Bull. Fac. Agric. Cairo Univ. 61: 17-32 (2010).

GROWTH, NUTRIENT STATUS AND YIELD OF LE-CONTE PEAR TREES AS INFLUENCED BY SOME ORGANIC AND BIOFERTILIZER RATES COMPARED WITH CHEMICAL FERTILIZER

(Received: 1.11.2009)

By
S. M. Mohammed, T.A. Fayed, A.F. Esmail* and N.A. Abdou*

Pomology Department, Faculty of Agriculture, Cairo University and Horticulture Research Institute, Agricultural Research Center, Giza, Egypt*

ABSTRACT

This investigation was carried out during the 2006 and 2007 growing seasons on a 3 year old Le-Conte pear trees (*Pyrus communis* L. X *Pyrus pyrifolia* N.) grafted on *Pyrus betulaefolia* rootstock and planted at 5 × 5 meters apart (169 trees / faddan) in sandy soil under drip irrigation system, at El-Kassasien Horticultural Research Station, Ismailia Governorate. One source of organic fertilizers (compost) plus natural rocks (rock phosphate + feldspare), with or without biofertilizers (phosphorein and biogein) plus humic acid plus compost tea, were compared with chemical fertilization. Application of compost with biofertilizers plus humic acid plus compost tea gave a better effect on all vegetative characteristics (growth rate of trunk diameter, shoot diameter, shoot length, number of leaves per shoot and leaf area) and chemical leaf constituents (leaf pigments, macro and micro elements, total carbohydrates, C/N ratio, protein contents) and yield compared to other organic treatments. Also vegetative growth, nutritional status and yield were significantly increased from the first till the second season indicating the accumulation effect of organic manure plus biofertilizers plus humic acid plus compost tea. Chemical fertilizer gave the highest vegetative and yield characteristics and leaf chemical contents compared to all organic rates with or without biofertilizers, humic acid and compost tea in the two seasons of study.

***Key words:** biofertilizer, compost, compost tea , humic acid, pear, organic fertilizer.*

1. INTRODUCTION

Organic fertilizers improve the physical, chemical and biological properties of nearly all soil types, adjusting soil pH, increasing nutrient solubility and production of the plants (Zhou *et al.*, 2001). The addition of organic manure to the soil encourages proliferation of soil micro organisms, increases microbial population and activity of microbial enzymes, *viz.* dehydrogenase, urease and nitrogenase (Abou-Hussein *et al.*, 2002). Some investigators studied the effect of organic manure as compared with chemical fertilizer on different fruit crops Huilian *et al.* (2000) on pears, Kassem & Marzouk, (2002) and El- Shenawy & Fayed (2005a) on grapevines, Abou- Taleb, (2004) on pecans, Fayed, (2005) on peaches, and Fayed (2005b) on apples]. They reported that, under organic systems, soil biotic life increased as a result of the plant synthesis of more vitamins and sugar. Moreover, the addition of organic fertilizer is necessary for the best growth when compared to mineral fertilizers. Application of natural rocks (rock phosphate + feldspare) caused the release of the macro and micro elements P, K, Ca and Mg, and converted them to soluble forms in comparison with the same mixtures (compost) without natural rocks (El-Haggar *et al.*, 2004).

Biofertilizers are of the most importance for plant production and soil, as they play an important role in increasing vegetative characteristics (Fayed, 2005b on apple). Also, Hassan and Abou-Rayya (2003) showed that all bio-fertilizers (nitrobein, phosphorein, biogein and rhizobacterien at 10, 20, 30 gm per tree) were effective in improving nutritional status of Anna apple trees.

Humic acid (polymeric polyhydroxy acid) was the most significant component of organic substances in aquatic systems. Humic acid is highly beneficial to both plants and soil; its importance for increasing microbial and mycorhizal activity, it is considered as a plant growth bio-stimulant, an effective soil enhancer; it promotes nutrient uptake (chelating agent) and improves vegetative characteristics, nutritional status and leaf pigments [Eissa *et al.* (2007a) and Ismail *et al.* (2007) on Le-Conte pear trees].

2. MATERIALS AND METHODS

This investigation was carried during the 2006 and 2007 growing seasons on 3 year old Le-Conte pear trees (*Pyrus communis* L. X *Pyrus pyrifolia* N.) on *Pyrus betulaefolia* rootstock, planted at 5 × 5 meters apart (169 trees / faddan) in a sandy soil under drip irrigation system at El-Kassasien Horticultural Research Station, Ismailia Governorate. The experimental soil was analyzed before starting the experiment and the data are presented in Table (1). The pear trees under investigation were nearly similar in size and shape. Two rates of organic fertilizers [15 kg compost plus natural rocks (263 g rock phosphate + 3kg feldspar) and 30 kg compost plus natural rocks (526 g rock phosphate + 6 kg feldspar)] were added in the first week of December of each season, delivering 172.5-345, 138-248.4 and 186-334.8 g N, P and K/tree in two rates respectively each with or without some stimulators (Biofertilizers, compost tea and humic acid. The stimulators were added either alone or in combination. The organic fertilizer treatments were compared with chemical fertilizer.

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

Physical character	%	Chemical character	%
Field capacity	11.77	$CaCO_3$	12.55
Available water	1.55	Organic matter	0.08
Wilting point	4.20	PH (1:25)	7.5
Coarse sand	67.08	Ec(mm hos/ cm)	6.14
Fine sand	9.5	Small ESP	19.3
Silt	0.7	Ca (mg/ 100g)	0.14
Clay	5.2	Mg (mg/ 100g)	0.10
Textural class	Sandy	Na (mg/ 100g)	0.34
		K (mg/ 100g)	0.16
		HCO_3 (mg/ 100g)	0.17
		CL (mg/ 100g)	0.30

The used compost and natural rocks are show in Tables (2) and (3) respectively. Biofertilizers (BF.) were obtained from the Ministry of Agriculture, produced by the General Organization for Agriculture Equalization Fund (GOAEF). Two types of bio fertilizers were used, namely, Phosphorein (containing phosphate dissolvers, vesicular Arbuscular mycrohizas, and silicate bacteria) and Biogein (a nitrogenous bio fertilizer containing nitrogen fixation bacteria such as *Azotobacter choroccocum*). The biofertilizer were added to the wetted compost as soil application (15 cm soil depth) in four equal doses each at 30 g/tree in December, March, June and September.

Table(2):Some chemical characteristics of the used compost

Parameter	Compost
Cubic meter weight (kg)	520
Moisture %	33.5
Organic matter %	45.70
Organic carbon %	25.4
PH (1:10)	7.40
EC	2.3
C/N ratio	22.1
Total N %	1.15
Total P %	0.92
Total K %	1.24
Total Mg %	0.86
Total Fe (ppm)	1990
Total Mn (ppm)	430
Total Zn (ppm)	130
Total Cu (ppm)	30

Compost tea was added as soil application in four doses, each at 2 liters/ tree in December, March, June and September. Compost tea was prepared by hand (10 kg compost + 100 liter clean water) variable period up to 10 days and is more akin to a compost watery extract than a brewed and aerated compost tea.

Table (3): Some components of natural rocks fertilizer

Component (%)	L.O.I	SiO_2	AlO2	FeO_2	CaO	MgO
Feldspar	0.72	71.94	13.92	0.09	0.32	0.08
Phosphate	nil	nil	nil	nil	nil	nil
Component (%)	K_2O	Na_2O	TiO_2	MnO_2	P_2O_2	Cl
Feldspar	10.6	1.94	0.01	0.01	0.04	0.03
Phosphate	nil	nil	nil	nil	22.8	nil

Humic acid was added as a soil application as 50 ml Actosol (2.9% humic acid + 10-10-10 NPK) in 1 liter of water every other week from late June till October 15th.

Chemical fertilizers were added at the recommended rate by the Ministry of Agriculture (168, 60 and 172 g N, P and K per tree/ year, respectively) in the first season and (315, 80 and

312g N, P, and K per tree /year, respectively) in the second season through drip irrigation system. The 17 treatments were replicated three times; each replicate was represented by 3 trees. The same treatments were applied in the second season.

During the two seasons the following parameters were recorded:

2.1. -Vegetative growth

2.1.1. Growth rate of the trunk diameter (cm / year) at 20 cm from soil surface was calculated each year according to the following equation; increase in trunk diameter = diameter at the season end (October) - diameter at the beginning of the following season (January).

2.1.2. Length and diameter of the new shoots (cm/year): 6 new shoots were randomly chosen per tree and their length and diameter were measured at the end of each season.

2.1.3. Number of leaves per shoot was recorded at the season end.

2.1.4. Leaf area: Six mature leaves were taken at the third node from the base of the shoot for estimating leaf area using leaf area meter (model CL – 203, USA)

2.2. Leaf minerals composition

Macro and micro elements were determined in the oven dried leaf sample (4-6th leaf from the base) collected at the 2nd week of July. Leaves were dried at 70° for 48 h. and used for the following analysis:

2.2.1.Total nitrogen: Total leaf (N) was determined by the modified micro keldahl Method as mentioned by Pregl (1945).

2.2.2. Total phosphorus: Total leaf P was determined by wet digestion of plant materials by using sulphuric and perchloric acid as recommended by Piper (1974).

2.2.3. Total potassium: Total leaf (K) was determined in the digested material using Zeiss flame photometer according to the method described by Brown and Lilliand (1946).

2.2.4. Calcium and Mg percentage, as well as Fe, Mn and Zn contents (ppm) were determined using an atomic absorption spectrophotometer model 305 B (Piper, 1958).

2. 3. Leaf concentration (percentage) of total carbohydrates and proline

These were estimated according to A.O.A.C. (1985) and Bates *et al.* (1973), respectively, as mg/100 g D.W. Moreover, C/N ratio and total protein % were also calculated.

2. 4. Leaf pigments

Representative fresh leaf samples of the same physiological age and position (at the 4-6th leaf from the base) were taken and photosynthetic pigments (chlorophyll a, b and carotenoids) were calorimetrically determined according to Mackinney (1941).

2.5. Fruiting measurements

2.5.1. Fruit set percentage: The total number of flowers on each limb was counted at full bloom. The number of set fruit was counted on the same limbs after one month from full bloom. Fruit set percentage was calculated as follows:

$$\text{Fruit set percentage} = \frac{\text{Number of developing fruitlets}}{\text{Total number of flower}} \times 100$$

2.5.2. Yield per tree: Fruits were harvested at maturity stage (the end week of August), from each tree of various replicates and yield was recorded, as number and weight in kilograms.

2.6. Statistical analysis

The obtained data were tabulated and statistically analysed according to the split plot design (Sendecor and Cochran, 1980). The value means were compared using LSD method at 5 % level. The percentages were transferred to the arcsine to find the binomial percentages according to (Steel and Torrie, 1980).

3. RESULTS AND DISCUSSION

3.1. Growth rate of trunk diameter (cm/year)

Trunk diameter was significantly affected by the different rates of fertilization throughout the two seasons of the study. Table (4) show that growth rate of trunk diameter was significantly higher in the second season (1.96 cm) than in the first one (1.71 cm). This might be due to their long time or accumulative effect since the tested treatment was applied on the same trees for the two seasons. Also, chemical fertilizer gave the highest trunk circumference (2.33 cm) followed by compost2 (30 kg / tree) treatment (1.61 cm), and then compost at compost1 (15kg / tree) treatment (1.56 cm). Interaction study between organic rates (compost) and stimulators (BF., humic acid and compost tea) and the highest significant value was compost 2 (30 kg / tree) plus bio-fertilization plus humic acid plus compost 1 tea treatment (1.87 cm) compared with other organic treatment. The lowest trunk circumference was obtained from compost1 without any addition (1.25 cm). These results are in harmony with those reported by Li *et al.*, (1997) on pear, Fayed (2005b) on apple, Kabeel (2004) on peach cv. Meet-Ghamr; El-Shenawy and Fayed (2005) on grapevine cv. Crimson and Abd-Rabou (2006) on mango and avocado seedlings.

3.2. Length of the current year shoots

Table (4) shows that new shoot length was significantly increased by different treatments in the two seasons. The second season was better than the first one (38.75 cm and 36.79 cm). The highest new shoot length was obtained with

Table (4): Effect of organic and bio–fertilizer treatments on vegetative characters of "Le-Conte" pear tree compared to chemical fertilization (2006 & 2007).

Treatments		Growth rate of trunk diameter (cm/year)			Shoot length (cm)			Shoot diameter (cm)		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	1.16	1.33	1.25	27.60	29.34	28.47	0.37	0.39	0.38
	Bio-Fertilizer	1.35	1.61	1.48	31.96	34.21	33.09	0.42	0.44	0.43
	Compost tea	1.29	1.54	1.42	31.29	32.78	32.03	0.41	0.43	0.42
	Humic acid	1.43	1.68	1.56	32.96	35.00	33.98	0.44	0.46	0.45
	Bio + Tea	1.50	1.72	1.61	35.05	37.07	36.06	0.53	0.55	0.54
	Tea + Humic	1.54	1.76	1.65	35.61	37.57	36.59	0.56	0.58	0.57
	Bio + Humic	1.62	1.82	1.72	36.19	38.17	37.18	0.58	0.60	0.59
	Bio + Tea + Humic	1.70	1.95	1.83	38.29	40.28	39.28	0.67	0.69	0.68
Av		1.45	1.68	1.56	33.62	35.55	34.59	0.50	0.52	0.51
compost 2(30kg /tree)	without	1.20	1.38	1.29	29.04	31.02	30.03	0.41	0.43	0.42
	Bio-Fertilizer	1.38	1.65	1.52	34.27	36.30	35.28	0.49	0.51	0.50
	Compost tea	1.33	1.59	1.46	33.14	35.42	34.28	0.47	0.49	0.48
	Humic acid	1.48	1.72	1.60	34.90	36.89	35.90	0.51	0.53	0.52
	Bio + Tea	1.54	1.76	1.65	36.50	38.37	37.44	0.59	0.61	0.60
	Tea + Humic	1.60	1.81	1.70	37.12	39.20	38.16	0.61	0.63	0.62
	Bio + Humic	1.66	1.88	1.77	37.69	39.98	38.69	0.60	0.65	0.63
	Bio + Tea + Humic	1.78	1.95	1.87	38.80	40.46	39.63	0.71	0.73	0.72
Av		1.50	1.72	1.61	35.18	37.17	36.17	0.55	0.57	0.56
Chemical fertilizer (N, P, K)		2.18	2.48	2.33	41.56	43.52	42.54	0.77	0.79	0.78
Average of stimulators	without	1.18	1.35	1.27	28.32	30.18	29.25	0.39	0.41	0.40
	Bio-Fertilizer	1.36	1.63	1.50	33.11	35.25	34.18	0.45	0.47	0.46
	Compost tea	1.31	1.56	1.44	32.21	34.10	33.15	0.44	0.46	0.45
	Humic acid	1.45	1.70	1.58	33.93	35.94	34.94	0.47	0.49	0.48
	Bio + Tea	1.52	1.74	1.63	35.77	37.72	36.75	0.56	0.58	0.57
	Tea + Humic	1.57	1.78	1.67	36.36	38.38	37.37	0.58	0.60	0.59
	Bio + Humic	1.64	1.85	1.74	36.94	39.07	37.93	0.59	0.62	0.60
	Bio + Tea + Humic	1.74	1.95	1.85	38.54	40.37	39.45	0.69	0.71	0.70
General Av		1.71	1.96		36.79	38.75		0.61	0.63	
L.S.D at 5% level at :										
Seasons		0.08			0.23			0.01		
compost		0.02			0.21			0.01		
Stimulators		0.01			0.45			0.02		
Seasons X Compost		0.03			0.39			0.02		
Season X Stimulators		0.02			0.64			0.03		
Compost X Stimulators		0.02			0.79			0.04		
Seasons X Compost X Stimulators		NS			1.11			0.05		

chemical fertilizer treatment (42.54 cm), followed by compost 2 (30 kg/tree) treatment (36.17 cm), then organic fertilizer compost 1 (15 kg/tree) treatment (34.59 cm). Concerning the interaction between (compost) and stimulators (BF, humic acid and compost tea) the data revealed that the highest significant value was recorded for compost 2 (30 kg / tree) plus bio-fertilization plus humic acid plus compost tea treatment (39.63 cm) compared with other organic treatments, while the lowest new shoot length was obtained from compost treatment without any addition (28.47 cm).The obtained results are in disagreement with the finding of Fayed (2005a) on peach. Similar results were obtained on apple by Fayed, (2005 b), El-Shenawy and Fayed(2005) and Ahmed *et al.*, (1997) on grapevine and Kabeel *et al.*, (2005) on apricot cv. Canino and Abd-Rabou, (2006) on mango and avocado seedlings.

3. 3. Shoot diameter (cm)

The average shoot diameter was significantly affected by different treatments in both seasons. Table (4) shows that shoot diameter was significantly greater in the 2nd season (0.63 cm) than in the first one (0.61 cm). The shoot diameter was at the highest values with the chemical fertilizer treatment followed by the compost 2 (30 kg/tree) treatment and then the compost 1 (15 kg/tree) treatment. Interaction between organic fertilization rates (compost) and stimulators (BF, humic acid and compost tea) showed that the highest significant value was recorded for compost 2 (30 kg / tree) plus bio-fertilization plus humic acid plus compost tea treatment (0.72 cm) compared with the other organic treatments. Moreover, the difference between the chemical fertilizer treatment and the organic fertilizer plus bio- fertilizer treatments in the first season was so limited compared to the same treatments in the second season. This could support the previous finding that bio-fertilizer treatments gave their effect at long time. These results are confirmed by those obtained by Roan Sufeng (1998) on pear, Kabeel (2004) and Fayed (2005a) on peach, Ahmed *et al.* (1997), El-Shenawy and Fayed(2005) and Fayed (2005b) on apple.

3.4. Number of leaves / shoot

Data in Table (5) indicate that the number of leaves / shoot was the significantly affected by different treatments in both seasons. Number of leaves / shoot was higher in the second season (19.95) than the first one (19.19). The highest number of leaves / shoot was obtained with chemical fertilizer treatment (22.75) followed by the compost 2 (30 kg/tree) treatment (18.55), then the compost1 (15 kg/tree) treatment (17.41) compared with the other organic treatments. Interaction between organic fertilization rates (compost) and stimulators (BF., humic acid and compost tea) showed that the highest significant value was recorded for compost 2 (30 kg / tree) plus bio-fertilization plus humic acid plus compost tea treatment (21.38) followed by compost1 (15 kg / tree) plus bio-fertilization plus humic acid plus compost tea treatment (21.17) compared with other organic treatments. The lowest number of leaves / shoot was obtained from compost1 treatment without any addition (14.56). Results of the present study confirm the previous findings of Roan Sufeng (1998) and Ismail *et al.* (2007) on pear, Fayed (2005b) on Anna apple, El-Shenawy and Fayed (2005) on grape

3.5. Leaf area (cm^2)

It is evident from the data in Table (5) that organic fertilizer plus bio-fertilizer, humic acid and compost tea treatments significantly increased leaf area compared with the same organic fertilizer alone in the two seasons. Also, leaf area in the second season was higher than that in the first one. In addition, the chemical fertilizer treatment resulted in the greatest average of leaf area (35.13 cm^2) followed by compost2 (30 kg / tree) treatment (30.22 cm^2), then compost1 (15 kg / tree) treatment (28.69 cm^2). Interaction between organic fertilization rates (compost) and stimulators (BF, humic acid and compost tea) showed that the highest significant value was recorded for compost2 (30 kg / tree) plus bio-fertilizer plus humic acid plus compost tea treatment (33.90 cm^2) followed by compost1 (15 kg / tree) plus bio-fertilization plus humic acid plus compost tea treatment (32.79 cm^2), compared with other organic treatments. Meanwhile, trees receiving the organic fertilization (compost 1) only had the lowest leaf area value (25.34 cm^2). The obtained results are in disharmony with those reported by El-Shenawy and Fayed (2005) on grape, Fayed (2005a) on peach, Fayed (2005b) on apple and Hegazi *et al.* (2007) on olive.

3.6. Leaf mineral contents

3.6.1. Leaf nitrogen (%)

Data in Table (6) show that leaf N % was significantly affected by the different treatments in both seasons. The leaf nitrogen % was generally higher in the second season (2.37%) than in the first one (2.34%).

Table (5): Effect of organic and bio-fertilizer treatments on vegetative characters of "Le-Conte" pear tree compared with chemical fertilization (2006 & 2007).

Treatments		No. of leaves/shoot			Leaf area (cm^2)		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	14.51	14.61	14.56	25.22	25.45	25.34
	Bio-Fertilizer	15.81	16.31	16.06	26.92	27.26	27.09
	Compost tea	15.64	15.54	15.59	26.38	26.92	26.65
	Humic acid	16.38	16.68	16.53	28.04	28.00	28.02
	Bio + Tea	17.53	18.21	17.87	29.47	29.37	29.42
	Tea + Humic	18.18	18.86	18.52	29.65	30.02	29.84
	Bio + Humic	18.42	19.50	18.96	30.01	30.80	30.41
	Bio + Tea + Humic	20.99	21.35	21.17	32.15	33.43	32.79
Av		17.18	17.63	17.41	28.48	28.91	28.69
compost 2(30kg /tree)	without	14.90	15.14	15.02	26.05	26.29	26.17
	Bio-Fertilizer	16.69	17.86	17.28	28.95	28.48	28.72
	Compost tea	16.60	17.47	17.03	28.50	28.23	28.36
	Humic acid	17.12	17.99	17.56	29.57	29.66	29.61
	Bio + Tea	18.81	19.88	19.34	30.44	31.60	31.02
	Tea + Humic	19.58	20.66	20.12	31.07	32.33	31.70
	Bio + Humic	20.28	20.99	20.64	31.59	33.01	32.30
	Bio + Tea + Humic	21.08	21.68	21.38	33.24	34.55	33.90
Av		18.13	18.96	18.55	29.93	30.52	30.22
Chemical fertilizer (N, P, K)		22.24	23.27	22.75	34.74	35.53	35.13
Average of stimulators	without	14.70	14.87	14.78	25.63	25.87	25.75
	Bio-Fertilizer	16.25	17.08	16.66	27.93	27.87	27.90
	Compost tea	16.12	16.50	16.31	27.44	27.57	27.50
	Humic acid	16.75	17.33	17.04	28.80	28.83	28.81
	Bio + Tea	18.17	19.04	18.60	29.95	30.48	30.21
	Tea + Humic	18.88	19.76	19.32	30.36	31.17	30.76
	Bio + Humic	19.35	20.24	19.79	30.80	31.90	31.35
	Bio + Tea + Humic	21.03	21.51	21.27	32.69	33.99	33.34
General Av		19.19	19.95		31.05	31.65	

L.S.D. at 5% level at :		
Seasons	0.18	0.15
compost	0.17	0.14
Stimulators	0.36	0.31
Seasons X Compost	0.31	0.27
Season X Stimulators	0.50	0.44
Compost X Stimulators	0.62	0.54
Seasons X Compost X Stimulators	0.87	0.76

Table (6): Effect of organic and bio – fertilizer treatments on leaf macro-elements (N, P and K) contents of "Le-Conte" pear tree compared with chemical fertilization (2006 & 2007).

Treatments		Nitrogen (%)			Phosphorus (%)			Potassium (%)		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	2.16	2.19	2.17	0.159	0.161	0.160	2.14	2.17	2.15
	Bio-Fertilizer	2.21	2.23	2.22	0.170	0.173	0.172	2.18	2.24	2.21
	Compost tea	2.19	2.22	2.20	0.164	0.167	0.166	2.17	2.22	2.19
	Humic acid	2.23	2.24	2.23	0.173	0.176	0.175	2.19	2.26	2.22
	Bio + Tea	2.29	2.31	2.30	0.177	0.180	0.179	2.26	2.31	2.28
	Tea + Humic	2.30	2.32	2.31	0.180	0.184	0.182	2.28	2.32	2.30
	Bio + Humic	2.31	2.34	2.32	0.185	0.188	0.186	2.30	2.33	2.31
	Bio + Tea + Humic	2.39	2.42	2.40	0.189	0.193	0.191	2.36	2.40	2.38
Av		2.26	2.28	2.27	0.175	0.178	0.176	2.26	2.28	2.27
compost 2(30kg /tree)	without	2.18	2.20	2.19	0.163	0.166	0.165	2.16	2.20	2.18
	Bio-Fertilizer	2.26	2.28	2.27	0.173	0.176	0.174	2.22	2.30	2.26
	Compost tea	2.24	2.25	2.24	0.167	0.170	0.169	2.20	2.28	2.24
	Humic acid	2.28	2.30	2.29	0.177	0.180	0.179	2.24	2.31	2.27
	Bio + Tea	2.33	2.36	2.34	0.181	0.184	0.182	2.32	2.35	2.33
	Tea + Humic	2.35	2.38	2.36	0.184	0.187	0.186	2.34	2.37	2.35
	Bio + Humic	2.37	2.40	2.38	0.188	0.191	0.189	2.35	2.38	2.36
	Bio + Tea + Humic	2.40	2.45	2.42	0.193	0.196	0.194	2.38	2.42	2.40
Av		2.30	2.32	2.31	0.178	0.181	0.180	2.28	2.32	2.30
Chemical fertilizer (N, P, K)		2.46	2.53	2.49	0.200	0.203	0.202	2.44	2.50	2.47
Average of stimulators	without	2.17	2.19	2.18	0.161	0.163	0.162	2.15	2.18	2.16
	Bio-Fertilizer	2.23	2.25	2.24	0.171	0.174	0.173	2.20	2.27	2.23
	Compost tea	2.21	2.23	2.22	0.165	0.168	0.166	2.18	2.25	2.21
	Humic acid	2.25	2.27	2.26	0.175	0.178	0.176	2.21	2.28	2.24
	Bio + Tea	2.31	2.33	2.32	0.179	0.182	0.181	2.28	2.33	2.30
	Tea + Humic	2.32	2.35	2.33	0.182	0.185	0.183	2.31	2.34	2.32
	Bio + Humic	2.34	2.37	2.35	0.186	0.189	0.187	2.32	2.35	2.33
	Bio + Tea + Humic	2.39	2. 43	2.41	0.191	0.194	0.192	2.37	2.41	2.39
General Av		2.34	2.37		0.182	0.187		2.32	2.36	

L.S.D at 5% level at :			
Seasons	0.003	NS	0.010
compost	0.003	0.002	0.010
Stimulators	0.006	0.004	0.021
Seasons X Compost	0.006	NS	0.018
Season X Stimulators	0.009	NS	0.030
Compost X Stimulators	0.011	NS	0.036
Seasons X Compost X Stimulators	0.016	NS	0.051

Also, leaf N % of the chemical fertilizer treatment in the first season was less than that in the second one. In the average, the chemical fertilizer gave the highest leaf N % (2.49%), followed by compost 2 (30 kg per tree) treatment (2.31%), then compost1 (15 kg per tree) treatment (2.27%). Interaction between organic fertilization rates (compost) and stimulators (BF, humic acid and compost tea) showed that compost 2 (30 kg/tree) + BF. + humic acid +compost tea gave the highest leaf N %, then compost1 (15 kg/tree) + BF. + humic acid + compost tea compared with other organic treatments. Meanwhile, trees receiving the organic treatment only (compost 1) had the least leaf N value. These results coincide with those reported by Ystaas (1990) and Ismail (2002) on pear trees, Fayed (2005 a) on peach, and Fayed (2005 b) on apple.

3.6.2. Leaf phosphorus (%)

Data in Table (6) indicate that the various fertilization treatments almost showed non-significant effect on leaf P % in the first and second seasons. Also leaf P % in the chemical fertilizer treatment was statistically equal in the two seasons. The chemical fertilizer gave the highest leaf P % (0.202%) followed by compost 2 (30 kg per tree) treatment (0.180%), and then compost 1 (15 kg per tree) treatment (0.176%). Interaction between organic fertilization rates (compost) and stimulators (BF, humic acid and compost tea) showed non-significant effect between organic fertilization treatments. These results are in line with those obtained by Hassan and Abou-Rayya (2003), Fayed (2005 a) on peach and Fayed (2005 b) on apple.

3. 6. 3. Leaf potassium (%)

Data in Table (6) reveal that leaf K % was significantly increased in the combined treatments of biofertilizers, humic acid and compost tea in both seasons. Moreover, the leaf K % was significantly higher in the second season (2.36%) than in the first one (2.32%) . In addition, the chemical fertilizer treatment gave the highest leaf K % (2.47%), followed by compost 2 (30 kg per tree) treatment (2.30%), then compost 1 (15 kg per tree) treatment (2.27). Interaction between organic rates (compost) and stimulators (BF, humic acid and compost tea) showed that compost 2 (30 kg/tree) + BF. + humic acid +compost tea gave the highest leaf potassium % (2.40%), then compost 1 (15 kg/tree) + BF. + humic acid + compost tea (2.38%), compared with other organic treatments. Meanwhile trees receiving the organic fertilization treatment (compost 1) only had the least leaf potassium value (2.15%). These results are in line with those obtained by El- Haggar *et al.*, (2004), Fayed (2005 a) on peach, Fayed (2005 b) on, apple, and Hegazi *et al.* (2007) on Picual olive tree.

3. 6. 4. Leaf calcium and Magnesium (%)

Data concerning leaf Ca and Mg % (Table 7) indicate that a pronounced increase in leaf Ca and Mg % was recorded due to all organic fertilization treatments plus biofertilizer plus humic acid plus compost tea in combination or each alone in the two seasons. The second season was better than the first one. Also, the chemical fertilizer gave the highest leaf Ca and Mg content followed by compost 2 (30 kg per tree) treatment, then compost 1 (15 kg per tree) treatment. Interaction between organic fertilization rates (compost) and stimulators (BF, humic acid and compost tea) showed that compost 2 (30 kg/tree) + BF. + humic acid +compost tea gave the highest leaf Ca and Mg, then compost 1 (15 kg/tree) + BF. + humic acid + compost tea compared with other organic treatments. Meanwhile, trees receiving the organic treatment only had the lowest leaf Ca and Mg values. These results are in contrast with those obtained by El-Morshedy (1997) on sour orange seedlings, Mahmoud and Mahmoud (1999), Fayed (2005a) on peach, and Fayed (2005b) on apple.

3. 6. 5. Leaf Fe, Zn and Mn (ppm)

Leaf concentration of Fe, Zn and Mn was significantly affected by the different fertilization treatments in both seasons (Table 8). Leaf Fe, Zn and Mn of the different fertilization treatments increased significantly with increasing the application rate and high level gave the highest value of the different nutrients. Meanwhile, the chemical fertilizer treatment increased leaf concentration of Fe, Zn and Mn (114.7 ppm for Fe, 54.0 ppm for Zn and 55.3 ppm for Mn), compared to all organic fertilizer treatments with or without bio fertilizer plus humic acid plus compost tea. However, the interaction between organic fertilization rates (compost) and stimulators (BF, humic acid and compost tea) showed that compost 2 (30 kg/tree) + BF. + Humic acid +compost tea gave the highest leaf concentration of Zn, Fe and Mn, then compost 1 (15 kg/tree) + BF. + humic acid + compost tea, compared with other organic treatments. The lowest leaf contents of Fe, Zn and Mn were obtained from compost 1 treatment without any addition. These results are in contrast with those obtained by El-Morshedy (1997), Mahmoud and Mahmoud (1999), Hassan and Abou-Rayya (2003), Fayed (2005b) on apple, Sharma and Bhutani (2000) Fayed (2005a) on peach, and Kassem El-Seginy (2002) on peach.

Table (7): Effect of organic and bio–fertilizer treatments on leaf macro-elements (Ca and Mg) contents of "Le-Conte" pear tree compared to chemical fertilization (2006 & 2007)

Treatments		Calcium (%)			Magnesium (%)		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	1.37	1.39	1.38	0.134	0.137	0.136
	Bio-Fertilizer	1.47	1.48	1.48	0.139	0.140	0.139
	Compost tea	1.44	1.45	1.45	0.138	0.139	0.138
	Humic acid	1.49	1.51	1.50	0.140	0.144	0.142
	Bio + Tea	1.53	1.55	1.54	0.143	0.146	0.144
	Tea + Humic	1.54	1.56	1.53	0.145	0.148	0.146
	Bio + Humic	1.57	1.59	1.58	0.147	0.154	0.150
	Bio + Tea + Humic	1.63	1.65	1.64	0.152	0.158	0.155
Av		1.51	1.52	1.51	0.142	0.146	0.144
compost 2(30kg /tree)	without	1.39	1.41	1.39	0.137	0.138	0.138
	Bio-Fertilizer	1.48	1.50	1.49	0.141	0.142	0.142
	Compost tea	1.46	1.47	1.45	0.139	0.141	0.140
	Humic acid	1.51	1.53	1.52	0.142	0.146	0.144
	Bio + Tea	1.53	1.57	1.55	0.146	0.148	0.147
	Tea + Humic	1.59	1.59	1.59	0.147	0.149	0.148
	Bio + Humic	1.61	1.62	1.61	0.150	0.157	0.153
	Bio + Tea + Humic	1.66	1.69	1.67	0.154	0.161	0.157
Av		1.53	1.55	1.54	0.145	0.148	0.146
Chemical fertilizer (N, P, K)		1.727	1.760	1.743	0.170	0.173	0.172
Average of stimulators	without	1.38	1.40	1.39	0.135	0.137	0.137
	Bio-Fertilizer	1.47	1.49	1.48	0.140	0.142	0.141
	Compost tea	1.45	1.46	1.45	0.138	0.140	0.139
	Humic acid	1.50	1.52	1.51	0.141	0.145	0.143
	Bio + Tea	1.56	1.56	1.56	0.144	0.147	0.145
	Tea + Humic	1.56	1.57	1.56	0.146	0.148	0.147
	Bio + Humic	1.59	1.61	1.60	0.148	0.155	0.151
	Bio + Tea + Humic	1.64	1.67	1.65	0.153	0.159	0.156
General Av		1.587	1.611		0.152	0.156	

L.S.D at 5% level at :		
Seasons	0.005	0.007
compost	0.002	0.003
Stimulators	0.017	0.001
Seasons X Compost	0.002	NS
Season X Stimulators	NS	0.001
Compost X Stimulators	0.029	0.001
Seasons X Compost X Stimulators	NS	0.002

Table (8): Effect of organic and bio-fertilizer treatments on leaf micro elements contents of "Le-Conte" pear tree compared to chemical fertilization (2006 & 2007).

Treatments		Fe (ppm)			Zn (ppm)			Mn (ppm)		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	81.7	84.0	82.8	39.2	40.3	39.8	40.6	42.0	41.3
	Bio-Fertilizer	87.0	89.3	88.2	41.8	42.5	42.1	43.5	44.6	44.0
	Compost tea	85.0	87.3	86.2	40.7	41.2	40.9	42.4	44.1	43.3
	Humic acid	88.0	90.0	89.0	42.3	42.9	42.6	44.6	45.7	45.1
	Bio + Tea	90.3	91.7	91.0	43.0	44.1	43.5	45.4	46.9	46.1
	Tea + Humic	92.7	93.3	93.0	43.8	45.5	44.7	46.0	48.1	47.1
	Bio + Humic	95.3	95.7	95.5	44.9	47.0	45.9	46.8	49.1	48.0
	Bio + Tea + Humic	98.0	99.7	98.8	46.8	48.4	47.6	48.6	51.1	49.8
Av		89.8	91.4	90.6	42.8	44.0	43.4	44.7	45.5	45.6
compost 2(30kg /tree)	without	83.3	86.0	84.7	40.0	41.0	40.5	41.3	42.8	42.0
	Bio-Fertilizer	89.0	91.0	84.7	42.4	43.3	42.8	44.4	45.4	44.9
	Compost tea	86.3	89.0	90.0	41.3	42.1	41.7	43.2	45.0	44.1
	Humic acid	90.0	92.0	87.7	43.1	43.8	43.4	45.3	46.3	45.8
	Bio + Tea	92.0	94.7	91.0	44.3	45.2	44.8	46.2	47.7	47.0
	Tea + Humic	94.3	96.7	93.3	46.3	46.7	46.5	47.1	49.3	48.2
	Bio + Humic	96.7	100.0	95.5	47.5	48.0	47.7	47.9	49.9	48.9
	Bio + Tea + Humic	101.0	105.0	98.3	48.3	49.4	48.8	50.3	52.1	51.2
Av		91.6	94.3	92.9	44.1	44.9	44.5	45.7	47.3	46.5
Chemical fertilizer (N, P, K)		113.0	116.3	114.7	53.3	54.7	54.0	54.5	56.1	55.3
Average of stimulators	without	82.5	85.0	83.8	39.6	40.7	40.2	41.0	42.4	41.7
	Bio-Fertilizer	88.0	90.2	89.1	42.1	42.9	42.5	44.0	45.0	44.5
	Compost tea	85.7	88.2	87.0	41.0	41.7	41.2	42.8	44.6	43.7
	Humic acid	89.0	91.0	90.0	42.7	43.4	43.1	45.0	46.0	45.5
	Bio + Tea	91.2	93.2	92.2	43.7	44.7	44.2	45.8	47.3	46.6
	Tea + Humic	93.5	95.0	94.3	45.1	46.1	45.6	46.6	48.7	47.7
	Bio + Humic	96.0	97.9	97.0	46.2	47.5	46.9	47.4	49.5	48.5
	Bio + Tea + Humic	99.5	100.1	99.8	47.6	48.9	48.3	49.5	51.6	50.6
General Av		98.1	100.7		46.7	47.9		48.3	50.0	
L.S.D at 5% level at :										
Seasons			0.7			0.7			0.2	
compost			0.7			0.6			0.4	
Stimulators			0.4			0.3			0.3	
Seasons X Compost			NS			NS			NS	
Season X Stimulators			NS			NS			0.4	
Compost X Stimulators			0.7			0.4			0.5	
Seasons X Compost X Stimulators			NS			NS			NS	

Table (9): Effect of organic and bio-fertilizer treatments on leaf protein, carbohydrate C/N ratio and proline contents of "Le-Conte" pear tree compared to chemical fertilization (2006 & 2007).

Treatments		Protein (%)			Carbohydrate (%)			C/N ratio			Proline mg/100 g D.W.		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	8.52	8.69	8.60	9.11	9.96	9.53	4.20	4.55	4.37	0.16	0.14	0.15
	Bio-Fertilizer	8.85	8.95	8.90	9.71	10.70	10.20	4.38	4.79	4.58	0.18	0.16	0.17
	Compost tea	8.73	8.87	8.80	9.60	10.37	9.98	4.36	4.67	4.52	0.17	0.16	0.16
	Humic acid	8.98	9.04	9.01	9.79	10.95	10.37	4.38	4.87	4.63	0.19	0.17	0.18
	Bio + Tea	9.31	9.43	9.37	10.21	11.42	10.81	4.45	4.94	4.70	0.19	0.18	0.19
	Tea + Humic	9.37	9.52	9.44	10.28	11.62	10.95	4.47	5.00	4.73	0.21	0.20	0.20
	Bio + Humic	9.48	9.64	9.56	10.37	11.78	11.07	4.48	5.03	4.75	0.22	0.21	0.21
	Bio + Tea + Humic	9.93	10.14	10.04	11.08	12.69	11.88	4.63	5.23	4.93	0.23	0.22	0.23
Av		9.15	9.29	9.22	10.01	11.18	10.59	4.42	4.89	4.65	0.19	0.18	0.18
compost 2(30kg /tree)	without	8.75	8.68	8.68	9.21	10.20	9.70	4.22	4.63	4.43	0.17	0.15	0.16
	Bio-Fertilizer	9.25	9.20	9.20	10.03	10.12	10.57	4.43	4.88	4.66	0.18	0.17	0.18
	Compost tea	9.08	9.05	9.05	9.88	10.96	10.42	4.40	4.86	4.63	0.18	0.16	0.17
	Humic acid	9.37	9.32	9.32	10.21	11.27	10.72	4.47	4.90	4.69	0.20	0.18	0.19
	Bio + Tea	9.77	9.67	9.67	10.44	11.86	11.15	4.48	5.02	4.75	0.22	0.19	0.20
	Tea + Humic	9.89	9.80	9.80	10.67	12.12	11.39	4.53	5.09	4.81	0.22	0.20	0.21
	Bio + Humic	10.02	9.93	9.93	10.94	12.24	11.59	4.60	5.09	4.85	0.23	0.21	0.22
	Bio + Tea + Humic	10.33	10.19	10.19	11.36	12.85	12.10	4.72	5.24	4.98	0.24	0.23	0.24
Av		9.40	9.56	9.48	10.34	11.57	10.95	4.48	4.96	4.72	0.21	0.19	0.20
Chemical fertilizer (N, P, K)		10.41	10.81	10.61	12.40	13.35	12.87	5.00	5.28	5.14	0.27	0.26	0.27
Average of stimulators	without	8.63	8.68	8.65	9.16	10.08	9.62	4.21	4.59	4.40	0.16	0.14	0.15
	Bio-Fertilizer	9.05	9.07	9.06	9.87	10.41	10.14	4.40	4.83	4.61	0.18	0.16	0.17
	Compost tea	8.91	8.96	8.93	9.74	10.66	10.20	4.38	4.76	4.57	0.17	0.16	0.16
	Humic acid	9.18	9.18	9.18	10.00	11.11	10.55	4.42	4.88	4.65	0.19	0.17	0.18
	Bio + Tea	9.54	9.55	9.54	10.32	11.64	10.98	4.46	4.98	4.72	0.20	0.18	0.19
	Tea + Humic	9.63	9.66	9.64	10.52	11.87	11.19	4.50	5.04	4.77	0.21	0.20	0.20
	Bio + Humic	9.75	9.78	9.76	10.65	12.01	11.33	4.54	5.06	4.80	0.22	0.21	0.21
	Bio + Tea + Humic	10.13	10.16	10.14	11.22	12.77	11.99	4.67	5.23	4.95	0.23	0.22	0.22
General Av		9.65	9.88		10.91	12.03		4.64	5.04		0.23	0.21	
L.S.D at 5% level at :													
Seasons			0.006			0.18			NS			NS	
compost			0.037			0.13			0.058			0.03	
Stimulators			0.006			0.28			0.018			NS	
Seasons X Compost			NS			0.24			NS			NS	
Season X Stimulators			0.003			0.39			NS			NS	
Compost X Stimulators			0.004			0.48			0.032			NS	
Seasons X Compost X Stimulators			0.005			0.68			NS			NS	

Table (10): Effect of organic and bio-fertilizer treatments on leaf pigments contents of "Le-Conte" pear tree compared to chemical fertilization (2006 & 2007).

Treatments		Chlorophyll (a) mg/g fresh weight			Chlorophyll (b) mg/g fresh weight			Carotene		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	0.61	0.56	0.59	0.50	0.51	0.51	0.52	0.54	0.53
	Bio-Fertilizer	0.64	0.64	0.64	0.53	0.55	0.54	0.56	0.61	0.58
	Compost tea	0.63	0.61	0.62	0.52	0.54	0.53	0.54	0.58	0.56
	Humic acid	0.65	0.65	0.65	0.54	0.56	0.55	0.57	0.63	0.60
	Bio + Tea	0.68	0.72	0.70	0.61	0.63	0.62	0.64	0.72	0.68
	Tea + Humic	0.69	0.74	0.71	0.62	0.65	0.63	0.65	0.73	0.69
	Bio + Humic	0.70	0.76	0.73	0.64	0.67	0.65	0.67	0.74	0.70
	Bio + Tea + Humic	0.74	0.82	0.78	0.70	0.75	0.72	0.72	0.79	0.75
Av		0.67	0.69	0.68	0.58	0.60	0.59	0.60	0.66	0.63
compost 2(30kg /tree)	without	0.62	0.59	0.60	0.51	0.52	0.51	0.53	0.55	0.54
	Bio-Fertilizer	0.66	0.68	0.67	0.57	0.59	0.58	0.60	0.66	0.63
	Compost tea	0.65	0.66	0.65	0.55	0.57	0.56	0.59	0.64	0.61
	Humic acid	0.67	0.70	0.68	0.59	0.62	0.60	0.62	0.70	0.66
	Bio + Tea	0.71	0.78	0.74	0.65	0.70	0.67	0.68	0.75	0.71
	Tea + Humic	0.72	0.80	0.76	0.67	0.71	0.69	0.69	0.76	0.72
	Bio + Humic	0.73	0.81	0.77	0.69	0.73	0.71	0.72	0.78	0.75
	Bio + Tea + Humic	0.75	0.83	0.79	0.70	0.77	0.73	0.73	0.80	0.76
Av		0.69	0.73	0.71	0.61	0.65	0.63	0.64	0.70	0.67
Chemical fertilizer (N, P, K)		0.78	0.88	0.83	0.73	0.82	0.77	0.75	0.85	0.80
Average of stimulators	without	0.61	0.58	0.60	0.51	0.52	0.51	0.51	0.54	0.53
	Bio-Fertilizer	0.65	0.66	0.65	0.55	0.57	0.56	0.58	0.63	0.60
	Compost tea	0.64	0.64	0.64	0.54	0.56	0.55	0.57	0.61	0.58
	Humic acid	0.66	0.68	0.67	0.57	0.59	0.58	0.60	0.66	0.63
	Bio + Tea	0.69	0.76	0.73	0.63	0.67	0.65	0.66	0.73	0.69
	Tea + Humic	0.71	0.77	0.74	0.65	0.68	0.67	0.67	0.74	0.70
	Bio + Humic	0.72	0.79	0.76	0.67	0.70	0.69	0.70	0.76	0.73
	Bio + Tea + Humic	0.74	0.82	0.78	0.70	0.76	0.73	0.71	0.79	0.75
General Av		0.71	0.76		0.64	0.69		0.66	0.73	
L.S.D at 5% level at :										
Seasons		0.003			0.003			0.003		
compost		0.003			0.003			0.003		
Stimulators		0.007			0.007			0.066		
Seasons X Compost		0.006			0.006			0.006		
Season X Stimulators		0.009			0.009			0.009		
Compost X Stimulators		0.011			0.011			0.011		
Seasons X Compost X Stimulators		0.016			0.016			0.016		

Table (11): Effect of organic and bio-fertilizer treatments on fruit set and yield of "Le-Conte" pear tree compared to chemical fertilization (2006 & 2007).

Treatments		Fruit set (%)			Yield/tree (kg)		
Organic fertilizers	Stimulators	2006	2007	Av	2006	2007	Av
compost 1(15 kg /tree)	without	8.28	9.67	8.97	15.57	17.35	16.46
	Bio-Fertilizer	9.59	10.74	10.17	18.50	20.15	19.33
	Compost tea	9.40	9.97	9.69	17.78	18.95	18.36
	Humic acid	10.05	10.94	10.50	19.37	20.75	20.06
	Bio + Tea	11.09	11.69	11.39	23.67	25.01	24.34
	Tea + Humic	11.46	12.59	12.02	24.71	25.79	25.25
	Bio + Humic	12.03	13.07	12.55	25.42	26.82	26.12
	Bio + Tea +	14.12	14.57	14.35	29.12	30.48	29.80
Av		10.75	11.66	11.20	21.77	23.16	22.47
compost 2(30kg /tree)	without	9.10	9.29	9.19	16.86	19.42	18.14
	Bio-Fertilizer	10.40	11.39	10.90	20.85	22.97	21.91
	Compost tea	9.95	10.33	10.15	19.52	22.10	20.81
	Humic acid	10.75	11.38	11.06	22.73	24.42	23.57
	Bio + Tea	12.60	13.44	13.02	26.20	27.88	27.04
	Tea + Humic	13.42	13.74	13.58	27.30	28.72	28.01
	Bio + Humic	13.76	14.35	14.05	28.14	29.95	29.05
	Bio + Tea +	14.96	15.18	15.07	30.73	32.81	31.77
Av		11.87	12.39	12.13	24.04	26.03	25.04
Chemical fertilizer (N, P, K)		15.97	16.53	16.25	34.85	37.88	36.37
Average of stimulators	without	8.69	9.48	9.08	16.21	18.38	17.29
	Bio-Fertilizer	9.99	11.06	10.52	19.67	21.56	20.61
	Compost tea	9.67	10.15	9.91	18.65	20.52	19.58
	Humic acid	10.40	11.16	10.78	21.05	22.58	21.81
	Bio + Tea	11.84	12.56	12.20	24.93	26.44	25.68
	Tea + Humic	12.44	13.16	12.80	26.00	27.25	26.62
	Bio + Humic	12.89	13.71	13.30	26.78	28.38	27.58
	Bio + Tea +	14.54	14.87	14.70	29.92	31.64	30.78
General Av		12.86	13.52		26.89	29.02	
L.S.D at 5% level at :							
Seasons			0.13			0.13	
compost			0.12			0.12	
Stimulators			0.24			0.26	
Seasons X Compost			0.22			0.22	
Season X Stimulators			0.36			0.36	
Compost X Stimulators			0.45			0.45	
Seasons X Compost X Stimulators			0.63			0.63	

3.7. Leaf total carbohydrates, proteins, proline and C/N ratio

Data presented in Table (9) reveal that total carbohydrates, C/N ratio and total proteins were significantly increased by the addition of biofertilizer, humic acid and compost tea to organic manures. Proline showed an opposite trend. Moreover, due to the organic fertilization, leaf chemical contents (except proline) were higher in the second season than in the first one, while proline had an opposite trend. In addition, chemical fertilization resulted in the highest leaf content of all determined components, followed by compost 2 (30 kg per tree) treatment, then compost 1 (15 kg per tree) treatment. Interaction between organic rates (compost) and stimulators (BF, humic acid and compost tea) indicated that compost 2 (30 kg/tree) + BF. + humic acid +compost tea gave the highest leaf chemical contents compared to other organic treatment. The lowest leaf chemical contents were obtained from compost 1 without any addition. Concerning leaf proline concentration the chemical fertilizer gave the highest level compared to organic fertilization treatments. These results go in parallel with those of Ahmed *et al.* (1997), Mahmoud and Mahmoud (1999), Huilian *et al.* (2000) and Fayed (2005b) on apple, Eissa *et al.,* (2007a) on pear, and Eissa *et al.,* (2007b) on peach.

3.8. Leaf pigments

It is quite evident as shown from the data in Table (10) that leaf pigments (chlorophyll a, b and carotenoids) were significantly affected by the different treatments in both seasons. The leaf pigments concentrations were generally higher in the second season than in the first one. The chemical fertilizer gave the highest leaf pigment, followed by compost2 (30 kg per tree) treatment, and then compost1 (15 kg per tree) treatment. Interaction between the two main factor fertilization (organic and chemical) and bio fertilizer stimulants concerning leaf pigment concentrations were statistically significant. The highest leaf pigment concentrations were obtained with the chemical fertilizer, followed by compost 2 (30 kg per tree) +biofertilizer +humic acid +compost tea treatment, and then compost 1 (15 kg per tree) + biofertilizer +humic acid. Meanwhile, trees receiving the organic treatment (compost 1) only had the lowest leaf pigments value. These results are in line with those obtained by Ismail (2002) and Kabeel *et al.,* (2005), Fayed (2005a), Fayed (2005b), Hegazi *et al.,* (2007) and Eissa *et al.* (2007a) on pear, apple, peach and Picual olive, respectively.

3.9. Fruit set and yield

Data depicted in Table (11) indicate that fruit set percentage on spurs and yield (kg/tree) were significantly improved by adding organic fertilizer and stimulators in the two seasons of study. Moreover the fruit set and yield were significantly higher in the second season than the first one. In addition, the chemical fertilizer treatment gave the highest value, followed by compost 2 (30 kg/tree) then compost 1 (15 kg/tree) treatment. Interaction between organic rates and stimulators showed that compost 2(30kg/tree) +biofertilizer+humic acid +compost tea gave the highest fruit set and yield, then compost 1 (15 kg/tree) +biofertilizer+humic acid+compost tea, compared with other organic treatment. These results are in harmony with those reported by EL-Hagger *et al.* (2004), Fayed (2005a) on peach, and Fayed (2005 b) on apple They recorded the stimulating effect of organic sources and rates of biofertilizers on growth rate of trunk diameter, leaf mineral contents, total carbohydrate, leaf pigments and yield. Chemical fertilizer increased proline content; this may be due to the increased chemical salinity of the soil.

Conclusion and recommendation

Application of compost with biofertilizer plus humic acid and compost tea on Le-Conte pear trees gave better effect on vegetative characteristics, chemical leaf constituents (leaf pigments, macro and micro elements, total carbohydrates, C/N ratio , and protein contents)and yield.

4. REFERENCES

A.A.C.C. (2000). Grude protein- Micro kejdahl method. In approved Methods of the American Association of Cereal Chemists. Vol. II, 10th Ed. AACC method 13-46.

Abd-Rabou F.A. (2006). Effect of Microbien, Phosphorene and effective micro-organisms (EM) as bio-stimulants on growth of Avocado, and Mango seedlings. Egyptian Journal of Applied Science, 21 (6B): 673-693.

Abou-Hussein S.D. El-Oksha I., El-Shorbagy T. and Gomaa A.M. (2002). Effect of cattle manure, bio fertilizers and reducing mineral fertilizer on nutrient content and yield of potato plant. Egypt. J. Hor., 29(1): 99-115.

Abou-Taleb S. A. (2004). Effect of cattle manure and reducing mineral fertilizer on growth, fruit quality and nutrient content of pecan trees. Annals of Agric. Sci. Moshohor, 42(3):1197-1214.

Ahmed F. F., Akl A.M., El-Morsy F.M. and Ragab M.A. (1997). The beneficial effects of biofertilizers on Red Roomy grapevines (*Vitis vinfera* L.). a- The effect on growth and nutritional status. Annals of Agriculture

Science Moshtohor, 35 (1): 489-495.

A.O.A.C. (1985). Official Methods of Analysis, A.O.A.C. 14th Ed.,Benjamin Franklin Station Washington DC, USA. p 494-510

Bates L.S., Waldern R.P. and Teare I.D. (1973). Rapid determination of free proline for water stress studies. Plant and Soil, 93:205-207.

Brown J.D. and Lilliand O. (1946): Rapid determination of potassium and sodium in plant material and soil extract by flame photometry Proc. Amer. Soc. Hort., Sci. 48: 341-346.

Eissa Fawzia M., Faith M.A .and El-Shall S. A. (2007a). The Role of humic acid and rootstock in enhancing salt tolerance of "Le-Conte" pear seedlings. J. Agric. Sci. Mansoura Univ., 32 (5): 3651-3666.

Eissa, F. M., Fathi M.A. and El-Shall S.A. (2007b). Response of peach and apricot seedlings to humic acid treatments under salinity condition. J. Agric. Sci. Mansoura Univ., 32(5): 3605-3620

El-Haggar S. M., Ali B. E. Ahmed S. M. and, Hamdy M. M. M. M. (2004). Solubility of some natural rocks during composting. Proceedings of the 2nd International Conference of Organic Agriculture. Cairo, Egypt, p. 105-116.

El-Morshedy F. A. (1997): Organic manure and sulphur interaction influence vegetative growth and elemental concentration of sour orange seedlings J. Agric. Sci. Mansoura Univ., 22 (12): 4599-4616.

El-Shenawy I. E. and Fayed T. A. (2005). Evaluation of the conventional to organic and bio-fertilizers on "Crimson seedless" grapevines in comparison with chemical fertilizers. A- Vegetative growth and nutritional status. Egypt. J. Appl. Sci., 20 (1): 192-211.

Fayed T. A. (2005a). Response of Desert Red Peach trees to organic and some bio-fertilizers in comparison with chemical fertilizers. A- Growth and nutritional status. Egypt. J. Appl. Sci., 20 (1): 127-143

Fayed T. A. (2005b). Effect of some organic manures and bio-fertilizers on Anna apple trees. A-Vegetative growth and leaf chemical constituents. Egypt. J. Appl. Sci., 20 (1): 159-175

Hassan H.S.A. and Abou-Rayya M.S. (2003). Effect of some bio fertilizers on leaf mineral content, yield and fruit quality of Anna apple trees grown under Northern Sinai condition. Egypt. J. Appl. Sci., 18(8B):559-574.

Hegazi E. S., El-Sonbaty M. R. Eissa M. A. Ahmed D. M. and Sharony T. F. (2007). Effect of organic and bio-fertilization on vegetative growth and flowering of Picual olive trees. World Journal of Agriculture Sciences, 3 (2) : 210-217.

Huilian X.U., Xiaojiu W. and Fujita M. (2000). Effect of organic farming practices on photosynthesis, transpiration and water relations and their contributions to fruit yield and the incidence of leaf scorch in pear trees. J. Crop Production, 3(1): 127-138.

Ismail A.F. (2002). Physiological Studies on Pear Trees. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Ismail A.F., Hussien S.M., El- Shall S.A. and Fathi M.A. (2007). Effect of irrigation and humic acid on Le-Conte pear. J. Agric. Sci., Mansoura Univ., 32(9): 7589-7603.

Kabeel H. (2004). Influence of different rates of nitrogen and potassium on vegetative growth, fruiting aspects, fruits characteristics and leaf mineral composition of "Meet-Ghamr" peach trees. Minufiya J. Agric. Res., 29 (1): 215-234.

Kabeel H., Abdel Latif G. S. and Khalil A. A. (2005). Effect of soil application of different mineral and bio-fertilizer treatments on growth, fruiting parameters, fruit properties and leaf nutrient content of "Canino" Apricot trees. J. Agric .Sci. Mansoura Univ., 30 (3): 1583-1594.

Kassem H. A. and El Seginy A. M. (2002). Response of Florida Prince peach trees to soil and foliar application of potassium. Journal of Advanced Agriculture Research, 7 (1): 103-115.

Kassem H. A. and Marzouk H. A. (2002). Effect of organic and / or mineral nitrogen fertilization on the nutritional status, yield, and fruit quality of flame seedless grapevines grown in calcareous soils. Journal of Advanced Agriculture Research, 7 (1): 118-126.

Li P., Yang P. X ., Gou C.F., Han Y.D., Chang B.C. Rong E.C. and Wang Z.H. (1997). Response of pear trees cv. Suli to organic fertilization. Agric. Tech. Ext. Cent. Ningling country, Henan, China, Journal of Fruit Science, 14(4):262-264.

Mackinney G. (1941): Absorption of light by chlorophyll solutions. J. Biochem., 140:315-322.

Mahmoud H. M. and Mahmoud F. A. F. (1999). Studies on effect of some biofertilizers on growth of peach seedlings and root rot

disease incidence. Egyptian Journal of Horticulture, 26(1):7-18.

Piper C.S. (1958). Soil and Plant Analysis. Inter. Sci. Pub., Inc. New York, 360-370.

Piper C.S. (1974). Soil and Plant Analysis.The University of Abdelaide, Australia.

Pregl F. (1945). Quantitative Organic Micro Analysis. 4th Ed. J.A. Churchill Ltd., London, p.53.

Roan Sufeng, N. (1998): Effect of time of nitrogen application on growth of sand pear (*Pyrus pyrifolia* (Burm. F.) Nakai). Taichung District Agricultural Improvement Station 38: 215-222. (C.F. Hort.Abst. 68:6480).

Sendecor, G. W. and Cochran W. G. (1980). Statistical Methods. Oxford and J.B.H. Bub Com.state Univ. Press, Iowa U.S.A 6th Edition.

Sharma S. D. and Bhutani V. P. (2000). Leaf nutrient status of apple seedlings as influenced by VAM, Azotobacter and inorganic fertilizers. Journal of Hill Research, 13 (2):63-66.

Steel R.G.D. and Torrie J.H. (1980). Reproduced from principles and procedures of statistics. Printed with the permission of C. I. Bliss, 448- 449.

Ystaas J. (1990). Pear tree nutrition. 4. Effects of different nitrogen supply *via* roots or leaves on yield, fruit size and fruit quality of "Moltke" pear. Acta- Agriculture – Scandinavica, 40(4): 357-362.

Zhou X.W, Li Z.Y., Lu B., Chen X.N., X u L. J., Yi Y.W. X.W. and Yi Y. W. (2001). Study on the improvement of soil of the newly established orchard on the reclaimed purple soil. J. of Fruit Sci; 18(1):15-19 (c.f. CAB Abs. 1001-7364).

تأثر النمو الخضرى والحالة الغذائية والمحصول فى أشجار الكمثرى الليكونت ببعض معدلات الأسمدة العضوية والحيوية مقارنة بالتسميد الكيميائى

سميرة منصورمحمد , طارق عبد العليم فايد ,عبد المنعم فتحى اسماعيل* ونور عبد السلام عبده*

قسم بساتين الفاكهه – كلية الزراعة – جامعة القاهرة – الجيزة – مصر

* قسم بحوث الفاكهه المتساقطة- معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة-مصر

ملخص

أجريت هذه الدراسة خلال موسمي (٢٠٠٦-٢٠٠٧) ، (٢٠٠٧- ٢٠٠٨) بمزرعة محطة بحوث البساتين بالقصاصين ، محافظة الإسماعيلية , لدراسةإستجابة أشجار الكمثرى صنف الليكونت للتسميد العضوي وبعض الأسمدة الحيوية مقارنة بالتسميد الكيميائى. سمدت الأشجار بأحد مصادر الأسمدة العضوية (سماد المكمورة) مضاف اليه الصخور الطبيعية (صخر الفوسفات + الفلدسبار) مع أو بدون الأسمدة الحيوية (البيوجين +الفسفورين) و حمض الهيوميك و منقوع الكمبوست مقارنة بالتسميد الكيميائى. أعطي سماد المكمورة مع الأسمدة الحيوية و حمض الهيوميك و منقوع الكمبوست أحسن تاثيرعلي كل الخصائص الخضرية للأشجار (معدل النمو في سمك الجذع , سمك وطول الأفرع الخضرية , عدد الأوراق علي الأفرع ومساحة الأوراق). وكذلك محتوي الأوراق من العناصر الكبري و الصغري , الكربوهيدرات الكلية , نسبة الكربوهيدرات / النيتروجين ,البروتين و محتوي الأوراق من الصبغات والمحصول مقارنة ببافي المعاملات الأخري. كما لوحظ أن النمو الخضري والحالة الغذائية للأوراق تزداد زيادة ملحوظة من الموسم الأول حتي الموسم الثاني. مما يوضح التأثير التراكمي لمعاملات الأسمدة العضوية والحيوية. كان تأثير الأسمدة الكيميائية علي الخصائص الخضرية والكيميائية للأشجار أكبر من تأثير الأسمدة العضوية والحيوية عليها.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (٦١) العدد الأول (يناير ٢٠١٠) : ١٧-٣٢.