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Response of Le Conte Pear Performance, Chlorophyll Content and Active Iron to Foliar Application of Different Iron Sources under the Newly Reclaimed Soil Conditions

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Abstract: The present study was conducted during 2013 and 2014 seasons on uniform in vigour thirteen year's old pear trees cv. Le Conte (*Pyrus communis*, L.) budded on Pyrus communis rootstock grown in sandy soil in a private orchard located at El-Tall El-Kepeer, Ismailia Governorate, Egypt speaced4x4 m, under drip irrigation system. The target of the present study to spotlight on the beneficial effect foliar application of different iron sources (Fe-EDTA, Fe-EDDHA and Fe-mineral as form ferric sulphate "$FeSO_4.7H_2O$") on leaf chlorophyll concentrations, active iron, nutritional status of leaves and fruits, yield and fruit quality , as well as for controlling iron deficiency Chlorosis under the newly reclaimed soil conditions.

Results showed that spraying all different iron sources were significantly very effective in increased macronutrients and micronutrients content in leaves, fruits and enhancing leaf content of chlorophyll and active iron compared with non-treated. Applications of different iron sources markedly produced higher fruit weight (g), number of fruits/tree, yield (kg)/tree and yield (ton) /fed., of Le Conte pear trees. Moreover, results proved that there is a strong significant relationship between fruit nutrient contents and fruit quality and yield.

Generally, the highest yield with best quality was obtained by Fe-EDTA and Fe-Mineral treatments are suggested it spraying two times to be a good recommendation for improved and enhanced yield and fruit quality under the newly reclaimed soil conditions.

Key words: Le Conte pear, Fe sources**,** nutritional status, active iron, chlorophyll content, yield, fruit quality.

Introduction

Le- Conte pear cultivar (*Pyrus communis*, L.) is one of the important deciduous fruits grown in Egypt. It suffers from several factors which have a negative effect on growth, yield and fruit quality. Among these major factors which may attribute to malnutrition especially with iron. Iron (Fe) is one of the most deficient micronutrient around the world. The main role of iron in the plant, it is most important for the respiration and photosynthesis processes. Iron deficiency decreased concentration of photosynthetic pigments in the leaf, lager decrease in leaf chlorophyll concentration[1], macronutrients (N, P, K, Ca and Mg) and micronutrients (Fe, Zn, Mn and Cu) decreased[2], resulted in smaller fruit also lead to a delay in fruit ripening it had the negative effect on gross yield and fruit quality[3].

Many agricultural crops worldwide, especially in semi-arid climates, suffer from iron deficiencies. Iron Chlorosis is one of the major problems in fruit tree crops growing in the Mediterranean area[4]. Among plants sensitive to iron deficiency are apples, avocado, bananas, barley, beans, citrus, cotton, grapes, peanuts, potatoes, sorghum, soya bean and numerous ornamentals plants. The major crops production affected by Fe deficiency include deciduous fruits (apple, peach, plum, grape and pear) as well as evergreen fruits (citrus, bananas and olive) develop symptoms of iron deficiency "intervened chlorosis of apical leaves" when cultivated in calcareous and alkaline soils[5]. Symptoms of iron chlorosis in orchards are usually more frequent in spring when shoot growth is rapid and bicarbonate concentration in the soil solution buffer soil pH in the rhizosphere and root apoplast. Since the solubility of Fe-oxide is pH dependent, under alkaline and calcareous soils inorganic Fe availability is far below that required to satisfy plant demand, Fe uptake is preceded by a reduction step from Fe^{3+} to Fe^{2+}[6]. Farmers not using fertilization face large losses in fruit yield and quality[7,3]. Sustainable management of Fe nutrition in orchards is in order to naturally enhance Fe availability in the soil and plant[8]. The major role on Fe nutrition of trees prevent iron chlorosis depended on the Fe-sources[9]. So rapid response is needed to correct a chlorotic condition, a foliar spray with iron sulfate or iron chelates solution may be applied when the tree is in full leaf. New growth that emerges will be chlorotic. Generally, soil applications of inorganic iron sources are not effective in supplying iron to the crop. Iron chelates have made correction of iron deficiency relatively easy. These materials can be applied safely as foliar sprays. Since this may take up to a few weeks to correct the problem, chelates iron can be used to quickly green up the plants. The most effective chelating agent is iron-EDDHA. Usually two sprays are required. Apply the first about 4 weeks after bloom and the second about 3 weeks later, apply as a separate spray[9].

Iron nutrition in plants:

Iron deficiency is a limiting factor of plant growth. Iron is presented at low or high quantities in soils, but its availability to plants is usually very low, and therefore iron deficiency is a common problem.

The present study target to throw light on the beneficial effect foliar application of different iron sources (Fe-EDTA, Fe-EDDHA and Fe-Mineral as form ferric sulphate ($FeSO_4.7H_2O$) on leaf chlorophyll concentrations, active iron, nutritional status of leaves and fruits, yield and fruit quality of Le Conte pear trees as well as for controlling iron deficiency Chlorosis under the newly reclaimed soil conditions.

Materials and Methods

Pear Orchard

The present study was conducted during 2013 and 2014 seasons on uniform in vigour thirteen year's old pear trees cv. Le Conte (*Pyrus communis*, L.) budded on Pyrus communis rootstock grown in sandy soil in a private orchard located at El-Tall El-Kepeer, Ismaalia Governorate, Egypt , spaced 4x4 m, under drip irrigation system. The trees received the same horticultural practices that are recommended by The Egyptian Ministry of Agriculture. Complete randomized block design was adopted. The soil analysis of the experimental site was used with organic matter 0.38%, pH 8.48, E.C 0.17 dsm^{-1} and $CaCO_3$ 1.33%, (P 0.26, K 19.0, Ca 325, Mg 12.1 and Na 15.2 mg/100g) and (Fe 3.2 , Mn 4.2, Zn 1.16 and Cu 0.12 ppm).

Foliar Spray Application

Three different Fe sources were (Fe-EDTA, Fe-EDDHA and Fe-Mineral"$FeSO_4.7H_2O$") at doses 250 ppm. All foliar sprayed two times in each season (May and June). Control trees were sprayed with water. All spray solutions contained 0.1% triton B as a wetting agent and sprayed till run off.

Measurements and Determinations

Chlorophyll Content of Leave

Chlorophyll content of leaves was measured (after second spray)as reading by Hydro N- Tester (Minolta, Japan) 502 meter, using the blades of the fully mature leaves of pear.Chlorophyll meters permit storage of 30 individual meter readings, reviewing of stored values and elimination of atypical readings, and an averaging function[10].

Active Iron Content (ppm)

The method was used[11]. Two grams of fresh chopped plant leaves were weighed in triplicates and immediately transferred into 50 ml. plastic cups; contain 20 ml 1.5 N HCl. The cups were capped and shaken at room temperature for 24 hours on shaker Uni Jogger model and then filtered through filter paper Whatman No. 1. Fe was measurement by atomic absorption.

Leaf Nutrient Contents

Samples of thirty leaves from the middle part of non fruited shoots were selected at random from each replicate. The leaves were washed, dried at 70ºC till constant weight, grind and digested to determine the macro-nutrients (N, P, K, Ca and Mg %) and micro-nutrient (Fe, Zn, Mn and Cu ppm) contents[12]. Where, mineral analyses were done in fruit.

Yield (Kg/tree)

In August of each year (2013 and 2014) at harvesting time, the fruit yield of Le Conte pear was estimated on basis of number and weight of fruits/tree (Kg). Also yield (ton)/fed were calculated.

Fruit Quality Assessment

Samples of 15 fruits from each tree were randomly taken for determining the physical and chemical characteristics.

Physical Characters

Fruit weight (g), fruit length (L), fruit diameter (D) and L/D ratio were calculated. Also, fruit firmness was determined as Lb/inch^2 by using fruit pressure tester model FT 327 (3-27Lbs).

Chemical Characters

Total Soluble solids percentage (TSS %) by using hand refractometer, Total Acidity (TA %) was estimated as percentage of Malic acid in fruit juice[13], Maturity index (MI) was calculated as a ratio of Total Soluble Solids/Total Acidity. Total Sugars (g/100g FW) was determined using the phenol and sulphoric acid[14].

Statistical Analysis

The results were submitted to analysis of variance[15]. Differences among treatment means were determined as using the LSD test at a significance level of 0.05[16].

Results and Discussion

Nutrition Status of Leaves and Fruits of Le Conte Pear Trees

Macronutrients content (%)

Table 1 Effect of Foliar Application Different Iron Sources on Macronutrients Content (%) of Le Conte Pear Leaves during the Two Seasons

Treatments	N		P		K		Ca		Mg	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	2.53	2.68	0.22	0.24	2.03	2.15	1.54	1.63	0.84	0.89
EDDHA (250 ppm)	2.49	2.64	0.19	0.2	2.13	2.26	1.15	1.22	0.74	0.79
Mineral (250 ppm)	2.59	2.75	0.24	0.26	2.41	2.56	1.82	1.93	0.95	1.00
Control	2.12	2.18	0.14	0.15	2.14	2.27	1.36	1.46	0.69	0.75
$LSD_{0.05}$	**0.28**	**0.09**	**0.002**	**0.02**	**0.23**	**0.01**	**0.16**	**0.09**	**0.09**	**0.01**

Mineral at form ($FeSO_4.7H_2O$)

Table 2 Effect of Foliar Application Different Iron Sources on Macronutrients Content (%) of Le Conte Pear Fruits during the Two Seasons

Treatments	N		P		K		Ca		Mg	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	0.60	0.64	0.070	0.08	1.17	1.25	0.062	0.065	0.154	0.163
EDDHA(250 ppm)	0.60	0.64	0.055	0.07	1.24	1.31	0.046	0.049	0.144	0.152
Mineral (250 ppm)	0.63	0.66	0.087	0.09	1.38	1.46	0.082	0.087	0.190	0.201
Control	0.53	0.57	0.069	0.07	1.13	1.21	0.062	0.065	0.140	0.155
$LSD_{0.05}$	**NS**	**0.013**	**0.014**	**NS**	**0.01**	**0.07**	**0.010**	**0.010**	**0.013**	**0.030**

Mineral at form ($FeSO_4.7H_2O$), NS: Not Significant

As shown in (Tables 1 & 2) all foliar application of different iron sources significant increased macronutrients content of N, P, K, Ca and Mg in the leaves and fruits when compared than the control, in both seasons. Foliar application of Fe-mineral was superior in macronutrients content leaves and fruits, since it was favorable in enhancing these nutrients than the other iron sources application. It recorded the highest significant values of nutrients content in both leaves and fruits, followed in a descending order by application of Fe-EDTA had high significant values of N, P, Ca and Mg leaves and fruits content. While, application of Fe-EDDHA had high significant value of K leaves and fruits content. The reduction macronutrients values of N, P, K and Mg in fruits content except K in leaves content were in the control treatments, other vise the reduction of K leaves content was in Fe-EDTA and the descending of Ca leaves and fruits content were in the Fe-EDDHA.

Micronutrients Content (ppm)

Table 3 Effect of Foliar Application Different Iron Sources on Micronutrients Content (ppm) of Le Conte Pear Leaves during the Two Seasons

Treatments	Fe		Zn		Mn		Cu	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	152.2	161.5	119.1	126.3	144.7	153.5	12.28	13.78
EDDHA (250 ppm)	94.8	100.6	142.1	150.8	167.9	178.2	11.19	12.69
Mineral (250 ppm)	238	252.5	166.4	176.5	204.1	216.6	12.09	13.59
Control	89.1	96.0	118.0	128.0	138.1	146.9	11.37	12.87
$LSD_{0.05}$	**15.5**	**3.4**	**16.1**	**1.21**	**19.0**	**1.4**	**0.02**	**0.11**

Mineral at form ($FeSO_4.7H_2O$)

Table 4 Effect of Foliar Application Different Iron Sources on Micronutrients Content (ppm) of Le Conte Pear Fruits during the Two Seasons

Treatments	Fe		Zn		Mn		Cu	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	41.0	43.5	112.2	119.1	9.7	10.3	5.64	5.98
EDDHA(250 ppm)	35.0	36.0	113.8	120.7	12.3	13.1	3.59	3.81
Mineral (250 ppm)	76.9	81.6	114.8	121.8	14.4	15.2	4.10	4.35
Control	23.1	24.5	113.3	120.2	11.3	12.0	1.65	2.00
$LSD_{0.05}$	**2.74**	**1.37**	**0.13**	**NS**	**0.18**	**NS**	**0.13**	**0.13**

Mineral at form ($FeSO_4.7H_2O$), NS: Not Significant

It is clear from the obtained data in Tables (3 & 4) that application spray all different iron sources were significantly very effective in enhancing micronutrients content of Fe, Zn, Mn and Cu in the leaves and fruits compared with the check treatments. Spraying Fe-mineral significantly improved these nutrients (Fe, Zn, Mn and Cu) in the leaves and (Fe, Zn and Mn) in the fruits. While, the application Fe-EDTA was enhanced Cu fruits content alone. The lowest values of micronutrients (Fe and Mn) in leaves and (Fe and Cu) in the fruits were recorded on the untreated trees. On the other side, the decrease values of Zn and Mn in fruits as well as Zn leaves were found in application iron form Fe-FDTA. While, Fe-EDDHA sprays revealed the low value of Cu leaves content. Similar results were announced in both seasons.

The effect of application different iron sources on formation of roots it's stimulating and encouraging the translocation of nutrients from soils via roots[17]. Sprays of Fe sulphate in all the crops tested showed similar or even higher re-greening effect than Fe DTPA[5]. Sprays of Fe (II) sulfate increased the concentrations of chlorophyll, Fe and zinc in leaves[18]. Foliar Fe fertilization significantly increased Fe concentration and to control Fe deficiency in fruit trees[1]. Moreover, [19]they found that foliar application of micronutrients on Le Conte pear trees under calcareous soil conditions gave the highest values of leaf and fruit mineral content. These results are in concordance [3, 2].

Chlorophyll and Active Iron

Table 5 Effect of Foliar Application Different Iron Sources on Chlorophyll, Active Iron, Yield and Yield Components of Le Conte Pear Trees during the Two Seasons

Treatments	Chlorophyll		Active iron		Fruit weight (g)		Number of fruit /tree		Yield (kg)/tree		Yield (ton)/fed.	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	538.7	585.7	3.88	3.29	159.61	182.27	297.7	314.3	47.51	57.42	8.55	10.34
EDDHA (250ppm)	524.7	556.3	2.43	2.38	150.22	173.45	243.3	248.7	36.65	43.13	6.60	7.72
Mineral (250ppm)	518.7	529.0	3.22	2.86	158.17	177.89	260.7	275.3	41.23	48.98	7.42	8.82
Control	486.3	499.7	1.76	1.96	136.35	146.76	220.7	229.3	30.09	33.65	5.42	6.06
$LSD_{0.05}$	**27.6**	**21.3**	**0.24**	**0.32**	**3.3**	**7.19**	**27.9**	**25.1**	**4.5**	**4.6**	**0.81**	**0.83**

Mineral at form ($FeSO_4.7H_2O$)

The results presented in (Table, 5) revealed that leaves content of chlorophyll and active iron were significantly affected by spraying all different iron sources in the both seasons. It was noticed that the application of Fe-EDTA recorded the highest statistical values of these parameters followed in a descending order by Fe-EDDHA and Fe-mineral, consecutively in case leaves content of chlorophyll, but with no significant differ with them in the first season only. Concerning leaves content of active iron, data indicated that Fe-mineral sprays gave the highest statistical values followed by Fe-EDDHA in this respect. Similar results were announced in both seasons. On the other hand, control recorded the lowest significant values of these parameters in the both seasons.

Extraction of leaves with dilute acids to characterize the so - called "active iron" often improved the correlation between iron and chlorophyll content in leaves of plants grown in field. If plants are grown under controlled conditions (nutrient solutions), these is a close positive correlation between the total iron content of the leaves and the chlorophyll content when the supply of iron is suboptimal[9]. The promoting effect of application of different iron sources on leaves content of chlorophyll and active iron might be attributed to their important role in chlorophyll formation and encouraging respiration and photosynthesis processes as well as producing more carbohydrates and amino acids which aid in the formation of new cells. Reflected on stimulation effect on cell division as well as the acceleration on the formation of organic foods and the movement of IAA could explain the present results[18].

These results agreed with[18] who reported that sprays of Fe (II) sulfate increased the concentrations of chlorophyll, and[1] who found that sprays of Fe (III)-chelates also increased leaf chlorophyll and Fe concentrations. Treatment with Fe-containing solutions always resulted in leaf chlorophyll increases, which however significantly depended on the Fe-source. Also, [19]they revealed that foliar application of micronutrients on Le Conte pear trees under calcareous soil conditions improved chlorophyll content of leaves. Moreover, the reason that effect of form Fe-EDTA is better than form Fe-EDDTA the due to the second form is large granules therefore preferably application to the soil and not foliar spray.

Yield and Yield Components

Results in Table (5) indicated that application of different iron sources markedly produced higher fruit weight (g), number of fruits/tree, yield (kg) /tree and yield (ton) /fed of Le Conte pear trees. This was true for

both experimental seasons. Fe-EDTA treatment recorded the highest significant values of these parameters followed by that of Fe-Mineral and Fe-EDDHA treatments. For example, these superior treatments increased the average of yield (kg) /tree than control treatment by about 57.9, 73.0 and 33.4% in the first season and 70.6, 45.6 and 28.2% in the second season, respectively. On the contrary, the lowest statistical values of all the previous characters were recorded with the untreated trees (control).

The stimulation on nutritional status of the Le Conte pear trees in response to application of Fe-nutrients surely reflected on improving the yield and yield components. These results are in are in harmony with the findings[7, 3, 20, 2, 19].

Physical Characteristics

Table 6 Effect of Foliar Application Different Iron Sources on Physical Characteristic of Le Conte Pear Fruits during the Two Seasons

Treatments	Fruit length (L)(cm)		Fruit diameter (D)(cm)		Fruit shape (L/D)		Fruit firmness (Lb/inch^2)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	8.33	8.50	6.40	6.55	1.30	1.30	20.83	21.17
EDDHA(250 ppm)	8.06	8.28	6.28	6.39	1.28	1.30	21.13	21.17
Mineral (250 ppm)	8.00	8.34	6.35	6.44	1.26	1.29	21.13	22.13
Control	7.94	8.22	6.11	6.22	1.30	1.32	15.80	16.87
$LSD_{0.05}$	**0.06**	**0.16**	**0.11**	**0.06**	**0.03**	**NS**	**1.31**	**1.6**

Mineral at form ($FeSO_4.7H_2O$), NS: Not Significant

With regard to the physical characteristics, data in Table (6) showed markedly produced higher in Fruit length (L) (cm), Fruit diameter (D) (cm), Fruit shape (L/D) and Fruit firmness (Lb/inch^2) of Le Conte pear trees with treated of different iron sources as compared with the check ones in both seasons. The form of Fe- EDTA recorded superior significant increase in this respect as compared with the other two forms, in most parameters except fruit shape in the second season. Fruit firmness was greatly improved in the trees that were sprayed with all iron sources with no differ significant among them in both studied seasons, while fruit diameter, it is true in the first season only. On the other hand, the lowest values of the previous characters were recorded with the untreated trees.

The enhancement in all aspects of these characteristics may be attributed to its effects in stimulating biosynthesis of organic materials especially carbohydrates and proteins and enhancement the formation and movement of natural hormones which are vital to improvement of cell division, especially in the meristematic tissues[21]. The present results are in agreement with those [7, 3, 20, 2, 19].

Chemical Characteristics

Table 7 Effect of Foliar Application Different Iron Sources on Chemical Characteristics of Le Conte Pear Fruits during the Two Seasons

Treatments	TSS (%)		TA (%)		TSS/TA ratio		Total sugars (g/100g FW)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EDTA (250 ppm)	10.3	10.5	1.08	1.17	9.62	8.99	10.34	10.55
EDDHA(250 ppm)	10.3	10.5	0.98	1.05	10.52	10.22	10.34	10.55
Mineral (250 ppm)	10.4	10.7	0.79	0.83	13.30	12.84	10.41	10.67
Control	9.9	10.3	1.11	1.19	9.36	9.05	9.85	10.26
$LSD_{0.05}$	NS	NS	NS	NS	2.30	2.25	NS	NS

Mineral at form ($FeSO_4.7H_2O$), TSS: Total Soluble Solids, TA: Total Acidity

It is evident from the data in Table (7) that spraying Le- Conte pear trees with different iron sources were significant promotion on fruit quality of increasing total soluble solids (TSS %), and total sugars (%) and in decreasing total acidity (TA %) as compared with unspraying ones. Although all parameters had the best

results of trees treated with different iron sources as compared with the control but without any significant between them except in case TSS/TA ratio. The form of Fe-Mineral recorded the largest significant value in this respect when compared with the other treatments including the control. This result is true in both seasons.

The beneficial effect of application of different iron sources on enhancing the biosynthesis of organic foods as well as its action as natural auxins could explain the present results surely reflected on improving the fruit quality[7]. In addition [20]they reported that foliar application of micronutrients on Le Conte pear trees under calcareous soil conditions improved the physical and chemical characteristics of fruits. These results are in harmony with the findings [3, 20, 2].

Correlation Coefficient

Table 8 Correlation Coefficients between Fruits Nutrient Contents and Yield and Fruit Quality of Le Conte Pear (Means of the Two Seasons)

Fruit nutrient contents	Correlation coefficients						
	Length	Diameter	Fruit weight	Fruit firmness	TSS	Total sugars	Yield / fed.
Nitrogen	0.50580**	0.87142***	0.94305***	0.97904***	0.55809**	0.5611**	0.75472***
Phosphorus	0.12901	0.44555**	0.46913**	0.42195**	0.5795**	0.57650**	0.41213**
Potassium	-0.07590	0.41635**	0.55356**	0.68415**	0.48178**	0.48366**	0.27534
Calcium	-0.04082	0.23893	0.30501	0.28479	0.28313	0.28056	0.22579
Magnesium	0.06335	0.43710**	0.51532**	0.51850**	0.37503	0.37389	0.37676
Iron	0.11525	0.55793**	0.63401**	0.65706**	0.41981**	0.41976**	0.45545**
Zinc	-0.32422	-0.02815	0.15316	0.35857	0.64120**	0.64236**	-0.09987
Manganese	-0.52996	-0.05103	0.10898	0.30969	0.28197	0.28369	-0.20915
Copper	0.88606***	0.97294***	0.92195***	0.78390***	0.34521*	0.3460*	0.9660***

TSS: Total Soluble Solids, * = Moderate positive relationship, ** = Strong positive relationship, * = Very Strong positive relationship.**

The relationship of fruit nutrient contents with fruit quality and yield of Le Conte pear, as average of the two seasons were detected in Table 8. Results indicated that very strong significant positive relationship between fruit N content and fruit diameter, weight, firmness and yield. Similar relationships were found between fruit Cu content and fruit length, diameter, weight, firmness and yield. At the same time, data revealed that strong significant positive relationship between fruit P, K and Fe content and fruit diameter, weight, firmness, TSS, total sugars and yield, except yield in case fruit K content. Same relationships were revealed between fruit N and Zn content and TSS and total sugars as well as between fruit Mg content and fruit diameter, weight and firmness. Conversely, the results revealed that Moderate significant positive relationship between fruit Cu content and TSS and total sugars.

This could be due to all essential elements play a vital role in deciding the growth and development the plants. For a particular nutrient, these exists a relationship between its concentration in soil as well as in plants and yield as well as quality attributes of fruits. This serves as a guide to obtain maximum productivity of quality fruits. These results are in conformity with the findings[22, 23].

Conclusion

Generally, it could be concluded that different iron sources foliar spray application enhanced leaf content of Chlorophyll, active iron and nutrition status of leaves and fruits as well as corrected some fertilizer deficiency and controlling iron deficiency chlorosis. Moreover increased yield and improved fruit quality of Le Conte pear trees, which was emphasized by the very strong significant positive correlation of most nutrients in fruits and fruit quality and yield. Thus, the highest yield with best quality was obtained by Fe-EDTA and Fe-Mineral treatments are suggested it spraying two times to be a good recommendation for improved and enhanced yield and fruit quality of the Le Conte pear trees under the newly reclaimed soil conditions.

References

1. Fernándeza V, Victor Del Ríoa, Lorena Pumariñoa, Ernesto Igartuab, Javier Abadíaa, Anunciación Abadíaa. "Foliar fertilization of peach (*Prunus persica* (L.) Batsch) with different iron formulations: Effects on re-greening iron concentration and mineral composition in treated and untreated leaf surfaces", Scientia Horti., 2008; 117: 241–248.
2. Álvarez-Fernández A, Juan Carlos Melgar1, Javier Abadía, Anunciación Abadía. "Effects of moderate and severe iron deficiency chlorosis on fruit yield, appearance and composition in pear (*Pyrus communis* L.) and peach (*Prunus persica* (L.) Batsch)", Environ & Exp Botany, 2011; 71: 280–286.
3. Àlvarez-Fernàndez A, Javier Abadía, Anunciación Abadía. "Iron Deficiency, Fruit Yield and Fruit Quality", Iron Nutrition in Plants and Rhizospheric Microorganisms, 2006; pp 85-101.
4. Sanz M, Pascual J, Machin J. "Prognosis and correction of iron chlorosis in peach trees: Influence on fruit quality", J Plant Nutr., 1997; 20: 1567–1572.
5. Tagliavinia M, Abadíab J, Rombolàa AD, Abadíab A, Tsipouridisc C, Marangonia B. "Agronomic means for the control of iron deficiency chlorosis in deciduous fruit trees", J Plant Nutr., 2000; 23: 2007-2022.
6. Tagliavini M, Rombolà AD. "Iron deficiency and chlorosis in orchard and vineyard ecosystems", Eur Agron., 2001; 15: 71-92.
7. Álvarez-Fernández A, Pilar Paniagua, Javier Abadía, Anunciación Abadía. "Effects of Fe Deficiency Chlorosis on Yield and Fruit Quality in Peach (*Prunus persica* (L.) Batsch)", J Agric Food Chem., 2003; 51 (19): 5738–5744.
8. Kacar B. "Plant and Soil Chemical Analysis III", Soil Analysis. Nobel Publication 2009; 1387: 467.
9. Kessel C. "Fertilizing Stone Fruit (Peaches, Plums, Nectarines, Apricots, Cherries) and Pears", Horti Crop Nutr/OMAFRA, 2003; 519: 826-404.
10. Benedict HM, Swidler R. "Nondestructive methods for estimating chlorophyll content of leaves", Sci., 1961; 133: 2015-2016.
11. Takkar PN, Kaur NP. "HCL method for Fe2+ estimation to resolve iron chlorosis in plants", J Plant Nutr., 1984; 7: 81- 90.
12. Rebbeca B. "Soil Survey Laboratory Methods Manual", Soil Survey Investigation Report. 2004; 42 Natural Resources Conservation Services.
13. AOAC. "Official Methods of Analysis", Association of Official Agricultural Chemists. 17th Ed, Washington DC. USA, 2000; 1970.
14. Smith FA, Gilles M, Haniltun KJ, Gedees AP. "Colrimetric methods for determination ofsugar and related substances", Analysis Chemistry, 1956; 28: 350.
15. Snedeco, GW Cochran WG. "Statistical methods", Iowa State College Press. Iowa, USA, 1967; 91-119.
16. Waller RA, Duncan DB "A bays rule for the symmetric multiple comparisons problem", J Amer Stat Assoc., 1969; 64: 1484-1503.
17. Nijjar GS. "Nutrition of Fruit trees,Published by Mrs", Ushu Rajkumar publishers, New Delhi, 1985; pp: 10-270.
18. Maribela Pestanaa, Pedro José Correiaa, Amarilis de Varennesb, Javier Abadía, Eugénio Araújo Fariaa. "Effectineness of different foliar iron application to control iron Chlorosis in orange trees grown on a calcareous soil", J Plant Nutri., 2001; 24, (4-5): 613-622.
19. Samia A Asad, Nagwa A Abd El-Megeed, Eman S Atalla. "Effect of foliar application of micronutrients on "Le-Conte" pear trees under calcareous soil conditions", J Amer Sci., 2013; 9(7): 123-128.
20. Mansour AEM, Ahmed FF, Shaaban EA, Amera A Fouad. "The beneficial of using citric acid with some nutrients for improving productivity of Le- Conte pear trees", Res. J. Agric. & Biol. Sci., 2008; 4(3): 245-250.
21. Kassem HA, Marzouk HA. "Effect of organic and/or 3 mineral nitrogen fertilization on the nutritional status, yield and fruit quality of Flame seedless grapevines grown in calcareous soils", J Adv Res., 2002; 7: 117-126.
22. Kumar J, Chandel JS. "Effect of different levels of N, P and K on growth and yield of pear cv. Red Bartlett", Progressive Horti., 2004; 36: 202-206.
23. Dar MA, Wani JA, Raina SK, Bhat MY. "Effect of available nutrients on yield and quality of pear fruit Bartlett in Kashmir valley India", J. Environ. Biol., 2012; 33: 1011-1014.

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