Zagazig J. Agric. Res., Vol. 35 No. (6) 2008 1315-1346

EFFECT OF CULTIVATION AND NITROGEN FERTILIZATION TIMES PER YEAR ON GROWTH AND PRODUCTIVITY OF PEAR (LE CONTE VAR.) TREES

Gawish, A.W.M. and A.M. Mohsen
Hort. Dept., Fac. Agric., Zagazig Univ., Zagazig

Accepted 15 / 12 /2008

ABSTRACT: Grafted pear trees (Le Conte var.) located at El-Koraien district, Sharkia Governorate, Egypt, cultivated in early Feb., 1991 in sandy soil at 4 X 4 m. apart and trained in cup shape, were subjected (2003 & 2004, seasons) to some horticultural management operations; i.e., cultivation (tillage) and nitrogen fertilization treatments.

The obtained results declared that number of cultivations (1 to 5 / year) and number of N (3 to 12 / year) fertilizer applications (900 gm actual N / tree/ year) showed clear variations which significantly increased all the values of studied vegetative (Av. No. of leaves / shoot, leaf area, shoot length and shoot diameter) and flowering (fruit set% , seasonal of fruit dropping (%) and fruit retention / tree) characters as the number of cultivations (negative relationship) were decreased and number of N applications (positive relationship) were increased per year with significant differences between the studied factors (cultivation X N application / year) and act dependently (interacted) in this concern.

Cultivated soil orchard (1 to 3 times/ year) and applied N in split doses (6–12 times/ year) increased fruit yield / tree and gave the best significant mean values of physical fruit properties (fruit weight, fruit size and oval shaped fruits) and chemical ones (TSS, acidity, TSS / acid ratio and total sugars) as compared with control trees (cultivated once / year and received N in three doses/ year) and the two studied factors were interacted (dependently) in this concern.

Leaf N content (%) was significantly affected by number of cultivations / year (negative relationship) and /or number of N doses/ year and the studied factors were interacted concerning leaf N content.

The least No. of cultivation (once/ year) and application N fertilizer in multy (split) doses (12/ year) were found to have the most proper treatment for growth, yield and high fruit quality of pear trees (Le conte var.) cultivated in newly reclaimed sandy soil.

Key words: Cultivation (tillage), Nitrogen (N), split (multy) doses - pear (Le conte var.)- orchard.

INTRODUCTION

Pear is one of the important deciduous fruits in Egypt and among the other deciduous fruits in the world.

Le conte (Pear var.) a hybrid between *P. communis* and *P. serotina* is considered the main pear variety grown in Egypt. It covers an area of more than 7557 feddans in 2003* with total fruit production of about 35,442 metric ton. Most of the pear area in the past was concentrated in lower Egypt specially in Behaira, Alexandria, Menoufia, Qalyubia and Cairo Governorates. Now, most of the new pear orchards were concentrated in newly reclaimed sandy soils (1865 fed. produced 11,492 metric ton with Av. 6.162 m.t* / fed.) in Egypt. However, the area cultivated with pear in clay or silt soils (El-Wady regions) was deteriorated due to the infestation with nemours of diseases specially fire blight disease (*Erwina sp.*) and some economic insects.

Under conditions of the experimental orchard (located at El-.Koraien region, El-Sharkia Governorate, Egypt), shedding of most leaves of pear trees (late) was noticed after mid December throughout period of investigation which correlated with warm winter and / or the decrements in natural chilling requirements. In addition, horticultural managements under sandy soil such as cultivation (tillage) or weed control methods, irrigation, nitrogen fertilization, pruning and other operations carried out in pear orchard vary in beneficial either concerning their effect on trees behaviour and productivity or the costs and finally net return.

Cultivation, however, was less beneficial, due probably to damage infected, to the tree roots. Mulching resulted in higher soil humidity than cultivation or herbicides, while soil nutrition status was not affected by the various cultural and chemical treatments. The covering materials proved to be favourable in terms of shoot growth of newly planted trees, increasing total shoot growth compared with clean cultivation. All systems were better than cultivation and the best results were obtained with mulches and green manures specially growth and yield of trees or fruit quality of different fruit species (Engle, 1992 ; Buban *et al.*, 1995; Zha and Zhao, 1995). The water content of the soil was decreased quickly under clean cultivation. Covering the soil surface also affected the uniformity of water distribution in the soil, it proved to be both ertically and horigonitally more uniform under effective covering materials compared to the clean

* Ministry of Agric. Statistics , 2003 , Egypt

cultivation system (Garg and Gupta, 1995; Lakatos *et al.*, 2002).

None of the treatments in peach tree affected leaf composition or fruit quality as N fertilizer applied in few or in split doses (Castellanos *et al.*, 1982). Increasing application frequency of N fertilizer reduced storability, but single split applications gave similar yields, varying between 35 and 40 kg in satsuma trees (Tsanava *et al.*, 1984).

Fruit yield tended to increase with increasing number of N application and least at the lowest rate and smallest number of application. Total yield varied from twice and six applications. Nitrogen (N) concentration in leaves increased with increasing N rate and increasing frequency of application in Eureka lemon trees (Aso *et al.*, 1987).

Accordingly, this research aimed to give information on the effect of number of cultivations per year (1,3, 4 and 5 cultivations/ year) and N fertilizer application times (3,6,9 and 12 doses /year) and their interactions on behaviour of such tested pear trees (Le Conte Var.); i.e., growth, flowering, yield and fruit quality, beside some physiological processes of such experimental trees.

MATERIALS AND METHODS

This investigation was carried out in private farm located at El-Koraien district, Sharkia Governorate, Egypt , on pear trees (Le conte var.) grafted on common (European) or communis pear rootstock *(Pyrus communis)* during two successive seasons (2003 and 2004). The trees were cultivated in early Feb., 1991 at 4 X 4 m apart. The selected trees were similar in vigour, size, healthy and appearance free from insects and diseases and trained according the cup shape under drip irrigation system (microget) system from canal of Ismailia (branch of River Niles). The trees also received the normal cultural practices, usually used in pear orchards except the experimental treatments as follows:

Cultivation (Tillage) Treatments

In split plot design , the selected trees for this part of study (48 trees) were subjected to traditional tillage treatments (early Jan.) during organic and super phosphate fertilizers application as a general treatment (main factor) used in pear orchard. Yet, the above mentioned treatment was considered as control or non tillage (non – cultivation trees) and 9 trees were lefted for this purpose; while, the other trees (39 trees were used for other cultivations treatments (3, 4 and 5 cultivations/year). In early

Jan. of each season during organic and super phosphate fertilization by using rotavator tool and the trees under this condition were considered as a check treatment (control) which received one cultivation per year (3 trees per one replicate) were used as a control (3 replicates) for the other tested cultivation treatments. The second cultivation, third, fourth and fifth were carried out by using hand hoe under the trees in early April (at 75% of total setting flowers) early May during stage of fruit development and in early June (before fruit maturing), respectively in both seasons. The cultivation depth by using hand hoe tool reached about 7-10cm. and carried out merely before irrigation.

Nitrogen Fertilization Treatments

This part of study aimed to clear the effect of number of N fertilization (number of applied or doses per year) a year round (sub-main factor) during active growing season. For this purpose, 48 trees were selected according to the same design mentioned in cultivation treatments in both seasons of study. Ammonium nitrate fertilizer (actual N: 33.5%) was used at rate of 2.700 kg as a raw fertilizer per tree per year (900 gms actual N/tree/ year) which was considered the ordinary program used in fertilization in sandy soil. Yet the fertilizer was distributed in three equal doses (300 gms actual N in each dose / tree) by broadcasting the fertilizer around the wet area of microget emmiter and this treatment was considered the control treatment for the other tested treatments (6,9 and 12 doses/ year) as follows:

a. Check (control) the fertilizer (900 gms actual N / tree /year) was added in three equal doses (each dose equal 300gms).
b. The fertilizer (900 gms actual N/ tree/ year) was added in six equal doses (each dose equal 150 gms. actual N).
c. The fertilizer (900 gms actual N/ tree/ year) was added in nine equal doses (each dose equal 100 gms actual N).
d. The fertilizer (900 gms actual N/ tree / year) was added in 12 equal doses (each dose equal 75 gms actual N).

For instance, the fertilizer in different treatments were distributed as: three trees were grown in cultivated soil once / year and received the fertilizer in three doses (control), three trees were grown in cultivated soil once/ year and received the fertilizer in six equal doses; three trees were grown in cultivated soil once/ year and received the fertilizer in nine equal doses and the last treatment for the e trees (three trees) were grown in cultivated soil (once / year) and received the fertilizer in 12 equal doses. The second group

of trees (12 trees) were distributed in soil cultivated (1, 3, 4 and 5 cultivations per year) and received the fertilizer in six doses per year. The third 12 trees were distributed in soil treated with nine doses of fertilizer and the last 12 trees were distributed in soil received 1, 3, 4 and 5 cultivations / year and received the fertilizer in 12 doses/ year (seasons, 2003 and 2004).

Methodology and measurements followed in this research were as follows:

1.Vegetative Growth

Samples necessary for vegetative growth measurements were obtained in a sufficient number of each replicate and treatment. On April 10th, four emerged shoots, nearly uniform in age, diameter and length were labeled in different tree directions, leaves of target shoots were counted and the average number of leaves per shoot was calculated as follows:

1.1 Main shoot length (cm) were determined in August.

1.2 Average leaf area was determined in samples of mature leaves (nearly about six months–old). In mid August of both seasons, samples consist of twenty mature leaves as the third one from the base (3rd node) of the previously tagged and non fruiting shoots were collected and the area was measured by using the apparatus of leaf area meter (model 203, USA). The apparatus previously used by (Hussein, 1998).

1.3 Average number of leaves/ shoot

1.4 Main shoot diameter (cm).

2. Flowering Measurements

The experimental trees of different treatments were chosen by using three trees (one tree /each replicate) per each treatment, and four branches (more than two years-old) with the same age were selected in each tree, the following parameters were used for the following measurements:

2.1 Percentage of fruit set was calculated according the following equation:

$$\text{Fruit set (\%)} = \frac{\text{No. of developing fruit- lets}}{\text{Total No. of flowers at full bloom}} \times 100$$

2.2 Average percentage of dropped fruits during May, June, July and August in each season.

2.3 Average fruit drop percentage was calculated according the following equation

$$\text{Fruit drop (\%)} = \frac{\text{No. of dropped fruit -lets}}{\text{Initial No. of fruit set}} \times 100$$

3. Yield Per Tree

At fruit maturity stage (August 25th) in both seasons, the number and weight of picked fruits (kg/ tree) were determined in both considered seasons (2003 and 2004).

4. Fruit Properties

Fruit samples were taken from tested trees of different treatments and operations at rate of 10 fruits per tree (10 fruits/ one replicate) for the following determinations:

4.1 Physical properties:

a. Average fruit weight (gm).

b. Average fruit size (cm^3).

c.Average fruit length (L) and diameter (D).

d. Fruit shape (L/D).

e.Fruit firmness (Lb) was determined by using penetrometer (Pressure tester FD 101).

4.2 Chemical properties:

4.2.1.TSS (%) by using a carl zeiss hand refractometer (Brix).

4.2.2 The percentage of total acidity.

4.2.3 TSS / acid ratio.

4.2.4 Total sugars (%).

All the chemical parameters were determined according to the method of A.O.A.C. (1970).

5. Leaf Nitrogen Content (%)

Nitrogen was determined in mature leaves (six months–old), using twenty leaves of each replicate were taken and dried at 70°C until constant dry weight. Samples of each replicate were finely grined and nitrogen (N) was determined according to Nagiub (1969) .

Statistical analysis

The obtained data were subjected to analysis according to Snedecor and Cochran (1972). The individual comparisons of averages were carried out by using least significant differences test (L.S.D.) according to Waller and Duncan (1969). Interaction studies between studied factors (2 factors) were calculated as refered by Snedecor (1966).

RESULTS AND DISCUSSION

Effect of Cultivation and Nitrogen Fertilizer Application Treatments

Foliar Characters

Average number of leaves/ shoot

As shown in Table 1 a , average number of leaves tended to increase with decreasing cultivation number and with increasing number of nitrogen application per year in both seasons of study. Yet, the highest values were obtained from trees cultivated once per year and received N in 12 equal doses through each season. However, the lowest values of number of leaves per shoot were obtained from trees received five cultivations per year and three to six doses of N per year.

Table 1-a. Effect of cultivation and N fertilization (combined effect) on some foliar characters of Le Conte pear trees (2003 and 2004 seasons)

Treatments			Av. No. of leaves / shoot		Av. area / leaf blade $(cm)^2$		Av. Shoot length (cm)		Av. shoot diameter (cm)	
No. of cultivation/ year	No. of N application / year		2003	2004	2003	2004	2003	2004	2003	2004
Control*	3	Control **	30.68	30.81	30.32	30.37	72.21	71.73	1.20	1.20
1	6	Application	32.31	30.69	30.45	31.15	74.16	73.30	1.31	1.23
	9	Application	34.60	35.93	32.86	33.57	75.68	77.68	1.31	1.33
	12	Application	36.44	35.15	35.53	33.90	77.13	78.14	1.33	1.36
3	3	Application	28.55	28.65	27.13	25.75	70.37	70.08	1.21	1.24
	6	Application	30.34	29.65	28.73	30.17	72.37	76.57	1.28	1.26
	9	Application	31.37	32.68	31.08	31.63	75.11	74.60	1.31	1.32
	12	Application	34.37	34.02	31.83	32.39	75.06	73.70	1.34	1.36
4	3	Application	26.55	26.91	25.28	25.37	67.61	69.03	1.25	1.27
	6	Application	28.51	27.13	26.22	25.98	70.34	69.69	1.28	1.26
	9	Application	30.42	30.14	28.54	27.82	70.30	71.20	1.33	1.34
	12	Application	33.53	32.59	31.28	31.08	73.09	73.68	1.36	1.39
5	3	Application	24.67	28.80	22.15	23.73	66.44	66.91	1.26	1.27
	6	Application	26.62	26.09	25.07	24.60	69.19	67.52	1.29	1.29
	9	Application	28.74	28.41	27.18	26.04	68.88	67.68	1.34	1.34
	12	Application	30.80	31.12	28.25	29.37	71.03	71.69	1.37	1.42
L.S.D. 0.05%										
Factor (A) Cultivation			0.8242	1.521	1.301	1.379	0.788	0.823	0.0147	0.0199
Factor (B) N fertilization			0.8242	1.522	1.301	1.379	0.789	0.823	0.0147	0.0199
Factor (AB) Interaction			N.S	N.S	N.S	N.S	N.S	1.645	0.0293	0.4000

* (Control) first cultivation during organic and P_2O_5 fertilizer application (once/ year)

** Total actual N (900 gm / tree/ year)

The interaction between the two studied factors showed insignificant differences and the two factors acted independently in this concern (Table 1a).

Number of leaves per shoot (Table 1b) was significantly decreased from 33.51 to 27.73 leaf/shoot in the first season and from 32.96 to 28.61 leaf per shoot in the second one as the number of cultivation was increased from three to five cultivations per year.

Average number of leaves per shoot (Table 1c), generally, increased as the number of N application were increased and made a positive relationship.

Average area per leaf blade

Table 1a shows that the largest area per leaf blade was obtained from trees cultivated once per year and received nitrogen in 12 subsequent equal doses whereas, the smallest area was obtained from trees cultivated five times per year and fertilized with N three times per year.

Studied interaction treatment between (No. of cultivations X No. of N fertilizer applications) acted independently in this concern (Table 1 a).

The obtained data, also, show that average leaf area was significantly decreased as the number of cultivations were increased per year in both seasons of study (Table 1b).

In addition, Table 1c shows that the highest values of leaf area were found in trees received 12 times (doses) of N fertilizer per year and the lowest ones were found in trees fertilized with N, three times per year (control) with significant differences among treatments.

Average shoot length

Recorded data in Table 1a proved that the highest values (77.13 and 78.14cm.) were found in trees received one cultivation per year and with applied N in split doses and the lowest values (66.44 and 66.91cm.) were obtained from trees received five cultivations per year and received N fertilizer in three times per year with significant differences among treatments. The studied factors were interacted and acted dependently in the second season only.

Also, Table 1b show the same direction noticed in the last two foliar characters which the short shoot was found in trees cultivated five times per year and the longest shoots were emerged on trees cultivated once per year with significant differences among treatments in most cases.

In this concern, the obtained data (Table 1c) show that shoot length was significantly increased

Table 1-b. Average representing the effect of cultivation times

No.of cultivations per year	Av. No. of leaves / shoot		Av. area / leaf blade (cm)		Av. shoot length (cm)		Av. shoot diameter (cm)	
	2003	2004	2003	2004	2003	2004	2003	2004
1 (control)	33.51	32.96	32.29	32.25	74.80	75.21	1.29	1.28
3	31.25	31.27	29.69	30.99	73.28	73.74	1.29	1.30
4	29.75	29.19	27.83	27.54	70.33	70.90	1.30	1.32
5	27.73	28.61	25.67	25.93	68.88	68.37	1.32	1.33
L.S.D. 0.05%	0.824	1.521	1.301	1.379	0.788	0.823	0.0147	0.0199

Table 1-c. Average representing the effect of No. of N application

No.of N applications per year	Av. No. of leaves / shoot		Av. area / leaf blade (cm)		Av. shoot length (cm)		Av. shoot diameter (cm)	
	2003	2004	2003	2004	2003	2004	2003	2004
3 (Control)	33.64	28.79	26.22	27.31	69.16	69.44	1.23	1.26
6 Applications	29.44	28.39	27.62	27.98	71.56	71.77	1.29	1.26
9 Applications	31.25	31.63	29.92	29.76	72.49	72.71	1.32	1.34
12 Applications	33.88	33.22	31.72	31.67	74.08	74.30	1.35	1.28
L.S.D. 0.05%	0.824	1.522	1.301	1.379	0.789	0.823	0.0147	0.0199

as number of N application increased and in trees received N in 12 equal doses.

Average shoot diameter

Shoot diameter Table 1a was significantly affected by the two studied factors; i.e., number of cultivation per year and/or number of N applications per year in both seasons of study. As such, the least diameter (1.20 and 1.20 cm.) were obtained from trees cultivated once per year (control) while, the biggest diameter (1.37 and 1.42cm.) were obtained from trees received 12 applications of N per year and cultivated five times per year with significant differences between factors. The two factors also acted dependently (correlated) in this concern (Table 1a).

The diameter of shoot (Table 1b) significantly decreased as the number of cultivations were increased with significant differences among cultivation treatments.

In addition, increasing number of N applications, generally, caused a significant increase in shoot diameter and the highest values were obtained from trees fertilized 12 times per year and vise-versa was noticed in trees received N in three doses per year (control).

The available literature in this concern is very rare, either with the effect of cultivation or the effect of number of N application. Anyhow, many investigators found that the covering materials proved to be favourable in terms of shoot growth of newly planted trees of apple Idared cv. on M. 26 rootstock increasing total shoot growth (cm/tree) by 6.22% compared with clean cultivation. There was a similar, but more uniform increase in average shoot length (12.22%). The stronger shoot growth was also reflected by increasing trunk circumiere in soil. Covering treatments increased the soil water content in tree rows (the highest under liver stock manure) the lowest values was recorded in plots of herbicide (Buban *et al.*, 1995; Zha and Zhao 1995; Jayant Kumar *et al.*, 1999) came to the same results concerning the effect of N application on growth of trees, also many investigators Doiccher and Vasilera (1988) working on apple trees on M.M.106 rootstocks, found that N application rates in different split doses had no marked effect on tree growth or fruit yield and composition. While, Sadowski *et al.* (1989) working on apple trees, found that application of N fertilizer in different uniform doses had no clear effect on vegetative growth of study trees, while it was correlated positively with doses (quantity) applied. However, Dencker (1992) on apple trees

found that split fertilization with NPK via a drip irrigation system made significantly more shoot growth, flowered more profusely in the flowering year and bare more flowers/m^2 of shoot growth than trees fertilized with few doses. Also Parachomchuk *et al.* (1994) working on apple, found in untreated soil that multiple applications resulted in better growth than with a single dose, but this effect was not evident in pasteurized soil. In addition, Smith (1993) reported, in apple trees, that tissue N concentration was not significantly affected either by the timing, number of application or the amount of N applied. Shoot growth, leaf size and colour, fruit set and fruit size of all trees were normal.

Flowering Characters

Percentage of fruit set

Data of Table 2a indicate the combined effect of both cultivation with N fertilization as carried out during growing season. Accordingly, and in this concern, experimental trees were significantly affected with number of cultivations and / or number of N applications per year in both seasons of study. Anyhow, percentage of fruit set tended to increase as the number of cultivations per year were decreased, at the same time, when number of N applications per year were increased with significant differences among treatments in most cases and the interaction between studied factors was significant and acted dependently in this concern.

Data recorded in Table 2b indicate that the number of cultivations / year made a negative correlation with fruit set (%).

Percentage of setting fruits as noticed in Table 2c showed a positive correlation with number of N applications per year with significant differences among treatments.

Seasonal dropping of pear fruit-lets (%)

The first period of fruit drop during April and May and the second period of fruit dropping during summer season (June and July) were recorded in Table 2a which shows the interaction between number of both cultivation and N application per year concerning dropping fruits in both tested seasons. Dropping fruits reached the maximum during April then gradually decreased after that and reached to the minimum in July, this was true in different treatments in both tested seasons.

As for the effect of both studied factors, it is clear that the lowest of dropping fruits (%) either in the period of spring dropping or in summer period were detected in trees received one cultivation per

Table 2-a. Effect of cultivation and N fertilization times (combined effect) on flowering and productivity of Le Conte pear trees (2003 & 2004, seasons)

Treatments			Fruit set (%)		Seasonal of fruit-lets dropping (%)								Av. Fruit retention per tree		Av. Fruit yield per tree (kgs)	
No. of cultivations/ year	No. of N applications / year				April		May		June		July					
			2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control	3	Application (control)	13.73	14.27	36.13	35.93	7.27	7.36	6.13	6.80	3.57	3.30	182.47	177.87	30.89	30.25
1	6	Application	14.40	14.73	34.80	34.17	6.43	6.50	5.97	5.53	2.70	2.67	140.90	190.90	33.67	33.28
	9	Application	14.53	15.47	34.96	33.93	6.47	5.80	5.70	5.36	2.50	2.67	204.70	193.20	36.55	34.75
	12	Application	15.50	16.07	33.47	32.53	5.83	6.17	5.30	5.33	2.43	2.50	208.53	206.23	38.02	37.75
3	3	Application	13.47	13.67	37.60	36.57	8.10	8.13	5.67	6.80	3.30	3.63	185.53	179.40	30.79	29.67
	6	Application	14.33	14.50	35.33	34.30	6.97	7.07	6.23	6.23	2.97	2.73	188.60	186.30	39	32.15
	9	Application	14.37	14.57	36.07	35.57	6.80	6.63	5.77	5.83	2.63	2.63	200.87	195.50	35.46	34.34
	12	Application	14.87	15.20	36.10	36.60	6.13	7.07	5.57	5.43	2.60	2.33	205.47	200.10	37.27	36.04
4	3	Application	12.70	13.07	38.40	37.38	8.47	8.73	6.50	6.43	3.60	3.47	177.100	174.03	28.80	28.42
	6	Application	13.43	12.97	37.43	36.87	8.20	8.13	6.47	6.30	3.27	3.23	179.40	182.47	30.27	30.67
	9	Application	13.73	13.57	37.10	38.60	7.27	2.37	6.33	6.07	3.27	2.60	193.97	189.37	33.48	32.56
	12	Application	13.57	13.70	36.62	37.13	6.77	6.63	6.30	5.93	2.80	2.20	200.10	202.40	35.24	35.14
5	3	Application	12.57	12.97	40.37	39.67	9.00	9.17	7.63	7.56	3.80	3.60	176.33	171.73	28.30	27.74
	6	Application	12.63	12.33	39.37	39.13	8.70	8.53	7.43	7.43	3.67	3.40	176.33	174.80	28.88	28.41
	9	Application	12.63	12.93	38.53	38.97	8.63	8.30	6.70	6.53	3.30	3.30	189.37	184.00	32.42	31.28
	12	Application	13.07	13.03	38.37	37.97	7.97	8.30	6.23	6.53	3.13	3.13	192.43	191.67	33.42	32.91
L.S.D. 0.05%																
Factor (A) Cultivation			0.197	0.305	0.472	0.435	0.192	0.262	0.216	0.430	0.180	0.221	2.810	2.466	5.239	4.119
Factor (B) N fertilization			0.197	0.305	0.472	0.435	0.192	0.262	0.430	0.430	0.180	0.221	2.810	2.466	5.239	4.119
Factor (AB) Interaction			0.394	0.610	N.S	0.700	0.383	0.528	0.431	N.S	0.360	0.442	N.S	2.143	M.S	3.581

Table 2-b. Average representing the effect of cultivation times

No.of cultivations per year	Fruit set (%)		Seasonal of fruit - lets dropping (%)								Av. Fruit retention per tree		Av. Fruit yield (kg) per tree	
			April		May		June		July					
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1 (Control)	14.54	15.13	34.69	34.14	6.50	6.46	5.78	5.76	2.80	2.80	196.65	192.05	34.78	34.01
3	14.26	14.48	36.28	35.76	7.00	7.22	5.81	6.08	2.88	2.83	195.12	190.33	33.98	33.05
4	13.36	13.33	37.39	37.61	7.68	7.62	6.40	6.18	3.23	3.13	187.64	187.07	32.02	31.70
5	12.73	12.82	39.16	38.93	8.57	8.58	7.00	7.02	3.48	3.36	183.62	180.56	30.75	30.82
L.S.D. 0.05%	0.197	0.305	0.472	0.435	0.192	0.262	0.216	0.430	0.180	0.221	2.810	2.466	5.239	4.119

Table 2-c. Average representing the effect of N applications

No of N applications per year	Fruit set (%)		Seasonal of fruit lets dropping (%)								Av. Fruit retention per +ve		Av. Fruit yield (kgs) per tree	
			April		May		June		July					
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
3 (Control)	13.12	13.49	38.13	37.50	8.21	8.20	6.48	6.83	3.57	3.50	180.36	175.76	29.69	29.02
6	13.70	13.63	36.63	36.77	7.57	7.61	6.48	6.18	2.97	2.94	183.81	183.62	31.30	31.13
9	13.82	14.13	36.63	36.12	7.29	7.04	6.17	6.17	2.93	2.92	147.23	190.52	34.54	33.23
12	14.25	14.50	36.14	36.05	6.68	7.03	0.85	5.84	2.92	2.75	201.63	200.10	35.99	35.46
L.S.D. 0.05%	0.197	0.305	0.472	0.435	0.192	0.262	0.216	0.430	0.180	0.221	2.810	2.466	5.239	4.119

year in winter and those trees received N in split doses (12 doses/year) while, high percentage of dropping fruits a year round in trees cultivated more than three times per year and received N in three doses / year with significant differences among treatments in most cases.

Interaction study between the two mentioned factors was significant except in the first season in April and in the second season in June and acted dependently in most studied periods (Table 2a).

Data in Table 2a show the same direction concerning the percentage of dropping fruits during different studied periods and made a positive correlation with number of cultivation carried out during growing season. In addition, the statistical analysis showed true differences among each period of fruit dropping specially when compared with control.

Data recorded in Table 2c proved that frequently N application decreased the dropping fruits specially when compared with 3 applications (control) per year and those received N in split doses (more than 3 applications per year) with significant differences between treatments in most cases.

Average number of fruit retention per tree

Data recorded in Table 2a proved that number of cultivations per year clearly affected the number of retained fruits per tree at the same time the other factor (number of N applications / year) also signific-antly effected the percentage of retained fruits per tree, and the two factors together were interacted specially in the second season. In other words, the highest number of retained fruits were obtained from trees received less number of cultivations and/or more number of N applications during growing season.

Values of Table 2b indicate the effect of number of cultivations per year on number of retained fruits per tree which tended to decrease as the number of cultivations was increased with significant differences among treatments

Data recorded in Table 2c declare the effect of number of N application per year on the fruit retention per tree. Accordingly, number of fruits per tree were increased as nitrogen fertilizer was applied frequently in multy doses a year round and the vise versa was detected with significant differences among different studied treatments, in both seasons.

Fruit Yield Per Tree

Data recorded in Table 2a in 2003 and 2004 seasons declare fruit yield per tree as affected by number of cultivations combined with number of N applications per year. The highest values were obtained from trees cultivated once per year and received N in split doses (12 doses/year). However, the lowest values were obtained from trees cultivated five times per year and received N in three applications in both seasons of study with significant differences in most cases and proved that cultivation combined with number of N doses per year had a clear effect (dependent) on fruit yield per tree.

Fruit yield (Table 2b) of pear trees was significantly affected with soil orchard cultivation. As such, increasing the number of cultivations per year significantly decreased fruit yield per tree and made a negative relationship.

As noticed in Table 2c frequently of N applications (multy doses) increased yield of fruits as compared with limited doses of N application with significant differrences among studied treatments.

The available literature concerning the effect of cultivation and number of N application specially on pear trees are very scarce. However, many workers found that results over four years on apple showed that all systems of weed control were better than clean cultivation concerning tree growth and yield; the best results were obtained with organic mulches and green manures Zha and Zhao (1995). Furthermore, the effect of five orchard soil management practices, (herbicide of simonize plus mulching with hay, herbicide, mulching with hay, mulching with white noted polyethylene and clean cultivation) on growth, yield and fruit quality of starking Delicious apple grafted on M.7 rootstock. The greatest trunk girth (55.8cm.), shoot length (46.6cm.) and fruit yield (89.4kg/tree) were observed with herbicide alone. The smallest trunk girth (52.4cm.), shoot length (32.8cm.) and fruit yield (66.6kg. /tree) were recorded with clean cultivation (Jayant Kumar *et al.*, 1999).

Azab, (1976), on Navel orange trees, found that fruit drop during May and early June reached 74% under tillage treatment, while it was 76% under mowing out, but uncultivation treatment gave the lowest percentage which was 67%. He added that, yield per tree under cultivation treatment was significantly increased by about 41.6 and 19.6% more than cultivation and mowing out treatments, respectively. He also added that, uncultivation treatment, increased yield weight significantly

by 19.2% over tillage treatments. The same author added that yield, as fruit number per tree was increased under uncultivation treatment by about 34.9% and 15.4% more than tillage and mowing out treatment, respectively. While, the later treatment gave about 16.9% increment over tillage treatment.

In addition, Schuricht *et al.* (1983), on apple trees, found that yield was greatly affected by cultivar but not method of cultivation, and grass mulch gave significantly lower yield than tillage. Furthermore, Pedersen and Petersen (1984) found that tillage resulted in more surface a roots and fewer deeper ones in apple. In this concern Misra *et al.* (1986), reported that apple yield per tree was lower in clean cultivation treatment as compared with other tested treatments. Also, Spring (1993) in apple found that the highest cumulative yield and the greatest percentage of top quality fruits were obtained with pine bark mulch of growing season and high evaporation from soil during noon hours which decreased the use of water and limited the uptake of water and nutrients and finally due probably to damage the tree roots.

As for, the effect of cultivation on fruit set (%), the obtained results proved that the percentage of fruit set tended to decrease as the number of cultivation were increased. In addition, dropping fruit-lets (%) throughout the season was increased as the number of cultivations were increased and showed positive relationship in this concern. Azab (1976), on Navel orange trees, reported that fruit drop during May and early June was 79% under tillage treatment while it was 76% under mowing out but uncultivation treatment gave the lowest percentage which was 67%. In the same direction Pedersen and Petersen (1984) on plum, pear and apple, proved that nontillage resulted in more surface roots and fewer deeper roots and tended to give higher yield. In addition, Engle (1992) proved that cultivation of old apple trees was less beneficial, due probably to damage reflected to the tree roots and mulching results in higher soil humidity than cultivation. Also, Lang and Lenz (1997) in apple trees, found that clean cultivation inhibited root growth and root dry weight.

The available literature concerning percentage of setting fruits as affected by number of cultivation or number of N application per year are very vague. While, data obtained by Hernandaz (1983) in apple and Smith (1993) on pear were in parallel, in general with the obtain herein results, they reported that

application of N in split doses increased fruit setting of studied trees.

Concerning the available literature dealing with fruit yield as affected by number of N applications per year, many investigators came to the same direction of the obtained results Castellanos, *et al.* (1982) on pear; (Chachibaya and Marshaniya, 1983) Satsuma trees; Koo (1986) on orange; Aso *et al.* (1987) on Eurka lemon and Satsuma trees; Sadowski *et al.* (1989) on apple; Smith (1993) on pear (Angou cv.); Ray and Yadav (1994) on banana. They proved that split application of N increased yield of such fruit trees species. However, Magalhaes *et al.* (1984) on citrus found that fruit yield per tree was similar in all variants (Urea applied annually in 1,2,3 or 4 split doses).

Fruit Quality

Fruit physical characters

Fruit weight

Table 3a shows the combined effect of studied factors (No. of cultivation X No. of N applications /year) on average fruit weight of Le conte pear var. Yet, average fruit weight reached to the maximum in the control (cultivated once/year trees and received N requirements in 12 equal doses). However, the lowest values were recorded in trees cultivated five times/year and received N in three times/ year and the other combinations treatments sited between the above mentioned values.

Interaction between studied factors concerning the average fruit weight was significant in the second season only.

Recorded data in Table 3b declare that the fruit weight tended to decrease as the number of cultivations/year were increased.

Data of Table 3c show that average fruit weight gradually increased as the number of N applications were increased/year with significant differences among treatments in both seasons of study.

Fruit size

The same Table 3a indicates that average fruit size showed the maximum values in trees received N in split applications doses/year, while the lowest values were found in cultivated trees five times/ year and received N in three doses/ year with significant differences between the studied factors and acted dependently in this concern in the second season only. The same trend was noticed in fruit weight in which the size of fruit tended to decrease as the number of cultivations/year were increased (Table 3b).

Fruit size tended to increase with significant differences among treatments by increasing number of N application /year (Table 3c)

Table 3-a. Effect of cultivation and N fertilization times (combined effect) on the physical characters of Le Conte pear fruits (2003 & 2004, seasons)

Treatments		Av. fruit weight (gm)		Av. fruit size (cm^3)		Av. fruit firmness (lb^2)		Av. fruit length (cm)		Av. fruit daimeter (cm)		Length / diameter Index	
No. of cultivations/ year	No. of N applications / year	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1 (Control)	3 Application (Control)	169.30	170.10	165.47	167.20	22.37	22.43	8.73	8.77	6.33	6.47	1.38	1.36
	6 Application	176.40	174.33	172.70	175.33	22.30	21.33	8.80	8.72	6.80	6.73	1.30	1.30
	9 Application	178.50	174.90	176.27	178.77	22.47	22.40	9.30	9.23	7.20	7.23	1.29	1.28
	12 Application	182.33	183.03	181.30	180.77	22.77	22.60	9.26	9.33	7.23	7.13	1.28	1.31
3	3 Application	165.93	165.40	161.43	165.67	22.23	22.38	8.40	8.50	6.20	6.26	1.36	1.36
	6 Application	171.73	172.57	171.37	170.83	22.50	23.27	8.63	8.70	6.60	6.57	1.31	1.33
	9 Application	176.53	175.63	174.20	171.53	21.87	21.50	9.03	8.90	6.47	6.86	1.30	1.30
	12 Application	181.40	180.10	178.47	176.70	22.27	22.20	9.07	9.00	6.93	6.87	1.31	1.31
4	3 Application	162.63	165.33	161.50	162.33	21.83	22.03	8.23	8.07	6.17	6.00	1.33	1.35
	6 Application	168.70	168.10	166.67	167.10	22.13	22.27	8.37	8.27	6.33	6.27	1.32	1.32
	9 Application	173.97	171.93	173.33	169.80	21.20	21.43	8.40	8.33	6.73	6.63	1.25	1.26
	12 Application	176.13	173.60	173.87	172.10	21.87	21.93	8.60	8.60	6.67	6.83	1.29	1.26
5	3 Application	160.47	161.50	158.30	160.53	20.57	21.10	7.93	7.80	6.03	5.93	1.32	1.31
	6 Application	163.80	162.53	164.13	162.47	21.93	20.67	8.13	8.03	5.90	6.03	1.38	1.33
	9 Application	171.20	170.00	167.67	165.47	21.10	21.73	8.30	8.13	6.27	6.17	1.33	1.32
	12 Application	173.67	171.75	170.33	167.07	21.33	21.70	8.47	8.40	6.47	6.17	1.31	1.36
L.S.D. 0.05%													
Factor (A) Cultivation		1.210	0.975	1.796	0.945	0.603	N.S	0.114	0.133	0.093	0.127	N.S	N.S
Factor (B) N fertigation		1.210	0.975	1.796	0.945	N.S	N.S	0.114	0.133	0.093	0.127	0.028	0.028
Factor (AB) Interaction		N.S	1.948	N.S	1.889	N.S	N.S	N.S	N.S	0.186	0.254	0.0564	N.S

Table 3-b. Average representing the effect of cultivation

No.of cultivations per year	Av. fruit weight (gm)		Av. fruit size (cm^3)		Av. fruit firmness (lb^2)		Av. fruit length (cm)		Av. fruit daimeter (cm)		Length / diameter Index	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1 (control)	176.64	176.84	173.93	175.52	22.48	22.19	9.03	9.03	6.89	6.89	1.31	1.31
3	173.90	173.45	171.37	171.18	22.22	26.13	8.78	8.79	6.77	6.64	1.32	1.32
4	170.36	169.24	168.84	167.83	21.76	21.92	8.40	8.32	6.48	6.43	1.30	1.30
5	167.28	166.45	165.13	163.89	21.23	21.30	8.21	8.09	6.17	6.08	1.33	1.33
L.S.D. 0.05%	1.210	0.975	1.796	0.945	0.603	5.980	0.114	0.133	0.093	0.127	0.028	0.028

Table 3-c. Average representing the effect of N applications

No.of N applications per year	Av. fruit weight (gm)		Av. fruit size (cm^3)		Av. fruit firmness (lb^2)		Av. fruit length (cm)		Av. fruit daimeter (cm)		Length / diameter Index	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
3 application (control)	164.38	165.08	161.68	163.93	21.75	26.03	8.33	8.28	6.18	6.18	1.34	1.34
6 applications	170.16	169.38	168.72	168.93	22.22	21.63	8.44	8.44	6.41	6.40	1.33	1.32
9 applications	175.06	174.37	172.89	171.40	21.66	21.27	8.76	8.65	6.79	6.73	1.29	1.29
12 applications	178.38	177.12	175.99	174.16	22.06	22.11	8.85	8.83	6.83	6.75	1.30	1.31
L.S.D. 0.05%	1.210	0.975	1.796	0.945	0.603	0.980	0.114	0.133	0.093	0.127	0.028	0.028

Fruit firmness

Fruit firmness values (Table 3a) as the result of interaction between the two studied factors showed significant differences in most cases.

Values of firmness (Table 3b) were significantly affected by number of cultivations/year and the highest values (L/b^2) were obtained from trees cultivated once or three times/year. However, the lowest values were obtained from trees received five cultivations/ year .

Data recorded in Table 3c show the effect of number of N applications/year on fruit firmness. The highest values (L/b^2) were obtained from trees received three and six applications/ year in the first and second seasons, respectively while the lowest values were obtained from trees received six and nine applications/ year with significant differences in most cases among treatments (No. of application).

Fruit shape

Fruit shape (length, diameter and length to diameter index) was recorded in Table 3a which declare the effect of number of cultivations / year on fruit shape in both seasons of study. Roundish fruits in shape were obtained from trees cultivated more than three times/ year and received N in three doses, while the oval shape was obtained from trees received more than three cultivations/year and nine to 12 N doses/year with significant differences among treatments in the first season only.

The roundish fruit in shape was noticed when the number of cultivations were increased and the vise versa was found with significant differences among treatments (number of cultivations) in most cases.

Table 3c showed that trees received three applications of N/year produced roundish fruits as compared with those received more than three applications/year (oval in shape) with significant differences among treatments.

The available literature concerning fruit physical characters, (fruit weight, fruit size and fruit shape) of pear or other fruit species are very vague. In Navel orange orchard, fruit physical parameters were not affected significantly by such treatments (cultivation, weed mowing out) Azab (1976). However, Pedersen and Petersen (1984) found, in cherry, plum, pear and apple, that quality of fruits was associated with nontillage treatments. In addition, Spring (1993) studied the effect of different methods of orchard soil management on yield and fruit quality of apple and found that the highest cumulative yield and the

greatest percentage of top quality fruits were obtained with pine bark mulch specially as compared with tillage with pine bark mulch. For instance, Zha and Zhao (1995) in apple showed that all systems (6 systems) were better than clean cultivation concerning yield and fruit quality. Moreover, the best results were obtained with organic mulches and green manure. Furthermore, Jayant Kumar *et al.* (1999) on growth, yield, fruit quality of starking Delicious apple, found that the greatest trunk girth (55.8.cm.), shoot length (46.6cm.) and fruit yield (89.4 kg/tree) were observed with herbicide plus mulching with hay followed by herbicide alone. The smallest trunk girth (52.4cm.) shoot length (32.8cm.) and fruit yield (66.6kg/ tree) were recorded with clean cultivation. The treatment herbicide plus mulching with hay resulted in the greatest fruit length (7.20cm.), fruit breadth (7.48cm.) and fruit weight (260.48g.) followed by mulching with hay. The smallest fruit length (6.78cm.), fruit breadth (6.97cm.) and fruit weight (232.6g.) were observed with clean cultivation. However, clean cultivation resulted in the highest total soluble solids (15.1 Brix). Other quality traits were not influenced.

The literature concerning the effect of N application on fruit physical characters in pear is very rare. However, many investigators (Castellanos, 1982) working on pear trees reported that non of the treatments (N application in two or four split application in each year) affected fruit quality. However, Tsanava *et al.* (1984) working on pear and apple concerning N fertilization rate and its frequency (1, 2, 3 or split doses) which affected the total N fraction and amino acid in the flesh and peel. Relationships were found among N rate, free amino acids content and storability. N at 125 or 250 g/tree produced the highest yields of fruit with moderate amino acids content and good storability. Increasing application frequency, reduced storability, but similar yield raring between 35 and 40 kg/tree. Chachibaya and Marshaniya (1983) working on citrus (Satsuma trees) found that, split application (60% before flowering + 40% at fruit set) of either N fertilizer gave the best yields (highest fruit numbers and highest fruit weight/ tree). In addition, Aso *et al.* (1987) on Eurka lemon, found that fruit yield tended to increase with increasing number of N applications.

Fruit Chemical Characters

Total soluble solids (TSS%)

Total soluble solids (TSS%) of fruit juice values (Table 4a) tended to increase as N fertilizer was applied frequently (in split doses) during the two growing seasons,

Table 4-a. Effect of cultivation and N fertilization times (combined effect) on the chemical properties of Le Conte pear fruits and leaf N content (%) (2003 & 2004 seasons)

Treatments			TSS (%)		Total acidity (mg/100 juice)		TSS / acid ratio		Total sugers (%)		Leaf N content (%)	
No. of cultivations/ year	No. of N applications / year		2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1 (Control)	3	Control **	13.267	12.633	0.220	0.250	60.343	51.237	42.167	43.633	1.505	1.514
	6	Applications	13.567	13.200	0.210	0.220	64.855	60.090	43.400	42.600	1.607	1.572
	9	Applications	13.267	13.233	0.213	0.220	64.560	60.270	43.400	42.933	1.680	1.669
	12	Applications	13.633	13.800	0.223	0.210	61.067	65.764	44.100	44.100	1.807	1.814
3	3	Applications	12.633	12.300	0.240	0.240	52.954	51.605	40.967	42.900	1.558	1.538
	6	Applications	13.200	12.900	0.227	0.220	58.287	58.745	41.533	41.500	1.502	1.569
	9	Applications	13.533	13.133	0.223	0.233	60.626	56.322	42.667	42.367	1.529	1.540
	12	Applications	13.433	13.200	0.207	0.230	65.063	57.388	42.400	43.200	1.710	1.709
4	3	Applications	11.867	12.200	0.267	0.247	44.643	49.572	39.900	39.467	1.520	1.536
	6	Applications	12.200	12.767	0.247	0.240	49.910	53.454	40.500	40.000	1.494	1.59
	9	Applications	12.567	12.667	0.263	0.243	47.810	52.231	41.533	41.233	1.561	1.594
	12	Applications	13.233	13.000	0.213	0.230	62.063	56.599	40.733	43.667	1.565	1.560
5	3	Applications	11.867	11.830	0.280	0.287	42.560	41.362	39.833	39.333	1.537	1.458
	6	Applications	12.533	12.400	0.247	0.257	50.887	48.338	39.600	38.467	1.480	1.509
	9	Applications	12.200	12.400	0.253	0.270	48.169	45.973	39.100	39.433	1.507	1.534
	12	Applications	12.933	12.567	0.249	0.237	54.057	53.177	40.867	40.500	1.574	1.612
L.S.D. 0.05%												
Factor (A) Cultivation					0.4276	0.2839	0.0100	0.0129	1.2041	0.7453	0.0354	0.0325
Factor (B) N fertilization					0.4276	0.2839	0.0100	0.0129	N.S	0.7453	0.0354	0.0325
Factor (AB) Interaction					N.S	N.S	0.0198	N.S	N.S	N.S	0.0708	0.0650

and when the soil cultivated once per year; i.e., the highest values (13.633 and 13.800) were obtained from juice of fruit trees received N in multy doses (12 doses per year). and cultivated once/year, while the lowest values (11.867 and 11.830%) were obtained from trees cultivated five times/year and received N in three doses only in the first and second seasons, respectively.

Interaction between the two main factors was insignificant, proved that the two factors act independently in this concern.

Data in Table 4b show the effect of cultivation in 2003 and 2004 seasons. As such, TSS% values were decreased from (13.558 and 13.217% to 12.383 and 12.300%) in fruit juice of trees cultivated once per year (control) and those trees grown in soil cultivated five times per year and the other values sited between the above mentioned limits with significant differences among treatments (number of cultivation/ year) in most cases.

Recorded data in Table 4c show the effect of number of N fertilizer application per year on TSS% of fruit juice. In this concern, TSS% values increased from (12.408 to 13.308%) in trees received N fertilizer in three doses per year and 12 doses per year, respectively and the other values ranked between the above mentioned limits in the first season, and the same trend was noticed in the second one with significant differences among treatments.

Total acidity

Data of total acidity (Table 4a) declare that the highest values of acidity were obtained from fruits of trees received the maximum number five of cultivations per year and received N in multy doses (12). This is clear in both seasons with significant differences among treatments and interaction in the first season only. Values of such character varied significantly (Tables 4 b,c) according to No. of cultivations / year (negative relationship) and No. of applied doses of N (positive relationship), in both seasons.

TSS / acid ratio

Values of TSS% acid ratio were calculated and recorded in Table 4a which reached to the maximum in juice of fruit trees received the lowest number of cultivations and received N fertilizer in multy split doses and vise-versa was noticed in both seasons of study.

Interaction between the main factors was statistically significant in the first season only.

TSS / acid ratio values tended to decrease as the number of cultivation per year was decreased in both seasons with significant

Table 4-b. Average representing the effect of cultivations

No.of cultivations per year	Total acidity (mg/100 juice)		TSS (%)		TSS / acid ratio		Total sugers (%)		Leaf N content (%)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1 (Control)	0.217	0.225	13.558	13.217	62.729	59.340	43.267	43.317	1.650	1.667
3	0.224	0.231	13.200	12.883	59.233	56.015	41.892	42.492	1.627	1.514
4	0.247	0.240	12.492	12.658	51.107	52.964	40.667	41.092	1.586	1.595
5	0.255	0.263	12.383	12.300	48.923	47.212	39.850	39.433	1.502	1.528
L.S.D. 0.05%	0.0100	0.10129	0.4276	0.2889	3.1008	3.1890	1.2041	0.7453	0.0354	0.0325

Table 4-c. Average representing the effect of N application

No.of N applications / year	Total acidity (mg/100 juice)		TSS (%)		TSS / acid ratio		Total sugers (%)		Leaf N content (%)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
1 (Control)	0.252	0.256	12.408	12.242	50.148	48.444	40.717	41.333	1.508	1.512
3 Applications	0.232	0.234	12.900	12.817	55.985	55.157	41.258	40.642	1.566	1.585
4 Applications	0.238	0.242	13.017	12.858	55.291	53.699	41.675	41.492	1.504	1.509
5 Applications	0.221	0.227	13.308	13.142	60.567	58.232	42.025	42.867	1.591	1.698
L.S.D. 0.05%	0.010	0.0124	0.4276	0.2839	3.1008	3.1890	1.2041	0.7453	0.0354	0.0325

differences among treatments (number of cultivations/year) in most cases (Table 4b).

Also the ratio tended to increase as the N fertilizer was added in multy doses per year and made a positive relationship with significant differences among treatments (Table 4c).

Total sugars

Values of total sugars showed insignificant variables due to the inter-acted factors. In other words, juice total sugars content tended to increase as the number of cultivations per year were decreased and the number of N fertilizer application per year was increased.

Interaction between studied factors showed insignificant differences and acted independently in this concern.

Values of total sugars content significantly decreased as the number of cultivations were increased with significant differences among treatments (No. of cultivations) in most cases of comparisons Table 4b. In addition, split N fertilizer application increased total sugars content as compared with trees received N fertilizer in few doses (three doses/ year) (Table 4c).

The available literature concerning the effect of clean cultivation on quality of pear fruits or other fruits crops are rare. However, many investigators reported that Azab, (1976) mowing out treatment in Navel orange trees gave juicy fruits than the other two treatments. (cultivated soil orchard) once per year and mowing out treatments caused significant decrease in ascorbic acid percentage than tillage. Other physical and chemical fruit properties were not affected significantly affected by the treatments. In addition, Spring (1993) on apple trees found that the highest cumulative yield for 1991 +1992 (10.34 and 7.45 kg/tree for elstar and golden Delicious, respectively) and the greatest percentage of top quality fruits were obtained with pine bark mulch specially as compared with tillage treatment. Moreover, Jayant Kumar *et al.* (1999) in apple trees, found that clean cultivation resulted in the highest total soluble solids (15.1 Brix). Other quality traits were not influenced.

In addition, in peach trees Castellanos (1982) non of N applications in split doses or in 1, 2 and 3 applications annually affected leaf composition or fruit quality. In addition, Tsanava *et al.* (1984) in citrus trees, reported that both the application rate and its frequency (1, 2, 3 or split doses) affected the total N fractions and amino acids in the flesh and peel. Increasing application frequency

reduced storability, but single and split applications gave similar yields. Also, Koo (1986) in citrus found no differences in fruit juice quality between the application frequencies of N (single or split).

Leaf nitrogen (N) content (%)

As shown in Table 4a leaf N content (%) was at the highest value in leaf of trees cultivated once per year during winter operations and received N fertilizer in split doses (12 doses), while the lowest values of leaf N content were noticed in leaves of trees cultivated five times/year and received N fertilizer in three doses per year and the other values sited between the above mentioned limits. The interaction between the two studied factors was statistically significant and act dependently in this concern.

Leaf N content clearly affected by number of cultivations (Table 4b). As such, leaf N content (%) tended to decrease as the number of cultivations per year was increased; i.e., leaf N % content ranged between 1.650 and 1.663% (Maximum values) to 1.502 and 1.528% (minimum values) in the first and second seasons, respectively and the other values sited between the above mentioned limits with significant differences in most cases among treatments.

The obtained data (Table 4c) also show that leaf N content (%) was increased from 1.508 to 1.698 % as the number of N fertilizer doses were increased from three to 12 times per year with significant differences among treatments and the same trend was noticed in the second season.

The available literature concerning the above summarized results are very rare. However, many investigators proved that Andrews *et al.* (2001) worked in apple trees, reported that total top soil N was significantly higher in the organic and integrated system compared to the conventional system, although nitrate N was lowest in the organic system. Even though these differences in available soil N did not lead to differences in leaf N among the three systems. In addition, Schuricht *et al.* (1983) on apple, using six treatments (tillage or mulch in various combinations). Grass mulch increased airiation (airing) in the top and the total and N contents, herbicide treatment with tillage produce the pH but increased available P content. However, Engle (1992) in apple trees, studied the influence of mechanical and chemical weed control, found that cultivation, however, was less beneficial, due probable to damage the tree roots. Mulching resulted in higher soil humidity than cultivation or herbicides, while soil nutrients status was un-affected by the

various cultivar and chemical treatments. Meanwhile, Yu-yi *et al.* (1998) with apple trees reported that, nitrate contents were the highest in the plastic soil treatments followed by the rotary hae treatment.

In addition, the effect of N either when applied in single or limited doses or in split (multy doses) on leaf N, P and K contents (Castellanos, 1982 working on peach trees), non of treatments (1, 2, 3 or 4 split applications) affected leaf composition or fruit quality. However, Hernandaz, (1983) working on Citrus latifolia trees, reported that there was little response to P and K application in single dose in split doses and N alone at 216 kg/ha resulted in the largest fruits with the highest juice percentage, and in high yields. In addition, Gysi *et al.* (1987) in apple, reported that, split N application (9 doses annually) and the various N forms used had a smaller effect on the soil composition than did the presence of the grass mulch or the amount of N applied. A high No. 3 content in the root zone, and therefore, a greater likelihood of losses by leaching could be avoided by using a grass mulch and lower levels of N fertilization. In addition, Koo, (1986)working on orange, reported that no differences regarding the effect found between the application frequencies with either of the controlled release sources of N, whereas with the soluble source two split applications/year were superior to a single application with regard to both leaf N content and fruit production. No differences in fruit juice quality were found between controlled release and soluble N sources. From anther point of view Koen (1987) in some trees species, reported that current recommendation of optimum leaf nutrient content for trees up to 7 years old are 1.6 - 1.8% N, 0.11-0.13% P and 1.2 to 1.6% K, respectively. The best time for leaf sampling was Mar., when the leaves were five month old. Fertilizer application (Principally N) as three equal split doses should be made one month before pruning and one and two months after pruning. In Eurka lemon Aso *et al.* (1987) reported that fruit yield tended to increase with increasing number of N application. N efficiency was highest at the intermediate N rate and the greatest number of application (67.7kg. fruit/kg. N applied). N concentration in leaves increased with increasing N rate and increasing frequencyof application.

REFERENCES

A.O.A.C. 1970. Official methods of analysis of the association of official agricultural chemists. Published by the association of

official agricultural chemists, 10th Ed. , Washington.

Andrews, P. K., J. K. Fellman, J. D. Glover, J. P. Reganold, D. Neilsen, and B. Fallahi. 2001. Plant mineral nutrition and fruit quality under organic, conventional and integrated apple production system in Washington state USA. Proceedings of the fourth international symposium on mineral nutrition of deciduous fruit crop, Penticton British Columbia, Canada, 13-18 August Acta – Horticultural No. 564: 291-298 .

Aso, P.J., C. Hernandez, and H. F. Vinciguerra. 1987. Effects of split nitrogen application on growth and yield of young lemon trees. Prevista. Industrial y- Agricola – de – tuman. 64 (2): 65-70.

Azab, S. A. 1976. Studies on orange fruit drop during different stages of development. M. Sc. Thesis, Fac. Agric. Ain-Shams Univ., Egypt.

Buban, T., B. Helmezi, J. Papp, E. Dorgo, I. Jakab, I., Kajati , I. Merwin, F. Polensy, W. Muller, and R. W. Olsazk. 1995. IFP. Compatible ground cover management system in a new – planted apple orchard proceeding of the international, conference on integrated fruit production, Cedzyna, Poland, 28 August, 2 September, Acta Horticulture No. 422: 263-267.

Castellanos, M., N. Peraza, and R. Hurtado. 1982. A study of split application of nitrogen fertilizer to young Valencia late orange trees (Citrus sinensis) on a reel ferraltilitic soil over a period of five years. Cultivars tropical received 4 (3): 437-448.

Chachibaya, T.G., and I. I. Marshaniya. 1983. Effect of the from, rate and date of nitrogen fertilizer application on the yield of a young application on the yield of a young Satsuma plantation. Subtropicheskie kultury (5): 90-97.

Dencker J. 1992. Drip irrigation of young apple trees with a nutrient solution. Frugtog Ba'r 21 (1): 15-17 [Da. 4 setion for havebrug, KVL, Rolighedsvej 23, 1958 Frederiksberg C, Denmark.

Doiccher, K. and D. Vasilera. 1988. The effect of different irrigation regimes and nitrogen application rates on the growth and yield of Golden Delicious apples grown under a grass – mulch system . Rastenier dni – Nauki , 25 (9): 78-89.

Engle, G. 1992. Comparison of integrated weed control and herbicide treatment in fruit crops. Zeitschrift fur pflanzenschntz. Sonder heft 13, 505-511. Presented at the 16th

German Conference on weed biology and control held at Stuttgart. Hohenheim, Germany 10-12 March.

Garg, B. K., and I. C. Gupta. 1995. Plant responses to saline sprinkling waters. Current . Agriculture. 19 : 1-2.

Gysi, C., F. Fankkhouser, and R. Schumacher. 1987. Influence of NPK fertilization on the yield , fruit quality and leaf composition of Persian lime . Cultivars troprcales. 5 (1): 137-147.

Hernandaz, G. 1983. Influence of NPK fertilization on the yield, fruit quality and leaf composition of Persian lime. cultivars Tropicales 5 (1):137-147.

Hussein, S.M. 1998. Influence of irrigation level on the growth mineral content, and fruit quality of "Anna" apple . M. Sc. Thesis, Cairo Univ., Egypt.

Jayant Kumar, A. S. Rhehalia, S.S. Rana, H.S. Verma, and J. Kumar. 1999. Long term effects of orchard soil management practices on growth , yield and fruit quality of apple (Malus domestica) . Indian Journal of Agricultural . Science 69 (5): 355-358.

Koen T. J. 1987. Manurial requirements and leaf forms of gugvas. Information – Bulletin, Citrus and subtropical fruit. Research Institute, South Africa: 10.

Koo, R.C. J. 1986. Controlled release sources of nitrogen for bearning citrus, proceedings of the Florida state Horticultural society pub 99 : 46-48.

Lakatos, T., Buban, W. Muller, F. Polesny, C. Verheyden, and A.D. Webster. 2002. Effectiveness of different ground cover materials to preservce soil water content in a young apple orchard. Proceeding of the international conference integrated fruit production, leauven, Belgium, 27July 1 August – Acta Horticulture, No. 525,425-426.

Lang , K. and F. Lenz. 1997. Root growth in apple tees as affected by soil cultivation methods Erwer bsobstban, 39 (4): 101-103 .

Magalhaes, A.F., L. F. J. Zouza, and A. P. S. Cunha- Sobrinho. 1984. Splitting nitrogen doses in Tahiti lime. Perquisa– Agropecuaria. Brasileira, 19 (4): 441-444.

Misra, L. P., D. P. Sharma, and M. K. Seth. 1986. Note on effect of orchard floor management practices on the growth, yield and leaf nutrient status in red. Delicious apples. Indian Journal of Horticulture. 41 (1-2): 37-39.

Nagiub, M. I. 1969. Colorimeter determination of nitrogen components of plant tissues. Bull. Fac. Sci., Cairo Univ. 43: 1.

Parachomchuk , P., G. H. Neilsen, E. Z. Hogue, and R. S. Utkhede. 1994. Apple trees growth response to N fertigation of replant soil: Comparison of green house pot tests and field results . Third international symposium on replant problems, Penticton, Cancla, 20-23 July. Acta Horticulture, No. (1): 65-73.

Pedersen, B. F., and O. Petersen. 1984. Non- tillage for fruit trees. Meddelelse, statens . Plantearls forsog. 86: 1764, 3pp.

Ray, P.K., and J. P. Yadav. 1994. Response of Basrai banana to different doses and timing of nitrogen application in lacaro us soil of nort Bihar: Horticultural Research Station. Rajendra Agricultural University. Birauhy 848113. Bihar, India.

Sadowski, A., M. Maszynski, D. Wrona, J. Szwedo, E. Zmuda, E. Pacholak, O. Kozera, J. Ostrowska, and E. Makossz. 1989. Effect of nitrogen fertilization in field trials conducted on commercial fruit orchards. Acta Horticulturae No. 247: 413-418.

Schuricht, R., G. Schonberg, and W. Fiedler. 1983. Effect of mechanical soil cultivation and weed control on apple trees and soil. Archiv- fur- Gartenbau, 31 (4): 199-213.

Smith, T. J. 1993. Effect of nitrogen application timing in commercially managed d' Anjou Pears. Good fruit Grower 44 (1): 28-29..

Snedecor, G. W. 1966. Statistical methods 5th the Iowa State Univ. Press, Iowa, USA. pp. 534.

Snedecor, G. W. and W. G. Cochran. 1972. Statistical Methods. 6th Ed. The State Univ. Press, Amer. Iowa, USA. pp.395.

Spring, J. L. 1993. Trials on soil managements along of trees intermediate results . Revue – Suisse de–viticulture, d Arboriculture et dl' Horticulture, 25 (6): 353-361.

Tsanava, N.G., T. B. Kiladze, and SH. A. Putkaradze. 1984. Effect of ammonium nitrate application rate and method on the composition of nitrogen compounds in Satsuma fruits. Subtropicheskie Kultury (3): 88-100.

Waller, P.A. and D.B Duncan. 1969. Abays rules for the symmetric multiple comparison problem . Amer. State Assoc. J., 1485-1503.

Yu- Yi; Yan – YuHua; Y. Yu and II. Yan. 1998. A study on the plant diversity in apple orchards towards sustainable pest management . Acta. Entomologica – Sinua 41: supplement, 82 – 90.

Zha, J.M., and F.Zhao.1995. Study on the soil management system for apple orchards in the arid region. Journal of Fruit Science, 12 -34.

تأثير عدد مرات العزيق والتسميد الآزوتى لكل سنة على نمو وإنتاجية أشجار الكمثرى (صنف ليكونت)

أحمد وجيه محمد جاويش - عبدالله محمود محسن

قسم البساتين – كلية الزراعة – جامعة الزقازيق - الزقازيق

أجرى هذا البحث على أشجار الكمثرى المثمرة "صنف ليكونت" المزروعة فى مركز القرين – محافظة الشرقية – مصر. تم زراعة الأشجار فى أول فبراير سنة ١٩٩١ فى أرض رملية على أبعاد ٤ × ٤م خلال موسمى ٢٠٠٣/٢٠٠٤ بهدف دراسة تأثير كل من عدد مرات العزيق وعدد مرات إضافة السماد الآزوتى (٩٠٠جم أزوت صافى/شجرة/سنة) على نمو وإنتاجية وصفات الثمار فى أشجار الكمثرى ، بالإضافة إلى تأثيرها على محتوى الأوراق من الآزوت كعمليات رعاية بستانية أساسية تجرى فى البستان، وأوضحت النتائج أن عدد مرات العزيق (١-٥ مرة/سنة) وعدد مرات إضافة السماد الآزوتى (٣-١٢ مرة/سنة) أحدثت زيادة معنوية فى الصفات الخضرية المدروسة (متوسط عدد الأوراق/فرع، مساحة الورقة، طول وقطر الساق)، بالإضافة إلى ذلك كانت النسبة المئوية لكل من : عقد الثمار، والتغير الموسمى لتساقط الثمار (أقصى معدل للتساقط فى شهرى أبريل ومايو وأقل نسبة للتساقط فى الثمار العاقدة فى شهرى يونيو ويوليو وذلك فى جميع المعاملات المدروسة) ، كما لوحظ حدوث زيادة معنوية فى نسبة العقد، وقلة التساقط الموسمى وزيادة فى نسبة الثمار المتبقية على الأشجار – وذلك عند نقص عدد مرات العزيق بالبستان أو زيادة عدد مرات إضافة السماد الآزوتى، وكان التداخل بين عاملي الدراسة معنويا .

كما أدى عزق البستان (١-٣ مرة/سنة) وإضافة السماد الآزوتى على دفعات (٦-١٢ مرة/سنة) إلى زيادة محصول الشجرة معنويا من الثمار وأعطى أفضل المتوسطات لكل من الصفات الطبيعية والكيمياوية للثمار وذلك عند المقارنة بأشجار الكنترول (عزقة واحدة وإضافة السماد الآزوتى ٣ دفعات/سنة) وكان التداخل بين عاملى الدراسة معنويا (متلازم) فى هذا الصدد.

كما أوضحت نتائج تحليل الأوراق اختلاف النسبة المئوية لمحتواها من الآزوت؛ حيث تأثر ذلك بعدد العزقات/سنة (علاقة سالبة) وعدد مرات إضافة السماد الآزوتى/سنة (علاقة موجبة) مع حدوث تلازم (تداخل) بين عاملى الدراسة فى هذا الصدد وذلك فى موسمى الدراسة.

يمكن التوصيه تحت هذه الظروف بأن أقل عدد من العزقات (مرة/سنة) وإضافة السماد الآزوتى على دفعات متعددة (١٢ مرة/سنة) هى أفضل معاملة للحصول على أفضل نمو ومحصول مع جودة عالية لصفات ثمار الكمثرى (صنف ليكونت) المزروعة فى الأراضى الرملية المستصلحة حديثاً.