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EFFECTS OF DIFFERENT SOIL APPLIED LEVELS OF (NPK) AND ACTOSOL COMPOUND ON GROWTH, FRUITING PARAMETERS AND FRUIT QUALITY OF PEAR TREES

BY

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ABSTRACT

This study was carried out to cover the influence of (NPK) and Actosol compound (NPK, humate) at different combinations on some vegetative growth, fruiting measurements and leaf nutrient status as well as fruit characteristics of "Le-Conte" pear trees budded on *Pyrus communis* L., rootstock. The trees were 15 years old and grown at El-Kanater Horticultural Research Station during 2007 and 2008 successive seasons.

Data obtained displayed obviously that most of combination treatments in this study exhibited a positive effect and a significant increase in all investigated vegetative growth measurements i.e., (shoot length, shoot diameter and number of leaves per shoot). Moreover, fruiting parameters (fruit set % and tree yield either kg/tree or number of fruits/ tree and yield as tons/fed.) were significantly increased with increasing the levels of (NPK x HA) soil applied combinations. Furthermore, fruit quality including fruit physical properties i.e., (fruit weight, volume, firmness, length, diameter and fruit shape index) and fruit chemical characteristics i.e., (TSS %, acidity %, TSS/acid ratio and total sugar content) were significantly improved as a result of the highest soil application rates of (NPK x HA) when compared to the lowest level i.e., ($N_1P_1K_1$ x HA_0). Furthermore, leaf nutrient composition of some macro elements (N, P and K) and some micro nutrients (Fe and Zn) were improved by the different investigated combination treatments under study from the standpoint of statistic during both 2007 and 2008 seasons.

In general, it could be concluded that most of studied combinations treatments of (NPK x HA) soil applied resulted in a positive and a significant influence on most investigated measurements and characteristics of "Le-Conte" pear fruit trees. Since, the ($N_4P_4K_4$ x HA_2) soil applied combination treatment was the most effective treatment for increasing growth measurements, fruiting parameters and improving both leaf nutritional status and the most of physical and chemical fruit properties of "Le-Conte" pear trees grown under Qalyoubia Governorate condition.

INTRODUCTION

It is well known that pear is considered one of the most delectable and important deciduous fruit trees cultivated in Egypt along time ago. Increasing and improving both yield and fruit quality. Additionally reducing both the production costs and environmental pollution are the vital and important aims of researchers.

Therefore, a great attention is focued on the soil applied of mineral fertilizers combined with some biostimulants to reduce or replace partially these fertilizers. Thus many attempts were carried out in this respect by several investigators, Awasthi *et al.* (1997), Jianguo *et al.* (1998) and Liu *et al.* (1998) on olive; Nassef (2000), and Kabeel and El-Saadany (2004) on pear; Kabeel (2004) on peach Eissa (2003) and Shaddad *et al.* (2005) on apricot and Fernandez *et al.* (1996) on olive trees.

These consideration led us to the current study for investigating the effect of the different levels of mineral (NPK) fertilizers and various rates of Actosol compound (NPK, humate), either alone or in combinations on some vegetative growth, fruiting parameters, leaf nutrient content and fruit quality of mature "Le-Conte" pear trees grown under El-Kanater region condition.

MATERIALS AND METHODS

The present investigation has been carried out in the experimental farm at El-Kanater Horticultural Research Station, Qalyoubia Governorate, Egypt, during two consecutive seasons (2007 and 2008) on "Le-Conte" mature pear trees budded on (*Pyrus communis* L.) rootstock. The trees were 15 years old planted at five maters apart in a square system and grown on loamy soil. Trees were carefully selected to be healthy, nearly uniform in vigour as possible and received regularly the same horticultural practices adopted in the region.

Physical and chemical analysis of the experimental soil at (0-30 cm.) depth are shown in Table (1). The standard method used were according to Piper (1950) and Jackson (1958).

Table (1): Physical and chemical analysis of the soil of pear orchard at (0-30 cm.) depth in 2007 season.

A- Physical analysis						
Sand %	Silt %	Clay %	Soil texture	F.C. (%)	W.P. (%)	A.W. (%)
17.80	29.00	52.30	Clay loam	42.30	20.90	20.40

B- Chemical analysis										
	Available nutrient (mg./kg.)							Ec. ds/m	pH (1:2.5)	$CaCO_3$
	N	P	K	Fe	Zn	Mn	Cu			
Total	695	360	4490	3080	112	138	46			
Avail.	59.00	13.80	602.0	21.00	5.60	16.70	2.40	2.60		

Four levels of mineral nitrogen were added to the soil i.e., (N_1= 0.5, N_2= 1.0, N_3= 1.5 and N_4= 2.0 kg/tree/year) in the form of Ammonium sulphate (20.6 % N) combined with four rates of both potassium and phosphorus i.e., (K_1= 0.25, K_2= 0.5, K_3= 0.75 and K_4= 1.0 kg/tree/year) and (P_1= 0.25, P_2= 0.5, P_3= 0.75 and P_4= 1.0 kg/tree/year) in the form of potassium sulphate (48 % K_2O) and mono-super phosphate (15.5 % P_2O_5), respectively. Each NK rate was divided and applied in three split equal doses in the first week of March, late April and mid-June, whereas P level was added once a year at the third week of January in the two seasons of study. Moreover, three rates of Actosol* compound i.e., (0, 50 and 100 ml/tree) were applied to the soil monthly for four times beginning of the first week of April till the first week of July during the two seasons of study.

Accordingly, the different investigated treatments in this study were as follows:

1- NPK soil applied at (0.50, 0.25 & 0.25 kg/tree) from each mineral fertilizer + no HA soil added ($N_1P_1K_1$ + HA_0) respectively.
2- NPK soil applied at (0.50, 0.25 & 0.25 kg/tree) from each mineral fertilizer + (50 cm.) HA soil added ($N_1P_1K_1$ + HA_1) respectively.
3- NPK soil applied at (0.50, 0.25 & 0.25 kg/tree) from each mineral fertilizer + (100 cm.) HA soil added ($N_1P_1K_1$ + HA_2) respectively.

* Actosol = NPK Humate (10-10-10-2.9) Guaranteed Analysis: Total nitrogen 10 % (w/w), Available phosphorus (P_2O_5) 10 % (w/w), Available potash (K_2O) 10 % (w/w) and Humate (chelator) 2.9 % (w/w)

4- NPK soil applied at (1.00, 0.50 & 0.50 kg/tree) from each mineral fertilizer + no HA soil added ($N_2P_2K_2$ + HA_0) respectively.
5- NPK soil applied at (1.00, 0.50 & 0.50 kg/tree) from each mineral fertilizer + (50 cm.) HA soil added ($N_2P_2K_2$ + HA_1) respectively.
6- NPK soil applied at (1.00, 0.50 & 0.50 kg/tree) from each mineral fertilizer + (100 cm.) HA soil added ($N_2P_2K_2$ + HA_2) respectively.
7- NPK soil applied at (1.50, 0.75 & 0.75 kg/tree) from each mineral fertilizer + no HA soil added ($N_3P_3K_3$ + HA_0) respectively.
8- NPK soil applied at (1.50, 0.75 & 0.75 kg/tree) from each mineral fertilizer + (50 cm.) HA soil added ($N_3P_3K_3$ + HA_1) respectively.
9- NPK soil applied at (1.50, 0.75 & 0.75 kg/tree) from each mineral fertilizer + (100 cm.) HA soil added ($N_3P_3K_3$ + HA_2) respectively.
10- NPK soil applied at (2.00, 1.00 & 1.00 kg/tree) from each mineral fertilizer + no HA soil added ($N_4P_4K_4$ + HA_0) respectively.
11- NPK soil applied at (2.00, 1.00 & 1.00 kg/tree) from each mineral fertilizer + (50 cm.) HA soil added ($N_4P_4K_4$ + HA_1) respectively.
12- NPK soil applied at (2.00, 1.00 & 1.00 kg/tree) from each mineral fertilizer + (100 cm.) HA soil added ($N_4P_4K_4$ + HA_2) respectively.

Thirty six trees were devoted for this study whereas the experimental treatments were arranged in a complete randomized block design with three replicates for each treatment and every replicate was represented by a single tree.

At the beginning of the growing season of both seasons. Four limbs well distrusted on the tree (one on each direction) were selected and labeled and the following parameters were determined:

1- **Vegetative growth measurements:** were evaluated through determining the average shoot length (cm.), number of leaves per shoot and the average of shoot diameter (cm.).

2- Fruiting aspects:

2-a- Percentage of fruit set: the total number of flowers at full bloom and the initial number of fruits at the end of blooming stage on the labeled limbs in all treatments were counted and recorded then the percentage of fruit set was calculated as the following equation 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 as kgs/tree and tons/fed as well as number of fruits per tree: tree yield was recorded at the time of harvesting, (at maturity stage) the average yield per tree in kgs for each treatment and yield (tons/fed.) were determined. Also, the yield as number of fruits/tree for each treatment was estimated:

3- **Fruit characteristics:** Samples of matured ten fruits at harvesting time from each replicate were collected and the following fruit characters were determined: fruit physical properties including the average values of fruit weight (gms.), fruit volume (ml^3), fruit dimensions (both fruit length and width in cm.), fruit shape index (fruit length/fruit width ratio) and fruit firmness ($lb/inch^2$) was determined using Magness and Taylor (1925) pressure tester with 7/18 plunger. In addition, fruit chemical properties were also estimated including average percentage of fruit juice TSS (%) by hand refractometer according to A.O.A.C. (1985), fruit juice titratable acidity (%) according to Vogel (1968) was calculated as well as TSS/acidity ratio was calculated. Also, total sugars content was determined as mg/100 gms pulp of fruit fresh according to Dubaist *et al.* (1956).

4- **Leaf mineral content:** Leaf nutrient composition of some macro nutrients i.e., (N, P, K) and some micro elements (Fe, Zn) were determined. The following procedures were used: Total N was determined by micro-kjeldahl method described by Pregl (1945). While P determination was carried out calorimetrically

according to Murphy and Reily (1962). Moreover, K, Fe and Zn were determined using atomic absorption spectrophotometer (3300) according to Jackson and Ulrish (1959) and Chapman and Pratt (1961).

All the obtained data 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).

RESULTS AND DISCUSSION

1- Response of some vegetative growth measurements:

Referring the specific effect of the (NPK) soil added levels on the average of shoot length & diameter (cm.) and number of leaves/shoot of "Le-Conte" pear trees, data in Table (2) shows clearly that the three growth measurements abovementioned responded specifically to the differential (NPK) rates during both 2007 and 2008 seasons. Hence, the greatest increase in both shoot length and diameter and the highest number of leaves per shoot were significantly gained by those "Le-Conte" pear trees supplied with ($N_4P_4K_4$) treatment, followed statistically in a descending order by ($N_3P_3K_3$) treatment. On the contrary, the least increase in shoot length & diameter and number of leaves/shoot were statistically induced by the treatment of ($N_1P_1K_1$) which was significantly the inferior during the two seasons of study. Concerning the specific effect of humic compound treatments (Actosol compound), obtained results obtained in the same Table displayed obviously that all vegetative growth parameters under study of Le-Conte pear trees gained annually responded to the various Humic acid soil application. Whereas, (HA_2) application of treatment was statistically the superior. However, it could be noticed that (HA_2) treatment induced longest shoots and thickness diameter of shoots which had the highest number of leaves per shoot than those of the two other (HA) soil application. On the other hand, the reverse true with the (HA_0), no humic acid soil applied) which was significantly the inferior. Moreover, soil added with Actosol compound (HA_1) ranked statistically the second as compared to either the superior treatment (HA_2) or the inferior one (HA_0). Such trend was detected during both 2007 and 2008 seasons of study.

Regarding the interaction effect of the different combinations between the two investigated factors (NPK) and (HA) on shoot length, shoot diameter and number of leaves/ shoot, data in Table (2) revealed clearly that the specific effect on each factor (NPK level and HA rates) was directly reflected on their combinations throughout the two experimental seasons. However, the combination between the ($N_4P_4K_4$) soil added level from one hand and the (HA) at either (HA_2) or (HA_1) exhibited statistically the greatest values of both shoot length and shoot diameter and the highest number of leaves/shoot. Since, ($N_4P_4K_4$ x HA_2) was relatively more effective than ($N_4P_4K_4$ x HA_1) but difference did not reach level of significance in both seasons of study. The opposite trend was observed with trees that being supplied with the ($N_1P_1K_1$) treatment and received no humic acid (Actosol compound) i.e., ($N_1P_1K_1$ x HA_0) was statistically the inferior as exhibited the least values of shoot length, diameter and number of leaves/shoot during both 2007 and 2008 seasons of study. Furthermore, other combinations were in between the abovementioned two extents.

The present results are generally in agreement with those being reported by many researchers i.e., Webb and Biggs (1988) and Alva and Obreza (1998) on citrus, Tantini *et al.* (1991) on olive, Kelting *et al.* (1997) on nuts, Nassef (2000) on pear, Kabeel (2004) on peach and both Eissa (2003) and Shaddad *et al.* (2005) on apricot trees.

2- Response of some fruiting parameters:

Data obtained during both 2007 and 2008 seasons as shown in Table (3) cleared that the percentage of fruit set and tree productivity of "Le-Conte" pear trees either kgs/tree or tons/fed. and number of fruits per

tree were responded specifically to the different levels of NPK mineral fertilizers soil applied. Hence, the ($N_4P_4K_4$) treated trees exhibited statistically the highest percentage of fruit set and tree productivity (kgs/tree or tons/fed and number of fruits/tree) followed in a descending order by the ($N_3P_3K_3$) treatment. Whereas, the trees received ($N_1P_1K_1$) treatment showed statistically the least fruit set percentage and the least fruit yield per tree either kgs/tree or tons/fed and number of fruits/tree. On the other hand, trees received the ($N_2P_2K_2$) were statistically intermediated as their fruit set (%) and yield expressed in kgs or tons/fed number of fruits per tree when compared to that of the abovementioned other (NPK) soil applied levels. Such trends were detected during the two seasons of study.

With respect to the specific effect of Actosol compared with (NPK humate), data in the same Table show that response of fruit set percentage in the two seasons and yield as number of fruits per tree in the second season were significantly absent. Meanwhile, tree productivity of pear trees either kgs/three and tons/fed in both seasons or number of fruits/ tree in the first one were significantly responded to soil application of Actosol compound treatments.

Regarding the interaction effect of the different combinations between the various variables of each investigated factors i.e., (NPK applied levels and Actosol soil added rates), data in Table (3) revealed obviously that fruit set (%) and yield (kgs tons/fed and number of fruits per tree) followed a firm trend regarding their response to interaction effect of the different combinations, whereas the highest percentage of fruit set and the heaviest yield per tree and per fed. were always in significant relationship to the ($N_4P_4K_4$ x HA_2) treated trees. On the other hand, the opposite trend was detected with those trees subjected to ($N_1P_1K_1$ x HA_0) treatment, however the least fruit set (%) and the lightest crop were significantly inclosed relationship to trees treated with ($N_1P_1K_1$ x HA_0) combination treatment in the 2007 and 2008 seasons of study. In addition, other combinations of (NPK x HA) were intermediated regarding their interaction effect on fruit set (%) and tree productivity either kgs/tree or tons/fed and number of fruits per tree. Such trend was true during both 2007 and 2008 seasons of study.

The obtained results are in harmony with findings of several investigators, Awasthi *et al.* (1997), Nassef (2000), Eissa (2003), Kabeel (2004), Kabeel and El-Saadany (2004) and Shaddad *et al.* (2005) on apple, peach, pear and apricot trees.

3- Fruit quality:

3-1. Fruit physical properties:

a- Fruit weight and fruit volume:

With regard to the average of both fruit weight (g.) and fruit volume (cm^3) of "Le-Conte" pear fruits as affected by the NPK soil applied level, data in Table (4) indicates that both investigated fruit characters responded specifically, whereas the heaviest fruits and the greatest volume were resulted from the ($N_4P_4K_4$) treated trees. Moreover, the opposite trend was gained by those subjected to the treatment of ($N_1P_1K_1$) which produced the lightest and smallest fruits. On the other hand, both ($N_3P_3K_3$) and ($N_2P_2K_2$) treatments were statistically in between in their average fruit weight and volume. Such trend was true during the first and second seasons.

As for the specific effect of Actosol compound as soil application, data obtained in the same Table displayed obviously that there was a positive relationships between soil added of Actosol rate and both fruit weight and volume. However, the heaviest and the greatest volume of fruits were significantly obtained from treated trees (with HA_2). Contrary, the lightest and smallest fruits were statistically produced by (HA_0) treatment. Meanwhile, both average of fruit weight and volume of the (HA_1) treated trees were significantly intermediated as compared to those being treated with both (HA_2) and (HA_0). Such trend was detected during both 2007 and 2008 seasons of study.

As for the interaction effect of different (NPK) and (HA) combinations on both weight and volume of pear fruits, data in

Table (4) clears that the specific effect of each tested factor was reflected on interaction effect of its combinations. However, trees being subjected to the highest rates of both (NPK) and (HA) i.e., ($N_4P_4K_4$ x HA_2) combination exhibited the heaviest and largest fruits. Meanwhile the combination between the least level of NPK and no soil added (HA) rate i.e., ($N_1P_1K_1$ x HA_0) treatment was statistically the inferior and showed significantly the lightest and smallest pear fruits. In addition, other combinations came in between with a tendency of variability in their effectiveness.

b- Fruit firmness:

Regarding the effect of NPK soil applied level, data in Table (4) displayed obviously that fruit flesh firmness of "Le-Conte" pear cv. was specifically responded to the studied levels. However, an obvious decrease in fruit flesh firmness was generally exhibited with both the highest and the lowest levels of (NPK), i.e., ($N_4P_4K_4$) and ($N_1P_1K_1$) treatments soil application level, but difference was significant as compared to each other. Both treatments of ($N_3P_3K_3$) and ($N_2P_2K_2$) soil applied levels resulted in inducing fruits having firmer flesh texture than of those either ($N_4P_4K_4$) and ($N_1P_1K_1$) treated trees. Differences between the ($N_3P_3K_3$) and ($N_2P_2K_2$) were insignificant and equally effective, while differences were significant as compared to both the highest and lowest levels of soil applied (NPK). Such trend was detected during both 2007 and 2008 seasons of study.

With respect to the effect of Actosol compound, data in the same Table revealed that both soil added rates of (HA) i.e., (HA_1 and HA_2) increased fruit flesh firmness as compared to the no HA i.e., (HA_0) soil application. Moreover, differences were significant with comparing both (HA_2) and (HA_1) soil added rates to (HA_0) treatment, whereas both (HA_2) and (HA_1) treatments were equally effective as compared to each other from the standpoint of statistics. Such trend was true throughout the first and second seasons in this study.

Concerning the interaction effect of different (NPK x HA) combinations on fruit flesh firmness data in Table (4) pointed out that the treatments of ($N_3P_3K_3$ x HA_1) in the 1st and 2nd seasons and ($N_2P_2K_2$ x HA_2) in the second season only, produced fruits had significantly the firmest flesh texture. Contrary to that, the combinations of ($N_4P_4K_4$ x HA_2) in the 2007 season, and both ($N_4P_4K_4$ x HA_0) and ($N_4P_4K_4$ x HA_1) in the 2008 season resulted in significant increased in fruit flesh softness as compared to any of the other investigated combinations during the two seasons of study. In addition, other (NPK x HA) combinations were intermediated.

c- Fruit dimensions (fruit length and diameter):

With regard to effect of different (NPK) soil applied level on fruit dimensions (both fruit length and diameter), data in Table (5) revealed that they responded significantly during both seasons. Whatever, the ($N_4P_4K_4$) treated trees produced fruit with more elongated length and widest diameter than those of the ($N_1P_1K_1$) treated trees. Differences in both fruit length and fruit diameter due to the two investigated abovementioned (NPK) soil applied levels i.e., ($N_4P_4K_4$) and ($N_1P_1K_1$) were significant as compared to each other during both 2007 and 2008 seasons. Moreover, ($N_3P_3K_3$) and ($N_2P_2K_2$) treated trees increased significantly fruit length and diameter over that in ($N_1P_1K_1$) treated trees. In spite of the ($N_3P_3K_3$) treated trees tended to increase fruit dimensions as compared to the ($N_2P_2K_2$) treated trees, differences did not reach the level of significance during the first and second seasons of study.

As for the response to various of soil added rates of Actosol compound, data presented in the same Table displayed clearly that both fruit length and diameter responded significantly to the two rates of Actosol compound (HA_2 and HA_1) as compared to the untreated trees (HA_0). On the other hand, the differences between the two (HA) rates i.e., (HA_2 and HA_1) were insignificant as compared to each other. Such trend was detected during both 2007 and 2008 seasons of study.

Table (2): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on some vegetative growth measurements during both 2007 and 2008 seasons.

Treatments	Shoot length (cm)				Shoot diameter (cm.)				Number of leaves/shoots			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
2007												
$N_1P_1K_1$	48.17d	49.33d	55.83c	**51.11C**	0.533c	0.533c	0.583bc	**0.550C**	17.17e	20.17cd	20.67c	**19.33C**
$N_2P_2K_2$	49.17d	50.33d	55.83c	**51.78C**	0.550c	0.583bc	0.657a	**0.597B**	18.00de	20.33cd	21.67bc	**20.00BC**
$N_3P_3K_3$	52.83cd	60.67b	62.5b	**58.67B**	0.583bc	0.617ab	0.667a	**0.622AB**	20.33c	20.67c	21.83bc	**20.94B**
$N_4P_4K_4$	62.67b	65.17ab	68.17a	**65.34A**	0.633ab	0.650a	0.667a	**0.650A**	23.67ab	23.67ab	25.50a	**24.28A**
Mean**	**53.21C**	**56.38B**	**60.58A**		**0.575B**	**0.596B**	**0.644A**		**19.79C**	**21.21B**	**22.42A**	
2008												
$N_1P_1K_1$	50.33d	51.33cd	55.67bc	**52.44C**	0.543c	0.543c	0.593bc	**0.560C**	18.27d	21.27c	21.77c	**20.43C**
$N_2P_2K_2$	51.67cd	52.33cd	69.00b	**54.33C**	0.560c	0.593bc	0.667a	**0.607B**	19.10d	21.77c	22.77bc	**21.21C**
$N_3P_3K_3$	55.67bc	65.33a	67.00a	**62.67B**	0.593bc	0.627ab	0.677a	**0.632AB**	21.43c	22.43bc	22.93bc	**22.27B**
$N_4P_4K_4$	66.67a	67.0a	70.00a	**67.89A**	0.643ab	0.660a	0.677a	**0.660A**	24.33b	24.43b	26.60a	**25.12A**
Mean**	**56.08C**	**59.00B**	**62.92A**		**0.585B**	**0.606B**	**0.651A**		**20.78C**	**22.48B**	**23.52A**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter's are not significantly different at 0.05 level.

Table (3): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on some fruiting aspects parameters during both 2007 and 2008 seasons.

Treatments	Fruit set (%)				Yield kg./tree				Number of fruits/tree				Fruit yield/ton/feed			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
2007																
$N_1P_1K_1$	4.10d	4.17cd	4.34b-d	**4.20B**	23.83e	39.73d	47.33c	**36.97D**	253.3f	276.7ef	306.7de	**278.9D**	4.01f	6.67e	7.95c-e	**6.21C**
$N_2P_2K_2$	4.27cd	4.37b-d	4.70b-d	**4.44B**	39.97d	45.7cd	56.33b	**47.33C**	303.3df	310.0c-e	350.0bc	**321.1C**	6.71e	7.68de	9.46b	**7.95B**
$N_3P_3K_3$	4.97a-d	4.58b-d	4.75b-d	**4.77B**	45.73cd	51.47bc	56.70b	**51.3B**	330.0b-d	346.7bc	350.0bc	**342.2B**	7.69de	8.65b-d	9.53b	**8.62B**
$N_4P_4K_4$	5.23a-c	5.44ab	5.87a	**5.51A**	54.2b	54.4b	67.07a	**58.56A**	366.7b	350.0bc	406.7a	**374.4A**	9.11bc	9.14bc	11.27a	**9.84A**
Mean**	**4.64A**	**4.64A**	**4.91A**		**40.93C**	**47.83B**	**56.86A**		**313.3B**	**320.8B**	**353.3A**		**6.88C**	**8.03B**	**9.55A**	
2008																
$N_1P_1K_1$	3.73d	3.97cd	4.27b-d	**3.99C**	30.43h	44.70g	51.70ef	**42.28D**	263.3f	286.7ef	313.3de	**287.8D**	5.11g	7.51f	8.68de	**7.10D**
$N_2P_2K_2$	4.79a-d	4.73a-d	5.00a-c	**4.81B**	48.13fg	56.87de	59.30cd	**54.77C**	320.0c-e	336.7b-d	340.0b-d	**332.2C**	8.09ef	9.55b-d	9.96bc	**9.20C**
$N_3P_3K_3$	5.00a-c	5.07a-c	5.67a	**5.24AB**	55.33de	60.87cd	65.23bc	**60.48B**	356.7b-d	360.0bc	360.0bc	**358.9B**	9.30cd	10.22bc	10.68b	**10.07B**
$N_4P_4K_4$	5.27ab	5.53a	5.79a	**5.53A**	60.43cd	70.13ab	81.09a	**67.93A**	360.0bc	376.7b	416.7a	**384.4A**	10.15c	11.78b	13.62a	**11.85A**
Mean**	**4.67A**	**4.83A**	**5.18A**		**48.58C**	**58.14B**	**64.33A**		**325.0A**	**340.0A**	**357.5A**		**8.16C**	**9.77B**	**10.74A**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter`s are not significantly different at 0.05 level.

Table (4): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on on some fruit physical characteristics (fruit weight, size and firmness) during both 2007 and 2008 seasons.

2007												
Treatments	Fruit weight (g.)				Fruit volume (ml^3)				Fruit firmness ($lb/inch^2$)			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
$N_1P_1K_1$	95.23g	143.2de	154.3a-c	**130.9C**	90.0e	146.7c	153.3B	**130.0C**	8.17de	9.60cd	10.80bc	**9.52B**
$N_2P_2K_2$	131.5f	146.8c-e	158.0ab	**145.4B**	138.0d	148.3bc	153.3B	**146.6B**	11.47bc	12.77ab	11.87b	**12.04A**
$N_3P_3K_3$	138.4ef	151.0b-d	161.7a	**150.4B**	145.0c	150.0bc	160.0A	**151.7A**	11.67bc	14.80a	12.33b	**12.93A**
$N_4P_4K_4$	149.6b-d	156.7ab	162.0a	**156.1A**	150.0bc	150.0bc	163.3A	**154.4A**	7.17e	7.87de	8.00de	**7.68C**
Mean**	**128.7C**	**149.4B**	**159.0A**		**130.8C**	**148.8B**	**157.5A**		**9.62B**	**11.26A**	**10.75A**	
2008												
$N_1P_1K_1$	117.7e	156.1d	164.9c	**146.2C**	173.0f	173.0f	186.7d	**163.2D**	9.27ef	10.50de	8.73ef	**9.50B**
$N_2P_2K_2$	150.6d	168.9bc	173.9bc	**164.5B**	173.3f	173.3f	196.7c	**178.3C**	14.00bc	13.73bc	16.23a	**14.65A**
$N_3P_3K_3$	155.1d	169.0bc	174.7b	**166.3B**	173.3f	173.3f	203.3b	**183.3B**	12.03cd	16.50a	15.23ab	**14.59A**
$N_4P_4K_4$	168.2bc	169.3bc	194.6a	**177.4A**	180.0e	190.0d	211.7a	**193.9A**	8.00f	8.00f	8.50ef	**8.17C**
Mean**	**147.9C**	**165.8B**	**177.0A**		**162.1C**	**177.4B**	**199.6A**		**10.82B**	**12.18A**	**12.17A**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter`s are not significantly different at 0.05 level

Regarding the interaction effect, Table (5) pointed out that, the responded significantly to the different (NPK x HA) combinations. It could be observed clearly that the specific effect of each investigated factor was directly reflected on their combinations. However as the ($N_4P_4K_4$) soil application level was combined with either the higher or lower Actosol rates i.e., (HA_2 and HA_1) exhibited statistically the greatest values of both fruit length and diameter. On the contrary, the combination between the ($N_1P_1K_1$) treated trees from one hand and no Actosol (HA_0) soil applied from the other i.e., ($N_1P_1K_1$ x HA_0) resulted in a significant depression on both fruit length and diameter of "Le-Conte" pear cv. In addition, other (NPK x HA) combinations were in between the aforesaid two extents with a relatively variable tendency of response. This trend was true in two seasons under study.

d- Fruit shape index:

The effect of soil added (NPK) level on fruit shape index of pear fruit, show by data obtained in Table (5) revealed clearly negligible variations, with all treatments during the two seasons of study except with the ($N_4P_4K_4$) treated trees in 2007 seasons only. Where it induced the least value in this concern. On the other hand, the absence of significance in response of fruit shape index to the three tested (HA) rates was detected in the first season. Meanwhile, in the second season, fruit shape index was in positive relationship with either (HA_1) or (HA_2) soil applied rate. the highest increase in shape index was observed with (HA_1) and (HA_2), respectively. Differences were significant between them, while (HA_0) treated trees resulted in the lowest value of fruit shape index from the standpoint of statistics.

Also, data in Table (5) indicates the variations in fruit shape index were due to the interaction effect of different combinations between the two studied factors. The differences in most cases were insignificant during both 2007 and 2008 seasons of study. Moreover, it could be noticed that both ($N_4P_4K_4$ x HA_2) and ($N_1P_1K_1$ x HA_0) treated trees in the first and second seasons, respectively showed relatively a tendency to decrease shape index of pear fruits, meanwhile the reverse trend was detected with treatment of ($N_4P_4K_4$ x HA_1) combination in the second season only, however induced significantly the highest value of fruit shape index.

Obtained results regarding the response of fruit physical characteristics to the investigated treatments are in a agreement with those previously mentioned by Yastaas (1990), Nassef (2000), Kabeel and El-Saadany (2004) on pear, Awasthi *et al.* (1997) on apple; Kabeel (2004) on peach; Eissa (2003) and Shaddad *et al.* (2005) on apricot trees.

3-2- Fruit chemical characteristics:

a- Fruit Juice TSS %:

Tabulated data in Table (6), displayed obviously that the highest value of fruit TSS % was significantly gained from trees supplied with ($N_4P_4K_4$) followed by ($N_3P_3K_3$). However, differences between the two levels did not reach level of significance. On the other hand, the opposite trend was true with the lowest (NPK) soil applied level i.e., ($N_1P_1K_1$) at which treated trees had significantly the poorest fruit in their TSS %. Such trend was observed during both 2007 and 2008 seasons of study.

As for the response of specific effect of Actosol compound as soil added rate, it is quite evident from data in the same Table that treated trees with Actosol at either (50) of (100) cm rate slightly increased the fruit TSS % over untreated trees (HA_0), whereas, differences in most cases were insignificant except at (HA_2) in 2007 season. Meanwhile, in 2008 season, the response was completely absent from the standpoint of statistic.

Referring to the interaction between the different combinations (NPK and Actosol soil added levels) on fruit TSS %, data in Table (6) revealed clearly that the ($N_4P_4K_4$) treated trees combined with Actosol at 100 cm rate i.e., ($N_4P_4K_4$ x HA_2) resulted in increasing fruit TSS % over than in the other (NPK x HA) combinations. On the other hand, combinations of the ($N_1P_1K_1$) especially as associated with the soil added (HA_0) were

statistically the inferior. Other combinations were in between with a slight tendency of variability in their effectiveness. Such trend was detected during both the first and second seasons of study.

b- Fruit juice total acidity %:

The effect of the soil applied NPK level on fruit juice total acidity %, data obtained during the first and second seasons as shown in Table (6) pointed out negligible variation, where differences were so little to reach the level of significance. On the other hand, the absent of significance during both 2007 and 2008 seasons of study.

The interaction effect of the different (NPK x HA) combinations, Table (6) displays that the ($N_3P_3K_3$ x HA_2) was significantly the most effective in increasing fruit acidity. On the contrary trees subjected to the ($N_4P_4K_4$ x HA_1) combination produced the poorest fruits in their acidity percentage. On the other hand, the other combinations came in between the abovementioned two extents. Such trend was true during both 2007 and 2008 seasons of study.

c- TSS/acid ratio

The results indicate that, providing pear trees with the highest rate of either (NPK) or (HA) rates i.e., ($N_4P_4K_4$, HA_2) induced statistically the highest values of fruit TSS/ acid ratio. On the other side, trees subjected to the treatments of either ($N_3P_3K_3$ & $N_1P_1K_1$) or (HA_0 & HA_1) were resulted in the least values of TSS/acid ratio from the standpoint of statistic with no differences between the two treatments for each factor. Such trend was true during both first and second seasons of study.

As for the interaction effect, the highest values of fruit juice TSS/acid ratio was in close relationship to both ($N_4P_4K_4$ & HA_1) and ($N_4P_4K_4$ & HA_2) treatments. However both combination treatments resulted in the greatest values of TSS/acid ratio in fruits with no significant differences between them during the two experimental seasons. Moreover, fruits produced from trees subjected to the combination treatments of ($N_1P_1K_1$ & HA_0), ($N_1P_1K_1$ & HA_1) and ($N_3P_3K_3$ & HA_2) showed statistically the lowest values of TSS/acid ratio as compared to the other combination treatments. In addition, the remain treatments were statistically responded in between to both aforesaid extents. This trend was detected in the first and second seasons of study.

d- Total sugars %:

Data in Table (6) clears the effect of NPK soil applied levels on total sugar (%). It shows that providing "Le-Conte" pear tress trees with the highest level i.e., (2.0, 1 & 1 kgs) from each of the (N, P and K) fertilizers respectively per the individual tree i.e., ($N_4P_4K_4$) produced fruits that had the highest sugar % followed by those from both ($N_3P_3K_3$) and ($N_2P_2K_2$) treated trees, respectively. Meanwhile, the least NPK soil applied level i.e., ($N_1P_1K_1$) ranked last in this concern. Differences in fruit total sugar % due to variable levels of NPK soil application were significant were compared each other during the first and second seasons of study.

As for the effect of soil added Actosol compound, it is quite evident that the untreated trees (HA_0) produced fruits with the lowest fruit total sugar % during the two seasons of study. The reverse was true with such trees treated with Actosol compound (NPK, humate) at 100 cm (HA_2), whereas the highest total sugar percentage was observed and the increase was significant, especially as compared to the untreated ones (HA_0) during both 1st and 2nd seasons. In addition, fruit total sugar percentage of the (HA_1) treated trees was in between the abovementioned two extents.

Referring to the interaction effect of different NPK combined with the various Actosol compound. Soil added data in the same Table reveals that trees received the NPK soil application at (2.0, 1.0 and 1.0) kgs from each element source per tree (N, P & K) respectively i.e., ($N_4P_4K_4$) associated with Actosol compound at 100 cm (HA_2) during both 2007 and 2008 seasons induced fruits with the highest total sugar % that surpassed statistically the analogous ones of the other (NPK x HA) combinations.

Table (5): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on some fruit physical characteristics (fruit length, diameter and fruit shape index) during both 2007 and 2008 seasons.

2007												
Treatments	Fruit length (cm.)				Fruit diameter (cm.)				Fruit shape index			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
$N_1P_1K_1$	7.20c	7.90b	7.93ab	**7.68C**	5.67d	6.03cd	6.10b-d	**5.93C**	1.28a	1.31a	1.30a	**1.30A**
$N_2P_2K_2$	8.00ab	7.95ab	8.13ab	**8.03B**	6.13bc	6.30bc	6.30bc	**6.24B**	1.31a	1.26ab	1.29a	**1.30A**
$N_3P_3K_3$	8.17ab	8.20ab	8.23ab	**8.20AB**	6.33bc	6.33bc	6.33bc	**6.33B**	1.29a	1.30a	1.30a	**1.30A**
$N_4P_4K_4$	8.23ab	8.30ab	8.43a	**8.32A**	6.43bc	6.57ab	6.97a	**6.66A**	1.28a	1.26ab	1.21b	**1.25B**
Mean**	**7.90B**	**8.09AB**	**8.18A**		**6.14B**	**6.31AB**	**6.43A**		**1.29A**	**1.29A**	**1.28A**	
2008												
$N_1P_1K_1$	7.87e	8.53d	8.60cd	**8.33C**	6.60ab	5.60d	6.23c	**6.14B**	1.17c	1.52a	1.38b	**1.36A**
$N_2P_2K_2$	8.60cd	8.80b-d	8.87b-d	**8.87B**	6.27c	6.27c	6.30bc	**6.28B**	1.37b	1.41b	1.38b	**1.39A**
$N_3P_3K_3$	8.87b-d	8.93a-d	8.97a-c	**8.92AB**	6.47a-c	6.60ab	6.63ab	**6.57A**	1.38b	1.36b	1.35b	**1.36A**
$N_4P_4K_4$	9.00a-c	9.10ab	9.30a	**9.13A**	6.63ab	6.67a	6.70a	**6.67A**	1.36b	1.37b	1.39b	**1.37A**
Mean**	**8.58B**	**8.84A**	**9.02A**		**6.28B**	**6.49A**	**6.47A**		**1.32C**	**1.41A**	**1.38B**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter's are not significantly different at 0.05 level

Table (6): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on some chemical characteristics during both 2007 and 2008 seasons

2007																
Treatments	TSS (%)				Acidity (%)				TSS/acid ratio				Total sugars (%)			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
$N_1P_1K_1$	9.67cd	9.33d	10.20a-d	**9.73B**	0.436ab	0.447ab	0.324b	**0.402A**	22.17f	21.07f	32.98a-c	**25.41C**	13.75i	15.73gh	15.92g	**15.13D**
$N_2P_2K_2$	9.33d	10.50a-c	10.33a-d	**10.06AB**	0.365ab	0.436ab	0.335ab	**0.379A**	29.59cd	24.30ef	32.34bc	**28.74B**	15.33h	17.00f	17.50f	**16.61C**
$N_3P_3K_3$	10.17a-d	10.33a-d	11.00ab	**10.50A**	0.353ab	0.391ab	0.492a	**0.406A**	30.57c	26.49de	22.42f	**26.49C**	18.63e	19.88cd	20.12c	**19.54B**
$N_4P_4K_4$	10.50a-c	10.00b-d	11.17a	**10.56A**	0.402ab	0.291b	0.313b	**0.335A**	26.62de	35.33ab	36.32a	**32.76A**	19.5d	21.00b	23.00a	**21.17A**
Mean**	**9.92B**	**10.04B**	**10.68A**		**0.385A**	**0.391A**	**0.366A**		**27.24B**	**26.80B**	**31.01A**		**16.80C**	**18.40B**	**19.14A**	
2008																
$N_1P_1K_1$	9.67c	9.83c	10.17bc	**9.89C**	0.437a-c	0.448ab	0.325bc	**0.403A**	22.12f	22.21f	33.10cd	**25.81C**	14.42g	16.40f	16.58f	**15.80D**
$N_2P_2K_2$	10.67a-c	10.83a-c	10.83a-c	**10.78B**	0.366a-c	0.437a-c	0.336bc	**0.380A**	34.28bc	25.31ef	33.80bc	**31.13B**	16.00f	17.67e	18.17e	**17.28C**
$N_3P_3K_3$	11.00a-c	11.00a-c	11.50ab	**11.17AB**	0.336bc	0.392a-c	0.493a	**0.493A**	32.78cd	28.13e	23.52f	**28.14C**	19.29d	20.54c	20.79bc	**20.21B**
$N_4P_4K_4$	11.50a-c	11.50ab	11.67a	**11.56A**	0.403a-c	0.292c	0.314bc	**0.336A**	29.24de	40.40a	37.81ab	**35.82A**	19.83cd	21.67b	23.33a	**21.61A**
Mean**	**10.71A**	**10.79A**	**11.04A**		**0.386A**	**0.392A**			**29.60B**	**29.01B**	**32.06A**		**17.39C**	**19.07B**	**19.72A**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter`s are not significantly different at 0.05 level

The obtained results concerning the effect of studied treatments on investigated fruit chemical properties, are in accordance with those mentioned by Awasthi *et al.* (1997), Liu *et al.* (1998), Nassef (2000), Kabeel (2004), Kabeel and El-Saadany (2004) and Shaddad *et al.* (2005) on some deciduous fruit trees.

4- Response of some macro (N, P and K) and micro-nutrients (Fe and Zn):

Regarding leaf content of N, P, K, Fe and Zn to specific effect of (NPK) soil added levels. It is quite evident from data tabulated in Tables (7 and 8) that a firm trend was obviously detected. Since, N, P, K, Fe and Zn content in leaves, were increased significantly by raising the applied level. However the richest leaves in their N, P, K, Fe and Zn contents were statistically coupled with those $N_4P_4K_4$ application followed in a descending order by those of ($N_3P_3K_3$) and ($N_2P_2K_2$) treatments, respectively. Whereas, leaves of the lowest NPK level i.e., ($N_1P_1K_1$) were significantly the poorest. Moreover, differences were significant between the four NPK levels with leaf N, P, K, Fe and Zn content, while both ($N_2P_2K_2$) and ($N_3P_3K_3$) treatments showed a completely absent from the stand point of statistic with leaf P content. Such trend was true during both 2007 and 2008 seasons of study.

With respect to the response of the specific effect of Actosol compound, data obtained in the same Table revealed that leaf N, P, K, Fe and Zn contents were increased significantly by increasing Actosol compound added rate, since the richest leaves in their N, P, K, Fe and Zn content were statistically in close relationship with those (HA_2) treatment followed in a descending order by those of (HA_1) and (HA_0) treatments, while those of the latter treatment was significantly the poorest. Such trend was detected in the two seasons of study.

Concerning the interaction effect of the different (NPK x HA) combinations on the leaf N, P, K, Fe and Zn content of "Le-Conte" pear trees, data represented in Tables (7 and 8) indicates clearly that trees subjected to either the ($N_4P_4K_4$ x HA_2) or ($N_4P_4K_4$ x HA_1) combinations exhibited generally the highest values of leaf N, P, K, Fe and Zn contents during both 2007 and 2008 seasons. The superiority of the abovementioned two combinations over the other studied treatments was clearly observed throughout the two seasons of study. On the other hand, the reverse trend was obtained with the combination treatment of the ($N_1P_1K_1$) especially as associated with (HA_0) i.e., ($N_1P_1K_1$ x HA_0) was statistically the inferior. In addition, other (NPK x HA) combinations came in between the abovementioned two extents with tendency of variability in their effectiveness. Such trends were detected during the two experimental seasons of study.

Present results are in conformity with those being previously reported by Awasthi *et al.* (1997), Jianguo *et al.* (1998) on apple; Fernandez *et al.* (1996) and Liu *et al.*, (1998) on olive; Nassef (2000), and Kabeel and El-Saadany (2004) on pear trees; Kabeel (2004) on peach Eissa (2003) and Shaddad *et al.* (2005) on apricot trees.

Generally, it could be say these beneficial effects were reported by many investigators as Jianguo *et al.* (1998); Liu and Cooper (2002); Eissa *et al.* (2003) and Shaddad *et al.* (2005). Likewise, Ghabbour and Davies (1998) explained that humic acid slowly release micronutrient to plants, has high water holding, stimulates plant growth, increases the availability of phosphate by breaking the bond between P and Fe or Ca as well as help mineralization and immobilization of N in soil. Besides, being a source of nutrients for plants, humic acid also affect the physico-chemical properties of soil, which are important in controlling the uptake of nutrients, their relation and counteracting soil acidity.

Table (7): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on some macro elements (N, P and K) during both 2007 and 2008 seasons.

2007												
Treatments	Nitrogen (%)				Phosphorus (%)				Potassium (%)			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
$N_1P_1K_1$	1.50g	1.73ef	1.77e	**1.667C**	0.205g	0.212fg	0.227d-f	**0.215C**	0.850f	0.910f	0.920f	**0.893D**
$N_2P_2K_2$	1.50g	1.73ef	1.83d	**1.689C**	0.220e-g	0.235c-e	0.237c-e	**0.231B**	1.163c-e	0.997ef	1.027d-f	**1.062C**
$N_3P_3K_3$	1.70f	1.83d	1.90c	**1.844B**	0.225d-f	0.235c-e	0.240cd	**0.233B**	1.217cd	1.217cd	1.343bc	**1.299B**
$N_4P_4K_4$	2.00b	2.00b	2.23a	**2.078A**	0.252bc	0.260ab	0.275a	**0.262A**	1.243c	1.523ab	1.610a	**1.459A**
Mean**	**1.675C**	**1.850B**	**1.933A**		**0.226C**	**0.226B**	**0.245A**		**1.118C**	**1.192B**	**1.225A**	
2008												
$N_1P_1K_1$	1.60g	1.83f	1.87ef	**1.767C**	0.212h	0.226gh	0.234d-g	**0.224C**	0.950d	1.043d	1.100cd	**1.031D**
$N_2P_2K_2$	1.60g	1.83f	1.93de	**1.789C**	0.227f-h	0.235d-g	0.247c-e	**0.236B**	1.263bc	1.127cd	1.127cd	**1.172C**
$N_3P_3K_3$	1.80f	2.03bc	1.97cd	**1.933B**	0.232e-g	0.246c-f	0.253b-d	**0.244B**	1.317b	1.403b	1.443b	**1.388B**
$N_4P_4K_4$	2.10b	2.10b	2.33a	**2.178A**	0.256bc	0.267ab	0.283a	**0.269A**	1.343b	1.623a	1.697a	**1.554A**
Mean**	**1.775C**	**1.950B**	**2.025A**		**0.231C**	**0.243B**	**0.254A**		**1.218C**	**1.299B**	**1.342A**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter`s are not significantly different at 0.05 level

Table (8): Effect of different (NPK) levels and soil applied Actosol compound rates and their combinations on some micro elements (Fe and Zn) during both 2007 and 2008 seasons.

2007								
Treatments	Iron (ppm)				Zinc (ppm)			
HA / NPK	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*	HA_0	HA_1 (50 cm.)	HA_2 (100 cm.)	Mean*
$N_1P_1K_1$	538.0g	767.0e	849.0d	**718.0D**	30.00g	37.50fg	42.50f	**36.60D**
$N_2P_2K_2$	672.0f	797.0de	1002.0b	**823.7C**	37.50fg	45.00ef	55.00de	**45.80C**
$N_3P_3K_3$	779.0e	994.0b	1035.0b	**936.0B**	42.50f	68.73bc	95.00a	**68.70B**
$N_4P_4K_4$	906.0c	1003.0b	1191.0a	**10.33A**	58.73cd	70.00b	96.33a	**75.00A**
Mean**	**723.8C**	**890.3B**	**1019.3A**		**42.20C**	**55.30B**	**72.20A**	
2008								
$N_1P_1K_1$	537.0g	670.0f	777.0e	**661.3D**	32.00f	39.50ef	47.00de	**39.50C**
$N_2P_2K_2$	765.0e	904.0c	1001.0b	**890.0C**	39.50ef	44.50d-f	57.00cd	**47.00B**
$N_3P_3K_3$	795.0de	992.0b	1000.0b	**929.0B**	44.50d-f	67.40bc	97.00a	**69.6A**
$N_4P_4K_4$	847.0d	1033.0b	1198.0a	**1026.0A**	60.73bc	72.00b	97.63a	**70.80A**
Mean**	**736.0C**	**899.8B**	**994.0A**		**44.20C**	**55.85B**	**74.66A**	

* and ** refer to the specific effect of investigated (NPK) and Actosol compound rates, respectively. Capital letters were used for distingushing between value in specific effect for each investigated factor. Meanwhile, small letters used for interaction effect of their combinations. Means followed by the same letter's are not significantly different at 0.05 level.

REFFERENCES

Alva, A. K. and Obreza, T.A. (1998): By-production humate increase tree growth and fruit production of orange and grapefruit. Hort. Sci., 33 (1): 71-74.

Association of Official Agricultural Chemists (A.O.A.C) (1985): "Official Methods of Analysis" Benjamin Franklin Station, Washington, D.C., U.S.A., 495-510.

Awasthi, R.P.; Kath, N.S. and Dev.; G. (1997): Influence of rate and method of potassium application on growth, yield, fruit quality and leaf mineral status of apple. Hort. Abst., 67 (11): 9178.

Chapman, H.D. and Pratt, F. (1961): "Methods of Analysis for Soils, Plants and Water". Univ. of Calif., 35 (5): 6-7.

Dubaist, M.; Gilles, K.; Hamilton, J.K.; Rebers P.A. and Smith, F. (1956): A colorimetric method for the determination of sugars and related substances.

Duncan, D.B. (1955): Multiple range and multiple F. tests. Biometrics, 11: 1-42.

Eissa, F. M. (2003): Use of some biostimulants in activation of soil microflora for yield and fruit quality improvement of "Canino" apricot. J. Agric. Res. Tanta Univ., 29 (1): 175-194.

Eissa, F.M; Fathi, M.A. and Yehia, M.M. (2003): Response of Canino apricot to foliar application of some biostimulants. Minia J. Agric. Res. & Dev., 23 (1): 69-82.

Fernandez, R.; Duemas and Guterrez, J.A. (1996): Response of olive trees to foliar application of humic acid. Scientia Hort., 66: 191-199.

Ghabbour, E.A. and Davies, G. (1998): Humic substance. Royal Society of Chemistry. 2nd Ed., P. 337-345.

Jackson, M.L. (1958): Soil Chemical Analysis. Prentice – Hall. Inc. Englewood Clif., N, I. Library Congress, U.S.A.

Jackson, M.L. and Ulrich, A. (1959): Analytical methods for use in plant analysis. Coll. of Agric. Exp. State Bull.766: 35 pp.

Jianguo, Yu.; Shuiying, Yu.; Yujuan, Z. and Yingchang, S. (1998): Influence of humic acid on the physiological and biochemical indexes of apple trees. Forest. Res., 11 (6): 623-628.

Kabeel, H. (2004): Influence of different rates of nitrogen and potassium on vegetative growth, fruiting aspects, fruit characteristics and leaf mineral composition of "Meet-Ghamr" peach trees. Minufiya, J.Agric., Res. Vol. 29, No. (4): 215-234.

Kabeel, H. and El-Saadany, S.M.M. (2004): Effectiveness of mineral fertilizers application and boron sprays on some fruiting parameters, fruit quality and leaf nutrient content of "Le-Conte" pear trees. Egypt. Jour. Appl. Sci., Vol. 19, No. (9B):658-679.

Kelting, M.; Harris, J.R.; Fanelli, J.; Appleten, B.and Niemiera, A. (1997): Humate based biostimulants do not consistently increase growth of container grown Turkish hazelnut. J. Env. Hort., 15 (4):197-199.

Liu, C. and Cooper, R.J. (2002): Humic acid application improve salt tolerance of hydroponically grown creeping bentgreass. J. Amer. Soc. Hort. Sci., 127: 2.

Liu, C.; Cooper, R.J. and Bowman, D.C. (1998): Humic acid application effects photosynthesis, root development and nutrient content of creeping bentgrass. Hort. Sci., 33 (6):1023-1025.

Magness, J.R. and Taylor, G.F. (1925): An improved type of pressure tester for the determination of fruit maturity. U.S. Dept. Agric. Circ., 350 8p.

Murphy, J. and Reily, J.P. (1962): A modified single method for the determination of phosphorus in natural water. Anal. Chemi. Acta, 27:31-36.

Nassef, A.A.H. (2000): Physiological studies on the effect of mineral fertilization on growth and fruiting of "Le-Conte" pear trees. M.Sc. Thesis, Fac. of Agric. Moshtohor, Zagazig Univ.

Piper, C. S. (1950): Soil and Plant Analysis. Inter. Sci. Publishers, New York, 213-217.

Pregl, E. (1945): Quantitative organic microanalysis 4th ed. J. & A Charchill, L.T.D. London.

Shaddad, G.; Khalil, A. and Fathi, M. A. (2005): Improving growth, yield and fruit quality of "Canino" apricot by using bio, mineral and humate fertilizers. Minufiya J. Agric. Res., 30 (1): 317-328.

Snedecor, G. W. and Cochran, W. G. (1980): "Statistical Methods". 7th ed ., Iowa State Univ. Press Amer. Iowa, USA pp.85-86.

Tantini, M.; Bertoni, P.; Landi, A. and Traversi, M.L. (1991): Effect of Humic acids on growth and biomass portioning of container-grown olive plants. Acta. Hort., 294: 75-80.

Vogel, A. (1968): A Text Book of Quantitative Inorganic Analysis. Longmans, New York, pp. 1216.

Webb, P.G. and Biggs, R.H. (1988): Effects of humate amended soils on the growth of citrus. Proc. Fla. State, Hort. Sci., 101:23-25.

Westwood, M.N. (1978): Temperate Zone Pomology W. H. Freeman and Company. San Francisco.

Yastaas, J. (1990): Pear tree nutrition 4- Effects of different nitrogen supply via roots or leaves on yield, fruit volume and fruit quality of "Moitke" pear. Acta Agricultural Scandinavica, 40(4): 357-362. (C.F. Hort. Abst. 61: 1802.).

تأثير المعدلات المختلفة من الإضافة الأرضية للنتروجين والفوسفور والبوتاسيوم ومركب الأكتوسول على النمو و قياسات الإثمار وصفات جودة الثمار لأشجار الكمثرى

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مركز البحوث الزراعية – الجيزة – مصر

تم إجراء هذا البحث لدراسة تأثير التسميد المعدنى بالـ (ن، فو، بو) مضافاً إليه مركب الأكتوسول الذى يحتوى على مادة الهيوميك وذلك كإضافة أرضية بتركيزات مختلفة على بعض قياسات النمو الخضرى والثمرى وكذلك الحالة الغذائية للأوراق وصفات جودة ثمار أشجار الكمثرى صنف ليكونت المطعومة على أصل الكمبونس والمنزرعة بمحطة بحوث البساتين بالقناطر الخيرية خلال موسمى ٢٠٠٧، ٢٠٠٨.

ولقد أشارت النتائج المتحصل عليها إلى أن معظم المعاملات التركيبية فى هذه الدراسة أدت إلى تأثير إيجابى وزيادة معنوية فى كل قياسات النمو الخضرى المختبرة (طول النمو – قطر النمو – عدد الأوراق/النمو). كذلك فإن القياسات الثمرية (النسبة المئوية لعقد الثمار ومحصول الشجرة سواء قدر بالكجم/شجرة أو بالطن وكذلك عدد الثمار/شجرة) فقد ازدادت هذه القياسات معنوياً بزيادة مستوى التسميد الأرضى من (ن، فو، بو × هيوميك) والأهم من ذلك فإن صفات جودة الثمار سواء الطبيعية (وزن وحجم الثمار – الصلابة أبعاد الثمار ومعامل شكل الثمرة) أو الكيماوية (النسبة المئوية للسكريات الذائبة الكلية –

النسبة المئوية للحموضة الكلية والنسبة بين كل منهما وكذلك النسبة المئوية للسكريات الكلية) قد تحسنت معنويا نتيجة للإضافة الأرضية للمعدلات الأعلى من الأسمدة المضافة عندما قورنت بأقل تركيز من هذه الأسمدة. هذا بالإضافة إلى أن محتوى الأوراق من بعض العناصر الكبرى (النيتروجين – الفوسفور – البوتاسيوم) والعناصر الصغرى (الحديد والزنك) قد تحسنت على المستوى المعنوى باستخدام المعاملات المختلفة تحت الدراسة خلال موسمى البحث ٢٠٠٧ – ٢٠٠٨.

وبصفة عامة فإنه يمكن القول بأن معظم المعاملات التركيبية من الأسمدة المستخدمة (ن، فو، بو، هيوميك) كإضافة أرضية أدت إلى تأثيرات إيجابية ومعنوية على معظم القياسات والصفات المدروسة لثمار أشجار الكمثرى (الليكونت). وكانت أفضل معاملة فى هذا الخصوص من حيث زيادة القياسات الخضرية والثمرية وتحسين الحالة الغذائية للأوراق وكذلك معظم صفات جودة الثمار هى المعاملة الأعلى تسميدياً أى (٢، ١، ١ كجم للشجرة) من كل N، P، K على التوالى مع إضافة ١٠٠ سم/شجرة من مركب الأكتوسول شهريا لمدة ٤ أشهر متتالية وذلك تحت ظروف منطقة القناطر الخيرية، محافظة القليوبية.