) Adequate transport of iron from roots to tops. (6) Less accumulation of phosphorous in roots and shoots, even in the presence of relatively high phosphorous in the growth medium (Tisidale *et al.*, 1990).

The present study was done to evaluate different antichlorotic agents for overcoming Fe deficiency in both "Anna" apple and "Le-Conte" pear trees grown Calcareous soil at Nobaria region, Behara Governorate, Egypt.

MATERIALS AND METHODS

The present study was carried out at Monier Abd-El-Salam orchaed, 82 Km Alex-Cairo road at Nubaria region, El-Behira Governorate during two successive seasons, (2006-2007) and (2007-2008) on 5 years old of "ANNA" apple (*Malus domestica* L.) budded on MM.106 rootstock, and on 5 years-old of "Le-Conte" pear trees (*Pyrus communis* L.) budded on communis rootstock. The tested trees were planted on calcareous soil and spaced at 4x3.5 meters apart for "Anna" apple while it was 5x4 meters apart for "Le-Conte" pear. All the trees were healthy and similar in their vigour as possible, and being treated with normal agricultural practices. Some physical and chemical properties of the soil under study had been shown in Table (1). Forty-two trees of each fruit cultivar were chosen for the present investigation.

The applied treatments in the two studied seasons could be summarized as shown in Table (2). The experimental treatments were arranged in a complete randomized block design and each treatment were replicated 3 times with 2 trees in each replicate, i.e. 7 treatments X 3 replicate X 2 experimental unit = 42 trees for each studied cultivar .

Table (1): Physical and chemical analysis of the experimental orchard soil

Physical properties (particle size distribution)	Sand (%)	84.5
	Silt (%)	4.2
	Clay (%)	11.3
	Soil texture class	Sandy clay loam
Chemical properties	PH	8.3
	EC (ds/cm)	3.57
	Ca Co3 (%)	25.8
	No3+No4 mg/g soil	140
	Exch.K mg/g soil	380

Measurement and Determination

Vegetative growth

Four main branches as uniform as possible were chosen at the four cardinal points of each studied tree being, tagged and the average of the current shoot number per selected branches were counted, their length and diameters were measured on late October. For determining the leaf area, samples of 10 mature leaves were collected at random from each studied tree on mid September, washed with tap water and dried with a piece of cotton tissue. Determination of leaf area was carried out using leaf area meter (Model CI-203, CID, Inc., U.S.A.).

Table (2): The applied treatments in the two studied years 2007 and 2008

Treat-ment	The used compound's name	Concentra-tion gm or cm/L.	Number of sprays/year	Total concentra-tion gm or cm/tree/year	Time of spraying	
					"Anna" apple trees	"Le Conte" pear trees
T1	Fe-ethylene diamine tetra acetic acid (Fe-EDTA)	1/2 gm	3	7.5	First of : April-May-June	Mid of : April-May-June
T2	Fe-ethylene diamine dihydroxy acetic acid (Fe-EDDHA)	1/2 gm	3	7.5	First of : April-May-June	Mid of : April-May-June
T3	Ferrous sulphate	5 cm	3	75	First of : April-May-June	Mid of : April-May-June
T4	Ferrous sulphate + Ascobine	5 cm 1 gm	3	75 cm 15 gm	First of : April-May-June	Mid of : April-May-June
T5	Ferrous citrate	5 cm	3	75 cm	First of : April-May-June	Mid of : April-May-June
T6	Ferrous citrate + Ascobine	5 cm 1 gm	3	75 cm 15 gm	First of : April-May-June	Mid of : April-May-June
Control	-----	-----	3	-----	First of : April-May-June	Mid of : April-May-June

* Each tree of the two studied cultivars was sprayed with 5 Liter in every spraying
* Control tree were sprayed with tap water only
* Ascobine compounds: Every gm of Ascobine contain 38% (Ascorbic a + Citric a) + 62% activator organic matter for plant growth. The compound was recommended by Agricultural Research Center (ARC)

Leaf chemical content:-

a- Leaf total chlorophyll content:

Leaf total chlorophyll content was determined using Minolta Chlorophyll Meter SPAD-502 (Minolta Camera Co., LTD Japan). Ten readings were taken on ten leaves (The fourth leaf of the new shoot) of each experimental tree on mid June. Reading was taken at the middle of leaf blade (Abd El-Messeih, 2000).

b- Leaf mineral composition:

To investigate the effect of different treatments on leaf mineral composition samples consisted of twenty mature leaves were collected at random, at the beginning of July for pear and apple trees in the two investigated seasons. The leaves were washed several times with tap water, rinsed three times in distilled water, and then dried at 70-80oc in an electric air-drying oven. The dried leaves of each sample were ground in a porcelain mortar to avoid contamination with any mineral, 0.3 gm from the ground dried material of each sample was digested with H2O2 according to Evenhuis and Deward (1980). Suitable aliquots were taken for minerals determination. Iron, Manganese and Zinc were determined by a Perkin-Elmer atomic absorption Spectrophotometer Model 305-B. The concentration of Fe, Mn and Zn were expressed as part per million (ppm), on dry weight basis.(A.O.A.C.1990).

Obtained data throughout the two studied experimental seasons were statistically analyzed according to Sendecor and Chochran, (1990) and L.S.D. test at 0.05 level was used for comparison between treatments.

RESULTS AND DISCUSSION

Shoot number, length and diameter of Anna apple trees:

Among the different iron resources, treatments both Fe-EDDHA and Fe-EDTA treatments induced the highest significant shoot number, length and diameter of Anna apple trees followed by Fe-sulphate plus Ascobine and Fe-sulphate.

While only Fe-EDDHA treatment increased apple shoot length significantly in the first season since both of Fe-EDDHA and Fe-EDTA increased apple shoot length slightly in the second season since the other treatments did not affect it significantly. Fe-EDDHA and Fe-EDTA developed the highest significant leaf area followed by Fe-citrate + Ascobine, Fe-sulphate + Ascobine and Fe-sulphate (Table, 3).

Table (3): Effect of iron application treatments on the vegetative growth of "Anna" apple and "Le-Conte" pear trees during 2007 and 2008 seasons

Treatments	"Anna" apple trees							
	Shoot number		Shoot length (cm)		Shoot diameter (cm)		Leaf area (cm^2)	
	2007	2008	2007	2008	2007	2008	2007	2008
Fe-EDTA	15.11a	15.91ab	16.98	17.10	0.58b	0.61b	30.98a	31.42a
Fe-EDDHA	15.56a	16.55a	17.21	17.33	0.62a	0.65a	31.11a	31.95a
Iron sulphate	10.85cd	11.74d	16.43	16.55	0.53e	0.56d	28.55b	28.73bc
Iron sulphate + Ascobine	12.42bc	12.93e	16.65	16.76	0.55d	0.59c	28.75b	29.12b
Iron citrate	10.95cd	11.42d	16.44	16.62	0.53e	0.55e	28.59b	28.82bc
Iron citrate + Ascobine	14.00ab	15.21b	16.88	16.93	0.57c	0.59c	28.83b	29.21b
Control	9.21d	9.73e	16.12	16.18	0.51f	0.52f	27.05c	27.48c
L.S.D. at 0.05	1.669	1.136	N.S.	N.S.	0.005	0.003	1.382	1.389
	"Le-Conte" pear trees							
Fe-EDTA	14.25ab	14.85a	51.65a	53.49a	0.96a	0.99b	28.92a	29.77ab
Fe-EDDHA	14.77a	15.33a	52.16a	55.14a	0.98a	1.21a	29.27a	30.65a
Iron sulphate	9.65de	10.69c	45.92b	46.95c	0.82d	0.87d	23.85b	26.21cd
Iron sulphate + Ascobine	10.87cd	10.88c	48.16b	50.12b	0.87c	0.91c	26.14b	27.33c
Iron citrate	9.70de	10.73c	46.14b	47.12c	0.84d	0.88d	25.12b	25.96c
Iron citrate + Ascobine	12.21bc	12.86b	48.55b	50.55b	0.92b	0.93c	26.33b	27.91bc
Control	8.35e	8.95d	38.65c	41.14d	0.75e	0.79e	21.18c	22.16d
L.S.D. at 0.05	2.340	1.541	2.734	2.736	0.026	0.026	2.482	2.743

Shoot number, length and diameter of Le-Conte pear trees:

Both Fe-EDDHA and Fe-EDTA induced the highest significant shoot number followed by Fe-citrate + Ascobine, Fe-citrate, Fe-sulphate + Ascobine and Fe-sulphate. While control trees induced the lowest shoot number in both seasons. At the same time, Fe-EDDHA and Fe-EDTA developed the highest significant shoot length followed by Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate. Meanwhile, Fe-EDDHA and Fe-EDTA induced the highest significant shoot diameter followed by Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate. At the same time, Fe-EDDHA treatment developed the highest significant leaf area followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-citrate, Fe-sulphate + Ascobine and Fe-sulphate since control trees developed the lowest leaf area (Table, 3).

Leaf chemical content of Anna apple trees:

Both Fe-EDDHA and Fe-EDTA induced the highest significant leaf chlorophyll content followed by Fe-sulphate + Ascobine, Fe-citrate + Ascobine, Fe-citrate and Fe-sulphate. So, all the different iron resources treatments increased apple leaf chlorophyll content significantly. At the same time, all different iron resources increased iron concentration in apple leaves significantly since Fe-EDDHA treatment induced the highest Fe-content followed by treatments Fe-EDTA, Fe-citrate + Ascobine, Fe-citrate, Fe-sulphate + Ascobine and Fe-sulphate. All treatments different iron resources treatments increased leaf manganese content significantly since Fe-EDDHA treatment developed the highest Mn content followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine and Fe-sulphate treatments. The highest Zinc apple leaf content induced by Fe-EDDHA followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-citrate, Fe-sulphate + Ascobine and Fe-sulphate while control trees developed the lowest leaf zinc content (Table.4).

Leaf chemical content of Le-Conte pear trees:

All the different iron resources treatments increased pear leaf chlorophyll content significantly. Fe-EDDHA treatment induced the highest significant leaf chlorophyll content followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-citrate, Fe-sulphate + Ascobine and Fe-sulphat treatments. The highest significant iron leaf content developed by both Fe-EDDHA and Fe-EDTA treatments followed by Fe-citrate + Ascobine, Fe-sulphate + Ascobine and Fe-sulphate treatments. At the same time, both of Fe-EDDHA and Fe-EDTA treatments developed the highest significant manganese (Mn) content followed by Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate treatments. On the other hand, all iron resources treatments did not affect Le-Conte pear content of Zinc significantly in both seasons (Table, 4).

Fruit yield/tree (Kg) of Anna apple trees:

All iron resources treatments increased fruit yield/tree significantly. Meanwhile, Fe-EDDHA treatment induced the highest significant fruit yield/tree followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate treatments (Table, 5).

Physical fruit yield/tree (Kg) of Le-Conte pear trees:

All the different iron resources treatments increased fruit yield/tree significantly since Fe-EDDHA treatment developed the highest fruit yield/tree followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate (Table, 5).

Fruit quality of Anna apple trees:

All the different iron resources treatments increased "Anna" apple fruit weight significantly since Fe-EDDHA treatment developed the highest fruit weight followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate. At the same time, Fe-EDDHA treatment induced the highest significant fruit length followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine and Fe-sulphate. On the other hand, the different iron application treatments did not affect "Anna" apple fruit width significantly. Meanwhile, Fe-EDDHA treatment induced the highest fruit firmness followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate (Table, 6).

Table (4): Effect of iron application treatments on the leaf chemical content of "Anna" apple and "Le-Conte" pear trees during 2007 and 2008 seasons

Treatments	"Anna" apple trees							
	Total chlorophyll reading (SPAD)		Fe (ppm)		Mn (ppm)		Zn (ppm)	
	2007	2008	2007	2008	2007	2008	2007	2008
Fe-EDTA	50.31a	52.11a	64.33a	88.60b	96.40b	106.60a	31.30b	33.60b
Fe-EDDHA	50.55a	52.31a	65.60a	92.80a	98.40a	104.60b	33.50a	35.70a
Iron sulphate	46.18b	46.65b	60.40c	71.40e	92.60c	93.70e	27.70d	28.50de
Iron sulphate + Ascobine	46.31b	46.76b	61.40c	72.70de	90.50d	96.80d	29.60c	30.80c
Iron citrate	46.25b	46.48b	61.60bc	73.60d	90.70d	95.70d	28.70cd	29.60d
Iron citrate + Ascobine	46.52b	46.86b	62.70b	75.60c	91.80cd	98.60c	29.80c	31.90c
Control	43.11c	43.19c	45.40d	47.60f	56.60e	59.50f	25.60e	27.50e
L.S.D. at 0.05	1.831	1.428	1.286	1.308	1.379	1.573	1.125	1.150
	"Le-Conte" pear trees							
Fe-EDTA	36.82ab	38.92ab	87.55a	102.14a	58.82a	59.77a	36.92	37.88
Fe-EDDHA	37.33a	39.14a	88.31a	106.16a	59.18a	59.92a	37.15	37.76
Iron sulphate	33.16c	34.21c	60.13d	70.18d	52.75bc	54.72bc	35.55	36.54
Iron sulphate + Ascobine	35.18abc	36.14c	65.21c	79.22c	54.17b	55.18b	36.16	36.73
Iron citrate	34.12bc	34.15c	60.16d	71.14d	53.18b	53.65bc	35.52	36.13
Iron citrate + Ascobine	35.65abc	36.31c	68.17b	82.18b	55.16b	56.18b	36.18	36.77
Control	29.18d	29.30d	50.85e	51.16e	50.14c	52.14c	35.13	35.33
L.S.D. at 0.05	2.732	2.740	2.782	2.743	2.707	2.704	N.S.	N.S.

Table (5): Effect of iron application treatments on fruit yield of "Anna" apple and "Le Conte" pear trees during 2007 and 2008 seasons

Treatments	Fruit yield/tree (Kg) "Anna" apple trees		Fruit yield/tree (Kg) "Le-Conte" pear trees	
	2007	2008	2007	2008
Fe-EDTA	26.75ab	28.73ab	27.75ab	29.86a
Fe-EDDHA	27.21a	29.18a	28.16a	31.21a
Iron sulphate	23.42cd	25.38c	21.32e	23.28c
Iron sulphate + Ascobine	24.87bc	26.92bc	24.15cd	26.33b
Iron citrate	24.33c	26.28c	22.11de	23.65c
Iron citrate + Ascobine	24.96bc	26.37c	25.12bc	26.92b
Control	21.55d	23.52d	17.45f	19.81d
L.S.D. at 0.05	2.059	1.812	2.808	2.679

Table (6): Effect of iron application treatments on the physical fruit quality of "Anna" apple and "Le-Conte" pear trees during 2007 and 2008 seasons

Treatments	"Anna" apple trees							
	Fruit weight (gm)		Fruit length (cm)		Fruit width (cm)		Fruit firmness (bound/Inch^2)	
	2007	2008	2007	2008	2007	2008	2007	2008
Fe-EDTA	111.55b	117.94b	6.52b	6.57b	5.47	6.52a	11.75a	11.79b
Fe-EDDHA	116.65a	119.52a	6.55a	6.59a	6.33	6.54a	11.77a	11.82a
Iron sulphate	82.95d	85.77e	5.92f	6.13e	5.89	6.16b	10.87d	10.96e
Iron sulphate + Ascobine	84.76c	86.83d	5.96d	6.14d	5.92	6.13b	10.95c	10.97d
Iron citrate	83.11d	85.22f	5.94e	6.12f	5.92	6.14b	10.81e	10.89f
Iron citrate + Ascobine	85.21c	87.25c	5.98c	6.15c	5.95	6.12b	10.98b	11.11c
Control	77.35e	79.14g	5.87g	5.91g	5.85	5.88c	10.47f	10.52g
L.S.D. at 0.05	0.6565	0.2715	0.007	0.008	N.S.	0.065	0.020	0.005
	"Le-Conte" pear trees							
Fe-EDTA	112.18a	115.21a	8.40b	8.80a	7.50b	7.60b	14.91a	14.93ab
Fe-EDDHA	113.35a	116.27a	8.70a	9.10a	7.80a	7.90a	15.12a	15.21a
Iron sulphate	107.14b	109.18b	7.50d	7.90c	6.50ef	6.70de	14.16ab	14.19c
Iron sulphate + Ascobine	108.12b	111.14b	7.90c	8.20b	6.80c	7.00c	14.46ab	14.52bc
Iron citrate	106.95b	108.88b	7.40d	7.80c	6.60de	6.90cd	14.15ab	14.20c
Iron citrate + Ascobine	108.52b	110.56b	7.80c	8.30b	6.70cd	7.10c	14.65ab	14.69abc
Control	96.21c	98.17c	7.10e	7.30d	6.40f	6.50e	13.48b	13.52d
L.S.D. at 0.05	2.842	2.859	0.272	0.277	0.197	0.277	1.250	0.544

Physical fruit quality of Le-Conte pear trees:

Both Fe-EDDHA and Fe-EDTA induced the highest significant fruit weight significantly followed by Fe-sulphate + Ascobine, Fe-citrate + Ascobine, Fe-citrate and Fe-sulphate. At the same time, Fe-EDDHA treatment developed the highest significant fruit length followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-sulphate and Fe-citrate treatments. Also, Fe-EDDHA treatment induced the highest significant fruit width followed by Fe-EDTA, Fe-sulphate + Ascobine, Fe-citrate + Ascobine, Fe-citrate and Fe-sulphate treatments. At the same time, Fe-EDDHA treatment developed the highest fruit firmness followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-citrate and Fe-sulphate (Table, 6).

Chemical fruit quality of Anna apple trees:

Fe-EDDHA treatment induced the highest significant total soluble solids of "Anna" apple fruits followed by Fe-EDTA, Fe-sulphate, Fe-citrate + Ascobine, Fe-sulphate + Ascobine and Fe-citrate. At the same time, both Fe-EDDHA and Fe-EDTA treatments developed the lowest fruit acidity percentages followed by Fe-citrate, Fe-sulphate and Fe-citrate + Ascobine and Fe-sulphate + Ascobine since the untreated fruits had the highest fruit acidity percentage. Meanwhile, both Fe-EDDHA and Fe-EDTA

treatments developed the highest total sugars content followed by Fe-citrate + Ascobine, Fe-sulphate + Ascobine and Fe-sulphate + Fe-citrate. On the other hand, the untreated fruits had the highest starch content followed by Fe-sulphate, Fe-sulphate + Ascobine, Fe-EDDHA, Fe-EDTA, Fe-citrate + Ascobine and Fe-citrate (Table, 7).

Table (7): Effect of iron application treatments on the chemical fruit quality of "Anna" apple and "Le-Conte" pear trees during 2007 and 2008 seasons

Treatments	"Anna" apple trees							
	T.S.S. (%)		Acidity (%)		Total sugars content (%)		Starch (%)	
	2007	2008	2007	2008	2007	2008	2007	2008
Fe-EDTA	13.28b	13.45a	0.40e	0.41cd	52.97a	54.95a	17.60b	16.38b
Fe-EDDHA	13.35a	13.55a	0.40e	0.41d	53.41a	55.42a	17.54b	16.31b
Iron sulphate	12.77f	12.88b	0.42c	0.43bc	47.12c	48.17d	19.41b	17.44ab
Iron sulphate + Ascobine	12.82d	12.93b	0.43b	0.44ab	48.33bc	49.31c	19.55b	17.41ab
Iron citrate	12.79e	12.88b	0.41d	0.42bcd	47.14c	48.21d	19.65b	17.45ab
Iron citrate + Ascobine	12.85c	12.95b	0.43b	0.44ab	49.22b	50.18b	19.35b	17.33ab
Control	12.65g	12.72c	0.45a	0.46a	44.21d	45.17e	22.45a	19.25a
L.S.D. at 0.05	0.0080	0.1179	0.007	0.020	1.291	0.755	2.495	2.493
	"Le-Conte" pear trees							
Fe-EDTA	12.82b	13.22b	0.37bc	0.40c	8.94b	9.11b	5.34d	4.77e
Fe-EDDHA	13.30a	14.21a	0.39b	0.41b	9.12a	9.24a	4.62g	4.21f
Iron sulphate	12.14f	12.96e	0.37bc	0.40c	8.41f	8.65d	5.85c	5.11b
Iron sulphate + Ascobine	12.33d	13.11d	0.38bc	0.41b	8.84d	8.94c	5.12e	4.89c
Iron citrate	12.21e	12.97e	0.36c	0.40c	8.45e	8.55e	5.91b	5.12b
Iron citrate + Ascobine	12.45c	13.18c	0.38bc	0.41b	8.86c	8.96c	4.92f	4.81d
Control	11.63g	11.75f	0.42a	0.42a	7.21g	7.33f	6.21a	6.18a
L.S.D. at 0.05	0.037	0.024	0.020	0.008	0.007	0.020	0.008	0.037

Chemical fruit quality of Le-Conte pear trees:

Fe-EDDHA treatment developed the highest significant total soluble solids of "Le-Conte" pear fruits followed by Fe-EDTA, Fe-sulphate + Ascobine, Fe-citrate + Ascobine, Fe-sulphate and Fe-citrate treatments in both seasons. Meanwhile, the untreated fruits had the highest significant acidity percentage followed by Fe- citrate, Fe-sulphate + Ascobine, Fe-citrate + Ascobine, Fe-sulphate, Fe-EDDHA and Fe-EDTA treatments. At the same time, Fe-EDDHA treatment resulted in a highest significant total sugars content of "Le-Conte" pear fruits followed by Fe-EDTA, Fe-citrate + Ascobine, Fe-sulphate + Ascobine, Fe-sulphate and Fe-citrate treatments since the untreated fruits had the lowest total sugars content percentage. Concerning "Le Conte" pear fruit starch content as affected by different iron resources treatment, the untreated fruits developed the highest significant starch percentage followed by Fe-EDDHA treatment induced the lowest significant fruit starch

percentage followed by Fe-EDTA, Fe-sulphate, Fe-sulphate + Ascorbic, Fe-citrate + Ascobine, Fe-citrate and control (Table 7).

The stimulating effect of different iron compounds especially Fe-EDDHA, Fe-EDTA, Fe-citrate + Ascobine and Fe-sulphate + Ascobine on the vegetative growth of "Anna" apple and "Le-Conte" pear trees grown in calcareous soils at Nobaria region coincided with findings of (Thomas and Staiff, 1988) who demonstrated that Anjou pear (*Pyrus communis* L.) when sprayed with different iron Fe compound reduced a severe Fe chlorosis condition. They added that the residual effect of the Fe Lignose Fonat sprays of the 1986 resulted in greater shoot growth and fruit set in 1987 than in unsprayed control. The positive relationship between the Fe-EDDHA, Fe-EDTA, Fe-sulphate + Ascobine, Fe-citrate + Ascobine, Fe-sulphate and Fe-citrate on leaves regreening effect of both "Anna" apple and "Le Conte" pear leaves as a result of increasing leaf chlorophyll content and increasing micronutrient concentration in the treated trees are in harmony with findings of [Manchanda (1974), Dixt *et al.* (1978) and Taha *et al,* (1979)] working on Mandarin trees, [Menn *et al,* (1985) and Salem *et al.*, 1995)] working with Balady mandarin grafted on sour orange rootstock grow in sandy soil. They demonstrated that foliar sprays of mixture of Fe, Zn and Mn alone or plus urea significantly increased leaf content of Fe, Zn and Mn content. Fisher *et al.* (2003) also indicated that foliar sprayes at 60mg/L Fe were more effective when Fe was applied as EDTA than as FeSo4. Fe-EDDHA at 20 to 80 mg/L were highly effective at correcting Fe-deficiency symptoms and had superior effects on plant growth compared with drenches of Fe-DTPA at 80mg/L. An Fe EDDHA drench at 20 to 80 mg/L was cost effective option for correcting severe Fe deficiency at high medium pH. Also, Tsipouridis and Thomidis (2005) working on peach trees outlined that increasing iron concentration was found in the leaves of trees supplied with K2So4 and FeSo4 15-30 days after application. At the same time, Costa (2007) outlined that the effectiveness of different Fe-sources as anti-chlorotic agents polysaccharides, carbomin iron, Fe 12% and carbomin blend Fe 3.9%, Mn 43% were compared to commercial Fe-chelates (sequestrene 138 and 330) over 3 year field trials on adult cling peach orchard cv. Adrialyca. Among foliar treatments, both sequestrene and carbomin iron increased leaf Fe-content. Quit recently Karaginnidis *et al.*, (2008) outlined that leaf Fe-concentration of peach trees were significantly higher in trees treated with FeSo4 7H2o 2 years after application.

On the other hand, Fernandez *et al.*, (2004) studied the effectiveness of foliar fertilization on re-green chlorotic leaves, in iron-deficient pear trees. Treatments were used ferrous sulphate alone, ascorbic, citric and sulphuric acids applied either alone or in combination with ferrous sulphate, and water as control. None of the treatments caused a full recovery from Fe deficiency chlorosis. Treatments containing Fe caused the largest re-greening effect as well as FeSo4 what ever, Fe-EDTA in foliar spray does not seem to be justified, since their effects are not better than the se of FeSo4.

CONCLUSION

From this study, it can be concluded that spraying Fe-EDDHA at 0.5 gm/l three times/year was the best treatment for over-coming Fe- deficiency, increasing vegetative growth and yield and improving fruit quality of Anna apple and Le Conte pear trees grown in calcareous soil .

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تأثير المعاملة بمضادات للاصفرار المختلفة على أشجار التفاح صنف "أنا" والكمثرى صنف "ليكونت" النامية فى آراضى جيرية

محمد محمود يحيي، سامية أيوب أسعد، ، وصفى ماهر عبد المسيح
معهد بحوث البساتين – مركز البحوث الزراعية

تم تجربه رش ست أنواع من مضادات الإصفرار وهى:

١. مركب حديد فى صوره ايدتا بتركيز ٠,٥ جرام/لتر.
٢. مركب حديد فى صوره ايدها بتركيز ٠,٥ جرام/لتر.
٣. كبريتات حديدوز بتركيز ٠,٥ جرام/لتر.
٤. كبريتات حديدوز بتركيز ٠,٥ جرام/لتر + اسكوبين بمعدل ٠,٥ جرام/لتر.
٥. خلات حديدوز بتركيز ٠,٥ جرام/لتر.
٦. خلات حديدوز بتركيز ٠,٥ جرام/لتر + اسكوبين بمعدل ٠,٥ جرام/لتر.

والرش بالماء فقط على الأشجار الغير معامله .

والأشجار التى تم رشها بهذه المركبات هى اشجار تفاح أنا مطعومه / ١٠٦ ، وأشجار كمثرى ليكونت مطعومه على أصل الكميونس وكان عمر أشجار التفاح والكمثرى خمس سنوات منزرعه بالنوباريه – محافظه البحيره (أرض جيريه) وذلك خلال موسمى ٢٠٠٦-٢٠٠٨ . وتم رش أشجار التفاح الأنا بهذه المركبات ثلاث مرات (فى الأول من أبريل ، فى الأول من مايو، فى الأول من يونيو) اما أشجار الكمثرى الليكونت فتم رشها فى منتصف أبريل ، ومنتصف مايو، ومنتصف يونيوفى كلا الموسمين .

وقد أوضحت نتائج الدراسه أن المعاملات ياستخدام الحديد فى صور ايدها اوايدتا وكذلك خلات الحديدوز + أسكوبين ، وكبريتات الحديدوز + أسكوبين الى زياده فى عدد الأفرخ وسمكها وزياده مساحه الورقه كما أدت الى زياده فى محتوى الأوراق من عناصر الحديد والزنك والمنجانيز ، وكذلك محتوى الأوراق من الكلوروفيل الكلى . كما أعطت هذه المعاملات السابقه أعلى محصول للشجره وأعلى مواد صلبه للثمار وكذلك أعلى سكريات كليه وأقل نسبه من حموضه الثمار ومحتواها من النشا.