RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSIONS

The influence of the two investigated factors namely: a- NPK application rate i.e., 1 and 2 kg from each of the N, P, K fertilizers soil added per tree fractionated into two equal doses, besides the ordinary NPK fertilization program adopted in Kalubia region as control ($N_0P_0K_0$; $N_1P_1K_1$ and $N_2P_2K_2$) and b- concentration of chelated iron spray solution i.e. 0.0; 0.2 % and 0.4 % of the iron sequesterated –12% solution (Fe_0; Fe_1 and Fe_2) and their possible nine combinations on Le-Conte pear trees were studied during both 1997 and 1998 seasons. Such influence was evaluated through the response of the vegetative growth measurements; nutritional status (leaf mineral composition) and some fruiting aspects of the treated Le-Conte pear trees.

Thus, results obtained during both seasons of study dealing with any of the aforesaid three aspects are separately discussed as follows:

IV.I. Response of vegetative growth measurements:

IV.II. Response of nutritional status "mineral composition":

IV.III. Response of some fruiting measurements:

IV.I. Response of vegetative growth measurements:

In this regard increase in shoot length; average number of leaves per shoot; increase % in trunk diameter; leaf dimensions (length and width); leaf shape index (L.: W.); leaf dry weight; leaf area and leaf area

factor were the nine growth measurements of Le-Conte pear trees investigated pertaining their response to the specific effect of investigated variables of each investigated factor i.e. (3 rates of NPK soil added) and (3 concentrations of chelated Fe spray solutions, as well as interaction effect of 9 combinations between 3 variables of both studied factors.

IV.I.1. Average increase in shoot length:

A- Specific effect:

Regarding the specific effect of the NPK soil added rate, data in Table (1) displayed obviously that the shoot length responded specifically to the differential NPK rates during both 1997 and 1998 seasons. Hence, the greatest net increase in shoot length was significantly gained by those Le-Conte pear trees supplied with $N_2P_2K_2$ treatment viz. 2.0 kg from each nutrient element source divided to be soil added at two equal doses in early Feb. and early May, followed by those of the $N_1P_1K_1$ treated trees (1.0 kg from each NPK fertilizer applied also at 2 equal portions). On the contrary, the least increase in shoot length was statistically induced by the control trees "$N_0P_0K_0$" i.e. those received the ordinary NPK regime adopted in this region (100 kg superphosphate + 100 kg ammonium sulphate + 50 kg potassium sulphate per Feddan). The $N_0P_0K_0$ was significantly the inferior during both seasons of study.

Referring the specific effect of chelated Fe concentration in the foliar sprayed solution (0.0, 0.2 % and 0.4 %), it is quite evident from

tabulated date in Table (1) that Fe_1 and Fe_2 sprayed trees i.e. Le-Conte pear trees sprayed twice with iron sequestereted – 12% solution at either 0.2 or 0.4 % concentrations, respectively surpassed statistically the Fe_0 sprayed trees (water sprayed ones). On the other hand, differences in the net increase of shoot length due to Fe concentration in spray solution were less pronounced than those previously discussed with the NPK applied rate whereas difference between Fe_1 and Fe_2 sprayed trees was so slight to reach level of significance in the first season.

B- Interaction effect:

As for the interaction effect of the various combinations between the various variables of both investigated factors on shoot length increase of Le- Conte pear trees, data in Table (1) revealed clearly that the specific effect of each factor (NPK rate and Fe concentration) was directly reflected on their combinations during both seasons of study. Since the combinations between the $N_2P_2K_2$ soil application rate from one hand and the Fe foliar spray at either Fe_1 or Fe_2 "especially later concentration" exhibited statistically the greatest value in shoot increase of Le-Conte pear trees. However, ($N_2P_2K_2 \times Fe_2$) was relatively more effective than ($N_2P_2K_2 \times Fe_1$) but difference did not reach level of significance during both seasons. Moreover the ($N_2P_2K_2 \times Fe_0$) ranked statistically second then followed by both combinations of ($N_1P_1K_1 \times Fe_2$) and ($N_1P_1K_1 \times Fe_1$). In addition, the control trees of Le-Conte pear cv. i.e. that supplied with the ordinary NPK treatment and received no chelated iron (water sprayed/Fe_0) was statistically the inferior as exhibited the least value of shoot increase during two seasons of study.

Meanwhile other combinations were in between the aforesaid discussed combinations.

The present results are in general agreement with those found by **Kabel et al (1981); Mohsen (1985)** on Thompson seedless grapevines. **Abbass and Said (1988) and Awad and Atawia (1995)** on Le-Conte pear trees, who found that spraying trees with Fe resulted in increasing the shoot length. Meanwhile, as for the influence of NPK level present result goes in the line of **Janjic (1978); Tattini et al (1986); Hegazy and Kilany (1987); Kilany and Kilany (1991); Hipps (1992) and Mekhael (1994)** on apple and peach trees. They indicated that shoot length significantly increased by increasing the rate of NPK fertilization.

IV.I.2. Average number of leaves per shoot:

A- Specific effect:

Table (1) shows clearly that the average number of leaves per shoot responded specifically to the rate of NPK soil surface applied. Whereas the same trend previously found with the net increase of shoot length was also detected in this regard. In other words, the $N_2P_2K_2$ was the superior followed statistically in a descending order by $N_1P_1K_1$ and $N_0P_0K_0$, whereas the ordinary NPK fertilization "$N_0P_0K_0$" showed the least number of leaves/shoot. Such trend was true during both 1997 and 1998 seasons.

Concerning the specific effect of the Fe concentration, data in Table (1) displayed that the number of leaves per shoot slightly

responded, whereas differences in most cases were not significant and could be safely neglected except in 1998 season when the Fe_2 sprayed trees were cpmpared to those sprayed with either Fe_1 or Fe_2 solutions. However, it could be generally observed that the Fe_2 sprayed trees induced shoots had relatively higher number of leaves than those of the two other Fe spray solutions.

B- Interaction effect:

With respect to the interaction effect of the various (NPK × Fe) combinations on the number of leaves per shoot, data in Table (1) revealed obviously that the highest number of leaves per shoot was always in concomitant with those three combinations between the $N_2P_2K_2$ from one hand and any the Fe_0, Fe_1 or Fe_2 from the other. This trend reflected clearly the lower response to Fe concentration in spray solution rather than NPK application rate in this concern. On the other hand, the reverse was true with those combinations between the ordinary NPK program adopted in Kalubia region ($N_0P_0K_0$) from one side and those of either water spray Fe_0 or Fe_1, whereas both resulted significantly in the least number of leaves per shoot during both 1997 and 1998 seasons. In addition, other combinations were in between the above mentioned two extents.

The obtained data concerning the response of average number of leaves per shoot to the different levels of NPK were supported by the findings of several investigators, **Sharaf et al (1994); Gomaa et al (1994) and Khamis et al (1994)** on Nemagaurd peach and Communis

pear seedlings, they stated that number of leaves per plant was positively affected by the different treatments of NPK fertilization. As for the influence of foliar spray was concerned the present results are in line with the findings of **Awad and Atawia (1995)** on "Le-Conte" pear trees in this respect.

IV.I.3. Increase percentage in trunk diameter:

A- Specific effect:

Regarding the increase percentage in trunk thickness, data obtained during both 1997 and 1998 seasons revealed clearly that the response to specific effect of both investigated factors followed a firmer trend. Hence the greatest percentage was resulted by the $N_2P_2K_2$ treatment followed statistically in a descending order by $N_1P_1K_1$ and $N_0P_0K_0$. On the other hand, the increase percentage in trunk diameter of Le-Conte pear trees gained annually responded specifically to the various Fe foliar spray solutions. Whereas Fe_2 foliar spray treatment was statistically the superior, while the reverse was true with the Fe_0 "no iron spray/water spray". Moreover, the foliar spray with the iron sequestereted –12% solution at 0.2% "Fe" ranked statistically second as compared to either the superior treatment "Fe_2" or the inferior one "Fe_0" during both 1997 and 1998 seasons.

B- Interaction effect:

With regard to the interaction effect of the various combinations between the three variables of each investigated factor, data in Table (1) displayed obviously that the highest percentage of increase in trunk diameter was in closed relationship with those trees received the $N_2P_2K_2$ combined with Fe_2 or Fe_1 spray solutions during two seasons or 1st season only, respectively. The opposite was detected by those supplied with the ordinary NPK program adopted in Kalubia region "$N_0P_0K_0$" combined with either Fe_0 or Fe_1 during both seasons. Since those two combinations "$N_0P_0K_0$ x Fe_0/Fe_1" exhibited statistically the least increase % in trunk diameter during both 1997 and 1998 seasons. In addition, other combinations were in between in spite of the combinations between $N_2P_2K_2$ from one hand and the Fe_0 and Fe_1 from the other tended statistically to be more effective, followed by those of $N_1P_1K_1$ combined with either Fe_1 or Fe_2 foliar spray application.

These results are confirmed with that reported by **Catzeflis (1971); Fielder (1975); Neilson et al (1984); Sharma and Awasthi (1987) and Ystaas (1990)** concerning the effect of NPK soil application, they mentioned that trunk diameter was increased by increasing the rate of NPK application. However, the obtained results on the influence of Fe foliar sprays go in line with those mentioned by **Abbass and Said (1988) and Awad and Atawia (1995).**

Table (1): Increase in shoot length, trunk diameter and average number of leaves per shoot of Le-Conte pear trees as influenced by soil added level of NPK fertilizers; concentration of Fe spray solution and their possible combinations during 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	Net increase in shoot length "cm"				Average No. of leaves/shoot				Increase % in trunk diameter			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_0P_0K_0$	76.30f	85.50ef	95.70df	**85.80C**	12.00c	12.00c	13.00bc	**12.30C**	0.71f	0.76f	0.82e	**0.76C**
2- $N_1P_1K_1$	103.10cd	110.20bc	113.60bc	**109.00B**	13.30b	13.00bc	13.30b	**13.20B**	1.74d	1.96c	2.01c	**1.90B**
3- $N_2P_2K_2$	118.50ab	122.60ab	127.00a	**122.7A**	14.30a	15.00a	15.00a	**14.80A**	2.36b	2.59a	2.64a	**2.53A**
Mean**	**99.30B**	**106.10A**	**112.00A**		**13.20A**	**13.30A**	**13.80A**		**1.6C**	**1.76B**	**1.83A**	
	1998 season											
1- $N_0P_0K_0$	91.70e	96.90df	102.00d	**96.80C**	10.00d	11.00cd	13.00ab	**11.30C**	0.94f	1.02f	1.18e	**1.05C**
2- $N_1P_1K_1$	114.01c	121.00bc	126.80b	**120.60B**	12.30bc	12.30bc	12.70ab	**12.40B**	2.36d	2.39cd	2.50c	**2.42B**
3- $N_2P_2K_2$	124.50b	136.10a	142.10a	**134.20A**	13.70ab	14.00a	14.00a	**13.90A**	2.86b	2.95b	3.13a	**2.98A**
Mean**	**110.10C**	**118.00B**	**123.60A**		**12.00B**	**12.44B**	**13.22A**		**2.05C**	**2.12B**	**2.27A**	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**

IV.I.4- Leaf dimensions:

A-Specific effect:

Regarding the specific effect of the NPK soil applied level, data obtained during both 1997 and 1998 seasons as shown in Table (2) revealed that both leaf dimensions i.e, length and width were significantly influenced. The greatest value of both leaf measurements (length and width) was in closed relationships with the highest NPK rate "$N_2P_2K_2$", while the opposite was generally coupled with the $N_0P_0K_0$-treated trees "supplied with the ordinary fertilization program of nitrogen, phosphorus and potassium adopted". On the other hand the response of leaf length was not only more pronounced but also followed a firmer trend as compared to the analogous one exhibited with leaf width. Whereas, the differences in leaf length were significant as the three $N_0P_0K_0$; $N_1P_1K_1$ and $N_2P_2K_2$ fertilization treatments were compared each other during both seasons. Meanwhile, differences in leaf width were so slight to reach level of significance as the $N_1P_1K_1$ was compared to either $N_2P_2K_2$ or $N_0P_0K_0$ during the 1997 and 1998 seasons, respectively.

Nevertheless, the response to specific effect of the concentration of the "chelated iron sequestrated- 12%" in the foliar spray solution was relatively less pronounced. Hence, the differences in most cases could be safely neglected especially as the water spray treatment (Fe_0) was compared to the foliar sprayed trees with Fe solution at 0.2% (Fe_1),

whereas differences were not significant in both leaf dimensions during both seasons of study. The only exception was detected as the leaf length of the Fe_2 sprayed trees was compared to that of the control/water sprayed trees "Fe_0" whereas difference was significant

B-Interaction effect:

Referring the interaction effect of the various NPK levels x Fe concentrations of spray solutions on the leaf dimensions of Le-conte pear trees, Table (3) shows clearly the slight influence. Since, most combinations were equally effective from the standpoint of statistic with few exceptions represented by the ($N_0P_0K_0$ x Fe_0) and $N_0P_0K_0$ combined with any other Fe solution which depressed statistically the extension of both leaf dimensions during 1997 and 1998 seasons, respectively.

Such slight influence of various NPK x Fe combinations may be attributed to the direct reflection of the specific effect of each investigated factor that approximately induced the same rate of response.

These results are in accordance with the findings of **Sharma and Singh (1980) on peach; Rezeto (1984); Raesse (1990) and Mekhael (1994)** on apple trees as for the influnce of NPK soil applied rate. Meanwhile, a similar observations were achieved by **Mohsen (1985)** on Thompson seedless grapevines and **Awad and Atawia (1995)** on Le-Conte pear trees with respect of the influence of Fe foliar sprays on leaf dimensions.

IV.I.5- Leaf shape index:

A- specific effect:

Table (2) shows that the leaf shape index (L/w) of Le-Conte pear trees was generally responded to specific effect of the NPK level. Since, the leaf blade tended to be slightly olbonged as the NPK applied rate was increased. In other words $N_2P_2K_2$ treated trees induced significantly the greatest value of leaf length : leaf width ratio "shape index" as compared with the analogous values of either the $N_0P_0K_0$ or $N_1P_1K_1$ treated trees. On the other hand difference between $N_0P_0K_0$ and $N_1P_1k_1$ treatment was so little especially in the second season, whereas both showed the same effectiveness from the standpoint of statistic.

As for the specific effect of the Fe concentration in foliar-sprayed solution, data obtained leaf during two seasons displayed that the more Fe concentration the most oblonged leaf was observed. Moreover, both Fe_0" water spray" and Fe_1 "0.2% iron sequestreted-12% solution" did not significantly differ pertaining their specific effect on the leaf shape index (L: W). Such trend was true during both 1997 and 1998 seasons.

B-Interaction effect:

Table (2) shows clearly that differences in the leaf shape index of Le-Conte pear trees due to the interaction effect of various combinations between the two investigated factors "NPK rate x Fe concentration" had generally a comparable values. Hence Le-Conte pear trees in most cases during 1997 season induced leaves had significantly the same shape

index value except those received both treatments of $N_0P_0K_0$ combined with either Fe_0 or Fe_1, which both statistically depressed the obligation tendency of leaf blade than the seven other NPK x Fe combinations. Moreover, in 1998 season the response of leaf shape index to the various NPK x Fe combinations did not follow a firm trend. This may be due to the unparallelled rate of response exhibited in both leaf dimensions to a given variable of the same investigated factor whereas any of leaf length or width showed its own rate of response to each individual combination.

Generally, the present results in most cases are in a partial agreement with these mentioned by some investigators **Cain (1955)** **Negrila et al (1968)** on apple trees for the influence of NPK spoil applied rate.

Table (2): Leaf dimensions and its shape index of Le-Conte pear trees in response to NPK soil added rate combined with Fe foliar spray application during two successive 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf length (L.) in cm.				Leaf width (W) in cm.				Leaf shape index (L/W).			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_0P_0K_0$	8.20b	8.60b	9.70a	**8.83C**	5.40b	5.70a	5.90a	**5.57B**	1.51b	1.52b	1.64a	**1.56C**
2- $N_1P_1K_1$	9.20a	9.37a	9.33a	**9.30B**	5.80a	5.83a	5.87a	**5.83A**	1.59a	1.61a	1.59a	**1.59B**
3- $N_2P_2K_2$	9.67a	9.67a	9.80a	**9.71A**	5.97a	5.93a	5.97a	**5.96A**	1.62a	1.62a	1.64a	**1.63A**
Mean**	**9.02B**	**9.21B**	**9.61A**		5.72B	5.82AB	5.91A		**1.57B**	**1.58B**	**1.62A**	
	1998 season											
1- $N_0P_0K_0$	8.60f	9.00ef	9.20ef	**8.93C**	5.63c	5.80bc	6.00a-c	**5.81B**	1.53e	1.55d	1.62a	**1.57B**
2- $N_1P_1K_1$	9.30c-e	9.53b-d	9.53b-d	**9.46B**	5.90a-c	5.90a-c	5.97a-c	**5.92B**	1.57c	1.54de	1.59b	**1.57B**
3- $N_2P_2K_2$	9.80a-c	9.87ab	10.23a	**9.97A**	6.20ab	6.23a	6.30a	**6.24A**	1.58bc	1.58bc	1.62a	**1.59A**
Mean**	**9.23B**	**9.47AB**	**9.66A**		5.91A	5.98A	6.09A		**1.56B**	**1.56B**	**1.61A**	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**

IV.I.6- Leaf dry weight and area measurements:

The leaf dry weight, leaf area and leaf area factor of Le-Comte pear trees as affected by the specific and interaction effects of NPK soil applied level and Fe concentration of foliar spray solutions, as well as their combinations during two 1997 and 1998 seasons were the three growth measurements concerned in this respect. Data obtained during both seasons of study are tabulated in Table (3).

A-specific effect:

Referring the dry weight and area of Le-Conte pear leaf in response to specific effect of NPK soil added rate, Table (3) shows clearly that both growth measurements followed typically the same trend during two seasons of study. Whereas, the highest value of both characteristics was significantly in concomitant to the $N_2P_2K_2$ treated trees "provided with 2 kg from each N, P, K fertilizer". The opposite was found with those trees subjected to the ordinary NPK fertilization treatment adopted in the region "$N_0P_0K_0$". However, the decrease exhibited by the $N_0P_0K_0$ treated trees was significant as both blade area and dry weight were compared to those of either $N_1P_1K_1$ or $N_2P_2K_2$ treated trees during two seasons of study.

On the other hand leaf area factor (leaf area ÷ "length × width"/2) did not respond specifically to the NPK applied level. Whereas, differences were so little to be significant during two seasons of study.

As for the specific effect of concentration of the iron sequestrated –12% sprayed solution, Table (3) shows that both area and dry weight of pear leaf followed the same trend during both 1997 and 1998 seasons. Such trend revealed that the Fe_0 treated trees "water sprayed ones" induced leaves each had significantly the lightest weight and smallest area espaesially as compared to those of the Fe_2 sprayed trees. Moreover, the Fe_1 sprayed trees were in between, however differences in most cases were insignificant as compared to those subjected to either Fe_0 or Fe_2 solutions.

Meanwhile the leaf area factor was less responsible to the Fe concentration, whereas all Fe variables i.e., Fe_0; Fe_1 and Fe_2 showed statistically the same effectiveness in this regard.

B-Interaction effect:

Concerning the interaction effect of various NPK x Fe combinations on both leaf parameters of dry weight and area, Table (3) indicates that the more pronounced response to NPK level than the Fe concentration was obviously reflected on their combinations. Hence, the three combinations of the $N_2P_2K_2$ soil applied level regardless of the concentration of the iron sequestrated sprayed solution exceeded statistically all the other NPK x Fe combinations. On the contrary the combinations between the $N_0P_0K_0$ from one hand and any Fe concentration especially both Fe_0 and Fe_1 were statistically the inferior. Moreover, other combinations were in between with relatively variable tendency of response.

As for the leaf area factor, Table (3) shows clearly that all combinations were equally effective except the $N_0P_0K_0$ x Fe_0 treatment which decreased it statisiically during both seasons of study.

The obtained result regarding the response of leaf dry weight, leaf area and leaf area factor to NPK soil applied level are coincident with that mentioned by **Luddurs and Bunemann (1969 a & b); Oud (1970); Tattini et al (1986); Kilany and Kiany (1991); Khamis et al (1994); and Sharaf et al (1994)**; on apple, pear and peach. They indicated that the above mentioned measurements i.e. Leaf dry weight and leaf area were increased by increasing the level of NPK fertilization. However, the trend of response to the Fe foliar sprays goes in line with those reported by **Mohsen (1985); Guyl-Akhmedov and Gasanova(1990); and Awad and Atawia (1995)** on grapevine, apple and pear trees, respectively.

Table (3): Leaf dry weight, leaf area and leaf area factor of Le-Conte pear trees as affected by soil application rate of NPK fertilizers combined with Fe foliar spray application in 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf dry weight (mg.)				Leaf area (cm2) .				Leaf area Factor			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_0P_0K_0$	267.00d	279.00cd	307.00bc	**284.30C**	22.86c	22.97c	25.62b	**23.82C**	0.71b	0.73b	0.78a	**0.74A**
2- $N_1P_1K_1$	298.00bc	307.00bc	311.00ab	**305.30B**	25.88b	25.93b	26.28b	**26.03B**	0.78a	0.76a	0.76a	**0.77A**
3- $N_2P_2K_2$	328.00ab	340.00a	341.00a	**336.40A**	27.83a	27.90a	27.86a	**27.86A**	0.78a	0.79a	0.79a	**0.79A**
Mean**	**297.70B**	**308.80AB**	**319.70A**		**25.27B**	**25.60B**	**26.58A**		**0.76A**	**0.76A**	**0.78A**	
	1998 season											
1- $N_0P_0K_0$	259.00b	262.00b	274.00b	**265.00B**	23.98c	25.12c	26.54b	**25.21C**	0.74b	0.78ab	0.80a	**0.77A**
2- $N_1P_1K_1$	277.00b	281.00b	286.00ab	**281.00B**	27.51b	27.57b	27.68b	**27.59B**	0.79a	0.79a	0.77ab	**0.78A**
3- $N_2P_2K_2$	326.00a	295.00ab	299.00ab	**307.00A**	29.17a	29.46a	30.06a	**29.56A**	0.76ab	0.76ab	0.76ab	**0.76A**
Mean**	**287.00A**	**279.00A**	**286.00A**		**26.89B**	**27.38AB**	**28.09A**		**0.76A**	**0.78A**	**0.78A**	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**

IV-II- Response of nutritional status "mineral composition":

In this regard leaf mineral content of Le-Conte pear trees as influenced by the differential N; P; K and Fe fertilization treatments were investigated. The leaf N; P; K; Ca; Mg; Fe; Zn; Mn and Cu contents estimated each either as an absolute value per an individual leaf (mg/leaf) or as a ratio on the dry weight base (% for the five macroelements and ppm for the four microelements were concerned). Data obtained during both 1997 and 1998 seasons were tabulated in Tables (4); (5); (6); (7); (8); (9); (10); (11) and (12) for N; P; K; Ca; Mg; Fe; Mn; Zn and Cu, respectively.

IV-II-1- Leaf nitrogen content

A. Specific effect

With regard to the leaf N content of Le-Conte pear trees in response to specific effect of NPK soil applied rate. Table (4) shows that nitrogen was increased significantly by raising the applied rate. The richest leaves in their nitrogen content was statistically coupled with those $N_2P_2K_2$ applied trees followed in a descending order by those of $N_1P_1K_1$ and $N_0P_0K_0$ treatments, whereas leaves of the latter level were significantly the poorest. Such trend was true during both 1997 and 1998 seasons regardless of nitrogen content was estimated as either a percentage of the leaf dry matter or absolute value "mg/leaf".

As for the response to specific effect of Fe concentration, data obtained revealed that spraying chelated iron – sequestereted –12% increased significantly the leaf N content than the control "Fe_0/water spray". However, differences were more pronounced as the Le-Conte pear trees were provided with iron – sequestereted –12% at the higher concentration (Fe_2/0.4 %). In other words Fe_2 – sprayed trees induced statistically the richest leaves in their N content as compared to either Fe_0 – sprayed trees "water sprayed" during both 1997 and 1998 seasons or the Fe_1 sprayed ones during the second (1998) season. Such trend was detected as the level of N content was expressed either as a percent or an absolute value. However, the rate of increase in leaf N content was relatively higher as N content was estimated in mg/leaf. This variance in changes of leaf N content according to the estimation base may be logically explained on such fact that the accummulation rate of dry matter in leaves was more responsible to Fe spray application than the N content itself.

B- Interaction effect:

Concerning the interaction effect of various NPK and Fe combinations on leaf N content of Le-Conte pear trees, data in Table (4) displayed clearly that the specific effect of each investigated factor was reflected on interaction effect of its combinations. Hence, the Le-Conte pear trees subjected to the ($N_2P_2K_2$x Fe_2) combination induced leaves with the highest N content. Meanwhile, the combinations between the same soil applied NPK rate "$N_2P_2K_2$"and the two other Fe spray treatments "Fe_0 and Fe_1" ranked second to the aforesaid superior

combination ($N_2P_2K_2$ xFe_2) in spite of differences did not reach level of significance in most cases of estimating N content as % of leaf dry weight, but with the measurement of mg per leaf differences became significant. Moreover, combinations between the ordinary NPK adopted program "$N_0P_0K_0$" and either the water spray "Fe_0" or the Fe_1 (iron-sequestereted–12 % spray solution at 0.2 % concentration) were statistically the inferior as both showed significantly the lowest N content, regardless of estimation method (% or mg/leaf). In addition, other combinations were in between with a slight tendency of variability in their effectiveness.

The obtained data regarding the response of leaf nitrogen content to NPK soil application rate are in agreement with those reported by many investigators, **Sadoweski et al (1990); Ystaas (1990); Mekhael (1994); Sharaf et al (1994 and Kabeel et al (1998).** They indicated that a significant increase in leaf N content was increased with nitrogen application rates in some deciduous fruit trees.

Furthermore, influence of Fe foliar spray of Le-Conte pear trees obtained data are in accordance with findings of **Abbass and Said (1988); Awad and Atawia (1995) and Di-Nardo et al (1995),** they mentioned that Le-Conte pear trees sprayed with different iron concentrations resulting in the highest leaf N content.

Table (4): Leaf nitrogen content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf N content							
	% on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	1.80f	2.00e	2.10de	**1.97C**	5.34f	5.53f	5.86ef	**5.58C**
2- $N_1P_1K_1$	2.20cd	2.33bc	2.37b	**2.30B**	6.55de	7.14cd	7.14c	**7.01B**
3- $N_2P_2K_2$	2.57a	2.63a	2.70a	**2.63A**	8.39b	8.81ab	9.20a	**8.80A**
Mean**	**2.19B**	**2.32A**	**2.39A**		**6.76B**	**7.16A**	**7.47A**	
	1998 season							
1- $N_0P_0K_0$	2.00g	2.10g	2.30f	**2.13C**	5.44f	5.48f	6.03e	**5.66C**
2- $N_1P_1K_1$	2.43ef	2.53de	2.60cd	**2.52B**	6.73d	7.11cd	7.42c	**7.09B**
3- $N_2P_2K_2$	2.73bc	2.80ab	2.93a	**2.82A**	8.01b	8.25b	8.76a	**8.34A**
Mean**	**2.39B**	**2.48B**	**2.61A**		**6.73B**	**6.95B**	**7.40A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-2-Leaf phosphorus content:

A- Specific effect:

Table (5) shows obviously that leaf phosphorus content of Le-Conte pear trees responded specifically to the soil applied rate of N, P, K fertilizers. The $N_2P_2K_2$ treated trees had leaves contained the highest phosphorus level, while the least leaf P content was in closed relationship to the control trees "subjected to the ordinary "$N_0P_0K_0$" treatment. Such trend was true during both 1997 and 1998 seasons either the leaf content was estimated as percentage of dry matter or as an absolute value "mg./leaf". The differences were significant as leaf P content of trees received any of the $N_0P_0K_0$; $N_1P_1K_1$and $N_2P_2K_2$ treatments were compared each other.

As for the specific effect of concentration of iron – sequestereted – 12% in foliar spray solution, data obtained during both seasons displayed clearly that the response was completely absent from the stand point of statistic. In other words, leaf P content of Le-Conte pear trees sprayed with Fe_0 "water spray" Fe_1 (iron sequestereted-12 % at 0.2 % concentration) or Fe_2 "0.4% concentration" were statistically the same irrespective of estimation method used for determining the concerned nutrient element.

B- Interaction effect:

Referring the interaction effect of the various NPK x Fe combinations on the leaf phosphorus content of Le-Conte pear trees, data tabulated in Table (5) declared that the various $N_2P_2K_2$ combinations exhibited generally the greatest value during both seasons of study. However, the $N_2P_2K_2$ treated trees which sprayed with the omitted Fe solution "Fe_0/water spray" tended to be relatively more effective than the two other $N_2P_2K_2$ combinations, especially as P content was expressed as mg./leaf during the second season whereas difference was significant. On the contrary Le-Conte pear trees received the ordinary NPK program adopted in the region "$N_0P_0K_0$" irrespective of they were sprayed with the Fe solution at either 0.2 % or 0.4% concentration as well as those completely deprived from Fe application "Fe_0/water spray" induced significantly the poorest leaves in their P content. Such trend was true during both 1997 and 1998 seasons. In addition, other NPK x Fe combinations i.e., $N_1P_1K_1$ x Fe_0; $N_1P_1K_1$ x Fe_1 and $N_1P_1K_1$ x Fe_2 were intermediate as compared to the abovementioned two extents.

The obtained results are confirmed with the findings of **Boynton and Compton (1944); Tayler and Goubran (1975 a &b); Shelton (1976); Raese et al (1984) and Gomaa et al (1994)** on some deciduous fruit trees regarding the influence of NPK soil applied rate. However, a similar observation was achieved by **Dekock et al (1974) and Kabeel et al (1998)** on Le-Conte pear trees with regard to the response of leaf phosphorus content to Fe foliar spray.

Table (5): Leaf phosphorus content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf P content							
	% on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	0.13d	0.13d	0.14cd	**0.13B**	0.35c	0.39bc	0.40bc	**0.38C**
2- $N_1P_1K_1$	0.15bc	0.14cd	0.13d	**0.14B**	0.44b	0.43b	0.39bc	**0.42B**
3- $N_2P_2K_2$	0.18a	0.16ab	0.17ab	**0.17A**	0.58a	0.55a	0.57a	**0.57A**
Mean**	**0.15A**	**0.14A**	**0.14A**		**0.46A**	**0.46A**	**0.45A**	
	1998 season							
1- $N_0P_0K_0$	0.14e	0.14e	0.15df	**0.14C**	0.36f	0.38e	0.39e	**0.38C**
2- $N_1P_1K_1$	0.17bc	0.17bc	0.16cd	**0.17B**	0.47d	0.47d	0.46d	**0.47B**
3- $N_2P_2K_2$	0.19a	0.18ab	0.17bc	**0.18A**	0.56a	0.54b	0.52c	**0.54A**
Mean**	**0.17A**	**0.16A**	**0.16A**		**0.46A**	**0.46A**	**0.46A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-3- Leaf potassium content:

A- Specific effect:

Regarding the leaf K content of Le-Conte pear trees in response to specific effect of NPK soil added rates, it is quite evident from Table (6) that a firm trend was obviously detected. Since, the highest NPK level added the greatest leaf K content was obviously recorded, while the opposite was true with the lowest NPK added rate i.e., the ordinary norm adopted in the region [$N_0P_0K_0$/100kg per Feddan from ammonium sulphate (20.6%) and 50 kg per Feddan from potassium sulphate (48%)]. Moreover, differences were significant between the three NPK investigated rates. Such trend was detected during both 1997 and 1998 seasons regardless of the base of estimation leaf potassium content i.e. as either % of dry weight or mg./leaf.

As for the response to specific effect of Fe concentration in iron-sequestereted-12 % spray solution, it was clear that leaf K content responded significantly. Whereas, the potassium level was generally raised with increasing Fe concentration. Differences were significant as the water sprayed trees (Fe_0 treatment) were compared to either the Fe_1 or Fe_2 sprayed trees. Moreover, the Fe_2 spray solution (0.4 % iron sequestereted-12% solution) was significantly more effective than the Fe_1 (0.2 % concentration). Such trend was so firmer during both seasons of study as the two ways of estimating leaf K content were taken into

consideration in spite of the rate of response was more pronounced with estimating leaf K content in mg./ leaf.

B- Interaction effect:

Concerning the interaction effect resulted by the various combinations of the three investigated levels of both NPK soil added and Fe foliar spray solution, data in Table (6) revealed that specific effect of both factors under study reflected directly on their interaction effect. Hence, the combinations between the highest NPK soil added rate i.e. $N_2P_2K_2$ from one hand and Fe spray solution at either 0.4 % (Fe_2) or 0.2% (Fe_1) from the other exhibited statistically the greatest leaf K content during both seasons and the second season for both combinations, respectively. Moreover both combinations of "$N_2P_2K_2$ x Fe_0) and ($N_1P_1K_1$ x Fe_2) descindingly, ranked second/third and third or fourth, whereas differences between the aforesaid 2 superior combinations and the two latter ones were significant either each compared to the three other combinations or two combinations of each category compared to both of the other one. The superiority of both ($N_2P_2K_2$ x Fe_1) and ($N_2P_2K_2$ x Fe_0) combinations rather than the ($N_1P_1K_1$ x Fe_2) could be logically explained on that fact based on the more pronounced effectiveness of NPK applied rather than the concentration of Fe spray solution. Moreover, this explanation is supported by the previously discussed trends of response to the NPK and Fe application from one hand and it may be due to the potassium soil added and its absorption that consequently will be reflected certainly on its accummulation rate in leaves from the other side.

Nevertheless, the poorest leaves in their potassium content were closely related to the ($N_0P_0K_0$ x Fe_0) and to great extent the ($N_0P_0K_0$ x Fe_1). In addition, other combinations were in between. Such trend was true during both 1997 and 1998 seasons, regardless of the base on which potassium content was expressed. However in some cases especially as compared both combinations of the inferior NPK x Fe category each other. Whereas differences in leaf K content expressed as mg/leaf were not significant when the interaction effect of ($N_0P_0K_0$ x Fe_0) and ($N_0P_0K_0$ x Fe_1) were compared during both 1997 and 1998 seasons.

The obtained results concerning the response of leaf K content of Le-Conte pear trees to the NPK soil applied level were supported by the findings of several investigators, **Titus and Boynton (1952); Bondarenko (1971); Holland et al (1975); Awasthi et al (1997) and Attala (1998)** on apple trees. They indicated that the leaf K content increased by increasing the rate of the NPK soil applied. However, the influence of the Fe foliar spray was in harmony with that mentioned by **Dekock et al (1974); Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees.

Table (6): Leaf potassium content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf K content							
	% on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	1.12f	1.24e	1.27e	**1.21C**	3.39f	3.44f	3.46f	**3.43C**
2- $N_1P_1K_1$	1.43d	1.54c	1.64c	**1.54B**	4.26e	4.73d	5.08c	**4.69B**
3- $N_2P_2K_2$	1.79b	1.92a	1.99a	**1.90A**	5.84b	6.50a	6.77a	**6.37A**
Mean**	**1.45C**	**1.57B**	**1.63A**		**4.50C**	**4.90B**	**5.10A**	
	1998 season							
1- $N_0P_0K_0$	1.20h	1.29g	1.38f	**1.29C**	3.29h	3.38gh	3.57g	**3.41C**
2- $N_1P_1K_1$	1.41ef	1.48e	1.58d	**1.49B**	3.89f	4.15e	4.51d	**4.18B**
3- $N_2P_2K_2$	1.47c	1.88b	1.98a	**1.87A**	5.10c	5.55b	5.91a	**5.52A**
Mean**	**1.45C**	**1.55B**	**1.65A**		**4.09C**	**4.36B**	**4.66A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-4- Leaf calcium content:

A- Specific effect:

Table (7) shows that leaf Ca content was significantly responded to the investigated rate of NPK soil applied. Whereas, the highest leaf Ca level was significantly exhibited by the $N_2P_2K_2$ treated trees of Le-Conte pear cv. However, the reverse was exhibited by those trees subjected to the ordinary NPK program adopted in the region i.e., $N_0P_0K_0$ [100kg per Feddan from ammonium sulphate (20.6%) and 50 kg per Feddan from potassium sulphate (48%)]. In addition, $N_1P_1K_1$ application rate "one kg from each nutrient element source per tree" was in between. Differences were significant as each NPK rate was compared to the two other ones. Such trend was detected during both 1997 and 1998 seasons, irrespective of the base on which leaf Ca content was expressed.

Referring the specific effect of the concentration of Fe sprayed solution on the leaf Ca content of Le-Conte pear trees, data obtained during both seasons of study and tabulated in Table (7) displayed that the response was less pronounced as compared to that previously detected with the NPK soil applied rate. Although it could be generally said that the Fe_2 sprayed trees had leaves were relatively richer in their Ca content than the Fe_0 treated ones. In addition, the Fe_1 sprayed trees were not significantly different than the Fe_2 sprayed trees in most cases as their leaf Ca content was concerned.

B- Interaction effect:

The leaf Ca content of Le-Conte pear trees was obviously responded to the various (NPK x Fe) combinations, whereas the richest Leaf Ca content was achieved by those trees subjected to the ($N_2P_2K_2$ x Fe_2) and to some extent the ($N_2P_2K_2$ x Fe_1) treated trees. The superiority of the above-mentioned two combinations over the other investigated combinations was clearly observed during two seasons of study. Differences were significant either the leaf Ca content was expressed as percentage of dry matter or mg./leaf.

On the other hand, the lowest leaf Ca content was always in concomitant to those Le-Conte pear trees received the ($N_0P_0K_0$ x Fe_0) combination. In addition, other NPK x Fe combinations came in between the aforesaid two extents with variable tendency of effectiveness.

Nevertheless, the rate of changes in the leaf Ca content expressed either as % or mg./leaf showed approximately the same tendency. This could be explained logically on such fact that accummulation rates of both dry matter and calcium in leaves were typically coincident.

These results regarding the influence of NPK soil application level on leaf calcium content go in line with those obtained by **Ludders et al (1974); Shelton (1976); Bhutani and Bhatia (1986); Ferree and Cahoon (1987) and Kassem (1991)** on apple and plum trees. They indicated that NPK fertilizeation increased leaf calcium content. Meanwhile, the present data are in confirmity with those stated by **Dekock et al (1974); Awad and Atawia (1995) and Kabeel et al (1998),** they found that the same trend of leaf Ca content in response to Fe foliar spray solution was also observed.

Table (7): Leaf calcium content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray / solution / NPK soil added rate	Leaf Ca content							
	% on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	0.96g	1.12f	1.15ef	**1.07C**	2.56f	3.21e	3.44df	**3.07C**
2- $N_1P_1K_1$	1.19e	1.26d	132c	**1.26B**	3.55d	3.55d	4.11c	**3.84B**
3- $N_2P_2K_2$	1.35c	1.43b	1.51a	**1.43A**	4.43b	4.43b	5.15a	**4.81A**
Mean**	**1.17C**	**1.27B**	**1.33A**		**3.51C**	**3.98B**	**4.23A**	
	1998 season							
1- $N_0P_0K_0$	1.06f	1.17e	1.21e	**1.15C**	2.75f	3.17e	3.21e	**3.04C**
2- $N_1P_1K_1$	1.33d	1.47c	1.56b	**1.45B**	367d	4.14c	4.48bc	**4.10B**
3- $N_2P_2K_2$	1.46c	1.61ab	1.66a	**1.58A**	4.27c	4.75ab	4.97a	**4.66A**
Mean**	**1.28C**	**1.42B**	**1.48A**		**3.56B**	**4.02A**	**4.22A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV.II.5. Leaf magnesium content:

A- Specific effect:

Table (8) shows that leaf magnesium content of Le-Cont pear trees was significantly responded to the NPK soil applied rate. Whereas, the highest NPK applied rate the greatest leaf Mg content. The specific effect of NPK soil added level on the leaf Mg content was significant as any of the three NPK rates were compared each other during the two seasons of study. Hence, the $N_2P_2K_2$ treated trees had significantly the richest leaves in their Mg content, followed in a descending order by those received the $N_1P_1K_1$ rate and the control trees i.e., the $N_0P_0K_0$ treated trees "subjected to the ordinary NPK program adopted in the region" which came latest.

As for the specific effect of Fe sprayed solution, data in Table (8) revealed that, however spraying Le-Conte pear trees with Fe solution either at 0.2 or 0.4% concentrations increased the leaf Mg content over the water sprayed trees "Fe_0 spray" from one hand, but the response to the Fe concentration was less pronounced than that of the NPK applied rate.

Nevertheless, these trends of response to specific effect of either NPK soil added rate or Fe concentration in foliar spray solution were true regardless of the base on which the leaf Mg content was expressed.

B-Interaction effect:

Regarding the Leaf Mg Content of Le-Conte pear trees in response to the interaction effect of the various (NPK x Fe) combinations, Table (8) displays that the ($N_2P_2K_2$ x Fe_2) and ($N_2P_2K_2$ x Fe_1) combinations were significantly the most effective in increasing the leaf Mg content during the first 1997 season. However, during the second season (1998) the former combination ($N_2P_2K_2$ x Fe_2) was significantly the superior. On the contrary, trees subjected to the ordinary NPK adopted regime in the region and sprayed with tap water i.e. received the ($N_0P_0K_0$ x Fe_0) combination induced the poorest leaves in their Mg content. In addition, other combinations were in between the above mentioned two extents. Such trend was true during both 1997 and 1998 seasons either leaf Mg content was expressed as % of leaves dry matter or an absolute value (mg magnesium per leaf).

These results are confirmed with those reported by **Beattia and Ellenwood (1950); Boynton and Anderson (1956)** and **Ystaas (1990);** on apple trees; **Bhtani and Bhatia (1986)** on plum trees **Joolka et al (1990)** on apricot and **Kassem (1991)** on pear trees. They found that leaf Mg content was significantly increased with increasing the NPK soil application rate. Moreover, the response of leaf Mg content to the Fe foliar spray of Le-Conte pear trees, data obtained is in general agreement with the findings of **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees, they reported that a similar trend to that of present study was also observed.

Table (8): Leaf magnesium content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf Mg content							
	% on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	0.50f	0.54f	0.60e	**0.55C**	1.44d	1.54d	1.67d	**1.55C**
2- $N_1P_1K_1$	0.70d	0.78bc	0.83ab	**0.77B**	2.07c	2.37b	2.57b	**2.34B**
3- $N_2P_2K_2$	0.75cd	0.86a	0.86a	**0.82A**	2.44b	2.87a	2.93a	**2.75A**
Mean**	**0.65C**	**0.73B**	**0.76A**		**1.98B**	**2.26A**	**2.39A**	
	1998 season							
1- $N_0P_0K_0$	0.54d	0.64cd	0.66cd	**0.61C**	1.48f	1.66e	1.73e	**1.62C**
2- $N_1P_1K_1$	0.78bc	0.83b	0.90b	**0.84B**	207d	2.33c	2.58b	**2.33B**
3- $N_2P_2K_2$	0.87b	0.92b	1.11a	**0.97A**	2.54b	2.71b	2.95a	**2.74A**
Mean**	**0.73B**	**0.80B**	**0.89A**		**2.03C**	**2.23B**	**2.42A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-6- Leaf iron content:

A- Specific effect:

Concerning the leaf content of Le-Conte pear trees in response to the specific effect of the NPK soil applied rate, it is obvious from the results of Table (9) that leaf Fe content was increased significantly by increasing the applied rate of the NPK soil added. The highest value of leaf Fe content was significantly in concomitant to the $N_2P_2K_2$ treated trees "supplied with 2 kg from each N, P and K fertilizer", while the opposite was true with those subjected to the lowest NPK added rate i.e. the ordinary adopted in the region "$N_0P_0K_0$". Such trend was true during both 1997 and 1998 seasons, regardless of the base on which leaf Fe content was estimated (% of leaf dry weight or mg./leaf).

Referring the specific effect of the Fe concentration, data obtained during both seasons displayed clearly that spraying the chelated iron – sequestereted - 12%, increased significantly the leaf Fe content as compared to the water sprayed trees "Fe_0 treatment".

However, differences were more pronounced as the Le-Conte pear trees were provided with iron – sequestereted - 12% at the higher concentration (Fe_2/0.4 %). It could be noticed that, Fe_2 sprayed trees induced statistically the richest leaves in their Fe content as compared to either Fe_0-sprayed trees "water sprayed as control" or the Fe_1 sprayed ones. Such trend was detected during both 1997 and 1998 seasons either

leaf Fe content was expressed as a part per milion "ppm" or an absolute value "mg./leaf".

B- interaction effect:

With respect to the leaf Fe content of Le-Conte pear trees in response to the interaction effect of various NPK and Fe combinations, data in Table (9) shows obviously that the specific effect of each investigated factor was reflected on interaction effect of its combinations. Thus, the Le-Conte pear trees subjected to the ($N_2P_2K_2$ x Fe_2) combination induced leaves with the highest value of leaf Fe content. Meanwhile, the combination between the same NPK soil applied rate "$N_2P_2K_2$" and the Fe foliar spray application with the Fe_1 solution ranked second. Moreover, both concentrations of ($N_2P_2K_2$ x Fe_0) and ($N_1P_1K_1$ x Fe_2) came third with a tendency showed that the latter one was relatively more effective. However, such trend was generally true during both seasons of study, regardless of estimation base of leaf Fe content, but it could be noticed that difference between the ($N_2P_2K_2$ x Fe_2) and ($N_2P_2K_2$ x Fe_1) combinations were less pronounced as leaf Fe content was experssed as mg./leaf. In other words difference in leaf Fe content estimated as ppm was significant as both ($N_2P_2K_2$ x Fe_2) and ($N_2P_2K_2$ x Fe_1) combinations were compared, while it did not reach level of significance as iron was estimated as mg./leaf. Such chift in trend due to the method of estimation could be easy explained by the unparallelled rate of accummaltion of both dry matter and iron in leaves resulted by the investigated NPK Fe treatments.

On the other hand, the lowest leaf Fe content was significantly exhibited and always in concomitant to those Le-Conte pear trees received the combinations between the ordinary NPK adopted program "$N_0P_0K_0$" and any of the Fe_0 "water spray"; the "Fe_1 or Fe_2/iron sequestereted-12% solutions, regardless of estimation method (ppm or mg./leaf). In addition, other NPK x Fe combinations came in between the aforsaid two extents with a slight variable tendency of effectiveness. Such trend was true during both 1997 and 1998 seasons irrespective of the base on which leaf Fe content was expressed.

The obtained result regarding the response of leaf iron content to NPK soil applied rate are in a complete agreement with those reported by **Joolka et al (1990) on apricot trees; Kassem (1991); Mekhael (1994); Awasthi et al (1997) and Attala (1998)** on apple trees. They mentioned that a significant increase in leaf Fe content was occurred with raising the NPK applied rates. Moreover, some investigators, **Dekock et al (1974); Abbass and Said (1988); Rasee and Staiff (1988); Awad and Atawia (1995)** on pear trees, mentioned that sprayed trees with different Fe concentrations resulting in increasing leaf Fe content.

Table (9): Leaf iron content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf Fe content							
	ppm on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	168.00f	170.00f	175.00f	**171.00C**	0.05e	0.05e	0.05e	**0.05C**
2- $N_1P_1K_1$	192.00e	237.00d	252.00c	**227.00B**	0.06d	0.07c	0.08b	**0.07B**
3- $N_2P_2K_2$	247.00c	271.00b	283.00a	**267.00A**	0.08b	0.09a	0.10a	**0.09A**
Mean**	**202.00C**	**226.00B**	**237.00A**		**0.06B**	**0.07AB**	**0.08A**	
	1998 season							
1- $N_0P_0K_0$	179.00f	182.00f	188.00f	**183.00C**	0.05f	0.05f	0.05f	**0.05C**
2- $N_1P_1K_1$	215.00e	233.00d	262.00c	**237.00B**	0.06de	0.07cd	0.08ab	**0.07B**
3- $N_2P_2K_2$	238.00d	278.00b	294.00a	**270.00A**	0.07cd	0.08ab	0.09a	**0.08A**
Mean**	**211.00C**	**231.00B**	**248.00A**		**0.06B**	**0.07A**	**0.07A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-7- Leaf manganese content:

A- Specific effect:

With regard to the influence of the NPK soil added levels on leaf Mn content of Le-Conte pear trees. Table (10) shows obviously that leaf Mn content was significantly responded to the investigated rate of NPK soil supplied. However, Mn content was increased significantly by increasing the NPK added rate, whereas the richest leaves in their manganese content were statistically in closed relationship with those $N_2P_2K_2$ applied trees followed in a decending order by those of $N_1P_1K_1$ and $N_0P_0K_0$ treatments, whereas those of the latter treatment was significantly the poorest. Such trend was detected during both seasons of study, regardless of manganese content was expressed as either a part per milion of the leaf dry matter (ppm) or an absolute value "mg./leaf".

As for the specific effect of concentration of iron seqyestereted – 12% in foliar spray solution, data obtained revealed that foliar spray with either the Fe_1 or Fe_2 solutions increased significantly the Leaf Mn content than the control "Fe_0/water spray". Moreover, the increase was more pronounced as the Le-Conte pear trees were sprayed with the Fe at the higher concentration i.e., at 0.4 % (Fe_2), whereas, such trees induced statistically the richest leaves in their Mn content as compared to either Fe_0- or Fe_1 sprayed trees during both seasons of study. Such trend was true regrdless of the Mn content was expressed as a ratio of leaf dry matter base (ppm) or absolute value (mg./leaf) when the leaf Mn content of Fe_2 sprayed trees was compared to both Fe_0 and Fe_1 sprayed trees during both seasons. However, the differences in the leaf Mn content expressed as absolute value "mg./leaf" were not significant when the Fe_1

and Fe_0 sprayed trees were compared during both 1997 and 1998 seasons of study.

B- Interaction effect:

Leaf Mn content of Le-Conte pear trees was obviously responded to the various (NPK x Fe) combinations, data tabulated in Table (10) displayed clearly that the various $N_2P_2K_2$ combinations increased generally its level during both seasons of study. Whereas, the richest leaf Mn content expredded as ppm was achieved by those trees subjected to the ($N_2P_2K_2$ x Fe_2) combination. Moreover, combinations of ($N_2P_2K_2$ x Fe_1); ($N_1P_1K_1$ x Fe_2) and ($N_1P_1K_1$ x Fe_1) were equally effective and surpassed statistically the other (NPK x Fe) combination for increasing leaf Mn content. Contrary to combinations of the $N_0P_0K_0$ especially as asseciated with the Fe_0 spray were statistically the inferior regardless of estimation method of Mn content. In addition, other combinations were in between with a slight tendency of variability in their effectiveness. Such trend was detected during both 1997 and 1998 seasons regardless of estimation method used in this respect.

Data obtained on the influence of NPK level on leaf Mn content are in general agreement with those mentioned by **Janje and Ko (1985); Johanson and Samuleson (1990); Kassem (1991); Mekhael (1994) and Sharaf et al (1994).** They indicated that leaf Mn content significantly increased by increasing the rate of NPK application. Meanwhile, the beneficial effect of Fe foliar spray on raising Mn content is in general agreement with those found by **Abbass and Said (1988); Awad and Atawia (1995) and Kabeel et al (1998)** from their working on pear trees as they indicated that spraying trees with Fe resulted in increasing leaf Mn content.

Table (10): Leaf manganese content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf Mn content							
	ppm on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	30.00g	38.00f	42.00f	**37.00C**	0.008b	0.011b	0.013b	**0.011B**
2- $N_1P_1K_1$	52.00e	63.00d	75.00c	**63.00B**	0.016b	0.020ab	0.023ab	**0.020A**
3- $N_2P_2K_2$	57.00e	81.00b	88.00a	**75.00A**	0.019b	0.028a	0.028a	**0.025A**
Mean**	**46.00C**	**61.00B**	**68.00A**		**0.014B**	**0.020A**	**0.021A**	
	1998 season							
1- $N_0P_0K_0$	32.00f	35.00f	36.00f	**34.00C**	0.008b	0.009b	0.010b	**0.009B**
2- $N_1P_1K_1$	48.00e	55.00d	65.00c	**56.00B**	0.013b	0.016b	0.021ab	**0.017A**
3- $N_2P_2K_2$	55.00d	83.00b	89.00a	**76.00A**	0.016b	0.025ab	0.027a	**0.023A**
Mean**	**45.00C**	**59.00B**	**64.00A**		**0.013A**	**0.016A**	**0.019A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-8- Leaf zinc content:

A- Specific effect:

Regarding the leaf Zn content of Le-Conte pear trees in response to specific effect of NPK soil applied levels, it is quite evident from Table (11) that the $N_2P_2K_2$ treated trees had leaves contained the greatest leaf Zn content, while the opposite was true with those trees subjected to the ordinary NPK regime adopted in the region "$N_0P_0K_0$". The differences were significant as leaf Zn contents of trees received any of the $N_0P_0K_0$; $N_1P_1K_1$ and $N_2P_2K_2$ treatments were compared each other. Such trend was detected during both 1997 and 1998 seasons either the leaf Zn content was estimated as part per milion of the leaf dry matter (ppm) or as an absolute value "mg./leaf", however differences were so easy to be distinguished as zinc content was expressed as ppm.

As for the specific effect of concentration of iron sequestereted-12% in foliar spray solution, it could be noticed clearly from data represented in the same Table during both seasons of study that leaf Zn content responded significantly. However, Zn level was generally raised with increasing Fe concentration. Moreover, the Fe_2 spray solution was significantly more effective than the Fe_1 solution in most cases. The differences were significant as the water sprayed trees (Fe_0 treatment) were compared to either the Fe_1 or Fe_2 sprayed trees. Such trend was true during both seasons of study as the two methods of estimating Zn content "ppm. Of leaf dry matter or mg./leaf".

B- Interaction effect:

Concerning the interaction effect of the various NPK x Fe concentration on the leaf Zn content of the Le-Contepear trees, data represented in Table (11) shows obviously that the Le-Conte pear trees subjected to either the ($N_2P_2K_2$ x Fe_2) or ($N_2P_2K_2$ x Fe_1) combinations exhibited generally the highest value of leaf Zn content during both 1997 and 1998 seasons. The superiority of the abovementioned two combinations over the other investigated ones was clearly observed during the two seasons of study. Moreover, the differences were significant either the leaf Zn content was estimated as a part per milion of the leaf dry matter "ppm" or as an absolute value "mg./leaf". On the other hand, combinations between the ordinary NPK adopted program "$N_0P_0K_0$" from one hand and any of either water spray "Fe_0" or the "Fe_1" during both seasons and "Fe_2" during second season only from the other resulted statistically in the lowest Zn content, regardless of estimation method "ppm. or mg./leaf". In addition, other NPK x Fe combinations came in between with tendency of variability in their effectiveness.

The obtained results regarding the response of leaf Zn content to the NPK soil applied rate are in accordance with findings of **Rogars (1972); Joolka et al (1990); Kassem (1991); Mekhael (1994); Sharaf et al (1994) and Awasthiet al (1997)** on some deciducus fruit species, who stated that the leaf Zn content was positively related to the NPK soil application. Meanwhile, other investigators, **Abbass and Said (1988); Awad and Atawia (1995) and Kabeel et al (1998),** reported a similar trend to that observed regarding the response of leaf Zn content to Fe foliar spray solution.

Table (11): Leaf zinc content of Le-Conte pear trees as affected by NPK soil application rate; Fe foliar spray application and their combinations during 1997and 1998 seasons.

Fe spray solution / NPK soil added rate	Leaf Zn content							
	ppm on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	20.00d	20.00d	23.00d	**21.00C**	0.005c	0.006c	0.007c	**0.006C**
2- $N_1P_1K_1$	36.00c	45.00b	48.00b	**43.00B**	0.011bc	0.014ab	0.015ab	**0.013B**
3- $N_2P_2K_2$	40.00c	54.00a	55.00a	**50.00A**	0.013ab	0.018a	0.019a	**0.017A**
Mean**	**32.00C**	**40.00B**	**42.00A**		**0.009B**	**0.012AB**	**0.013A**	
	1998 season							
1- $N_0P_0K_0$	20.00f	22.00ef	25.00e	**22.00C**	0.005e	0.006de	0.007c-e	**0.006B**
2- $N_1P_1K_1$	34.00d	44.00c	51.00b	**43.00B**	0.009b-e	0.012a-c	0.014ab	**0.012A**
3- $N_2P_2K_2$	38.00d	57.00a	55.00ab	**50.00A**	0.011a-c	0.017a	0.016a	**0.015A**
Mean**	**31.00B**	**41.00A**	**44.00A**		**0.009B**	**0.012AB**	**0.013A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV-II-8- Leaf cupper content:

A- Specific effect:

With respect to the influence of the various NPK soil added levels on leaf Cu content of Le-Conte pear trees, tabulated data in Table (12), displayed clearly that the highest value of leaf Cu content was significantly gained by Le-Conte pear trees supplied with "$N_0P_0K_0$" treatment i.e., those received the ordinary NPK regime adopted in the region. The opposite was true with the highest NPK added rate i.e., $N_2P_2K_2$ treated trees which had significantly the poorest leaves in their Cu content. Such trend was detected during both 1997 and 1998 seasons, as Cu content was expressed as a rate of the leaf dry matter (ppm), however differences between the $N_0P_0K_0$ and $N_1P_1K_1$ levels did not reach level of significance. On the other hand, with estimating leaf Cu content as absolute value per leaf "mg./leaf" differences were completely absent from the standpoint of statistic in both seasons of study.

Referring the response to specific effect of Fe concentration in iron sequestereted- 12 % foliar spray solution, it is quite evident from data in the same Table that spraying Le-Conte pear trees with Fe solution at either 0.2 % or 0.4 % concentrations slightly increased the leaf Cu content over water sprayed trees "Fe_0 spray", whereas differences in most cases were insignificant except as both Fe_0 and Fe_1 were compared in 1997 season only. Meanwhile, in 1998 season, the response was completely absent from the standpoint of statistic. Such trend was true as

the leaf Cu content was expressed as a part per milion "ppm", however as it estimated as an absolute value (mg./leaf) neither differences nor trend were accurred during both 1997 and 1998 seasons.

B- Interaction Effect:

With regard to the interaction effect of the different combinations between the various variables of both investigated factors (NPK rate and Fe %) on leaf Cu content of Le-Conte pear trees, tabulated data in Table (12) revealed abviously that the $N_0P_0K_0$ treated trees and sprayed with Fe solution at either 0.2 or 0.4 % concentration (Fe_1 & Fe_2) resulted in increasing leaf Cu content (ppm) over than the other (NPK x Fe) combinations. Such trend was detected during both 1997 and 1998 seasons of study as leaf Cu content was estimated as ppm on the leaf of leaves dry matter base. Moreover, data obtained during both seasons displayed clearly that the response was completely absent from the standpoint of statistic with estimating the leaf Cu content as an absolute value (mg./leaf).

Data obtained concerning the response of leaf Cupper content to the NPK soil application rate are confirmed with the findingss of **Johanson and Samuleson (1990); Kassem (1991); Mekhael (1994) and Awasthi et al (1997)** on apple trees. However, the influence of the Fe foliar spray was in harmony with that reported by **Kabeel et al (1998)** on Le-Conte pear trees.

Table (12): Leaf cupper content of Le-Conte pear trees as affected by NPK soil application rate Fe foliar spray application and their combinations during 1997and 1998 seasons.

NPK soil added rate \ Fe spray solution	Leaf Cu content							
	ppm on dry weight base				mg per leaf			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season							
1- $N_0P_0K_0$	11.00b	12.00a	12.00a	**11.67A**	0.003a	0.003a	0.004a	**0.003A**
2- $N_1P_1K_1$	11.00b	12.00a	11.00b	**11.33A**	0.003a	0.004a	0.003a	**0.003A**
3- $N_2P_2K_2$	9.00c	10.00c	10.00c	**9.67B**	0.003a	0.003a	0.004a	**0.003A**
Mean**	**10.33B**	**11.33A**	**11.00AB**		**0.003A**	**0.003A**	**0.004A**	
	.1998 season							
1- $N_0P_0K_0$	11.00bc	12.00ab	13.00a	**12.00A**	0.003a	0.003a	0.004a	**0.003A**
2- $N_1P_1K_1$	11.00bc	11.00bc	11.00bc	**10.78B**	0.003a	0.003a	0.003a	**0.003A**
3- $N_2P_2K_2$	10.00de	10.00de	9.00e	**9.56C**	0.003a	0.003a	0.002a	**0.003A**
Mean**	**10.67A**	**11.00A**	**11.00A**		**0.003A**	**0.003A**	**0.003A**	

* and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.

IV.III. Response of some fruiting measurements:

In this regard fruit set %; yield (kg/tree & increment %); fruit physical characteristics (fruit dimensions, shape index, weight, size and firmness) and some chemical properties (fruit juice TSS %, total titritable acidity and TSS/Acid ratio) were the fruiting measurements investigated in response to the specific and interaction effects of the three variables of each investigated factor i.e. NPK soil added rate; concentration of Fe foliar spray solution and their combinations. Data obtained during both 1997 and 1998 seasons are presented in Tables (13); (14); (15) and (16).

IV-III-1- Fruit set percentage:

A- Specific effect:

Data obtained during both 1997 and 1998 seasons as shown from Table (13) declared that fruit set % of Le-Conte pear trees responded specifically to the investigated rates of the NPK fertilizers. As the $N_2P_2K_2$ treated trees exhibited statistically the highest percentage of fruit set, followed in a decreasing order by the $N_1P_1K_1$ and $N_0P_0K_0$ treated trees. Whereas the Le-Conte pear trees received the ordinary NPK regime ($N_0P_0K_0$) showed statistically the least fruit set %. Such trend was true during both seasons of study.

As for the specific effect of Fe - sequestereted concentration in the foliar spray solution, Table (13) show that response of fruit set % was significantly absent.

B- Interaction effect:

Referring the interaction effect of the various combinations between the three variables of each investigated factor i.e., NPK applied rates and Fe spray solution, data in Table (13) revealed that all $N_2P_2K_2$ combinations irrespective of the concentration of Fe solution resulted significantly in the highest % of fruit set. Moreover, the opposite was detected with the Le-Conte pear trees subjected to any of the $N_0P_0K_0$ combinations, especially those received the ($N_0P_0K_0$ x Fe_0) i.e., those supplied with the ordinary NPK fertilization regime adopted in the region (100 kg from each N or P fertilizers + 50 kg potassium sulphate per Feddan) and received no iron spray "water spray/Fe_0", whereas the least fruit set % was resulted. In addition combinations of the $N_1P_1K_1$ and any of the Fe_0, Fe_1 or Fe_2 were intermediate regarding their interaction effect on fruit set % of Le-Conte pear trees during both 1997 and 1998 seasons.

The obtained data concerning the response of fruit set percentage to the NPK soil applied level are in harmony with those mentioned by **Lilleland et al (1962)** on peach trees, **Weeks and Southwick (1952); Kulesza (1990); Hipps (1992) and Attala (1998)** on apple trees, they indicated that a significant increase in fruit set % was increased with raising the NPK soil supplied rates. With respect to the influence of the

Fe foliar spray of Le-Conte pear trees, obtained results are in a complete agreement with those reported by **Austin (1977); Rasee and Staiff (1988) and Awad and Atawia (1995)** on pear trees.

IV-II-1- Yield "productivity in kg/tree":

A- Specific effect:

Table (13) shows clearly that the productivity of Le-Conte pear trees was responded significantly to the investigated NPK soil applied rate. Hence, the $N_2P_2K_2$ treated tree surpassed statistically those received either the $N_0P_0K_0$ (the ordinary NPK adopted regime) or the $N_1P_1K_1$(one Kg from each nutrient source per tree).On the other hand the increase in tree productivity "kg fruits per tree" exhibited due to applying the $N_2P_2K_2$ rate represented approximately or slightly more than 50% of the yield gained by the $N_0P_0K_0$ treated trees during both seasons of study. Moreover, the $N_1P_1K_1$applied trees were statistically intermediate as their yield expressed in Kg of fruits per tree was compared to that of the two other NPK soil applied rates.

Nevertheless, the response to the concentration of Fe sprayed solution was less pronounced than that previously discussed with the NPK added rate. However, the differences reached level of significance and spraying the Le-Conte pear trees with iron sequestereted-12 % at the higher concentration i.e., 0.4 % increased significantly the yield over that of both Fe_0 and Fe_1, whereas the latest one induced significantly the lowest yield/ tree. Any how, the response of yield to the Fe sprayed

solution was more pronounced than that previously found with the fruit set %. This difference may be due to the prolonged duration spent from spraying Fe solution until harvesting as compared to the analogous period from spraying till fruit set.

B- interaction effect:

Data obtained during both 1997 and 1998 seasons and tabulated in Table (13) revealed obviously that yield of Le-Conte pear trees (Kg / tree) followed a firm trend regarding their response to the interaction effect of the different combinations between the various variables of both investigated factors (NPK rate and Fe %). The heaviest yield per tree was always in significant relationship to the ($N_2P_2K_2$ x Fe_2) treated trees. On the contrary, the lightest crop was significantly in closed relationship to those Le-Conte pear trees subjected to the ordinary NPK regime and water spray. On the other hand the ($N_2P_2K_2$ x Fe_1) combination ranked statistically second to the superior combination ($N_2P_2K_2$ x Fe_2), while both ($N_2P_2K_2$ x Fe_0) and ($N_1P_1K_1$ x Fe_2) combinations came descendingly third and fourth from the standpoint of statistic. In addition, other (NPK x Fe) combinations were less effective on tree yield, however all surpassed statistically the inferior combination ($N_0P_0K_0$ x Fe_0) with relatively slight variance between them.

These results regarding the response of yield in kg/tree to the NPK soil added level are in a complete agreement with those mentioned by **Niederholzer et al (1991)** on plum trees; **Kassem (1991); Kilany and Kilany (1991); Mekhael (1994) and Awasthi et al (1997)** on apple

trees. They indicated that trees supplied with high NPK rates produced higher yield than those of low NPK level. As for the influence of the Fe foliar spray solution, data obtained are in confirmity with those stated by some investigators, **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees,who found that application of Fe as foliar spray significantly increased tree yield.

IV.III.3- Yield increment % over control:

A-Specific effect:

Regarding the increment % in yield over the control ($N_0P_0K_0$ x Fe_0) in response to the specific effect of the NPK soil added rate, data in Table (13) showed that supplying Le-Conte pear trees with the $N_2P_2K_2$ norm (two Kg from each fertilizer source per tree) resulted in the greatest increase % in yield. Such increase reached about 56 and 62 % over the control during both 1997 and 1998 seasons, respectively. Moreover, the $N_1P_1K_1$ soil added rate exhibited an increase over the control i.e., about 17.45 % and 19.82 % during both seasons. Any how, the differences between the three investigated NPK soil applied rates were significant as they were compared each other pertaining their effectiveness on the yield increment % over control was considered during both seasons of study.

As for the specific effect of the Fe concentration in the foliar spray solution, it is quite clear that however differences were relatively less

pronounced than those found with the specific effect of NPK rate, but the three Fe_0; Fe_1 spray and Fe_2 solutions significantly varied during both seasons in this concern. In other words the yield increment % over control gained by the three Fe spray solutions could be significantly arranged into the following descending order: a- Fe_2; b- Fe_1 and c- F_0 solutions.

B- interaction effect:

Regarding the interaction effect due to the various NPK x Fe combinations on the yield increment %, data in Table (13) displayed obviously that the response typically followed the same trend previously detected with the average yield per tree in kg. Since, the greatest percentage of yield increment over control was always in concomitant to the ($N_2P_2K_2$ x Fe_2) treated trees. The reverse was true with the $N_0P_0K_0$ supplied trees that received no Fe application viz those trees subjected to the ($N_0P_0K_0$ x Fe_0) fertilization treatment.

The present results are in harmony with those reported by **Kilany and Kilany (1991); Mekhael (1994)** on apple trees and **Kabeel et al (1998)** on pear trees, regarding the influence of both NPK soil added level and the Fe foliar spray solution. They found that the same trend was observed in this respect.

Table (13) : Fruit set %, yield and yield increment % over control of Le-Conte pear trees in response to soil added level of NPK fertilizers; concentration of Fe spray solution and their possible combinations during 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	Fruit set (%)				Yield (kg/tree)				Yield increment % over control			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_0P_0K_0$	7.96de	5.94e	8.97cd	**7.62C**	15.89f	17.92e	18.06e	**17.29C**	00.00f	3.64ef	4.45ef	**2.70C**
2- $N_1P_1K_1$	10.63b-d	11.46bc	11.98b	**11.36B**	18.39e	20.48d	22.00c	**20.29B**	6.48e	18.46d	27.42c	**17.45B**
3- $N_2P_2K_2$	15.17a	15.47a	15.86a	**15.50A**	25.86b	26.31b	28.64a	**26.94A**	49.83b	52.37b	65.91a	**56.04A**
Mean**	**11.25A**	**10.96A**	**12.27A**		**20.05C**	**21.57B**	**22.90A**		**18.77C**	**24.82B**	**31.59A**	
	1998 season											
1- $N_0P_0K_0$	9.56e	10.39d	10.48d	**10.14C**	15.92g	17.58f	18.79e	**17.43C**	00.00f	0.86f	7.80e	**2.89C**
2- $N_1P_1K_1$	13.72c	13.90c	14.47b	**14.03B**	18.92e	21.50d	22.08d	**20.83B**	8.86e	23.67d	26.94d	**19.82B**
3- $N_2P_2K_2$	16.87a	16.94a	17.12a	**16.98A**	26.39c	28.27b	29.82a	**28.16A**	51.90c	62.61b	71.37a	**61.96A**
Mean**	**13.38A**	**13.75A**	**14.02A**		**20.41C**	**22.45B**	**2356A**		**20.25C**	**29.05B**	**35.37A**	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**

IV-III-4- Fruit physical characteristics:

The dimensions (height and diameter); shape index (height: diameter); weight; volume and flesh firmness of Le-Conte pear fruit were the evaluated physical characteristics pertaining their respone to the specific and interaction effects of the various variables of the two investigated factors (NPK soil appliced rate and concentration of Fe foliar spray solution). Data obtained during both 1997 and 1998 seasons are presented in Table (14) and (15).

IV.III.4.a.Fruit height:

A-Specific effect:

Regarding the fruit height of Le-Conte pear cv. As influenced by the specific effect of NPK soil applied rate, Table (14) shows that it responded significantly during both seasons. Whereas, the highest rate of NPK application "$N_2P_2K_2$" resulted significantly in the greatest value. Moreover, the $N_1P_1K_1$ treated trees induced fruit with more elongated height than those of the $N_0P_0K_0$ treated trees. Differences in height of Le-Conte pear fruit due to three various rates of NPK fertilization were significant as fruits of each level were compared to those of the two other levels.

With respect to the specific effect of the concentration of the Fe sprayed solution, data obtained during both 1997 and 1998 seasons as

shown from Table (14) displayed that fruit height was significantly responded to spraying Fe solution. However the response was relatively less pronounced as compared to that detected with the NPK applied rate. Since both Fe_1, and Fe_2 spray solution increased significantly the fruit height of Le-Conte pear cv. over that of Fe_0 sprayed trees (water spray). In spite of the higher Fe concentration i.e. Fe_2 tended to slightly increase fruit height as compared to the Fe_1 solution (0.2 % of iron sequestereted-12% solution), but difference did not reach level of significance during both 1997 and 1998 seasons.

B- Interaction effect:

Table (14) shows clearly that the Le-Conte pear fruit responded significantly to the various (NPK x Fe) combinations. It could be obviously noticed that the specific effect of each investigated factor was directly reflected on their combinations, whereas as the $N_2P_2K_2$ soil application rate was combined with either the lower or higher Fe concentration i.e., Fe_1 or Fe_2 exhibited statistically the greatest fruit height value. Contrary to that the combinations between the ordinary NPK regime adopted in this region from one hand the no iron applied (Fe_0) and the Fe spray at 0.2 % concentration (Fe_1) from the other resulted in a significant depression on fruit height of Le-Conte pear cv.. Such trend was true during both 1997 and 1998 seasons. Since, the superiority of both ($N_2P_2K_2$ x Fe_2) and ($N_2P_2K_2$ x Fe_1) combinations from one side and the inferiority of both ($N_0P_0K_0$ x Fe_0) and ($N_0P_0K_0$ x Fe_1) combinations from the other one could be logically explained on the base

of the more pronounced effectiveness of NPK applied rate rather than the Fe concentration in spray solution.

Nevertheless, other (NPK x Fe) combinations were in between the above mentioned two extents with a relative tendency of the $N_1P_1K_1$ combinations especially these of Fe_2 spray to be more effective in this concern.

The present results are in an agreement with those found by **Williams and Billingesley (1974); Raese (1990) and Kilany and Kilany (1991)** on apple and pear trees, who stated that fruit height significantly increased by increasing the rate of NPK fertilization. Meanwhile, as for the influence of Fe foliar spray was concerned the obtained data are in line with the findings of **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees in this respect.

IV-III-4-b- Fruit diameter:

A- Specific effect:

With regard to the specific effect of NPK soil applied rate on fruit diameter of Le-Conte pear cv., data in Table (14) revealed that the previously detected trend with fruit height was also found for the other fruit dimension "fruit diameter". Hence, the widest diameter was statistically gained by the $N_2P_2K_2$ treated trees followed in decreasing order by the $N_1P_1K_1$ and $N_0P_0K_0$ treated trees. Differences in fruit

diameter due to the differential investigated NPK soil applied rates were significant as compared each other during both 1997 and 1998 seasons.

As for the response to the various Fe foliar spray solutions, data presented in Table (14) displayed that diameter of Le-Conte pear fruit responded significantly to the two concentrations of iron sequestereted-12 % solution as compared to the water foliar spray (Fe_0 or no Fe spray). On the other hand the difference between the two Fe concentrations i.e., Fe_1 and Fe_2 solutions was completely absent during both 1997 and 1998 seasons as their influence on fruit diameter of Le-Conte pear cv. was concerned.

B-Interaction effect:

Regarding the interaction effect of the various combinations between the differential variables of both investigated factors on fruit diameter of Le-Conte pear cv., Table (14) shows that the response followed typically the same trend previously found with the former fruit dimension (fruit height). Since, both ($N_2P_2K_2$ x Fe_2) and ($N_2P_2K_2$ x Fe_1) combinations were statistically the superior during two seasons of study. The opposite was true with both combinations of ($N_0P_0K_0$ xFe_0) and ($N_0P_0K_0$ x Fe_1). Moreover, the other NPK x Fe combinations were in between with various tendency of response revealed that $N_1P_1K_1$ combinations regardless of Fe spray solutions tended relatively to be more effective.

Nevertheless, the rate of response exhibited in the fruit diameter by any of the two investigated factors was relatively less pronounced

than those detected with the fruit height in spite of both trends of response were equally coincident in their direction.

The obtained data concerning the response of fruit diameter to the different levels of NPK were supported by the findings of several investigators, **Williams and Billingesley (1974); Raese (1990) and Kilany and Kilany (1991)** on apple and pear trees, they reported that fruit diameter was positively affected by the different treatments of NPK fertilization. As for the influence of Fe foliar spray was concerned the present results are in line with the findings of **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees in this respect.

IV-III-4-c- Fruit shape index:

A- Specific effect:

Concerning the fruit shape index (fruit height: fruit diameter) of Le-Conte pear cv. as influenced by the investigated level of NPK soil applied, data in Table (14) revealed that the trend was no so firm to be the same during both seasons. In spite of the fruits tended to be more prolonged by the ordinary NPK program adopted in this region ($N_0P_0K_0$) as compared to these of either the $N_1P_1K_1$ or $N_2P_2K_2$ treated trees during both seasons of study, especially these of $N_1P_1K_1$ supplied trees. Differences in fruit shape index could be logically discussed on such fact resulted by the unparallelled response of both fruit dimensions to a given fertilization treatment. Since, the increase in fruit height gained by the higher rates of NPK soil added was more pronounced than that exhibited with the fruit diameter.

As for the specific effect of Fe foliar spray solution, Table (14) shows also that no firm trend could be detected during two seasons. Since, in 1997 season the fruits trended to be elongated with increasing Fe concentration, while the difference was entirely absent in the second season "1998".

B- Interaction effect:

However, the specific effect of each investigated factor did not follow determined trend, but with the interaction effect it could be clearly observed that Le-Conte pear trees subjected to the ($N_0P_0K_0$ x Fe_0) combination induced fruits had the least fruit shape value as compared to the eight other combinations. This proved that the positive relationships between the higher rate or concentration of both NPK soil added and Fe spray solution, respectively from one hand and both fruit dimensions (height & diameter) from the other did not take place at the same rate, whereas the height of fruit was more responsible than its diameter.

The obtained results regarding the response of fruit shape index "Fruit height/fruit diameter" of Le-Conte pear cv. to both the NPK soil application rate and Fe foliar spray solution are in accordance with the findings of **Kabeel et al (1998)** on Le-Conte pear trees.

Table (14): Fruit dimensions and its shape index of Le-Conte pear trees in response to NPK soil added level ;concentration of Fe spray solution and their possible combinations during 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	Fruit height (mm.)				Fruit diameter (mm.)				Fruit shape index (H/D)			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_0P_0K_0$	69.00f	72.00e	75.00e	71.30C	56.00d	58.00cd	58.00cd	57.30C	1.20f	1.24e	1.29d	1.24C
2- $N_1P_1K_1$	80.70d	82.30cd	84.70c	82.60B	60.30bc	62.70b	63.00b	62.00B	1.33b	1.31c	1.35b	1.33B
3- $N_2P_2K_2$	88.70b	95.30a	98.30a	94.10A	68.30a	70.70a	70.70a	69.90A	1.30cd	1.35b	1.39a	1.35A
Mean**	78.80B	83.20A	86.00A		61.60B	63.80A	63.90A		1.28C	1.30B	1.34A	
	1998 season											
1- $N_0P_0K_0$	71.00e	75.00de	77.00d	74.30C	58.00f	61.00ef	62.00e	60.30C	1.23c	1.25b	1.26b	1.25B
2- $N_1P_1K_1$	84.70c	88.30c	89.30bc	87.40B	66.00d	68.30cd	69.30c	67.90B	1.28a	1.29a	1.29a	1.29A
3- $N_2P_2K_2$	93.70b	98.70a	100.30a	97.60A	74.70b	79.00a	80.70a	78.10A	1.26b	1.25b	1.25b	1.25B
Mean**	83.10B	87.30A	88.90A		66.20B	69.40A	70.70A		1.26A	1.26A	1.27A	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**

IV-III-4-d- Fruit weight:

A- Specific effect:

Regarding the average fruit weight of Le-Conte pear cv. as influenced by the NPK soil applied rate, data in Table (15) revealed that it responded specifically, whereas the heaviest fruits were gained by the $N_2P_2K_2$ treated trees. Moreover, the lightest fruits were those of the Le-Conte pear trees subjected to the ordinary NPK regime adopted in Kalubia Governarate ($N_0P_0K_0$). In addition, $N_1P_1K_1$ treated trees induced fruits were statistically in between in their average weight.

Referring the specific effect of the Fe foliar spray solution, data obtained during both seasons revealed obviously the positive relationships between the Fe concentration and fruit weight of Le-Conte pear cv. Since, the heaviest fruits were significantly produced by the Fe_2 sprayed trees. Contrary to that the Fe_0 sprayed trees "water sprayed" induced significantly the lightest fruits. Meanwhile, the average fruit weight of the Fe_1 sprayed trees was significantly intermediate as compared to those of both Fe_2 and Fe_0 sprayed trees. Such trend was true during both seasons.

B-Interaction effect:

Tables (15) shows that the average fruit weight of Le-Conte pear cv. responded significantly to the interaction effect of the various (NPK x Fe) combinations. The heaviest fruit weight was significantly in closed

relationships with the Le-Conte pear trees subjected to the ($N_2P_2K_2$ x Fe_2) treatment, followed in descending order by those of ($N_2P_2K_2$ x Fe_1); ($N_2P_2K_2$ x Fe_0) and/or ($N_1P_1K_1$ x Fe_2). Contrary to that the lightest fruits in their average weight were always in concomitant to those trees received any of the three $N_0P_0K_0$ combinations. Meanwhile, other combinations were significantly in between. Differences during both 1997 and 1998 seasons were significant as fruit weight of each of the aforesaid three categories was compared to the two other ones.

These results are in harmony with that reported by **Beattie (1954); Williams and Billingesley (1974); Kilany and Kilany (1991); Mekhael (1994) and Awasthi et al (1997)** on apple and pear trees concerning the effect of the NPK soil application on fruit weight, who indicated that fruit weight was increased significantly by increasing the rate of NPK soil applied. However, the obtained data on the influence of Fe foliar sprays goes in line with those menthined by **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees.

IV-III-4-e- Fruit size:

A-specific effect:

Data in Table (15) declared that fruit size of Le-Conte pear cv. followed typically the same two trends previously detected with fruit weight regarding the specific effect of either the NPK level or Fe concentration in foliar spray solutions. Such two trends of response were

true during both 1997 and 1998 seasons as every investigated factor and its own trend was separately or individually taken into consideration.

B-Interaction effect:

Table (15) indicates that the specific effect of each investigated factor i.e. NPK soil added rate and the concentration of the iron sequesrereted-12 % spolution was directly reflected on the interaction effect of the various NPK x Fe combinations on Le-Conte pear fruit size. On the other hand, Le-Conte pear trees received the higher rate of NPK soil added "$N_2P_2K_2$" associated with spraying the iron sequestereted-12 % solution at 0.4 % "Fe_2" induced fruits had significantly the greatest volume (size) during both seasons of study. Moreover, two other combinations of the $N_2P_2K_2$ i.e., ($N_2P_2K_2$ x Fe_1) and ($N_2P_2K_2$ x Fe_0) descendingly ranked second and third respectively, while the ($N_1P_1K_1$ x Fe_2) situated the fourth one after the superior combinations ($N_2P_2K_2$ x Fe_2). Differences between the aforesaid four combinations were significant during both seasons as their effect on fruit size of Le-Conte pear cv. was taken into considerations. Contrary to that the $N_0P_0K_0$ combinations i.e., ($N_0P_0K_0$ x Fe_0); ($N_0P_0K_0$ x Fe_1) and ($N_0P_0K_0$ x Fe_2) were the inferior, whereas they resulted in inducing the smallest fruits during both seasons of study from the standpoint of statistic. In addition, other NPK x Fe combinations were in between the above mentioned two extents as their interaction effect on fruit size of Le-Conte pear cv. was concerned during both 1997 and 1998 seasons.

The obtained result regarding the response of fruit size to NPK soil applied level are in accordance with the findings **of Boynton and**

Anderson (1956); Barden and Thompson (1962); Richardson (1986); Raese (1990) and Mekhael (1994) on apple trees, who indicated that fruit size was increased by increasing the level of NPK fertilization. Meanwhile, the trend of response to the Fe foliar sprays goes in line with those mentioned by **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees in this respect.

IV-III-4-f- Fruit firmness:

A-specific effect:

Concerning the influence of the NPK soil applied treatments, data in Table (15) displayed that the fruit flesh firmness of Le-Conte pear cv. was specifically responded to the investigated rates. Hance, an obvious decrease in fruit flesh firmness was generally exhibited with raising the NPK soil applied rate, whereas the NPK soil application at the highest rate ($N_2P_2K_2$) induced significantly the most softened fruits as compared to those of the two other investigated rates ($N_0P_0K_0$ and $N_1P_1K_1$). Moreover, in spite of the ordinary NPK adopted regime ($N_0P_0K_0$) resulted in inducing fruits having firmer flesh texture than those of either $N_1P_1K_1$ or $N_2P_2K_2$ treated trees, but difference was significant as compared to the later rate only during both 1997 and 1998 seasons.

As for the specific effect of the concentration of iron sequestereted-12 % in the spray solution, data in Table (15) revealed that both concentrations i.e. Fe_1 and Fe_2 solutions decreased fruit flesh

firmness of Le-Conte pear cv. as compared to the no iron foliar application (water spray/Fe_0 treatment). Differences were significant with comparing Fe_0 to Fe_2 only, while Fe_1 treatment was equally effective as compared to both two other Fe treatments (Fe_0 and Fe_2) from the stand point of statistic.

Nevertheless, it is so interesting to be noticed that both fruit size "volume"and its flesh firmness of Le-Conte pear cv. were in a negative relationship. Since, the smallest fruits in their size had the firmest flesh texture from one hand and were always in concomitant to the ordinary NPK adopted regime in the region "$N_0P_0K_0$"from the other. While the reverse was true with the biggest fruits which had the most softened texture from one hand and closely coupled to the $N_2P_2K_2$ soil applied level from the other.

B-Interaction effect:

Referring the interaction effect of the various NPK x Fe combinations on the flesh firmness of Le-Conte pear fruits, data presented in Table (15) revealed that the various combinations between the ordinary NPK adopted program ($N_0P_0K_0$) and any of the sprayed Fe solutions (Fe_0; Fe_1 and Fe_2), as well as the $N_1P_1K_1$ soil added level combined with Fe_0 or /and Fe_1 solutions during 1997 and 1998 seasons, respectively, induced fruits had significantly the firmest flesh texture. Contrary to that both combinations of $N_2P_2K_2$ soil applied rate associated with Fe spray solution at either 0.2 or 0.4 % concentration(Fe_1 or Fe_2) resulted significantly in increase flesh softness of Le-Conte pear fruits as

compared to any of the other investigated combinations during both seasons of study. Moreover other NPK x Fe combinations were in between the above mentioned two extents.

As for the flesh softness of Le-Conte pear fruits exhibited by raising the soil applied rate of the 1 st investigated factor "NPK" or the concentration of foliar spray solution "2 nd factor" may be attributed to the parallelled trend previously discussed with average fruit size. Since, the increase in a given fruit size is mainly depending on the increase in size "volume" of each individual cell (not on the number of cells per fruit) and consequently the decrease in cell wall thickness which took place with the cell swollen from one hand. On the other side, the enlargement of cells within a plant tissue is always associated with increasing the intercellular spaces. Accordingly, with agricultural treatments increase fruit size the flesh softness is expected.

The obtained data are in confirmity with those stated by **Smock and Boynton (1944); Forshey (1963); Meheriuk and Lau (1979); Ferree and Cahoon (1987) and Kilany and Kilany (1991)** on apple and pear fruit trees regarding the influence of NPK soil applied rate. However, a similar observation was achieved by **Raese and Staiff (1988); Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees with regard to the response of fruit firmness to Fe foliar spray.

Table (15): Average weight; size and firmness of Le-Conte pear fruit in response to NPK soil added level fertilization; concentration of Fe spray solution and their possible combinations during 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	Fruit weight (gm.)				Fruit size (ml.)				Fruit firmness (lb/inch2)			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_0P_0K_0$	124.00f	125.00f	126.00f	**125.00C**	115.00h	120.00gh	125.00g	**120.00C**	12.93a	12.77ab	12.57ab	**12.76A**
2- $N_1P_1K_1$	148.00e	156.00d	166.00c	**157.00B**	140.00f	147.00e	157.00d	**148.00B**	12.57ab	12.47bc	12.27cd	**12.43B**
3- $N_2P_2K_2$	190.00b	196.00b	203.00a	**196.00A**	175.00c	182.00b	192.00a	**183.00A**	12.40c	12.00d	11.90d	**12.10C**
Mean**	**154.00C**	**159.00B**	**162.00A**		**143.00C**	**149.00B**	**158.00A**		**12.63A**	**12.41AB**	**12.24B**	
	1998 season											
1- $N_0P_0K_0$	127.00f	131.00f	133.00f	**130.00C**	120.00f	125.00f	125.00f	**123.00C**	13.10a	13.07a	12.90ab	**13.02A**
2- $N_1P_1K_1$	159.00e	173.00d	176.00d	**169.00B**	152.00e	167.00d	168.00d	**162.00B**	12.97ab	12.97ab	12.80b	**12.91A**
3- $N_2P_2K_2$	195.00c	203.00b	214.00a	**204.00A**	187.00c	195.00b	203.00a	**195.00A**	13.00a	12.50c	12.30c	**12.60B**
Mean**	**160.00C**	**169.00B**	**174.00A**		**153.00B**	**162.00A**	**166.00A**		**13.02A**	**12.84AB**	**12.67B**	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**

IV-III-5- Fruit chemical properties:

Fruit juice total soluble solids perecntge (TSS %); total titratable acidity percentage (Acidity %) and the TSS/acid ratio were the three chemical properties of Le-Conte pear cv. investigated regarding their response to both specific and interaction effects of the two factors under study viz NPK soil applied rate and concentration of chelated iron spray solution.

IV-III.5.a. Fruit juice total soluble solids percentage (TSS %):

A-specific effect:

Table (16) shows the positive relationship between the fruit juice TSS % of Le-Conte pear cv. and the NPK soil applied rate during both 1997 and 1998 seasons. Whereas providing Le-Conte pear trees with the highest rate i.e., 2.0 kg from each of the NPK fertilizers per the individual tree ($N_2P_2K_2$) induced fruits had the highest TSS % followed by the $N_1P_1K_1$ treated trees, while the ordinary NPK soil applied regime ($N_0P_0K_0$) ranked last in this concern. Differences in fruit juice TSS % due to variable rates of NPK soil application were significant during both seasons of study with an exception that both $N_2P_2K_2$ and $N_1P_1K_1$ soil applied rates were approximately the same from the stanpoint of statistic as they were compared each other during the second (1998) season.

Referring the specific effect of the chelated iron concentration in the sprayed solution of iron sequestereted-12 %, it is quite evident that

the water sprayed trees "Fe_0 treated ones" produced fruits with the lowest juice TSS % during two seasons of study. The reverse was true with such trees sprayed with iron sequestereted-12 % solution at 0.4 % concentration (Fe_2 solution), whereas the highest TSS percentage was observed and the increase was significant, especially as compared to the Fe_0/water sprayed ones during both 1997 and 1998 seasons. In addition, fruit juice TSS % of the Fe_1 sprayed trees was in between the above mentioned two extents, however difference was significant as compared to the water spray (Fe_0 solution) and the Fe_2 spray solution during the 1 st (1997) and 2 nd (1998) seasons, respectively.

B-Interaction effect:

As for the interaction effect of the various NPK soil applied rates combined with the differential Fe foliar spray solutions, Table (16) reveals that the Le-Conte pear trees received The NPK soil application at 2.0 kg from each element source per tree ($N_2P_2K_2$) associated with spraying with iron sequestereted solution at 0.4 % (Fe_2) during both 1997 and 1998 seasons, as well as the ($N_2P_2K_2$ x Fe_1) treated trees especially in the 1 st (1997) season induced fruits with the highest TSS % that surpassed statistically the analogous ones of the other (NPK x Fe) combinations. Contrary to that Le-Conte pear trees subjected to the ordinary NPK fertilization regime ($N_0P_0K_0$) and Fe_0 foliar spray (received no chelated iron/water spray) induced the poorest fruits in their juice TSS content. Moreover, the ordinary NPK fertilization regime combined with spraying Fe chelated solution at 0.2 % ($N_0P_0K_0$ x Fe_1) had to great extent a comparable effectiveness as compared to the

inferior combination ($N_0P_0K_0$ x Fe_0) in this concern, especially during the 2 nd (1998) season. In addition, other combinations were in between with a noticeable tendency proved that both ($N_2P_2K_2$ x Fe_0) and ($N_1P_1K_1$ x Fe_2) as well as ($N_1P_1K_1$ x Fe_1) were more effective than the other members of such cotegory.

The beneficial effect of raising the NPK rate on fruit juice TSS % as shown from the obtained result may be principally discussed on that fact depending on the real function of potassium in some physiological processes. Since, potassium plays agreat role in translocation of carbohydrates from the producer organs (leaves) towards the accumulator organs such as fruits and other perminant plant organs viz-trunk, limbs, roots.....etc.

These results concerning the response of fruit juice total soluble solides percentage (TSS %) to the various levels of NPK were supported by the findings of **Somck and Boynton (1944); Bardenand and Thompson (1962); Meheriuk and Lau (1979); Abou Aziz et al (1987); Kilany and Kilany (1991); Mekhael (1994) and Awasthi et al (1997)** on apple and pear trees, they indicated that TSS % increased significantly by increasing the rate of NPK fertilization. Meanwhile, as for the influence of Fe foliar spray the detected trend from present study goes in line with the findings of **Awad and Atawia (1995) and Kabeel et al (1998).**

IV-III.5.b. Fruit juice total acidity percentage:

A-specific effect:

Table (16) reveals obviously that fruit juice acidity percentage of Le-Conte pear cv.followed typically the same trends previously disiussed with the TSS % regarding the response of specific effect of each investigated factor i.e., NPK soil applied rate and concentration of iron sequestereted in foliar spray solution. Such trends were true during both 1997 and 1998 seasons. Whereas the total acidity % was in positive relationship with either the NPK ssoil applied rate from one hand or the concentration of the Fe sprayed solution from the other. In other words the highest acidity % was the highest NPK soil applied rate and the Fe concentration of sprayed solution.

B-Interaction effect:

Referring the fruit juice acidity % as influenced by the interaction effect of various NPK x Fe combinations, data in Table (16) declared that the Le-Conte pear trees subjected to any of the ($N_2P_2K_2$ x Fe_2) and ($N_2P_2K_2$ x Fe_2) during both seasons, as well as ($N_2P_2K_2$ x Fe_0) and ($N_1P_1K_1$ x Fe_2) and ($N_1P_1K_1$ x Fe_1) especially in the second season (1998) induced fruits contained statistically the highest acidity %. Contrary to that the ($N_0P_0K_0$ x Fe_0) combination and to great extent the ($N_0P_0K_0$ x Fe_1) during both 1997 and 1998 seasons and the second one only, respectively resulted in the lowest value of fruit juice acidity percentage from the standpoint of statistic. In addition the other

investigated NPK x Fe combinations were in between the aforesaid two extents.

Increasing the fruit juice acidity percentage with raising level of each investigated factor NPK soil added or Fe spray solution may be attributed to delaying maturation process which usually associated with the increment of the final fruit volume /size of mature fruits.

The obtained results are confirmed with that reported by **Beattie (1954); Barden and Thompson (1962); Meheriuk and Lau (1979); Abou Aziz (1987) and Awasthi et al (1997)** concerning the effect of NPK soil application, they indicated that acidity % was increased slightly by increasing the rate of NPK application. However, the obtained data concering the influence of the Fe foliar sprays go in line with those stated by **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees in this respect.

IV-III.5.c. Ratio of fruit juice total soluble solids percentage/total acidity percentage (TSS/Acid ratio):

A-specific effect:

Regarding the specific effect of the NPK soil applied rate on the TSS/acid ratio in Le-Conte pear fruit juice, data obtained during both 1997 and 1998 seasons as shown from Table (16) pointed out the negligible variation, whereas differences were so little to reach level of significance. On the other hand, the absent of significance in the response of TSS/Acid ratio to the investigated Fe concentration of spray solution was also detected during both seasons of study.

B-Interaction effect:

Table (16) shows that variations in fruit juice TSS/Acid ratio due to the interaction effect of various combinations between variables of both investigated factors were generally less pronounced as compared to that exhibited with either TSS% or acidity % each individually. Moreover, it could be noticed that differences in most cases were so slight and could be safely neglicted from one hand, in spite of the ($N_0P_0K_0$ x Fe_2) combination showed relatively a tendency to increase TSS/Acid ratio of Le-Conte pear fruit juice especially in comparison with both ($N_2P_2K_2$ x Fe_2) and ($N_0P_0K_0$ x Fe_0) combinations during both seasons of study.

Data obtained regarding the stability of TSS/Acid ratio againest the investigated factors (NPK & Fe) treatments and its non responding reaction to their combinations reflected that however both parameters (TSS % & Acidity %) followed the same trend of response but the rates of change in one parameter were not coincident to those of the other characteristic.

These results are in accordance with the findings of **Abou Aziz (1987); Kilany and Kilany (1991); Mekhael (1994) and Awasthi et al (1997)** on pear and apple trees as for the influence of NPK soil added rate. Meanwhile, a similar observation was achieved by **Awad and Atawia (1995) and Kabeel et al (1998)** on Le-Conte pear trees with respect of the influence of Fe foliar sprays on TSS /Acid ratio.

Table (16): Fruit juiceTSS %; total acidity % and TSS/Acid ratio of Le-Conte pear cv. in response to NPK soil added level; concentration of Fe spray solution and their possible combinations during 1997 and 1998 seasons.

Fe spray solution / NPK soil added rate	TSS %				Acidity %				TSS/Acid ratio			
	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*	Fe_0	Fe_1	Fe_2	Mean*
	1997 season											
1- $N_1P_1K_0$	11.97e	12.18d	12.22d	**12.12C**	0.22f	0.25d	0.25d	**0.24C**	47.56c	48.88bc	56.73a	**51.06A**
2- $N_1P_1K_1$	12.32cd	12.34b-d	12.41bc	**12.36B**	0.24e	0.26c	0.26c	**0.25B**	53.09ab	50.56bc	52.35a-c	**52.00A**
3- $N_1P_2K_2$	12.40bc	12.50ab	12.63a	**12.51A**	0.27b	0.28a	0.27b	**0.27A**	50.27bc	50.65bc	50.65bc	**50.52A**
Mean**	**12.23B**	**12.34A**	**12.42A**		**0.24B**	**0.26A**	**0.26A**		**50.31A**	**50.03A**	**53.24A**	
	1998 season											
1- $N_1P_1K_0$	12.11d	12.16d	12.38c	**12.22B**	0.22c	0.22c	0.24b	**0.23C**	51.79c	55.27ab	56.27a	**54.44A**
2- $N_1P_1K_1$	12.51bc	12.63b	12.64b	**12.59A**	0.24b	0.24b	0.25ab	**0.24B**	56.29a	53.33a-c	54.24a-c	**54.62A**
3- $N_1P_2K_2$	12.55b	12.64b	12.83a	**12.67A**	0.25ab	0.25ab	0.26a	**0.25A**	54.96a-c	52.03bc	51.66c	**52.88A**
Mean**	**12.39B**	**12.48B**	**12.62A**		**0.24B**	**0.24B**	**0.25A**		**54.35A**	**53.54A**	**54.06A**	

*** and ** reffer to specific effect of NPK fertilization treatments and concentration of Fe spray solution, respectively. Values of each investigated characteristic obtained in every season were significantly distinguishing by capital and small letters for specific and interaction effects, respectively.**