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GROWTH; FRUITING AND NUTRITIONAL STATUS OF "LE-CONTE" PEAR TREES IN RESPONSE TO MINERAL AND HUMATE FERTILIZERS

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ABSTRACT

The response of "Le-Conte" pear trees to the different combinations of nitrogen, potassium and humic acid soil applied rates on vegetative growth, some fruiting aspects, fruit characteristics and leaf mineral composition were studied during the two consecutive seasons of 2005 and 2006.

The obtained results revealed a noticeable effect of the investigated treatments on the vegetative growth measurements under study i.e., shoot length increase, number of leaves per shoot and leaf area which were in closed positive relationship with (NKH) soil added levels. Furthermore, all tested fertilization treatments significantly increased all studied fruiting parameters i.e., percentage of fruit set and yield (as kg/tree). In addition to that, fruit physical properties i.e., (fruit weight, volume, firmness, height, diameter and fruit shape index) and some fruit chemical characteristics such as (TSS %, acidity % and TSS/acid ratio) in most cases were statistically improved by the different tested combinations. Also, leaf nutrients contents of some macro and micro elements responded statistically to all investigated treatments in two seasons of study.

Generally, it could be concluded that all the investigated combinations treatments of (NKH) under study exhibited a significant response and beneficial effects on majority of "Le-Conte" trees parameters and properties under study were achieved. However, the ($N_3K_2H_1$) combination was the most effective treatment for increasing and improving most growth; fruiting parameters and fruit quality as well as nutritional status (leaf mineral composition) of "Le-Conte" pear trees.

INTRODUCTION

Undoubtedly, increasing and improving productivity and quality of pear fruits are the great important aims of researches to fuffill locally demands. Mineral fertilization especially with nitrogen and potassium is considered one of the most important factors which plays an excellent role by which the best striking response of growth, yield and quality of pears and many others fruit trees could be achieved.

Although, mineral fertilization have an obvious role that certainly could be reflected negatively on the mankind health. Moreover, leaching chemical fertilizations led to disturbance in the natural biological balance in either soil and underground water that accumulate in food chain causing several hazardous effects for human health. Besides, the high costs of mineral fertilizers application.

Therefore, a great attention is focused on the application of mineral fertilizers combined with humate to correct the nutriational status and enhancing growth which in turn reflected on increasing yield and improving fruit quality from one hand associated

with reducing the used amounts of mineral N and K fertilizers by using some biostimulants to replace partially a considerable portion of N and K, mineral form with an organic one since later is cheaper and unpolluted.

For that, several attempts were tried in this concern, Abou-Aziz *et al.* (1987), Yastaas (1990) Nassef (2000) and Kabeel and El-Sadaany (2004) on pear; Awasthi *et al.* (1997) on apple; Eissa (2003) and Shddad *et al.*, (2005) on apricot and Kabeel (2004) on peach trees. Some investigators worked on citrus and olive, Webb and Biggs (1988), Tantini *et al.*, (1991), Kelting *et al.*, (1997) and Alva and Obreza (1998).

Accordingly, the present investigation was planned and carried out to study the influence of different rates of N and K mineral fertilizers in combinations with Humate on some growth and fruiting parameters, fruit quality and leaf mineral composition of "Le-Conte" pear trees.

MATERIALS AND METHODS

This investigation has been carried out throughout the two consecutive 2005 and 2006 seasons on adult "Le-Conte" pear trees budded on (*Pyrus communis* L.) rootstock, planted at 5 meters apart in clay loamy soil at the Experimental Farm of El-Kanater Horticultural Research Station, Kalyubia Governorate, Egypt.

Trees were carefully chosen to be healthy, nearly uniform in their growth vigour as possible and receiving regularly the same horticultural practices adopted in the farm. The investigated 18 treatments were representtative of the different combinations between; (a) three mineral N fertilizer rates (N_1= 1.0 kg; N_2= 1.5 kg and N_3= 2.0 kg/tree/ year) soil added in the form of ammonium sulphate (20.6 % N); (b) three mineral K fertilizer rates i.e., (K_0= no K added; K_1= 0.75 kg and K_2= 1.2 kg/tree /year) soil added in the form of potassium sulphate (48 % K_2O) and (c) two levels of Humic acid solution i.e., (H_0= no HA added and H_1= 60 cm./tree/year) was applied to the soil as humic acid solution (humate salt 85 %). However, phosphorus was added once at a constant dose (1.5 kg/ tree/year) at the third week of January in the two seasons of study for all investigated treatments in the form of monsuperphosphate (15.5 % P_2O_5). The corresponding amount of each N or K fertilizer rate was fractionated into three equal split doses to be applied in the third week of (February, April and June). Whereas Humic acid was monthly added six times at the last week of each month beginning from February till July in every season of study. Soil physical and chemical properties of the experimental orchard at 0-30 cm depth were determined as shown in Table (1) according to the standard methods used by Piper (1950); Allam (1951) and Jackson (1958).

Table (1): Soil physical and chemical analysis of the experimental pear orchard at 0-30 cm. depth.

a- Physical analysis:

Sand (%)	Silt (%)	Clay (%)	Soil texture	F.C. (%)	W.P. (%)	A.W. (%)
17.70	28.80	52.40	Clay loam	42.30	21.10	20.00

b- Chemical analysis:

	Available nutrients (mg./kg.)							Ec ds/m	Soil extract PH (1:2.5)	$CaCO_3$ %
	N	P	K	*Fe*	Zn	Mn	Cu			
Total	690.0	350.0	4520	3130	116	154	51	2.90	7.88	3.65
Avail.	62.0	14.9	609.5	22.0	5.8	16.3	2.9			

Therefore, the various studied treatments applied in this work were as follows:

1- ($N_1K_0H_0$) soil applied of N at 1.0 kg with neither K (K_0) nor HA (H_0).
2- ($N_1K_0H_1$) soil applied of N at 1.0 kg + no K (K_0) + 60 cm of HA (H_1).
3- ($N_1K_1H_0$) soil applied of N at 1.0 kg + 0.75 kg K (K_1) + no HA (H_0).

4- ($N_1K_1H_1$) soil applied of N at 1.0 kg + 0.75 kg K (K_1) + 60 cm of HA (H_1).
5- ($N_1K_2H_0$) soil applied of N at 1.0 kg + 1.2 kg K (K_2) + no HA (H_0).
6- ($N_1K_2H_1$) soil applied of N at 1.0 kg + 1.2 kg K (K_2) + 60 cm of HA (H_1).
7- ($N_2K_0H_0$) soil applied of N at 1. 5 kg with neither K (K_0) nor HA (H_0).
8- ($N_2K_0H_1$) soil applied of N at 1.5 kg + no K (K_0) + 60 cm of HA (H_1).
9- ($N_2K_1H_0$) soil applied of N at 1.5 kg + 0.75 kg K (K_1) + no HA (H_0).
10- ($N_2K_1H_1$) soil applied of N at 1.5 kg + 0.75 kg K (K_1) + 60 cm of HA (H_1).
11- ($N_2K_2H_0$) soil applied of N at 1.5 kg + 1.2 kg K (K_2) + no HA (H_0).
12- ($N_2K_2H_1$) soil applied of N at 1.5 kg + 1.2 kg K (K_2) + 60 cm of HA (H_1).
13- ($N_3K_0H_0$) soil applied of N at 2.00 kg with neither K (K_0) nor HA (H_0).
14- ($N_3K_0H_1$) soil applied of N at 2.00 kg + no K (K_0) + 60 cm of HA (H_1).
15- ($N_3K_1H_0$) soil applied of N at 2.00 kg + 0.75 kg K (K_1) + no HA (H_0).
16- ($N_3K_1H_1$) soil applied of N at 2.00kg + 0.75 kg K (K_1) + 60 cm of HA (H_1).
17- ($N_3K_2H_0$) soil applied of N at 2.00 kg +1.2 kg K: (K_2) + no HA (H_0).
18- ($N_3K_2H_1$) soil applied of N at 2.00 kg + 1.2 kg K (K_2) + 60 cm of HA (H_1).

Thus, for investigating the response of vegetative growth; productivity (fruit set & yield); fruit quality (physical & chemical properties) and nutritional status (leaf mineral composition) of "Le-Conte" pear trees to specific and interaction effects of the aforesaid 18 treatments, a factorial experiment was conducted using the complete randomized block design with 3 replications, whereas each replicate was represented by a single tree.

- Investigated measurements:

At beginning of each season four main limbs well distributed around every tree periphery selected and labelled for investigating the response of the following measurements:

1- Vegetative growth measurements:

These characters were studied through determining the average increment in shoot length and the average number of leaves/shoot, where 16 newly emerging shoots/tree (4 per every labeled limb) were tagged. Shoot length was measured twice, first when shoot became suitable for measuring (at the third week of April), while the second when shoot elongation was ceased (in mid-August) in both seasons. Mean shoot length increase was calculated as follows:

Shoot length increase = the 2nd measured (Aug.) – the 1st one (Apr.)

Moreover, the average number of leaves/shoot and leaf area (using the planimeter) were measured in mid August..

2- Fruiting aspects:

2-a- Percentage of fruit set: the initial number of flowers at full bloom and set fruitlets were counted on each tagged limb then the fruit set % was estimated according to Westwood (1978) as follows:

$$\text{Fruit set (\%)} = \frac{\text{Number of set fruitlets}}{\text{Total No. of flowers at full bloom}} \times 100$$

2-b- Tree productivity: Yield per tree expressed as harvested fruits (kg) for each tree (an average of four tagged limbs) as estimated at harvesting date.

3- Fruit quality:

From each tree twenty fruits were randomly sampled (5 from every labelled limb) at harvesting date for determining the following fruit physical and chemical properties.

3-a. Fruit physical characteristics:

In this concern, average fruit weight (g.); volume (ml3); dimensions (height & diameter in mm); shape index (height :diameter ratio) and flesh firmness (lb/inch^2) using the Magness and Tylor (1925) pressure tester with 7/18 plunger were determined after A.O.A.C. (1985).

3-b. Fruit chemical characteristics:

Fruit juice total soluble solids % (TSS %) using hand refractometer and fruit juice total acidity % as malic acid/100 ml fruit juice were determined besides TSS /acid ratio was

also estimated after A.O.A.C. (1985) and Vogel (1968).

4- Leaf nutritional status:

Leaf contents of some-macro elements (N, P, K, Ca, Mg,) and some micro nutrients (Fe, Zn, Mn, and Cu) were determined. The following procedures were used: Total N was determined by micro-kjeldahl method described by Pregl (1945), while P was determined colormeterically according to Murphy and Reily (1962). Other nutrients; i.e. (K, Ca, Mg, Fe, Zn, Mn and Cu) were determined using atomic absorption spectrophotometer (3300) according to Jackson and Ulrish (1959) and Chapman and Pratt (1961).

All data obtained during two seasons were statistically analyzed using the analysis of variance method according to Snedecor and Cochran (1980). However, means were distinguished by the Duncan's multiple range test (Duncan, 1955). Whereas capital and small letters were used for distinguishing between values (means) of specific effect of investigated factors and their combinations (interaction effect), respectively.

RESULTS AND DISCUSSION

1- Some vegetative growth measurements:

Regarding the vegetative growth measurements under study i.e., shoot length increase, number of leaves per shoot and leaf area in response to the specific effect of investigated (N), (K) and (H) soil applied treatments, data presented in Table (2) disclosed clearly that an obvious increase in three growth parameters was generally exhibited with increasing (N), (K) and (H) rates. However, the highest rate of any N: (N_3); K: (K_2) and H: (H_1) induced significantly the longest shoot, the highest number of leaves per shoot and the greatest value of leaf area during the first and second seasons. Contrary to that, the shortest shoot, the least number of leaves/shoot and the smallest leaf area were always in concomitant to those trees subjected to the lowest rate of N: (N_1); K: (K_0) and H: (H_0). Such trend was detected during 2005 and 2006 seasons.

With respect to the interaction effect between (NKH) fertilization treatments on studied growth parameters, data in the same Table declared obviously that the combination between the highest rate of N, K and H i.e., ($N_3K_2H_1$) treatment was statistically the superior as it had the most simulative effect on three investigated growth measurements with comparison to the other tested combinations. Herein the longest shoots with the highest values for both number of leaves per shoot and average leaf area were induced, descendingly followed by the ($N_3K_2H_1$) combination treatment during two seasons of study. On the other hand, the opposite was detected with trees subjected to the lowest (NKH) rate i.e., ($N_1K_0H_0$) combination which was significantly the inferior and exhibited the shortest shoot of the lowest number of leaves per each and the smallest area of leaf. This trend was true during two seasons of study. In addition, the other combinations were statistically intermediate with relatively tendency of variance in this concern. The obtained data concerning the response of vegetative growth measurements to the different studied treatments are in general agreement with the earlier findings of Alva and Obreza (1988), Webb and Biggs (1988), Tatini *et al.*, (1991), Kelting *et al.*, (1997), Nassef (2000), Eissa (2003), Kabeel (2004) and Shddad *et al.*, (2005) on citrus, olive, pear, apricot and peach trees.

2- Fruiting aspects parameters fruit set (%) and yield (kg/tree):

Data obtained in Table (3) displayed obviously that there were positive relationship between the rate or level of N, K and H soil application from one hand and both investigated fruiting measurements of "Le-Conte" pear trees i.e., (percentage of fruit set and yield as kg per tree) from the other. However, both parameters were responded specifically to all used treatments, where they increased gradually and significantly with increasing the applied of 3 fertilizers rates. Herein, the highest rate of N, K and H (N_3);

(K_2) and (H_1) exhibited significantly the highest values of fruit set % and the greatest statistically values of yield as kg/tree. Contrary to that, the reverse was observed with subjected Le-Conte trees to the lowest rate of N, K and H i.e., (N_1); (K_0) and (H_0) which were statistically the inferior as induced the least values of two studied fruiting parameters. Such trend was true both seasons of study.

Concerning the interaction effect of different combinations treatments of (NKH), data presented in the same Table indicate clearly that the specific effect of any studied factor in this investigation was directly reflected on the interaction effect of its own combinations. Whereas, trees subjected to the highest rate of (NKH) combinations treatments i.e., ($N_3K_2H_1$) was the most effective treatment which resulted statistically in the highest values of fruit set percentage and the heaviest yield as kg per tree. Meanwhile, the least values of both fruiting parameters were always in concomitant to that trees supplied with the lowest rate of (NKH) combinations treatments i.e., ($N_1K_0H_0$). In addition, the other combinations were intermediate as compared to the aforesaid two categories. Such trend was detected throughout the two experimental seasons of study.

The obtained results regarding the response of fruiting parameters to different investigated treatments under study were in harmony with those mentioned by Awasthi *et al.*, (1997) on apple; Nassef (2000) and Kabeel and El-Saadany (2004) on pear; Eissa (2003) and Shddad *et al.*, (2005) on apricot and Kabeel (2004) on peach.

3- Fruit quality:-

3-1- Fruit physical properties:

3-1-a- Fruit weight and fruit volume:

Regarding the response of both fruit weight (gm.) and fruit volume (ml^3) to specific effect of (N); (K) and (H) fertilizer rate, data in Table (4) pointed out that two fruit physical characteristics under study increased significantly by increasing the rate of each investigated fertilizer i.e., N, K and H soil applied in two seasons of study. However, trees received the highest rate of N: (N_3); K: (K_2) and H: (H_1) induced fruits had significantly the heaviest weight and the greatest volume. Contrary to that, "Le-Conte" pear trees subjected to the lowest rate i.e., (N_1); (K_0) and (H_0) were statistically the inferior, whereas they resulted in the lightest weight and the smallest volume of pear fruits. Such trend was detected during both 2005 and 2006 seasons of study.

Furthermore, data tabulated in the same Table revealed that the average fruit weight and volume responded significantly to the interaction effect of the (NKH) combinations. Hence, the heaviest weight and the greatest volume of pear fruits were statistically in closed relationship to "Le-Conte" pear trees subjected to the ($N_3K_2H_1$) combinations as compared to other investigated combinations. Meanwhile, the reverse was true with the ($N_1K_0H_0$) treated trees which exhibited significantly the lightest and smallest pear fruits. In addition, other combinations were intermediate as compared to the aforesaid two extremes. This trend was true throughout two seasons of study.

These results are coincident with that reported by many investigators, Abou-Aziz *et al.*, (1987), Yastaas (1990), Nassef (2000) and Kabeel and El-Sadaany (2004) on pear; Awasthi *et al.*, (1997) on apple; Kabeel (2004) on peach and Eissa (2003) and Shddad *et al.*, (2005) on apricot.

3-1-b- Fruit firmness:

concerning the specific effect of soil applied rates of N; K and H on fruit firmness, data in Table (4) showed clearly that an obvious decrease in fruit flesh firmness was generally exhibited with increasing N rate, however the highest N rate i.e., (N_3) resulted significantly the most softened fruits as compared to those of the two other rates (N_1) and (N_2). Since, the medium rate of N:(N_2) inducing fruits having firmer flesh texture. On the other hand, the trend took the other way around with both K rate and H level, whereas the highest values of fruit firmness belonged to the higher rate of K (K_2) and the highest level of H (H_1). Such trend was observed throughout two seasons of study.

Table (2): Shoot length, number of leaves per shoot and leaf area of "Le-Conte" pear trees in response to the different (N), (K) and (H) soil applied rates and their possible combinations during both 2005 and 2006 seasons.

Treatments		Shoot length increase				Leaf area (cm^2)				Number of leaves/shoot			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	68.90g	71.80fg	74.50fg	**73.52C**	24.76h	25.05h	26.13g	**25.63C**	11.67i	12.00hi	12.33g-i	**12.28C**
	N1H1	72.00fg	76.80f	77.10f		24.94h	26.25fg	26.66d-g		12.00hi	12.67gh	13.00fg	
N_2	N2H0	85.80e	88.30e	98.27d	**94.81B**	26.10g	26.57e-g	26.92c-g	**26.77B**	13.67ef	14.00de	14.33de	**14.44B**
	N2H1	90.20e	97.50d	108.8c		26.58e-g	27.09c-f	27.35c-e		14.33de	14.67cd	15.67ab	
N_3	N3H0	99.80d	109.3c	120.7b	**113.70A**	26.88c-g	27.51cd	28.38b	**28.10A**	14.33de	14.67cd	15.33bc	**15.39A**
	N3H1	106.7c	118.5b	127.4a		27.70bc	28.45b	29.69a		15.67ab	16.00ab	16.33a	
Mean**		**87.23C**	**93.70B**	**101.1A**		**26.16C**	**26.82B**	**27.52A**		**13.61C**	**14.00B**	**14.50A**	
Mean***		**(H0) 90.82B**		**(H1) 97.22A**		**(H0) 26.48B**		**(H1) 27.19A**		**(H0) 13.59B**		**(H1) 14.48A**	
		2004 season											
N_1	N1H0	81.30j	85.90ij	91.00hi	**88.65C**	25.21i	25.68i	26.43h	**26.08C**	12.33i	12.33i	13.00hi	**13.11C**
	N1H1	87.50h-j	91.20hi	95.00h		25.67i	26.55h	27.04gh		13.33g-i	13.67gh	14.00f-h	
N_2	N2H0	102.4g	103.6g	114.9ef	**111.80B**	26.58h	27.30fg	27.90d-f	**27.55B**	14.33e-g	15.00d-f	15.00d-f	**15.33B**
	N2H1	.109.0fg	113.7ef	127.5bc		27.38fg	27.87d-f	28.27cd		15.33c-e	16.00b-d	16.33bc	
N_3	N3H0	118.7de	124.5cd	129.8bc	**128.9A**	27.51e-g	28.03de	28.67bc	**28.52A**	15.00d-f	16.00b-d	16.67ab	**16.50A**
	N3H1	122.9cd	134.2b	143.3a		27.89d-f	28.98b	30.06a		16.67ab	17.00ab	17.67a	
Mean**		**103.6C**	**108.8B**	**116.9A**		**26.69C**	**27.40B**	**28.06A**		**14.50C**	**15.00B**	**15.44A**	
Mean***		**(H0) 105.8B**		**(H1) 113.8A**		**(H0) 27.03B**		**(H1) 27.73A**		**(H0) 14.41B**		**(H1) 15.56A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

Table (3): Fruit set (%), Yield (kg/tree) of "Le-Conte" pear trees as affected by (N), (K) and (H) soil application rate and their combinations during 2005 and 2006 seasons.

Treatments		Fruit set (%)				Yield (kg)			
		2005 season							
		K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	9.63l	10.70j	11.17i	**10.99C**	19.60k	20.40j	21.90hi	**20.98C**
	N1H1	10.27k	11.83h	12.35g		20.30j	20.90j	22.80fg	
N_2	N2H0	12.12gh	13.40f	13.70ef	**13.58B**	20.50j	21.70i	24.60d	**22.73B**
	N2H1	13.37f	14.14e	14.72d		20.90j	22.80fg	25.90c	
N_3	N3H0	13.99e	15.38c	15.73bc	**15.54A**	22.40gh	23.90e	27.50b	**25.25A**
	N3H1	15.67bc	15.93b	16.53a		23.30ef	24.60d	29.80a	
Mean**		**12.51C**	**13.57B**	**14.03A**		**21.17C**	**22.38B**	**25.42A**	
Mean***		**(H0) 12.87B**		**(H1) 13.87A**		**(H0) 22.50B**		**(H1) 23.48A**	
2004 season									
N_1	N1H0	10.52m	11.15l	12.22k	**11.84C**	20.47k	21.27j	22.77i	**22.25C**
	N1H1	11.49l	12.49jk	13.17i		21.20j	22.90i	24.90fg	
N_2	N2H0	12.81ij	13.98gh	14.33fg	**14.32B**	21.90j	23.67h	26.77e	**24.79B**
	N2H1	13.93h	15.19e	15.70d		22.70i	24.73fg	29.00c	
N_3	N3H0	14.40f	16.15c	16.93b	**16.30A**	24.37g	26.10e	30.63b	**27.81A**
	N3H1	16.09c	16.87b	17.37a		25.20f	27.97d	32.57a	
Mean**		**13.21C**	**14.31B**	**14.95A**		**22.64C**	**24.44B**	**27.77A**	
Mean***		**(H0) 13.61B**		**(H1) 14.70A**		**(H0) 24.21B**		**(H1) 25.69A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

Table (4): Average fruit weight (gm.), volume (ml.) and firmness (in/inch^2) of "Le-Conte" pear trees in response to specific effect of N, K and H soil application rates and their possible combinations during both 2005 and 2006 seasons.

Treatments		Fruit weight (gm.)				Fruit volume (ml.)				Fruit firmness			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	121.8l	130.2k	142.8h	**135.1C**	116.7l	123.3k	136.7h	**128.6C**	12.47g-i	12.43h-j	12.57fg	**12.54B**
	N1H1	127.5k	135.0j	153.4e		121.7k	128.3ij	145.0ef		12.53gh	12.50g-i	12.73de	
N_2	N2H0	130.2k	139.1i	157.9d	**145.9B**	125.0jk	131.7i	150.0d	**138.9B**	12.50g-i	12.80cd	12.93ab	**12.80A**
	N2H1	135.7ij	147.6fg	164.8c		130.0i	140.0gh	156.7c		12.67ef	12.87bc	13.03a	
N_3	N3H0	137.3ij	150.0f	169.9b	**157.1A**	130.0i	141.7fg	161.7b	**148.6A**	12.17lm	12.10m	12.23kl	**12.25C**
	N3H1	146.2gh	156.7de	182.6a		138.3gh	148.3de	171.7a		12.33jk	12.27kl	12.40ij	
Mean**		**133.1C**	**143.1B**	**161.9A**		**126.9C**	**135.6B**	**153.6A**		**12.44B**	**12.64A**	**12.50B**	
Mean***		**(H0) 142.1B**		**(H1) 149.9A**		**(H0) 135.2B**		**(H1) 142.2A**		**(H0) 12.47B**		**(H1) 12.69A**	
		2004 season											
N_1	N1H0	125.9m	137.7k	143.9ij	**138.9C**	120.0k	131.7hi	135.0gh	**131.7C**	12.57gh	12.63fg	12.80de	**12.74B**
	N1H1	133.3l	142.8j	149.9h		126.7j	135.0gh	141.7f		12.73ef	12.77de	12.93c	
N_2	N2H0	135.8k	149.6h	153.4g	**149.5B**	130.0ij	141.7fg	146.7e	**142.2B**	12.80de	12.87cd	13.07ab	**12.99A**
	N2H1	142.7j	154.5g	161.1e		135.0gh	146.7e	153.3cd		12.97bc	12.97bc	13.23a	
N_3	N3H0	146.3i	163.9d	172.0b	**166.0A**	138.3fg	155.0c	163.3b	**157.5A**	12.27k	12.40ij	12.43i	**12.41C**
	N3H1	158.2f	169.5c	186.3a		150.0de	160.0b	178.3a		12.30jk	12.47hi	12.57gh	
Mean**		**140.4C**	**153.0B**	**161.1A**		**133.3C**	**145.0B**	**153.1A**		**12.61B**	**12.69B**	**12.84A**	
Mean***		**(H0) 147.6B**		**(H1) 155.4A**		**(H0) 140.2B**		**(H1) 147.4A**		**(H0) 12.64B**		**(H1) 12.78A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

As for the interaction effect of different combinations treatments on fruit firmness, data in the same Table declared obviously that both combinations treatments of the ($N_2K_2H_1$) and ($N_2K_2H_0$) soil applied rates induced fruits had significantly the firmest flesh texture. Meanwhile, the reverse was true with both combinations treatments between the (N_3K_0) soil applied rates associated with any of H levels (either H_0 or H_1) resulted in statistically increasing flesh softness of "Le-Conte" pear fruits as compared to any other investigated combinations. Moreover, the other (NKH) combinations treatments were in between as compared with the abovementioned two extents. Such trend was true during both 2005 and 2006 seasons of study.

The present results are generally in agreement with those mentioned by Nassef (2000), Kabeel and El-Sadaany (2004) on pear; Awasthi *et al.*, (1997) on apple and Kabeel (2004) on peach.

3-1-c- Fruit dimensions (fruit height and diameter):

Referring the response of both fruit height and fruit diameter (mm.) to the specific effect of different (N); (K) and (H) fertilizer rates, data in Table (5) showed clearly that both tested fruit characteristics increased significantly by increasing the (N); (K) and (H) soil applied rate. Since, the greatest values of both fruit height and equatorial diameter (wide) were statistically in closed relationship to those trees supplied with the higher rate of N: (N_3); K: (K_2) and H (H_1). On the other hand, the least values of both fruit height and diameter were statistically resulted by the lowest rate of N; K and H i.e., (N_1); (K_0) and (H_0). Moreover, differences in fruit dimensions due to the different rate of N, K and H were significant as fruit dimensions of each rate for a given fertilizer were compared to the analogous ones of the other investigated rates. Such trend was observed during two experimental seasons.

With respect to, the response of pear fruit dimensions to the interaction effect, Table (5) indicates clearly that specific effect of each investigated fertilizer rate reflected obviously on its own combinations and variance were significantly quite evident. Anyhow, the $N_3K_2H_1$ treated "Le-Conte" trees induced significantly the highest and widest fruits during two seasons. However, the $N_1K_0H_0$ treated trees were statistically the inferior as their produced fruits had the least values of both fruit height and width in two seasons. Moreover, the other combinations were in between the abovementioned two extremes. Such trend was the same during both 2005 and 2006 seasons.

These results are in conformity with that previously reported by Nassef (2000) and Kabeel and El-Sadaany (2004) on pear; Eissa (2003) and Shddad *et al.*, (2005) on apricot.

3-1-d- Fruit shape index (fruit height / diameter ratio):

With respect to fruit shape index (fruit height/fruit diameter ratio), data in Table (5) pointed out that variation due to the specific effect of soil applied rates of N, K and H fertilizer in most cases was not so pronounced to be taken into consideration during both seasons. Herein, the changes in fruit shape index due to the specific effect of applied rates of three NKH fertilizers were too slight and it could be safely neglected. Such trend could be logically explained on that fact detected from the discussed results pertaining the paralleled rate of response for two fruit dimensions to investigated rates of a given fertilizer.

The present results are in a partial agreement with those stated by Kabeel (2004) on peach; Nassef (2000) and Kabeel and El-Sadaany (2004) on pear.

3-2- Fruit chemical properties:

3-2-a- Fruit juice total soluble solids percentage (TSS %):

Data in Table (6) show obviously the positive relationship between the fruit juice TSS % and soil applied rate of each investigated factor (fertilizer) i.e., (N); (K) and H. However, providing pear trees with the highest rate i.e., (N_3); (K_2) and (H_1) induced fruits had significantly the highest values of TSS %. On the other hand, the lowest values of fruit juice TSS % was always in

concomitant to those trees received (N_1); (K_0) and (H_0) soil added rate which ranked last in this concern. Differences in fruit juice TSS % due to variable rates of N; K and H were significant as investigated rates of each fertilizer were compared each other during two experimental seasons.

Moreover, data in the same Table indicated that fruit juice TSS % responded significantly to interaction effect of (NKH) combinations, whereas treated trees with ($N_3K_2H_1$) induced fruits containing the highest statistical value of total soluble solids percentage. The opposite was observed with subjected trees to ($N_1K_0H_0$) which produced the poorest fruits in their juice TSS content. Meanwhile, other (NKH) combinations were statistically intermediate in this concern. This trend was detected throughout both 2005 and 2006 seasons of study.

3-2-b- Fruit juice total titratable acidity percentage:

Data in Table (6) revealed clearly that fruit juice acidity % followed similar trend to that previously discussed with fruit juice TSS % regarding the specific effect of both (N & K) and (H) soil applied rate during the two seasons of study. However, rate of response was relatively less pronounced with fruit juice acidity.

Referring the interaction effect on fruit juice total acidity, Table (6) displays that two higher N rates i.e., N_2 and N_3 when combined with H_1 from one hand and K_1 and/or K_2 from the other resulted generally in the highest fruit juice total acidity during both seasons. However, three combinations of (N_3H_0), regardless of the K soil applied rate especially during 2nd season were statistically similar to the aforesaid superior combinations. On the contrary, the least fruit juice total acidity was statistically in closed relationship to three combinations of (N_1H_0) regardless of K soil applied rate during two seasons of study. In addition, other combinations were in between the aforesaid extremes.

3-2-c- TSS/acid ratio:

With regard to the specific effect of different investigated of N, K and H fertilizers rate on TSS/acid ratio of "Le-Conte" pear fruits, it is so worthy to be noticed from data in Table (6) that a positive relationship was observed between TSS/acid ratio and K soil added rate. Whereas, TSS/acid ratio was increased significantly by increasing (K) soil applied rate, since the highest rate of K i.e., (K_2) induced the greatest value of TSS/acid ratio. The opposite was observed with H soil application. However, the response of fruit juice TSS/acid ratio to N rates did not follow firm trend in spite of the intermediate N rate (N_2) was significantly more effective to increase fruit juice TSS/acid ratio as compared to either lower or higher levels (N_1, N_3) during both seasons.

As for the interaction effect of different combinations between N, K and H on TSS/acid ratio of pear fruits, data in the same Table pointed out that pear trees subjected to (N_2K_2) rates regardless of H was applied or not exhibited statistically the highest TSS/acid values. On the other hand, the least values of TSS/acid ratio was always in concomitant produced fruits by. Such trees representative of eight combinations between (K_0 & K_1) from one hand and no soil added Humate (H_0) from the other, regardless of N soil added. However, three of N_1 x K_0 tended relatively to reduce TSS/acid ratio during two seasons. Moreover, other combinations were in between the aforesaid two extremes. Such trend was true in two experimental seasons.

The obtained data concerning the response of fruit chemical properties to the investigated treatments were supported by the findings of several investigators, Awasthi *et al.*, (1997); Kabeel (2004) on peach; Eissa (2003) and Shddad *et al.*, (2005) on apricot; Abou-Aziz *et al.* (1987), Yastaas (1990) Nassef (2000) and Kabeel and El-Sadaany (2004) on pear trees.

4- Leaf nutritional status (leaf mineral composition):-

4-1- Leaf content of some macronutrients (N, P, K, Ca and Mg):

Data in Tables (7 & 8) showed obviously that leaf macro nutrients contents (N, P, K, Ca and Mg) of "Le-Conte" pear trees responded specifically to the investigated soil

applied rates of N; K and H fertilizers. Hence, leaf contents of N, P, K, Ca and Mg increased significantly by increasing N; K and H applied levels. However, treated trees with the higher rate of N: (N_3); K: (K_2) and H: (H_1) had leaves contained the highest values of the studied macronutrients except Ca % which did not respond to H soil application. On the other hand, the least values of leaf N, P, K, Ca and Mg contents were in closed relationship to the trees subjected to the lowest rate of N: (N_1); K: (K_0) and H: (H_0). Moreover, differences were significant between all the investigated rates of either N or K from one hand and H application except Ca % from another. Such trend was detected during both seasons of study.

With regard to the interaction effect, data in the same Tables displayed clearly that the specific effect of three factors under study reflected directly on their interaction effect. Anyhow, trees received the combinations representing the highest rates of (N x K) soil application from one hand and (H) soil added rate from the other i.e., ($N_3K_2H_1$) treated trees exhibited statistically the greatest leaf macronutrients (N, P, K, Ca and Mg) contents. Besides, the $N_3K_2H_0$ treated trees showed also the same influence on leaf Ca %. On the contrary, the least N, P, K, Ca and Mg contents in most cases were markedly coupled with three combinations of the least N rate (N_1) i.e., ($N_1K_0H_0$); ($N_1K_0H_1$) and ($N_1K_1H_0$) especially former one with leaf N % which was significantly the inferior as compared to two other combinations of such category during two seasons. In addition, other combinations were in between the aforesaid two extremes during two seasons of study.

4-2- Leaf content of some micronutrients (Fe, Zn, Mn, and Cu):

with respect to the leaf (Fe, Zn Mn and Cu) contents, data presented in Tables (8 & 9) revealed that there are a positive relationship between the rate or level of N; K or H soil applied and the studied leaf micronutrients contents. However, trees received the highest rate of N: (N_3); K: (K_2) or H (H_1) was the most effective and resulted significantly the greatest values of the leaf (Fe, Zn, Mn and Cu) contents. Meanwhile, the opposite was observed with trees subjected to the lowest rate i.e., (N_1); (K_0) and (H_0) where each was significantly the inferior and exhibited the poorest leaf (Fe, Zn, Mn and Cu) contents throughout two experimental seasons.

Moreover, data obtained in the same Tables indicated that leaf micronutrients content responded obviously to the interaction effect of (NKH) combinations, whereas those of the higher rates of (NKH) resulted in a significant increase in leaf (Fe, Zn, Mn and Cu) content as compared with other NKH combinations during two seasons. On the other hand, the differences between most investigated combinations were significant in most cases as they were compared each other in the two seasons of study. Furthermore, the highest rate of (NKH) soil applied i.e., ($N_3K_2H_1$) treatment was more effective and induced significantly the highest value and richest leaves in their (Fe, Zn, Mn and Cu) contents during 2005 and 2006 seasons. Whereas, the remained combinations were in between the aforesaid two extremes with relative tendency of various in two seasons. This trend, was true during two seasons of study.

Generally, the present results are in a general agreement with those reported by Awasthi *et al.*, (1997) on apple; Nassef (2000); Kabeel and El-Saadany (2004) on pear trees; Kabeel (2004) on peach trees; Liu *et al.*, (1998) and Shddad *et al.*, (2005) on apricot trees.

Table (5): Average fruit dimensions (length & diameter and shape index (height/diameter ratio) of "Le-Conte" pear trees in response to specific effect of N, K and H soil application rates and their possible combinations during 2005 and 2006 seasons.

Treatments		Fruit height (mm.)				Fruit diameter (mm.)				Fruit shape index			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	74.33j	76.67h-j	79.33gh	**77.78C**	59.00i	61.33hi	64.00f-h	**62.28C**	1.24e-g	1.25c-f	1.26cd	**1.25A**
	N1H1	76.00ij	77.00h-j	83.33ef		61.00hi	62.00h	66.33d-f		1.26cd	1.24e-g	1.25c-e	
N_2	N2H0	77.33h-j	78.67hi	86.33c-e	**82.28B**	62.67gh	64.00f-h	69.00b-d	**66.00B**	1.25d-e	1.23g	1.23fg	**1.25A**
	N2H1	79.33gh	82.33fg	89.67b		63.33f-h	65.67e-g	71.33b		1.26cd	1.25c-e	1.25c-e	
N_3	N3H0	82.00fg	85.00d-f	88.33bc	**87.06A**	64.00f-h	68.00c-e	70.67bc	**68.61A**	1.26cd	1.25c-e	1.28b	**1.27A**
	N3H1	86.00c-e	87.00b-d	94.00a		65.33e-g	69.33bc	74.33a		1.27bc	1.26cd	1.32a	
Mean**		**79.17C**	**81.11B**	**86.83A**		**62.56C**	**65.06B**	**69.28A**		**1.26AB**	**1.25B**	**1.27A**	
Mean***		**(H0) 80.89B**		**(H1) 83.85A**		**(H0) 64.74B**		**(H1) 66.52A**		**(H0) 1.25A**		**(H1) 1.26A**	
		2004 season											
N_1	N1H0	76.67j	80.67g-i	82.00e-h	**80.50C**	61.00i	64.00gh	65.00fg	**64.28C**	1.26bc	1.26bc	1.26bc	**1.25A**
	N1H1	78.33ij	81.33f-h	84.00d-f		62.33hi	65.00fg	68.33cd		1.26bc	1.25bc	1.24b-d	
N_2	N2H0	80.00hi	83.00d-g	85.00cd	**83.39B**	64.00gh	66.00e-g	68.33cd	**66.61B**	1.25bc	1.25bc	1.24b-d	**1.25A**
	N2H1	80.67g-i	84.33de	87.33c		64.00gh	67.33de	70.00c		1.26bc	1.26bc	1.25bc	
N_3	N3H0	83.33d-g	87.33c	92.00b	**89.06A**	67.00d-f	69.67c	73.33b	**71.06A**	1.24b-d	1.25bc	1.26bc	**1.25A**
	N3H1	85.00cd	90.00b	96.67a		68.00c-e	72.33b	76.00a		1.26bc	1.23d	1.28a	
Mean**		**80.67C**	**84.44B**	**87.83A**		**64.39C**	**67.39B**	**70.17A**		**1.25A**	**1.25A**	**1.25A**	
Mean***		**(H0) 83.33B**		**(H1) 85.30A**		**(H0) 66.48B**		**(H1) 68.15A**		**(H0) 1.25A**		**(H1) 1.25A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

Table (6): Fruit juice TSS %, acidity % and TSS/acid ratio of "Le-Conte" pear trees as affected by specific effect of soil applied (N), (K) and (H) rates and their possible combinations during 2005 and 2006 seasons.

Treatments		TSS (%)				Acidity (%)				TSS/acid ratio			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	12.10k	12.17jk	12.20jk	**12.26C**	0.227g	0.227g	0.233fg	**0.238C**	50.51c-e	49.71d-f	51.23b-d	**49.23B**
	N1H1	12.27i-k	12.33h-j	12.47f-i		0.233fg	0.243e-g	0.267a-d		47.06h	48.23f-h	48.62e-h	
N_2	N2H0	12.43g-i	12.57e-g	12.77c-e	**12.64B**	0.247ef	0.253c-e	0.250d-f	**0.258B**	50.50a	52.30a-c	53.68a	**51.13A**
	N2H1	12.50f-h	12.67e-g	12.90cd		0.260b-e	0.270a-c	0.267a-d		46.91h	50.77b-d	52.60ab	
N_3	N3H0	12.67e-g	12.93c	13.33b	**13.06A**	0.250d-f	0.260b-e	0.270a-c	**0.268A**	49.45d-g	49.88d-f	50.72cd	**48.81B**
	N3H1	12.70d-f	13.17b	13.57a		0.270a-c	0.277ab	0.283a		47.16h	47.71gh	47.94f-h	
Mean**		**12.44C**	**12.64B**	**12.87A**		**0.248B**	**0.255A**	**0.262A**		**40.76B**	**41.73AB**	**42.70A**	
Mean***		**(H0) 12.57B**		**(H1) 12.73A**		**(H0) 0.246B**		**(H1) 0.263A**		**(H0) 50.89A**		**(H1) 48.56B**	
		2004 season											
N_1	N1H0	12.37j	12.47ij	12.53hi	**12.53C**	0.237f	0.250d-f	0.257c-e	**0.254B**	47.77e-j	48.14d-i	48.64c-h	**47.56C**
	N1H1	12.53hi	12.60g-i	12.67f-h		0.247ef	0.267a-d	0.270a-c		45.59k	46.08jk	49.12c-f	
N_2	N2H0	12.67f-h	12.77d-f	12.87c-e	**12.78B**	0.263b-e	0.263b-e	0.270a-c	**0.269A**	48.88c-g	50.00bc	52.37a	**49.40A**
	N2H1	12.73e-g	12.73e-g	12.90cd		0.260b-e	0.277ab	0.283a		46.94h-k	47.31f-k	50.90ab	
N_3	N3H0	12.87c-e	12.97c	13.33a	**13.12A**	0.273a-c	0.267a-d	0.270a-c	**0.272A**	47.16g-k	48.63c-h	49.48b-e	**48.39B**
	N3H1	12.93c	13.13b	13.47a		0.260b-e	0.283a	0.277ab		46.49i-k	48.71c-h	49.88b-d	
Mean**		12.68C	12.78B	12.96A		0.257B	0.268A	0.271A		39.54B	40.47B	41.88A	
Mean***		**(H0) 12.76B**		**(H1) 12.86A**		**(H0) 0.261B**		**(H1) 0.269A**		**(H0) 49.01A**		**(H1) 47.89B**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

Table (7): Leaf N, P, K contents of Le-Conte pear trees in response to specific effect of N, K, H soil applied rates and interaction effect of their combinations during 2005 and 2006 seasons experimental seasons.

Treatments		Nitrogen (%)				Phosphorus (%)				Potassium (%)			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	1.90k	2.10ij	2.47c	**2.20C**	0.123h	0.127gh	0.137d-h	**0.134B**	1.23j	1.30ij	1.37hi	**1.37C**
	N1H1	2.03j	2.20f-h	2.50c		0.133e-h	0.137d-h	0.150b-e		1.37hi	1.47g	1.50fg	
N_2	N2H0	2.13hi	2.23fg	2.50c	**2.36B**	0.130f-h	0.133e-h	0.143c-g	**0.146A**	1.43gh	1.50fg	1.60de	**1.58B**
	N2H1	2.27ef	2.37d	2.63b		0.147c-f	0.153b-d	0.167ab		1.57ef	1.63de	1.77b	
N_3	N3H0	2.17g-i	2.37d	2.67b	**2.48A**	0.137d-h	0.133e-h	0.147c-f	**0.151A**	1.60de	1.67cd	1.73bc	**1.75A**
	N3H1	2.33de	2.53c	2.83a		0.157a-c	0.160a-c	0.173a		1.78b	1.80b	1.90a	
Mean**		**2.14C**	**2.30B**	**2.60A**		**0.138B**	**0.141B**	**0.153A**		**1.50C**	**1.56B**	**1.64A**	
Mean***		**2.28B**		**2.41A**		**0.134B**		**0.153A**		**1.49B**		**1.64A**	
		2004 season											
N_1	N1H0	2.07k	2.37ij	2.53f-h	2.38C	0.130h	0.133gh	0.140e-h	0.145C	1.30h	1.40g	1.40g	1.44C
	N1H1	2.17k	2.50gh	2.67c-e		0.150c-g	0.157b-e	0.160b-d		1.47fg	1.53ef	1.57ef	
N_2	N2H0	2.33j	2.50gh	2.70cd	2.58B	0.140e-h	0.137f-h	0.150c-g	0.152B	1.47fg	1.57ef	1.62de	1.63B
	N2H1	2.47g-i	2.63d-f	2.83ab		0.153c-f	0.160b-d	0.173ab		1.57ef	1.70cd	1.88b	
N_3	N3H0	2.43h-j	2.70cd	2.77bc	2.69A	0.143d-h	0.147d-h	0.157b-e	0.162A	1.63de	1.70cd	1.77c	1.79A
	N3H1	2.57e-g	2.77bc	2.90a		0.167bc	0.173ab	0.187a		1.77c	1.87b	2.03a	
Mean**		2.34C	2.58B	2.73A		0.147B	0.151B	0.161A		1.53C	1.63B	1.71A	
Mean***		**(H0) 2.49B**		**(H1) 2.61A**		**(H0) 0.142B**		**(H1) 0.164A**		**(H0) 1.54B**		**(H1) 1.71A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

Table (8): Leaf Ca, Mg, Fe contents of Le-Conte pear trees in response to specific effect of N, K, H soil applied rates and interaction effect of their combinations during 2005 and 2006 seasons experimental seasons.

Treatments		Calcium (%)				Magnesium (%)				Iron (ppm)			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	1.18i	1.20hi	1.30e-g	1.26C	0.533i	0.567hi	0.617e-h	0.616C	143.3j	148.3h-j	146.7ij	152.5C
	N1H1	1.25g-i	1.27gh	1.38c-e		0.633e-g	0.650d-f	0.693cd		156.7e-h	161.7b-f	158.3d-g	
N_2	N2H0	1.32e-g	1.37d-f	1.49b	1.37B	0.583g-i	0.593f-h	0.660de	0.665B	145.0ij	148.3h-j	148.3h-j	155.8B
	N2H1	1.28fg	1.32e-g	1.46bc		0.700cd	0.693cd	0.760b		160.0c-g	163.3b-e	170.0ab	
N_3	N3H0	1.37d-f	1.45bc	1.61a	1.50A	0.600f-h	0.633e-g	0.743bc	0.713A	153.3f-i	151.7g-j	156.7e-h	162.2A
	N3H1	1.43b-d	1.47b	1.65a		0.700cd	0.750bc	0.850a		166.7b-d	168.3bc	176.7a	
Mean**		1.31C	1.34B	1.48A		0.625C	0.648B	0.721A		154.2B	156.9AB	159.4A	
Mean***		**(H0) 1.37A**		**(H1) 1.39A**		**(H0) 0.614B**		**(H1) 0.714A**		**(H0) 149.1B**		**(H1) 164.6A**	
		2004 season											
N_1	N1H0	1.27i	1.37f-h	1.47de	1.36C	0.590j	0.633h-j	0.700fg	0.699C	150.0i	153.3hi	155.0g-i	159.2C
	N1H1	1.32hi	1.35gh	1.38fg		0.677g-i	0.760e	0.833cd		161.7e-g	166.7de	168.3c-e	
N_2	N2H0	1.37f-h	1.45de	1.58b	1.46B	0.623ij	0.683gh	0.767e	0.759B	155.0g-i	156.7f-i	161.7e-g	165.8B
	N2H1	1.38fg	1.44de	1.53bc		0.750ef	0.840b-d	0.890bc		168.3c-e	173.3b-d	180.0b	
N_3	N3H0	1.44de	1.53bc	1.70a	1.54A	0.650g-i	0.750ef	0.850b-d	0.819A	158.3f-h	163.3ef	171.7cd	173.6A
	N3H1	1.41ef	1.49cd	1.67a		0.823d	0.893b	0.950a		175.0bc	180.0b	193.3a	
Mean**		1.36C	1.44B	1.56A		0.686C	0.760B	0.832A		161.4C	165.6B	171.7A	
Mean***		**(H0) 1.46A**		**(H1) 1.44B**		**(H0) 0.694B**		**(H1) 0.824A**		**(H0) 158.3B**		**(H1) 174.1A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

Table (9): Leaf Zn, Mn, Cu contents of Le-Conte pear trees in response to specific effect of N, K, H soil applied rates and interaction effect of their combinations during 2005 and 2006 seasons experimental seasons.

Treatments		Zinc (ppm)				Manganese (ppm)				Cupper (ppm)			
		2005 season											
		K0	K1	K2	Mean*	K0	K1	K2	Mean*	K0	K1	K2	Mean*
N_1	N1H0	21.00g	22.00g	24.17ef	23.94C	32.33j	33.00ij	36.00gh	35.11C	10.90i	10.77i	10.97i	11.15B
	N1H1	23.33f	25.00e	28.17d		35.33h	35.00hi	39.00de		11.33h	11.40h	11.53f-h	
N_2	N2H0	25.33e	25.00e	27.17d	27.72B	34.00h-j	36.33f-h	39.00de	38.94B	11.47gh	11.50gh	11.70e-g	11.72AB
	N2H1	27.33d	28.33d	33.17b		38.00e-g	41.67c	44.67b		11.80ef	11.73e-g	12.10cd	
N_3	N3H0	25.00e	27.17d	30.00c	30.22A	35.67h	38.33d-f	42.33c	41.78A	11.93de	12.07cd	12.17cd	12.25A
	N3H1	27.67d	32.33b	39.17a		40.33cd	45.00b	49.00a		12.27bc	12.43ab	12.63a	
Mean**		24.94C	26.64B	30.31A		35.94C	38.22B	41.67A		11.62A	11.65A	11.85A	
Mean***		**(H0) 25.20B**		**(H1) 29.39A**		**(H0) 36.33B**		**(H1) 40.89A**		**(H0) 11.50A**		**(H1) 11.81A**	
		2004 season											
N_1	N1H0	23.33k	23.50k	26.67hi	25.83C	36.33i	38.33kl	42.00ij	41.61C	11.70i	11.93hi	12.13e-h	12.09B
	N1H1	25.50j	26.67hi	29.33f		40.33jk	47.00e-g	45.67f-h		11.97g-i	12.33d-g	12.50c-e	
N_2	N2H0	25.83ij	27.50h	30.17e	29.97B	39.00kl	42.00ij	45.00gh	46.28B	12.03f-i	12.47c-e	12.67b-d	12.5A4B
	N2H1	28.33g	30.67e	37.33b		46.00f-h	52.33c	53.33c		12.37d-f	12.70b-d	13.00b	
N_3	N3H0	27.33h	30.33e	35.00c	32.97A	44.00hi	49.33de	48.33d-f	51.78A	12.40c-f	12.63b-d	13.00b	12.86A
	N3H1	30.33e	33.50d	41.33a		51.00cd	57.00b	61.00a		12.77bc	12.97b	13.40a	
Mean**		26.78C	28.69B	33.31A		42.78C	47.67B	49.22A		12.21B	12.51A	12.78A	
Mean***		**(H0) 27.74B**		**(H1) 31.44A**		**(H0) 42.70B**		**(H1) 50.41A**		**(H0) 12.33B**		**(H1) 12.67A**	

*; ** and *** reffer to specific effect of investigated N, K and H rate, respectively. Mmeans followed by the same letter/s are not significantly different at 5 % level..

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أستجابة النمو والإثمار والحالة الغذائية لأشجار الكمثرى "ليكونت" للأسمدة المعدنية والهيوميت

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* أجرى هذا البحث خلال موسمى ٢٠٠٥، ٢٠٠٦ بهدف دراسة استجابة أشجار الكمثرى "ليكونـــت" لمعـــدلات مختلفة من الإضافة الأرضية من النيتروجين والبوتاسيوم وحمض الهيوميك علـــى بعـــض قياســـات النمـــو الخضرى والإثمار وخصائص (جودة) الثمار ومحتوى الأوراق من العناصر الغذائية.

* وقد أشارت النتائج المتحصل عليها أن هناك تأثيراً واضحاً للمعاملات المختبرة تحت الدراسة حيث لـــوحظ أن هناك علاقة (طردية) إيجابية بين كل قياسات النمو الخضرى ومستويات الإضافة الأرضية من السمدة الثلاثـــة خلال موسمى الدراسة وكان ذلك مقروناً بزيادة معنوية فى قياسات الإثمار (النســـبة المئويـــة لعقـــد الثمـــار، محصول الشجرة بالكجم).

* إضافة إلى ذلك فإن كل من الصفات الطبيعية (وزن وحجم وصلابة الثمار وأيضاً ارتفاع وقطر ودليل شـــكل الثمرة) وكذلك بعض الصفات الكيماوية للثمار مثل (النسبة المئوية للمواد الصلبة الذائبة الكلية – النسبة المئوية للحموضة الكلية والنسبة بين كل منهما) قد تحسنت معنوياً نتيجة للمعاملات التسميدية المختلفة المختبـــرة فـــى معظم الحالات خلال موسمى الدراسة.

* كما أظهرت النتائج أن الحالة الغذائية للأشجار (محتوى الأوراق من بعض العناصر الكبرى منها والصـــغرى) قد استجابت إحصائياً لكل المعاملات السمادية تحت الدراسة خلال موسمى التجربة.

* وبصفة عامة فإنه يمكن القول بأن كل المعاملات المختبرة من النيتروجين والبوتاســـيوم وحمـــض الهيوميـــك تحت ظروف التجربة كان لها التأثير الفعال المعنوى على القياسات الهامة من نمو وإثمـــار وجـــودة الثمـــار والحالة الغذائية لأشجار الكمثرى صنف "ليكونت" ولقد كانت المعاملة التى تمثل إضافة ١,٥ كجـــم/N + ١,٢ كجم/K_2O + ٦٠ سم من حمض الهيوميك لكل شجرة/سنوياً هى أفضل المعاملات وأكثرها فعالية فى زيـــادة وتحسين تلك القياسات.