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PROPER NITROGEN FERTILIZATION RATE FOR GROWTH, YIELD AND FRUIT QUALITY OF "LE-CONTE" PEAR (*PYRUS COMMUNIS* L.) TREES GROWN IN SANDY CALCAREOUS SOIL UNDER SOHAG CONDITIONS

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ABSTRACT

The effect of nitrogen fertilization as a soil application, in the form of ammonium nitrate at the rates of 250, 500, 750 and 1000g actual N/tree on vegetative growth, leaf pigments and mineral content, flowering and fruit set, yield and fruit quality of "Le-Conte" pear trees grown in sandy calcareous soil was studied through three field trails conducted in 2006, 2007 and 2008 seasons. The obtained results revealed that, nitrogen fertilization, generally, tended to increase shoot length and average leaf area and rate of 1000g actual N/tree were the most effective rates in the three studied seasons. Moreover, N fertilization rate had a clear effect on leaf pigments content determined as total chlorophyll and carotene as well as rate of 1000g actual N/tree stimulated it. Results of leaf analysis indicated that rate of 1000g actual N/tree was the most effective rate concerning leaf N and P content while, rate of 500g actual N/tree was the most effective level concerning leaf K content than other tested rates in the three experimental seasons. Data also, showed that, moderate N rate of fertilization (750g actual N/tree) have been found to be effective in stimulated the growth and flowering of pear trees such as the number of spurs and the percentage of blooming spurs and increased fruit set percentage and yield/tree. Rate of fruit drop decreased with increasing N fertilization and rate of (750g) actual N/tree lesser fruit drop. Fruit weight and acidity were increased as the rate of N was increased up to 1000g actual N/tree. Otherwise, total soluble solids, firmness and TSS/acid ratio as well as, total sugars were decreased as the rate of nitrogen was increased up to 1000g actual N/tree.

From the results it could be recommended that using rate of 750g actual N/tree was the most effective rate stimulating flowering in pear trees, increasing fruit set as a percentage and yield /tree than other tested treatments.

Keyword: "Le-Conte" cv. Pear, *Pyrus communis*, Nitrogen fertilization, Flowering, Fruit set, and Yield.

INTRODUCTION

"Le-Conte" pear cultivar is one of the most important deciduous fruit that shows a great success and wide spreading in the new reclaimed soils.

Nitrogen is responsible for the biosynthesis of proteins, organic nutrients, enhancing cell division and chlorophylls, building cellulose and lignin which play an important role in forming plant structure. It is also beneficial in the synthesis of enzymes. As matter of fact, fruit trees did not produce fruits without such essential macro-element (Mengel and Kirkby, 1987 and Miller *et al.,* 1990).

Hence, nitrogen is the key fertilizer element affecting yield. It has a pronounced effect on growth and appearance of the tree and fruit quality. Moreover, optimum rates of nitrogen application have not been clearly established for different pear cultivars.

Therefore, adjusting and finding out an appropriate nitrogen management for improving the production and fruit quality of "Le-Conte" pear trees is necessary. Increasing the rate of N application increase average shoot length, leaf area (Sanchez *et al.,* 1994; Roan Sufeng, 1998 and El- Ramah, 2002), leaf pigments content (El-Ramh, 2002), leaf N content (Ystaas, 1990, Umemoto, 1991 and El-Ramh,2002) leaf P content (El-Ramh, 2002) and reduce leaf K content (El-Ramh, 2002) in pear trees.

N application increased number of spure/branch and percentage of blooming spurs (El-Ramh, 2002), fruit set (El-Ramh, 2002) and yield (Ystaas, 1990; Thomas Raese, 1977 and 1998; Roan Sufeng, 1998 and El-Ramh,2002) while, decreased fruit drop (El-Ramh,2002).

N application increased average fruit weight (Henry *et al.,* 1985; Thomas Raese, 1997 and El-Ramh, 2002); fruit firmness and acidity (El- Ramh,2002) in pear trees. On other hand, TSS and TSS/acid ratio were reduced (Raese and Staiff, 1989 and El-Ramh, 2002) in pear

trees as well as total sugars (Abo El-Maged, 1992) in persimmon trees.

Accordingly, this study was conducted to investigate the effect of nitrogen fertilization level as a soil application on vegetative growth, leaf mineral and pigments content, yield and fruit quality of "Le-Conte" pear grown in sandy calcareous soil at El-Kawther Region, Sohag Governorate, Egypt.

MATERIALS AND METHODS

This study was carried out in the Experimental Orchard of Sohag Fac. Of Agriculture situated at El-Kawther region, Sohag Governorate, on "Le-Conte" pear trees (*Pyrus communis* L. x *Pyrus pyrifolia* N.) grafted on communis pear rootstock (*Pyrus communis* L.) during three successive seasons of 2006, 2007 and 2008. Twelve healthy trees of 5 years old, spaced at 5x5 meters apart trained to open center vase form system were used. Trees were selected at random of uniform canopy and grown in sandy calcareous soil, irrigated by Nile water using surface irrigation system.

Physical and chemical properties of soil samples at 0.0 to 90 cm. depth were determined according to the standard procedures that outlined by Chapman and Parker (1961), Wilde *et al.,* (1985) and Osama (2003) and the obtained data are shown in Table (1).

Table (1) Physical and chemical properties of soil at the trail location:

Physical properties	Field capacity%	Available water%	Wilting point%	Corse sand%	Fine sand%	Silt %	Clay%	Texture class
	11	1.5	4.22	46	38	13	3	Sandy
Chemical properties	Ec(1:25extract) mmhos/1cm/25^{0}C	CEC (meq/100 g soil)	Available P olsen, ppm)	PH(1:25 extract)	Organic matter %	Ca CO_3 %	Total N%	K(mg/ 100g)
	1.91	7.40	1.00	8.02	0.90	18.8	0.05	0.21

Natural chilling requirement was calculated as accumulating constant chilling hrs ≤+ 7.2 ^{0}C from 1st Oct. to 31 Mar. for El-Kawther region (Experimental location)during the three experimental seasons (according to El-Kawther Meteorological station, Sohag Governorate) are shown in Table(2).

Table (2): Accumulation chilling hours (^{0}C) at + 7.2 ^{0}C or below in El-Kawsar region during three experimental seasons.

Month	≤+ 7.2 ^{0}C		
	2005/2006	2006/2007	2007/2008
Oct.	0.0	0.0	0.0
Nov.	0.0	0.0	0.0
Dec.	29	16	9
Jan.	142	153	191
Feb.	55	69	70
Mar.	0.0	0.0	0.0
Total	226	238	270

Average minimum and maximum temperature (^{0}c) and humidity (%) for the location during the three experimental seasons (according to El-Kawther Metrological station, Sohag Governorate) are shown in Fig. (1&2).

"Le-Conte" pear trees that selected for carrying out the experiment were almost equal in size, vigor cropping and visually diseases free. The considered trees were in good physical condition and had been subjected to the same cultural practices concerning irrigation, pruning, weeds and pests control and other normal managements used in pear orchards expect nitrogen fertilization. Ammonium nitrate (33.5%N) was used as source of nitrogen to achieve 4 treatments (250, 500, 750 and 1000g actual N/tree) of nitrogen equal (746.27, 1492.54, 2238.81 and 2985.08g /tree) of ammonium nitrate. In 4 equal doses at growth season start (at the first week of Mar.), just after fruit setting (at the third week of Apr.), two months later and just after fruit harvesting (in the mid Aug.). All the trees received P and K nutrition that including the addition of 1.0 kg calcium monosuperphosphate (15.5%P_2O_2) and 1.0kg potassium sulphate (48% K_2O). Farmyard manure (0.25%N, 1.2% K_2O and 0.8% P_2O_5) was added to all trees at 10 kg/tree. It was added once at the last week of Dec. in the three seasons in two trenches with depth of 25cm at both tree sides, phosphate fertilizer was divided into two equal batches, the first was added with farmyard manure and the second was applied just after fruit setting. Potassium fertilizer was splitted into three equal batches, the first with farmyard manure, the second before

blooming (at the first week of Mar.) and the third just after fruit setting.

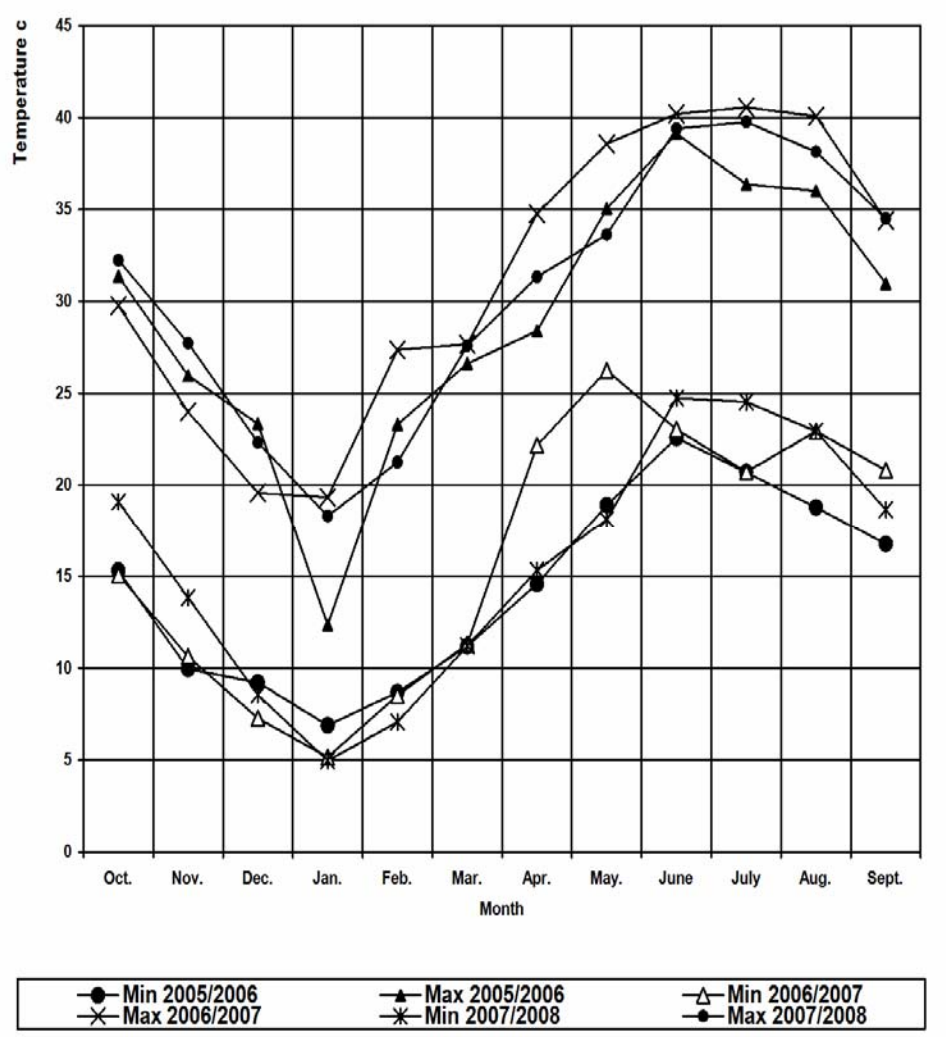

Figure (1): Average minimum and maximum temperature (0 c) for El-Kawther region during 2005/2006, 2006/2007 and 2007/2008 seasons.

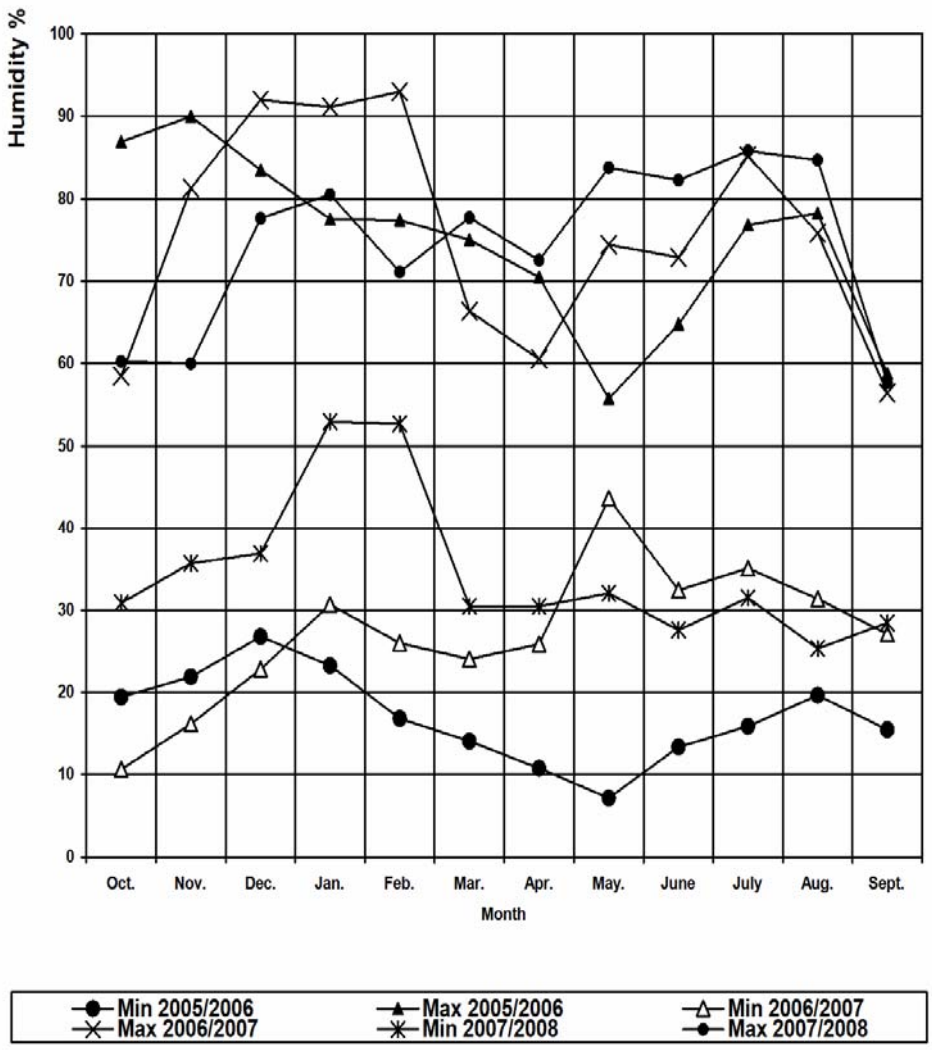

Figure (2): Average minimum and maximum humidity percentage for El-Kawther region during 2005/2006, 2006/2007 and 2007/2008 seasons.

Experimental Design: The experiment was conducted on twelve pear trees "Le-Conte" cv. in the three seasons, four treatments were carried out, each treatment replicated three times considering each one tree as replicate using complete randomized block design.

Vegetative growth: Samples necessary for vegetative measurements were obtained from a sufficient number of experimental trees from each replicate and treatment. In late Apr., four emerged branches, nearly the same in age, diameter and length were labeled at different tree directions. The mean increase in a selected shoot was calculated as shoot length (cm) = shoot length (cm) in late Aug.-shoot length (cm) in late Apr.)

Leaf area (cm^2) was determined in samples of mature leaves (5months old). In late Aug. of the three seasons, samples of twenty mature leaves as the third one from the base (3^{rd} node) of the previously tagged non-fruiting shoots were collected, leaf area was measured according to the following equation outlined by Ahmed and Morsy (1999).

$$\textbf{Leaf area } (cm^2) = 0.41 \text{ (length x width of leaf)} + 2.01$$

Flowering and fruit set : Four branches of two–years-old was selected in each tree were labeled, the number of spurs at full bloom (at the last week of Mar.) and the number of blooming spurs were counted for estimating blooming spurs percentage.

Thirty spurs distributed around each tree were selected and tagged and their flowers were counted at the last week of Mar. during the three seasons. Number of fruitlets on each spur was also counted and recorded in different treatments. Fruit set percentages and consequently percentage of retained fruits were calculated on the bases of the persistent number of emerged flowers each selected on spur as follows:

$$\textbf{Fruit set (\%)} = \frac{\textbf{Number of fruitlets}}{\textbf{Total number of flowers at full bloom}} \times 100$$

The number of fruitlets on each tagged spur was counted, every 15 days intervals starting from petal fall at the third week of April, till the usual date of harvesting at the mid August in the three seasons.

Average number of dropped fruits was counted also at 15 days intervals and total number of dropping fruit were also calculated on the bases of the initial number of fruit set as follows:

$$\textbf{Fruit drop (\%)} = \frac{\textbf{Number of dropped fruitlets}}{\textbf{Initial number of fruit set}} \textbf{ x100}$$

Yield and fruit quality: Yield as number and weight (kg) of fruits per tree were recorded at harvest time. Ten fruits were selected at random from each tree at harvest time in mid Aug. for measuring fruit weight (g) and firmness (Ib/inch^2) was measured at two opposite sides on the equator of each fruit using pressure tester at 5/1b plunger (Magness and Taylor, 1925). Total acidity using titration by NaOH at0.1 N and phenolphthalene as an indicator then expressed as malic acid according to A.O.A.C. (1975), total soluble solids (TSS percentage was estimated by using the hand refractometer, TSS/acid ratio was obtained from the values of total soluble solids divided by the values of total acids and total sugars were analyzed according to the method of Lane and Eynon outlined in A.O.A.C. (1975).

Leaf chemical composition : In order to determine percentage of nitrogen (N), phosphorus (P) and potassium (K) in the leaves, twenty mature leaves (5 month old) were taken as previously described, dried, at 70^{o}C and digested using concentrated salphoric acid and fresh hydrogen peroxide and kept for carrying out the following chemical analysis(Pregel, 1945).

1- Percentage of N by the semi–micro kjeldahl/technique (Peach and Tracey, 1968)

2- Percentages of P and K by colorimetry and flame photometry methods, respectively (Brown and Lilleland, 1945).

A representing sample of fully expanded basel leaves was taken from the flowering spur at the last week of Mar. in the three seasons. Total chlorophyll and carotene were determined according to Soric *et al.,* (1967).

Statistical analysis: Obtained data were statistically analyzed using the MSTAT-C statistical analysis package (Freed *et al.,* 1989), then

LSD test was used to recognize the significance between the treatment means according to the procedure of Snedecor and Cochran (1972).

RESULTS AND DISCUSSION

1-Effect of some fertilization treatments on vegetative growth parameters:-

a- shoot length (cm):

Data in Table (3) indicated that, significant differences concerning shoot length in response to N fertilization treatments were noticed.

For example, shoot length increased by increasing N rate in the three seasons and could be arranged as follow: 100>750>500>250g actual N/tree. Statistical analysis showed significant differences within treatments except 750 and 1000g actual N/tree in the third season.

These results could be attributed to high nitrogen level which enhanced the net photosynthesis than lowest nitrogen one due to increasing total chlorophylls (Campbell and Marini, 1990).

b- Leaf area (cm^2)

Data in Table (3) declared the effect of N rate on the leaf area. In general, average leaf area tended to increase by increasing N level in all the three seasons and could be arranged as follows: 1000>750>500>250g actual N/tree. Significant differences were found within treatments except 750 and 1000g actual N/tree in the three seasons.

The increment in leaf growth parameters by adding high rates of nitrogen fertilizer be due to its effect in increasing leaf area and total chlorophyll content which in turn improved photosynthesis and increased photosynthetic products (Campbell and Marini, 1990).

It can be concluded that, increasing nitrogen rate resulted in vigorous growth (1000 actual N/tree) while, the lowest amount of this fertilization (250g actual N/tree) associated with the weakness or inadequate foliage. The obtained results are in harmony with (Sanchez *et al*., 1994, Roan Sufeng, 1998 and El-Rmah, 2002) working on pear trees, who reported that, tree vigour increased with high rates of nitrogen application.

It is interesting to mention that growth of tree (i.e. shoot length and average leaf area) was characterized with a decrements in vigour

and development in the first and second seasons as compared with the growth vigour in the same trees of the third one, where chilling hours needed for breaking bud rest increased in the third season (Table,2), where the in adequate chilling hours in the first and second seasons lead to a reduction in growth than in the third one.

Table (3): Effect of nitrogen fertilization rate on shoot length (cm and leaf area (cm^2) of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	Shoot length (cm)			Leaf area (cm^2)		
	2006	2007	2008	2006	2007	2008
250	57.64	58.19	58.74	21.69	22.06	22.42
500	61.71	63.15	64.59	24.29	24.55	24.80
750	68.36	69.70	71.04	27.09	27.51	27.92
1000	73.48	72.81	72.14	27.71	28.49	29.26
LSD at 5% level	**1.06**	**1.17**	**1.40**	**0.78**	**0.89**	**0.99**

2-Effect of some fertilization treatments on leaf chemical composition:-

A- Leaf pigments content:

Data in Table (4) represent the effect of fertilization treatments on leaf pigments contents. As such, total chlorophyll content reached to the maximum (40.30, 40.37 and 40.46 mg/gFW) in trees fertilized with the rate of 1000g actual N/tree followed by those fertilized with a rate of 750g actual N/tree, However, the lowest values (37.53, 37.79, and 38.04 mg/g.FW) were found in leaves of trees fertilized with the rate of 250g actual N/tree. This is clear in the three seasons. Differences within treatments were statistically significant except between 250 and 500g actual N/tree in the three seasons.

As for the effect of N on leaf carotene content, it is clearly that trees fertilized with a rate of 1000g actual N/tree gave the highest values (0.727,0.750 and 0.790 mg/g FW) followed by those fertilized with the rate of 750g actual N/tree. On the contrary, the lowest values (0.590, 0.603 and 0.630 mg/g FW) were found in trees fertilized with a rate of 25g actual N/tree. . Statistical analysis showed significant differences within treatments except 750 and 1000g actual N/tree as well as 250 and 500g actual N/tree in the last two seasons , while

unsignificant differences were noticed within treatments in the first season.

It can be concluded that the rate of N fertilization had a clear effect on foliar pigments formation and development and the rate of 1000g actual N/tree stimulated it, while fertilization with a rate of 250g actual N/tree depressed formation and development of leaf pigments.

The available literature in pear trees in this concern was El-Ramh, (2002) who proved that, increasing N rates were concomitant with increasing leaf content of total chlorophyll and carotene.

Table (4): Effect of nitrogen fertilization rate on leaf total chlorophyll and carotene (mg/gm FW) contents of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	Total chlorophyll (mg/gm Fw)			Carotene (mg/gm Fw)		
	2006	2007	2008	2006	2007	2008
250	37.53	37.79	38.04	0.590	0.603	0.630
500	38.20	38.35	38.49	0.627	0.650	0.697
750	39.09	39.36	39.62	0.697	0.723	0.783
1000	40.30	40.37	40.46	0.727	0.750	0.790
LSD at 5% level	0.64	0.60	0.58	N.S.	0.089	0.090

b- Leaf NPK contents:-

Data in Table (5) showed the effect of N fertilizer rates on leaf N content. Significant variation in this concern was noticed between N rate treatment and accumulation in leaves of the experimental trees. Accordingly, leaf N content was the highest (2.217, 2.220 and 2.220%) in trees received 1000g actual N/tree followed by 750, 500 and 250g actual N/tree in a descending order, making a positive relationship in response to rate of N application and significant differences within treatment were also detected in the three seasons.

It can be concluded that, the rate of 1000g actual N/tree was the most effective rate than other tested N rates. In agreement with the obtained results, in pear trees (Ystaas, 1990, Umemoto, 1991 and El-Ramh, 2002) reported that, an increase in N leaf content as N applied was increased.

Data in Table (5) showed the effect of N fertilizer rate on leaf P content. No significant variations in this concern was detected between N rate and accumulation of P in leaves. However, leaf P content was the highest (0.185, 0.186 and 0.186%) in trees received 1000g actual N/tree followed by trees received rates of 750, 500 and 250g actual N/tree in a descending order, no significant differences within treatment were detected in the three seasons.

It can be concluded that the rate of 1000g actual N/tree was the most effective rate than other tested N rates. In agreement with the obtained results, (El-Ramh, 2002) on pear trees found that, leaf P content increased significantly with increasing N application. In addition, on pear tree, (Umemoto, 1991) proved that, total P showed no obvious changes in response of N application.

Data in Table (5) show the effect of N fertilizer levels on different levels of leaf K content. However, leaf K content was the highest (2.0777, 2.090 and 2.100%) in trees received 500g actual N/tree, followed by 750, 1000and 250g actual N/tree where high N level application (750 and 1000g actual N/tree decreased leaf K content than other treatment (500g actual N/tree). The lowest values was detected in 250g actual N/tree.

Table (5): Effect of nitrogen fertilization rate on leaf nitrogen (N), phosphorus (P) and potassium (K) contents as percentage of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	N%			P%			K%		
	2006	2007	2008	2006	2007	2008	2006	2007	2008
250	1.990	2.000	2.010	0.176	0.177	0.177	1.947	1.940	1.927
500	2.077	2.087	2.097	0.179	0.181	0.180	2.077	2.090	2.100
750	2.167	2.177	2.177	0.184	0.184	0.185	2.040	2.040	2.047
1000	2.217	2.220	2.220	0.185	0.186	0.186	1.987	2.023	2.037
LSD at 5% level	0.010	0.007	0.007	N.S.	N.S.	N.S.	0.015	0.010	0.026

It can be concluded that, the rate of actual N/tree was the most effective level concerning leaf K content than other tested N rates. The available reports in this concern was (Umemoto, 1991) who worked on pear trees and proved that total K showed no obvious change. However (El-Ramh,2002) on pear trees reported that, a rate of 600g

actual N was the most effective level concerning leaf K content than other tested N rates.

3-Effect of some fertilization treatments on flowering and fruit set percentages:-

a- Number of spurs/branch

Data in Table (6) showed the effect of N fertilizer rate on number of spurs/branch. The obtained results declared that, average number of spurs/shoot significantly increased by increasing nitrogen rate in the three seasons. The values concerning the above mentioned character were in the descending order of 1000 >750 >500 > 250g actual N/tree in the three studied seasons. Statistical analysis showed significant differences within treatments expected 750 and 1000g actual N/tree as well as 250 and 500g actual N/tree in the last two seasons, while unsignificant differences were noticed within treatments in the first season.

Table (6): Effect of nitrogen fertilization rate on number of spurs/branch and blooming spurs percentage of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	No. of spurs/branch			Blooming spurs %		
	2006	2007	2008	2006	2007	2008
250	34.33	35.00	35.67	84.00	84.67	85.33
500	34.67	35.33	36.00	85.00	85.67	86.33
750	35.33	36.33	36.67	87.33	87.67	88.00
1000	35.67	36.67	37.33	86.00	86.67	87.67
LSD at 5% level	N.S.	0.94	1.11	0.58	N.S.	0.75

b- Percentage of blooming spurs:

Data in Table (6) showed the effect of N fertilizer rate on percentage of blooming spurs. Unsignificant differences were noticed in the percentage of blooming spurs in response to the added nitrogen rate in the second season. However, it was significantly increased in the first and third seasons by increasing rate of N, with no significant differences between 750 and 1000g actual N/tree. It can be concluded that, increasing nitrogen rate resulted in an enhancing effect on the growth and flowering of pear trees (750g actual N/tree) while, lesser

amount of this fertilizer (250 actual N/tree) was associated with the weakness of growth and flowering. Available literature on pear trees concerning the effect of N rate application on flowering are vague. However, El-Ramh(2002) found that, number of spurs/branch and percentage of blooming spurs significantly increased by increasing N rate. Also, the obtained results are in line with those reported by Bertschinger *et al.,* (1997) who found that, percentage of flower bud was greatly decreased by high nitrogen level.

c-Fruit set percentage:

Percentage of fruit set as recorded in Table (7) proved that the percentage of setting fruits tended to increase with increasing rate of N application. Fruit set percentage was the highest (13.69, 14.08 and 14.46%) in trees received 750g actual N/tree followed by trees received rates of 1000, 500 and 250g actual N/tree in a descending order. Statistical analysis showed significant differences in this character within treatments. In agreement with the obtained results, on pear trees (El-Ramh, 2002) revealed that, the percentage of setting fruits showed a true differences and tended to increase with increasing rate of N application . However, (Ystaas, 1990) on pear trees, proved that, increasing N rate had no effect on fruit set. This result may be due to role of nitrogen in fruit shading which stimulated fruit abscission (Kitjima *et al.,* 1990). Moreover, the increment in vegetative growth by raising nitrogen rate may be consumed sugars and starch which lead to reduce fruit set. These results are in agreement with those reported by Aoki *et al.,* (1979) who found that, nitrogen application to persimmon trees increased fruit drop.

Table (7): Effect of nitrogen fertilization rate on fruit set percentage and yield/tree (kg) of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	Fruit set %			Yield/tree (kg)		
	2006	2007	2008	2006	2007	2008
250	10.66	10.52	10.31	23.39	25.27	27.14
500	11.55	11.85	12.14	26.65	27.29	27.96
750	13.69	14.08	14.46	28.80	30.76	32.71
1000	12.93	13.15	13.36	28.18	29.58	30.97
LSD at 5% level	0.28	0.31	0.40	0.49	0.49	0.56

d- Fruit drop percentage:

As for fruit drop percentage calculated in each interval on the basis of initial number of setting fruits after anthesis stage. Fig. (3) exhibited that fruit drop increased sharply during the early stage of fruit life i.e. immediately after fruit set (at the third week of April then fruit drop percentages were greatly reduced as the season was advanced till the termination of the season and /or at mid August. The dropping in pear fruits is seemingly due to the competition between fruits and the unfavorable climatic conditions prevailing during that critical period. (Fig. 1&2).

Data recorded in Fig. (3) showed that, percentage of fruit drop through different stages of fruit development in response to N rate application significantly differ where the dropping fruits percentage reached to the maximum in trees treated with low rate of N(250g actual N/tree). In this concern, values of dropping fruits in trees received (750g actual N/tree) reached to the minimum i.e. at the third week of April (29.07, 27.26 and 24.50%) while it was reached to the maximum (34.26, 32.09 and 30.20%) in trees received (250g actual N/tree) and the values fluctuated between those extremes. The obtained data also proved that, trees fertilized with (750g actual N/tree) showed significant differences in most cases as compared with those received (1000g actual N/tree) in the three seasons. From this view, the same trend concerning fruit drop throughout the season was noticed in different tested stages of fruit development from starting of fruit set up to mid of August (fruit maturity).

The obtained data declared that, dropping fruits increased by decreasing the rate of applied nitrogen. In other words, N application clearly affected fruit dropping and 750g actual N application showed lesser fruit drop and vise versa. This is true in the three seasons of investigation. In line with the obtained results (El-Ramh, 2002) on pear trees reported that, the rate of fruit drop decreased with increasing (N) fertilization rate.

As noticed above, flowering attributes of "Le-Conte" cv pear trees (i.e. number of spurs/branch, blooming spurs percentage, fruit setting percentage and total percentage of fruit drop of fruitlets throughout the grown season) were characterized in general, with decrements in flowering behavior and fruits development, in the first and second seasons as compared with the third one. Yet, accumulated

chilling hours needed for breaking bud rest increased in the third season (Table, 2) than in the first and second one correlated with breaking rest of dormant buds and concomitant with setting fruit affected directly by effective pollination period, fertilization stage and /or production of parthenocarpic fruits.

As for the role of fertilization in this concern, 750g actual N rate of fertilization stimulated the flowering and increased fruit set percentage.

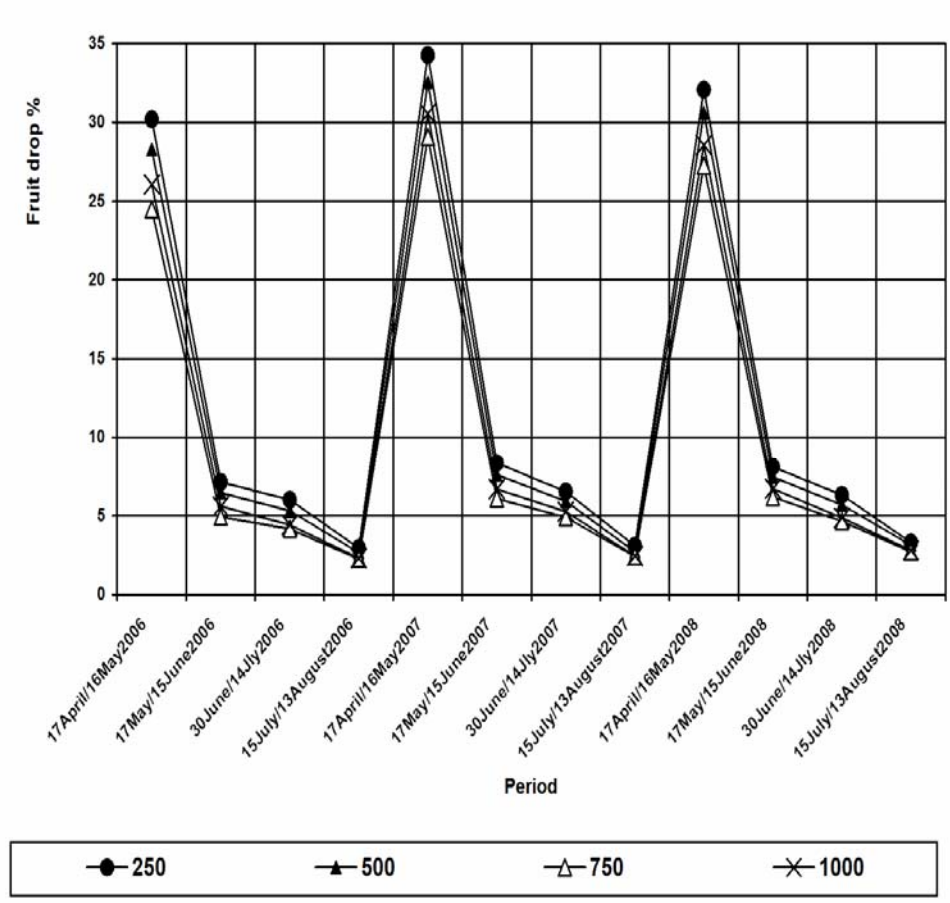

Figure (3): Effect of nitrogen fertilization rate on fruit drop percentage of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

c- Yield:

Table (7) shows the effect of N fertilization on the average yield (kg)/tree. In general, yield/tree (kg) tended to increase as experimental trees received moderate rate of N, this is clear in the three seasons. As such, high N fertilization increased yield of trees than trees received low level of N.

As for the effect of N rate on yield of pear trees, the obtained data proved that, yield/tree was the highest (28.80, 30.76 and 32.71 kg) in trees received 750g actual N/tree followed by trees received rates of 1000, 500 and 250g actual N/tree in a descending order. Statistical analysis showed significant differences in this character within treatments. Results of many investigators (Ystaas, 1990; Thomas Raese, 1977 and 1998; Roan Sufeng, 1998 and El-Ramh, 2002) working on pear trees proved that, applying N fertilizer increased the yield and had a significant effect in this concern. Also, these results are in harmony with those obtained by Gasanova (1985) who found that, N application at 60, 90 or 120 kg/ha markedly improved yield of persimmon tree and the moderate N rate gave the best results.

The data also clarified that, yield was decreased with high rate of N fertilization. In this concern Hipps and Ridout (1990) found that high rate of nitrogen application significantly decreased the yield.

The obtained data show that, yield /tree tended to increase in the third season than in the first and second ones which might be correlated with accumulated chilling hours needed for breaking bud rest of trees which were increased in the third season than in the first and second one (Table,2).

5- Fruit quality:

a- Physical properties:

Fruit weight:

As shown in Table (8) Fruit weight as affected with nitrogen rate in the experimental trees show true variation in the three tested seasons. As such, fruit weight ranged between 143.79, 148.78, 156.17, 157.35; 144.35, 150.24, 155.58, 158.16; 144.07, 149.51, 155.88, 157.76g, when the trees fertilized with nitrogen at rate of 250, 500, 750 and 1000g actual N/tree, in the three seasons respectively. In other words, the largest fruits as weight were produced from trees

received the high rate of nitrogen (750 and 1000g actual N/tree), accordingly a positive correlation can be detected in this concern in the study treatments in the three seasons. In agreement with the obtained results (Henry, *et al.,* 1985; Thomas Raese, 1997 and El-Ramh, 2002) on pear trees, who found that, the increase in fruit weight was associated with higher rates of nitrogen application. This increment may be due to the effect of nitrogen treatments on reducing the number of fruits and increasing carbohydrate synthesis.

Table (8): Effect of nitrogen fertilization rate on fruit weight (g) and fruit firmness (Ib/inch 2) of "Le-Conte" pear trees during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	Fruit weight (g)			Fruit Firmness (Ib/inch^2)		
	2006	2007	2008	2006	2007	2008
250	143.79	144.35	144.07	12.47	12.24	12.36
500	148.78	150.24	149.51	12.62	12.60	12.61
750	156.17	155.58	155.88	12.87	12.95	12.91
1000	157.35	158.16	157.76	12.94	13.02	12.98
LSD at 5% level	1.79	1.74	1.07	0.06	0.04	0.05

Fruit firmness (Ib/inch^2)

The obtained results in this concern (Table 8) showed that fruit firmness gradually increased by increasing nitrogen rate in the three seasons. As such, fruit firmness ranged between12.42, 12.62, 12.87, 12.94; 12.24, 12.60, 12.95, 13.02 and 12.36, 12.61, 12.91, 12.98 Ib/inch^2, when the trees fertilized with nitrogen at rate of 250, 500, 750 and 1000g actual N/tree in the three seasons, respectively. In other words, the highest values concerning firmness of fruits were produced from trees received the high rate of nitrogen (750 and 1000g actual N/tree) the vise versa was noticed. On pear trees (Raese and Staiff 1989) proved that, fruit firmness was inconsistent with treatments while soluble solids and titratable acids were slightly higher in fruits from trees treated with the lower rather than the higher rates of N fertilizer. And also, (Raese, 1997) on pear trees, reported that, fruit firmness were highest for trees treated in the late winter, low rate of N. In addition, (El-Ramh, 2002) on pear trees, found that firmness values gradually increased by increasing nitrogen rate. This

reduction in fruit firmness may be due to the increase in fruit size and reduction of Ca-concentration as affected by nitrogen application.

b- Fruit chemical properties:

Total soluble solids (TSS %)

Table (9) indicated that, total soluble solids (TSS %) values decreased as nitrogen rate was increased. Where, TSS values were: 14.08, 13.99, 13.71 and 13.50% in the fist season; 14.19, 14.11, 13.77 and 13.36% in the second season and 14.13, 14.05, 13.74 and 13.43% in the third one as the rates of nitrogen were : 250, 500, 750 and 1000g actual N/tree respectively. As such, the lowest values (13.50, 13.36 and 13.48%) were detected in fruits of trees received N at the rate of 1000g actual N/tree in the three seasons, respectively , However, the highest values (14.08, 14.19, and 14.13%) were noticed in fruits of trees received 250g actual N/tree in the three seasons, respectively, inagreement with the obtained results (Raese and Staiff, 1989 and El-Ramh, 2002) on pear trees, proved that, soluble solids was slightly higher in fruits from trees treated with lower rather than higher rates of N fertilizer. On the contrary, (Lazorov, 1985) on pear trees proved that, the treatments had no significant effect on TSS%.

Total acidity:

Data concerning the effect of nitrogen application rates (Table 9) showed that acidity increased as the rate of N was increased. According , total acidity values in the first season increased from 0.190, 0.210, 0.230 and 0.247 as the rate of nitrogen increased from 250, 500, 750, 1000g actual N/tree, respectively. The same trend was noticed in the second and third seasons. Differences between treatments were statistically significant in the three seasons. In this concern, resulted obtained with (Lazarov, 1985) on pear trees, proved that the treatment of N, NP and NPK at different rates had no significant effect on acid content of the fruit. And also (Raese and Staiff, 1989) on pear trees reported that titratable acids were slightly higher in fruits from trees treated with the lower rather than the higher rates of N fertilizer. On the contrary, (El-Ramh, 2002) proved that, total acidity in pear fruit juice was increased as the rates of N was increased.

Table (9): Effect of nitrogen fertilization rate on total soluble solids (TSS%) and acidity percentage of "Le-Conte" pear fruits during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	TSS %			Acidity %		
	2006	2007	2008	2006	2007	2008
250	14.08	14.19	14.13	0.190	0.210	0.200
500	13.99	14.11	14.05	0.210	0.230	0.220
750	13.71	13.77	13.74	0.230	0.250	0.240
1000	13.50	13.36	13.43	0.247	0.260	0.257
LSD at 5% level	0.13	0.07	0.10	0.005	0.001	0.004

TSS/acid ratio:

As noticed in Table (10) TSS/acid ratio values were decreased as the rate of nitrogen was increased in the three seasons. As such, the obtained values were, 74.14, 66.65, 59.63 and 54.71 in the first season; 67.60, 61.38, 55.08 and 51.40 in the second season and 70.71, 63.90, 57.27 and 52.32 in the third season when trees were fertilized with 250, 500, 750 and 1000g actual N/tree, respectively. Differences between treatments were statistically significant. The available literature in this concern (Raese and Staiff, 1989 and El-Ramh, 2002) on pear trees proved that TSS/acid ratio values were decreased as the rate of nitrogen was increased.

Total sugar percentage:

Data recorded in Table (10) showed that. Total sugar percentage in fruits decreased as the rate of nitrogen was increased in the three seasons. As such, the obtained values were, 10.94, 10.74, 10.36 and 10.05 in the first season; and 10.94, 10.75, 10.34 and 9.93 in the third season when trees were fertilized with 250, 500, 750, 1000g actual N/tree respectively. Differences between treatments were statistically significant. The available literature on pear trees concerning the effect of N rate fertilization on fruit total sugars percentage are not available. However, in persimmon trees (AboEl-Maged, 1992 proved that, total sugars were reduced while, total sugars gave inconsistent results of apple (Abd El-Megeed, Nagwa A., 2007).

Table (10): Effect of nitrogen fertilization rate on TSS/acidity ratio and total sugars percentage of "Le-Conte" pear fruits during 2006, 2007 and 2008 seasons.

Actual N rate (g)/tree	TSS/acidity ratio			Total sugars %		
	2006	2007	2008	2006	2007	2008
250	74.14	67.60	70.71	10.94	10.94	10.94
500	66.65	61.38	63.90	10.74	10.76	10.75
750	59.63	55.08	57.27	10.36	10.32	10.34
1000	54.71	51.40	52.32	10.05	9.81	9.93
LSD at 5% level	1.89	0.78	1.66	0.13	0.07	0.10

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أنسب معدل تسميد نتروجينى للنمو والمحصول وجودة الثمار فى اشجار الكمثرى الليكونت الناميه فى ارض رمليه جيريه تحت ظروف سوهاج

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تم دراسة تاثير التسميد النتروجينى كاضافه ارضي فى صورة نترات الامونيوم بمعدلات 250و 750و 1000جم نتروجين/شجره على كل من النمو الخضرى ومحتوى الاوراق من الصبغات والعناصر المعدنيه والتزهير وعقد وتساقط الثمار والمحصول وجودة الثمار فى اشجار الكمثرى الليكونت الناميه فى ارض رمليه جيريه خلال ثلاث مواسم متتاليه 2006،2007،2008 وقد اشارت النتائج المتحصل عليها ان التسميد النتروجينى ادي الى زيادة طول النموات الخضريه ومساحة الاوراق والمعدل 1000جم نتروجين/شجره كان الاكثر تاثيرا فى مواسم الدراسه الثلاثه. وكان لمعدل التسميد النتروجينى تاثير واضحا على محتوى الاوراق من الصبغات (الكلوروفيل الكلى و الكاروتين) والمعدل 1000جم نتروجين /شجره كان الاكثر تاثير. نتائج تحليل الاوراق اشارة الى ان المعدل 1000جم نتروجين/شجره كان الاكثر تاثير فيما يتعلق بمحتوى الاوراق من النتروجين والفوسفور فى حين المعدل 500جم نتروجين /شجره كان المستوى الاكثر تاثير فيما يتعلق بمحتوى الاوراق من البوتاسيوم عن المعدلات الاخرى المختبره فى مواسم التجربه الثلاثة. كما اظهرت نتائج الدراسه ان المعدل 750جم نتروجين/شجره نشط النمو والتزهير فى اشجار الكمثرى مثل عدد الدوابر/فرع والنسبه المئويه للدوابر المزهره وادى ال زيادة النسبه المئويه لعقد الثمار والمحصول الكلى. معدل تساقط الثمار قل مع زيادة معدل التسميد النتروجينى والاشجار التى تسمد بالمعدل 750 جم نترجين/شجره الاقل فى معدل تساقط الثمار. وزن الثمار والحموضه زادت بزيادة معدل التسميد النتروجينى (1000جم نتروجين/شجره) ومع ذلك المواد الصلبه الذائبه الكليه ودرجة صلابة الثمار ونسبة المواد الصلبه الذائبه الكليه/الحموضه كذلك السكريات الكليه قلت كلما زاد معدل التسميد النتوجينى (1000جم نتروجين /شجره).

من النتائج يمكن التوصيه ان استخدام معدل التسميد النتروجينى 750جم نتروجين /شجره كان المعدل الاكثر تاثير فى تنشيط التزهير وزيادة عقد الثمار والمحصول الكلى للاشجار عن المعاملات الاخرى المختبره.