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**EFFECT OF CATTLE MANURE AND REDUCING MINERAL
 FERTILIZER ON GROWTH, FRUIT QUALITY AND NUTRIENT
 CONTENT OF PECAN TREES**

BY

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ABSTRACT

A field experiment was conducted at the experimental farm of Kaha Research Station (kalubia governorate) during the two successive seasons of 2002 & 2003 to study the effect of different fertilizers i.e., mineral (ammonium sulphate, potassium sulphate & Calcium super phosphate) or organic manure (cattle manure) or their combinations on growth, fruit quality and leaf mineral contents of five pecan cultivars namely: Cape Fear, Choctaw, Desirable, Graking and Grazona. The obtained results showed that, Choctaw & Graking cvs. showed the tallest shoots and highest values of leaves dry weight, while, Desirable cv. exhibited the greatest number of leaves/shoot. In addition, the maximum average of leaflet area was significantly coupled with Choctaw & Grazona cvs. Shoots of Cape Fear & Desirable trees had higher number of fruits/ shoot than other cvs. The highest records of growth characteristics, i.e. number of leaves/shoot, leaflet area and leaves dry weight were obtained from plants treated with 75% organic manure + 25% mineral fertilizers. On the other hand, 25 % organic manure in combination with 75 % mineral NPK fertilizers were promising for producing the maximum number of fruits / shoot & the tallest shoots. Applying organic manure succeeded in enhancing nut properties as compared with the full dose of mineral fertilization treatment especially when supplemented with 25% or 75% of recommended dose of (NPK) fertilizer. Furthermore, nut length, width, shape index, weight & flesh oil content were significantly higher in Graking cv., while average kernel weight and % of total nut were greater in Choctaw cv. Moreover, the application of the combination between half recommended rates of organic & NPK fertilizers exerted higher positive effect on flesh weight and % of oil content Using 25% organic manure + 75% NPK gave higher records of chlorophyll (A). The highest N, Mn & chlorophyll (B) contents were recorded in Choct. trees, while leaves of Grazona trees contained larger amounts of Zn and Fe contents. The highest levels of N (especially in 2nd season) & chlorophyll (B) contents were observed in 75% organic manure + 25% (NPK) treatment. However, P in leaves of pecan trees didn't significantly respond to fertilizer treatments. In addition, all combinations between organic & mineral fertilizers resulted in a positive remarkably effect on leaf K content. Leaf Zn significantly increased with increasing the levels of organic manure (except at 100% level) in 1st-season and with 50% organic manure + 50% (NPK) treatment in 2nd season. Fertilizing pecan

trees with either 50% organic manure + 50% mineral fertilizer or 25% organic manure + 75% mineral fertilizer recorded the highest levels of Mn & Fe contents.

Key words: Pecan trees (Cape Fear, Choctaw, Desirable, Graking & Grazona.) cvs. – organic manure – mineral fertilizer – growth — fruiting - photosynthetic pigments – mineral content.

INTRODUCTION

Pecan is a native North American tree – nut crop that is becoming increasingly important, through the world as a new horticultural crop (Wood and Payne, 1991). As the economics of the developed and developing nations grow, the demand for high quality foods, such as pecan, increase; hence, providing opportunities of foreign exchange and offers the citizens of many developing nations opportunity to consume a very high domestically produced food. The species of pecan is most productive on high quality soils with plenty of soil moisture (Aboy-Taleb, 1992). Nitrogen and phosphatic chemical fertilizers are commonly used in the production of fruit trees. Application of such chemical fertilizers to the soil causes some problems especially for exportation. It is well known that the nitrogenous fertilizers are lost via nitrate reduction, denitrification and ammonia volatilization. Moreover, some nitrogenous fertilizers can be leached to the surface and underground water causing environmental pollution (Attia, 1990; El-Morshedy 1997; Sorial & Abd El-Fatah 1998; Soliman, 2001 and Zaghloul, 2002). Also immobilization of phosphorus is the most problem of phosphatic fertilization in Egypt and this is due to soil alkalinity. Organic matter plays an important role in soil through its active group which have the ability to retain the inorganic elements in complex and chelated forms. In this accord, organic manures are well established to be involved in fertilization of plants in almost all countries around the world, due to their beneficial effects on their physical, chemical and biological characteristics of the soil, which in turn, influence the growth and increase production of plants. Many investigators reported that adding organic manures as fertilizer led to decreasing soil pH which results in increasing solubility of nutrients and nutrients availability to the plants (Salem, 1986). With regard to the effect of organic manure on plant growth and microbial activity, Abdel- Magid *et al.*, (1996); Neweigy *et al.*, (1997); Youssef *et al.*, (2001) and Abou-Hussein *et al.*, (2002) reported that the addition of organic manures to the soil encouraged proliferation of soil microorganisms, increased microbial populations and activity of microbial enzymes i.e. dehydrogenase, urease and nitrogenase. Some investigators studied the effect of organic manure application as compared with mineral fertilizers on different fruit crops (Worley and Mullinix, 1996; Foshee *et al.*, 1999; Smith, 2000 and Smith *et al.*, 2000) on pecan; (Kassem & Marzouk, 2002) on grapevines; (El-Kobbia, 1999; Obreza and Ozores, 2000; Fuad *et al.*, 2002; Tayeh, 2003 and Helail *et al.*, 2003) on citrus and (Haggag, 1996) on olive trees. They reported that, under organic system soil biotic life increased and as a result plant synthesis more vitamins and amount of total sugars. The addition of organic fertilizer is necessary for giving the best growth and leaf nutrient contents as well as greater yield, fruit quality and leaf & soil mineral contents as compared with mineral fertilizer. The increasing costs of

chemical fertilizers, plus an increasing awareness of the pollution effects that excess fertilizer applications have on environment led us to plan this research to study the effect of organic manure in the form of cattle manure and mineral fertilizers in the form of calcium super phosphate, potassium sulphate and ammonium sulphate as well as their combinations on growth, fruit physical and chemical characters and leaf pigments and minerals contents of Cape Fear, Choctaw, Desirable, Graking and Grazona pecan trees.

MATERIALS AND METHODS

A field experiment was conducted at the experimental farm of Hort. Res. Instit. at Kaha Res. Station (kalubia governorate) during the two successive seasons of 2002 & 2003 to study the effect of different fertilizers i.e., mineral and organic manure on growth, fruit quality and leaf mineral contents of five pecan cultivars namely: Cape Fear (C.F), Choctaw (Choct.), Desirable (Desi.), Graking (Grak.) and Grazona (Graz.). The trees were about 20 years old, uniform in vigour, grown in clay loamy soil, planted at 5x6 meters apart and received the same culture management.

Soil physical and chemical analysis of Kaha Res. Station were determined at the Soil and Water Research Institute, ARC (Table, 1).

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

Variable	0-30 cm depth	30-60 cm depth
1) Physical properties		
Sand %	18.6	18.4
Silt %	21.8	21.8
Clay %	60.4	64.4
2) Chemical properties		
pH	7.9	7.8
Available N (ppm)	97.9	107.8
Available P (ppm)	5.9	5.3
Available K (ppm)	215.8	216.3
Total Ca Co₃ (%)	2.4	2.8

The experiment involved the following five treatments:

1. 100% organic fertilizer.
2. 75% organic fertilizer + 25% mineral fertilizer.
3. 50% organic fertilizer + 50% mineral fertilizer.
4. 25% organic fertilizer + 75% mineral fertilizer.
5. 100% mineral fertilizer.

The amounts of organic and mineral fertilizers are shown in Table (2).

Table (2):

Fertilizer type	Fertilizer rate (%)	Amount of fertilizer (Kg.) /tree			No. of doses	Time of application
Organic (Cattle manure)	100	20			1	January
	75	15			1	January
	50	10			1	January
	25	5			1	January
Mineral	100	N	P	K	P (1)	January
		5.0	2.0	2.0	N & K (3)	March, May & July
		3.75	1.5	1.5		
		2.5	1.0	1.0		
		1.25	0.5	0.5		

Source of fertilizers:-

1. Organic fertilizer was applied in the form of cattle manure (1.61% N).
2. Mineral fertilizers:
 - (a) Ammonium sulphate (20.5% N) as a source of nitrogen.
 - (b) Potassium sulphate (45% K₂O) as a source of potassium.
 - (c) Calcium super phosphate (15.5% P₂O₅) as a source of phosphorus.

Organic fertilizer was applied in two parallel ditches of 100x40x30 cm. for length, width and depth, respectively. The ditches surrounded the tree from two directions in the end of the canopy shade. In the 2nd season, they were dug in the other two directions. Analysis of cattle manure is shown in Table (3):

Table (3): Analysis of cattle manure

Organic fertilizer	C %	O. M %	C/N ratio	Macro Elements (%)					Micro elements	
				N %	P %	K %	Ca %	Mg %	Fe %	Mn ppm
Cattle manure	18.71	37.41	11.62	1.61	0.732	1.27	0.160	0.696	0.6499	190.2

Mineral fertilizers were added by mixing with the soil surface layer (20-cm depth) surrounding the trunk till the external end of canopy shade.

The experiment was set in a complete randomized block design with 3 replications (an individual tree/each). In each season of study, 30 terminal shoots/each treated tree were selected at random for the following measurements:

1. **Growth parameters:** At the end of growing season, the selected shoots were measured for averages of length (cm), no. of leaves/ shoot, leaflet area (cm²) using area meter CI-203, leaves dry weight (gm) and no. of fruits / shoot.
2. **Nut physical characteristics:** When the fruits reached the harvesting stage (at the beginning of hull cracking in late October and early November), samples of 50 nuts were taken from each tree and cured by storage under temperature of about 20-30°C for about 40-50 days, to determine nut characteristics as follows: the averages of nut weight in grams, nut dimensions (polar & equatorial diameters / length & width) in cm., and nut shape index was

calculated by dividing polar diameter by equatorial one. Kernel percentage was also calculated according to the following equation:

$$\text{Percentage of kernel} = \frac{\text{Av. weight of kernel}}{\text{Av. weight of nut}} \times 100$$

In addition, percentage of kernel's oil content was determined by extracting the oil from the dried kernel samples by means of Soxhlet fat extraction using petroleum ether as a solvent at 60-80°C boiling point (A.O.A.C. 1975).

3. Leaf chemical composition: Leaf samples consisting of twenty middle leaflets of the middle leaves of terminal shoots were collected on 1st of September as leaf samples according to William (1989) for the following determinations:

A. **Photosynthetic pigments:** i.e., chlorophyll A&B as mg/g were colorimetrically determined in fresh leaf samples (0.5 g /each) at wavelength of 660 and 640 for A & B, respectively according to Brougham, (1960).

B. **Mineral composition:** Sampled leaves from each tree (replicate) were separately oven dried at 70°C till a constant weight, then grounded for determination of the following nutrient elements:

Nitrogen : was determined by the modified micro-Kjeldahl method as outlined by (Pregl, 1945).

Phosphorus : was determined colorimetrically according to the stannous chloride method (Jackson, 1958).

Potassium : was flame photometrically determined (Brown and Lilleland, 1946).

Micronutrients (Zn, Mn & Fe): were determined by using Atomic Absorption spectrophotometer (Model, Spectronic 21D) according to Jackson (1970).

Statistical analysis:

All data obtained during both 2001&2002 experimental seasons were subjected to analysis of variances according to Snedecor and Cochran, (1980) and means were differentiated using Duncan's multiple range test (Duncan, 1955). Whereas capital and small letters were used for differentiating the values of specific and interaction effects of the investigated factors, respectively.

RESULTS AND DISCUSSION

1. Growth parameters:

Data presented in Table (4) indicate that, Choctaw & Graking cvs. showed significantly the tallest shoots and highest values of leaves dry weight, while, Desirable cv. exhibited the greatest No. of leaves/shoot. In addition, the maximum average of leaflet area was significantly coupled with Choctaw & Grazona cvs. Moreover, shoots of C. F. & Desi. Cvs. had higher No. of fruits/

shoot than other cvs. At the meantime, growth characteristics, i.e No. of leaves/shoot, leaflet area and leaves dry weight were significantly increased with organic manure (O.M.) application. The highest records was obtained from plants treated with 75% (O.M.) + 25% (NPK) fertilizations, while the lowest values was recorded due to using 100% (NPK) fertilization. On the other hand, the tallest shoots was obtained by application of 25% (O.M.) + 75% (NPK) fertilizations, while the shortest from 100% (O.M.) application. Fertilizing the studied pecan trees with 25 or 50 % organic manure in combination with 75 or 50 % mineral NPK fertilizers were promising for producing the maximum No. of fruits / shoot. Thus was true in the two seasons of study. Regarding the interaction, Choct. Cv. treated with 25% (O.M.) + 75% (NPK) exhibited the tallest shoots/leaves in both seasons, while the reverse was true with No. of leaves /shoot. The maximum average leaflet area was significantly coupled with Choct. trees received 75% (O.M.) + 25% (NPK) treatment. On the other hand, Graz. cv. subjected to 75% (O.M.) + 25% (NPK) treatment recorded the highest values of leaves dry weight, whereas the lowest were obtained when treated with half recommended dose of both (O.M.) & (NPK) fertilizations in both 2002 & 2003 seasons. Generally, the maximum values of No. of fruits/ shoot were recorded on C.F. & Desi. trees treated with 25% (O.M.) + 75% (NPK) fertilizers, while the reverse was true with the 100% (NPK) treated trees of both Grak. & Choct cvs. during 2002 & 2003 seasons. The beneficial effect of organic fertilizer in increasing the availability of most nutrients and improving physical and chemical properties of soil in favour of increasing nutritional status and growth of the tree could explain the present results for the necessary of using organic manure with mineral fertilizers (Nijjar, 1985). In Addition, the microorganisms produce growth promoting substances which increase the plant growth. This increase in plant growth may increase the photosynthetic rates leading to an increase of the assimilation rates. The improving effect of using organic fertilizer was supported by the results of Smith, (2000); Smith, *et al.*, (2000); Youssef *et al.*, (2001); Abou-Hussein *et al.*, (2002); Fuad *et al.*, (2002); Tayeh, (2003) and Helail *et al.*, (2003).

2. Nut physical characteristics:

The effect of organic manure and reducing mineral fertilizers on nut physical characteristics of the studied pecan cvs. expressed as nut dimensions (polar & equatorial diameters); shape index; nut weight (g.); kernel oil %; weight (g.); and % of total nut are reported in Tables (5) and (6) during 2002&2003 seasons. Applying (OM.) succeeded in enhancing nut properties as compared with the full dose of mineral fertilization treatment especially when supplemented with 25% or 75% of recommended dose of (NPK) fertilizer (Table, 5). Furthermore, nut length; width, shape index and weight were significantly higher in Graking cv. followed by Choctaw cv. than the corresponding ones of other cultivars. Also, nut characteristics responded significantly to the interaction between cultivars & tested treatments. In this respect, Graking & Choctaw cvs. treated with 75 or 25 % of (OM.) & 25 or 75 % (NPK) exerted statistically higher stimulate effect than other treatments (except for shape index in 1st season). Concerning the effect of different fertilizer treatments on kernel (flesh) qualities i.e., % of oil content, average weight (g.) and % of total nut, Table (6) shows that, Grak. trees produced fruits richer in their oil content than other cvs. in both seasons. Moreover, the

Table (4): Effect of mineral fertilizers and organic manure on some growth parameters of the studied pecan cultivars during 2002& 2003 seasons.

Treatments	Shoot length (cm)											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	8.73 i	10.46 f	9.49 gh	9.42 gh	9.47 gh	9.51 C	7.56 k	8.30 j	6.73 l	9.47 h	8.66 l	8.14 C
75% organic man. + 25% mineral fert.	9.51 g	6.78 k	7.20 k	10.47 f	9.53 g	8.70 C	6.50 lm	13.13 b	6.83 l	8.88 l	8.00 j	8.67 C
50% organic man.. + 50% mineral fert.	10.60 f	15.01 b	8.95 hi	13.37 c	8.66 i	11.32 B	6.33 m	8.83 i	9.70 gh	9.56 gh	8.83 i	8.65 C
25% organic man. + 75% mineral fert.	10.93 ef	17.60 a	8.06 j	17.13 a	11.73 d	13.09 A	11.24 e	13.82 a	12.35 c	11.66 d	11.09 e	12.03 A
100% mineral fertilizer	11.22 e	12.87 c	9.06 g-i	13.08 c	12.00 d	11.65 B	9.83 g	8.93 l	10.72 f	10.51 f	9.86 g	9.97 B
Mean**	10.20 B	12.55 A	8.55 C	12.69 A	10.28 B		8.29 C	10.60 A	9.26 B	10.02 A	9.29 B	
Leaflet area (cm2)												
100% organic manure	22.80 ij	28.00 b	27.19 d	22.57 j	27.17 d	25.55 B	23.79 g	27.59 d	29.06 b	21.97 jk	25.62 e	25.61 B
75% organic man. + 25% mineral fert.	24.39 g	28.47 a	28.51 a	25.31 f	27.50 cd	26.84 A	24.37 f	29.83 a	27.33 d	24.60 f	28.55 c	26.94 A
50% organic man.. + 50% mineral fert.	23.68 h	25.85 e	27.82 bc	24.27 g	23.10 i	24.94 B	22.54 hi	29.06 b	25.39 e	22.92 h	21.76 k	24.33 C
25% organic man. + 75% mineral fert.	24.09 gh	24.44 g	20.42 l	23.68 h	26.13 e	23.75 C	22.39 ij	25.66 e	21.71 k	24.62 f	28.30 c	24.54 C
100% mineral fertilizer	20.76 l	22.60 j	19.07 m	21.93 k	27.62 bc	22.40 D	18.58 m	23.91 g	19.07 l	22.16 l-k	25.31 e	21.81 D
Mean**	23.15 C	25.87 A	24.60 B	23.55 C	26.31 A		22.33 D	27.21 A	24.51 C	23.26 D	25.91 B	
Leaves dry weight (gm)												
100% organic manure	9.14 k	9.54 h	8.27 p	9.50 h	9.81 g	9.25 B	9.05 jk	10.08 d	9.44 h	8.86 lm	9.91 ef	9.47 B
75% organic man. + 25% mineral fert.	10.07 e	10.37 c	10.22 d	10.61 a	10.51 b	10.36 A	10.36 c	10.70 b	10.69 b	10.40 c	11.11 a	10.65 A
50% organic man.. + 50% mineral fert.	8.79 m	9.02 l	9.12 k	9.25 j	8.18 q	8.87 C	9.32 hi	9.75 g	9.15 j	9.10 jk	9.83 fg	9.43 B
25% organic man. + 75% mineral fert.	9.41 l	9.89 f	8.59 n	9.36 i	8.81 m	9.21 B	8.98 kl	9.98 de	9.83 fg	9.20 ij	9.41 h	9.48 B
100% mineral fertilizer	8.42 o	8.57 n	8.81 m	8.32 p	8.97 l	8.62 D	8.74 m	9.15 j	8.90 l	8.56 n	9.10 jk	8.89 C
Mean**	9.17 CD	9.48 A	9.00 D	9.41 AB	9.26 BC		9.29 C	9.93 A	9.60 B	9.22 C	9.87 AB	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

*,** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

Table (4): Cont. :

Treatments	No. of leaves/shoot											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	10.07 fg	9.43 hi	11.17 b	9.40 i	7.71 op	9.55 B	9.16 de	7.73 jk	9.63 c	8.60 f	8.26 gh	8.68 B
75% organic man. + 25% mineral fert.	10.72 c	10.32 ef	11.90 a	10.44 de	9.31 i	10.54 A	10.18 b	8.49 fg	10.55 a	9.01 e	9.31 d	9.50 A
50% organic man.. + 50% mineral fert.	10.00 g	8.31 lm	10.67 cd	6.56 r	8.68 k	8.84 C	8.06 hi	7.80 ij	8.00 h-j	8.16 h	7.26 lm	7.86 C
25% organic man. + 75% mineral fert.	9.00 j	5.30 t	9.66 h	7.86 no	7.66 op	7.90 D	7.11 mn	6.06 o	8.70 f	7.73 jk	6.93 n	7.31 C
100% mineral fertilizer	7.47 p	5.91 s	8.36 l	6.93 q	8.08 mn	7.35 E	7.23 lm	7.03 mn	6.83 n	7.50 kl	8.03 hi	7.32 C
Mean**	9.45 B	7.85 C	10.35 A	8.24 C	8.29 C		8.35 AB	7.42 C	8.74 A	8.20 AB	7.96 BC	
Treatments	No. of fruits/shoot											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	11.34 b	10.27 d	9.73 e	8.41 hi	9.46 f	9.84 B	10.77 c	10.13 f	9.43 ij	8.53 o	9.51 hi	9.67 C
75% organic man. + 25% mineral fert.	11.40 b	9.21 g	10.25 d	8.05 j	10.27 d	9.83 B	9.28 jk	9.32 jk	10.75 c	8.96 mn	10.10 f	9.68 C
50% organic man.. + 50% mineral fert.	10.53 c	10.40 cd	10.22 d	9.25 g	9.63 ef	10.01 B	10.47 de	10.62 cd	10.70 c	9.18 kl	9.66 gh	10.13 B
25% organic man. + 75% mineral fert.	11.90 a	11.48 b	11.29 b	9.73 e	11.46 b	11.17 A	11.63 a	11.38 b	11.51 ab	9.74 g	10.45 e	10.94 A
100% mineral fertilizer	8.31 i	8.51 h	10.40 cd	7.10 k	9.46 f	8.76 C	9.10 lm	8.90 n	10.00 f	7.63 p	9.56 hi	9.04 D
Mean**	10.70 A	9.97 C	10.38 AB	8.50 D	10.06 BC		10.22 A	9.81 B	10.50 A	9.06 C	9.85 B	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

*, ** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

Table (5): Effect of mineral fertilizers and organic manure on nut characteristics of the studied pecan cultivars during 2002& 2003 seasons.

Treatments	Nut																							
	Av. length (cm)												Av. width (cm)											
	2002						2003						2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	2.23 p	3.50 i	3.69 h	4.58 b	4.07 ef	3.61 C	3.00 m	3.97 d	3.13 k	4.00 d	3.79 e	3.58 B	1.94 m	2.58 c	2.11 l-k	2.15 hi	2.26 g	2.21 B	2.11 l	2.94 b	2.02 n	2.73 e	2.30 l	2.42 A
75% organic man. + 25% mineral fert.	3.72 h	4.05 f	3.19 m	4.97 a	3.54 l	3.89 A	3.07 l	3.80 e	3.23 j	4.10 c	3.81 e	3.60 B	2.34 e	2.60 c	1.75 op	2.92 a	2.56 c	2.43 A	2.00 o	2.76 d	2.13 l	2.80 c	2.24 j	2.38 A
50% organic man. + 50% mineral fert.	3.25 l	3.86 g	3.13 m	4.38 c	2.66 n	3.45 D	2.57 o	3.67 fg	3.03 lm	4.17 b	3.72 f	3.43 C	2.18 h	2.10 jk	1.78 o	2.66 b	1.98 i	2.14 BC	1.97 p	2.46 g	1.98 op	2.52 f	2.16 k	2.22 B
25% organic man. + 75% mineral fert.	3.43 j	4.12 de	3.27 l	4.58 b	3.34 k	3.75 B	3.29 i	4.14 bc	3.55 h	4.46 a	4.11 c	3.91 A	2.11 jk	2.40 d	1.73 p	2.23 g	2.10 jk	2.11 C	1.93 q	2.97 a	2.23 j	2.38 h	2.44 g	2.39 A
100% mineral fertilizer	3.41 j	3.72 h	3.25 l	4.16 d	2.54 o	3.41 D	3.63 g	3.51 h	3.20 j	4.16 b	2.71 n	3.44 C	2.13 ij	2.30 f	1.83 n	2.35 e	2.08 k	2.14 BC	1.98 p	2.07 m	1.85 r	2.22 j	2.18 k	2.06 C
Mean **	3.21 C	3.85 B	3.30 C	4.53 A	3.23 C		3.11 E	3.82 B	3.23 D	4.18 A	3.63 C		2.14 B	2.39 A	1.84 C	2.46 A	2.19 B		2.00 E	2.64 A	2.04 D	2.53 B	2.26 C	
	Shape index (L:W ratio)												Av. weight (gm)											
100% organic manure	1.14 q	1.35 no	1.74 fg	2.12 a	1.79 de	1.63 B	1.41 k	1.34 m	1.55 g	1.45 j	1.64 e	1.48 B	4.79 q	7.54 ef	7.57 ef	7.82 d	5.45 n	6.63 C	5.08 q	7.20 g	6.73 k	8.03 b	6.00 m	6.61 B
75% organic man. + 25% mineral fert.	1.58 kl	1.55 l	1.82 d	1.69 h	1.37 n	1.60 B	1.53 gh	1.37 l	1.51 hi	1.45 j	1.69 cd	1.51 B	5.19 o	8.28 c	7.60 e	8.46 b	5.87 m	7.08 B	4.90 r	7.51 e	7.08 h	8.61 a	5.85 o	6.79 A
50% organic man. + 50% mineral fert.	1.49 m	1.83 d	1.75 f	1.63 l	1.33 o	1.61 B	1.30 n	1.49 l	1.52 gh	1.65 e	1.72 c	1.53 B	4.37 s	7.21 g	6.38 j	7.49 f	4.96 p	6.08 D	4.67 s	7.03 h	5.91 n	7.33 f	5.52 p	6.09 C
25% organic man. + 75% mineral fert.	1.62 ij	1.71 gh	1.88 c	2.05 b	1.59 j-l	1.77 A	1.69 cd	1.38 kl	1.58 f	1.87 a	1.67 d	1.64 A	5.44 n	8.69 a	7.82 d	8.74 a	5.98 l	7.33 A	5.53 p	7.77 c	7.57 d	6.90 i	5.93 n	6.74 A
100% mineral fertilizer	1.59 jk	1.61 i-k	1.77 ef	1.76 ef	1.22 p	1.59 B	1.83 b	1.68 d	1.72 c	1.80 a	1.24 o	1.67 A	4.28 t	6.88 i	6.24 k	7.02 h	4.66 r	5.82 E	4.46 t	6.83 j	6.19 l	7.05 h	4.93 r	5.89 D
Mean**	1.48 C	1.61 B	1.79 A	1.85 A	1.46 C		1.55 B	1.45 C	1.57 B	1.66 A	1.59 B		4.81 E	7.72 B	7.12 C	7.91 A	5.38 D		4.93 E	7.27 B	6.69 C	7.85 A	5.65 D	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

* ** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

Table (6): Effect of mineral fertilizers and organic manure on kernel characteristics of the studied pecan cultivars during 2002& 2003 seasons.

Treatments	Kernel Oil (%)											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	59.00 h	52.00 p	60.33 g	62.00 d	56.00 mn	57.87 C	60.33 e	50.00 n	58.00 g	62.67 c	52.67 l	56.73 C
75% organic man. + 25% mineral fert.	60.33 g	55.67 n	61.67 de	63.67 b	58.33 ij	59.93 B	62.00 d	51.00 m	60.33 e	64.00 b	56.00 i	58.67 B
50% organic man.. + 50% mineral fert.	62.00 d	58.67 hi	63.00 c	66.67 a	61.33 ef	62.33 A	63.00 c	53.33 k	62.00 d	67.00 a	58.00 g	60.67 A
25% organic man. + 75% mineral fert.	58.00 j	51.00 q	58.67 hi	61.00 f	57.00 k	57.13 C	60.67 e	49.00 o	57.33 h	62.00 d	54.00 j	56.60 C
100% mineral fertilizer	56.33 lm	48.67 r	56.67 kl	60.00 g	53.33 o	55.00 D	57.67 gh	46.67 p	53.67 jk	59.00 f	49.33 o	53.27 D
Mean**	59.13 C	53.20 E	60.07 B	62.67 A	57.20 D		60.73 B	50.00 E	58.27 C	62.93 A	54.00 D	
Kernel Av. Weight (gm)												
100% organic manure	2.98 r	4.68 f	4.82 a	3.81 g	2.95 i	3.85 C	2.14 w	3.70 k	3.42 n	3.70 k	2.46 w	3.14 D
75% organic man. + 25% mineral fert.	3.10 q	5.41 b	4.90 d	3.97 i	2.99 r	4.07 B	2.84 t	4.21 g	4.62 e	3.95 i	3.27 o	3.78 B
50% organic man.. + 50% mineral fert.	2.46 u	3.84 j	3.69 t	3.24 p	2.26 v	3.10 A	2.98 s	5.03 b	4.80 d	4.18 h	3.14 q	4.02 A
25% organic man. + 75% mineral fert.	3.39 n	5.64 a	4.98 c	4.187 h	3.33 o	4.30 A	3.19 p	5.19 a	4.91 c	3.63 l	3.08 r	4.00 A
100% mineral fertilizer	2.65 s	4.48 g	3.76 k	3.62 m	2.53 t	3.41 D	2.71 v	4.34 f	3.58 m	3.82 j	2.76 u	3.44 C
Mean**	2.91 D	4.81 A	4.43 B	3.76 C	2.81 D		2.83 E	4.49 A	4.26 B	3.85 C	2.94 D	
Kernel % of total nut												
100% organic manure	54.74 de	59.83 c	63.78 a	50.61 h	54.19 ef	56.63 B	55.97 i	58.52 g	68.66 a	49.17 q	54.50 kl	57.36 B
75% organic man. + 25% mineral fert.	53.52 fg	59.76 c	59.13 c	50.20 h	50.97 h	54.72 B	58.01 gh	61.75 e	60.51 f	52.09 no	49.97 p	56.47 B
50% organic man.. + 50% mineral fert.	55.49 d	63.97 a	64.49 a	48.00 ij	50.87 h	56.57 B	60.73 f	66.97 c	67.84 b	52.53 n	53.61 m	59.53 A
25% organic man. + 75% mineral fert.	62.46 b	64.55 a	63.63 a	48.19 i	55.73 d	58.91 A	57.82 h	66.79 c	64.90 d	52.63 n	51.88 o	58.80 A
100% mineral fertilizer	52.71 g	54.69 de	59.10 c	47.09 j	48.57 i	52.43 C	54.86 jk	54.19 l	55.30 j	48.51 r	49.86 p	53.35 C
Mean**	55.78 B	60.56 A	62.03 A	48.82 D	52.07 C		57.48 C	61.64 B	63.44 A	50.99 D	51.96 D	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

*,** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

application of the combination between half recommended rates of (O.M.) & (NPK) fertilizers or 75 % (O.M.) + 25 % (NPK) treatments exerted higher positive effect on flesh oil content. The average kernel weight and % of total nut were significantly greater in Choct. cv. followed by Desi. in both seasons (except for % of total nut in 2nd season). Besides, heavier fruits were obtained from adding 50 % of both investigated fertilizers or the combination between them as 25 % (O.M.) + 75 % (NPK). In addition, kernel characteristics responded significantly to the interaction between cultivar and tested treatments. In this respect, Graking trees treated with half recommended rates of organic & mineral fertilizers produced the richest kernel oil content and % of total nut, while Graking & Choctaw treated with the recommended rates of NPK mineral fertilizers took the other way around. Nevertheless, the heaviest kernels were closely related to Choctaw trees subjected to 25 % (O.M.) + 75 % (NPK) treatment in both studied seasons.

This superiority may be attributed to the favorable effect of mixed organic manure with mineral fertilizers which reserved the sufficient amounts of N and K for plant development. Moreover, the addition of organic manure to the soil encouraged proliferation of soil microorganisms, increased microbial populations and activity of microbial enzymes i.e. dehydrogenase, urease and nitrogenase. These results agree with those obtained by (Smith *et al.*, 2000) on pecan, (El-Kobbia, 1999; Obreza & Ozores, 2000; Fuad *et al.*, 2002; Tayeh, 2003 and Helail *et al.*, 2003) on citrus, (Zaghloul, 2002); on potato plants and (Haggag, 1996) on olive trees.

3. Leaf chemical composition:

A. Photosynthetic pigments:

With respect to leaves chlorophyll (A & B) contents (Table, 7), cultivars differed significantly in both years of study i.e., leaves of Des. cv. (in 1st season) and Graking cv. (in 2nd season) were significantly the richest in chlorophyll (A) content, whereas Choctaw leaves were the richest in chlorophyll (B) during both seasons. Meanwhile, using 25% (O.M.) + 75% (NPK) gave statistically higher records of chlorophyll (A) while, application of (O.M.) either solely or combined at 75% with (NPK) fertilizers at 25% exerted statistically the highest stimulate effect on leaves chlorophyll (B) in both seasons. Regarding the interaction, Desi. trees treated with 25% (O.M.) + 75% (NPK) showed significantly the highest values of chlorophyll (A) content, while, Choct. trees treated with 100% (O.M.) had the richest leaves in chlorophyll (B) content. These results are in agreement with those were reported by El-Morshedy (1997); Sorial & Abd El-Fattah (1998) and Soliman (2001).

B. Mineral composition:

Data concerning the effect of organic and mineral NPK-fertilizers on leaf N, P, K, Zn, Mn, & Fe contents during 2002 & 2003 seasons are presented in Tables (8 & 9). Regarding the effect of cultivars, the highest N (in both seasons) & Mn (in 2nd season) contents were recorded in Choct. trees, while leaves of Grazona trees contained larger amounts of Zn (in both seasons) and Fe (especially in 1st season) contents. Hence, no significant differences were obvious in leaves P & K contents of all tested cvs. In view of the effect of tested treatments, the

Table (7): Effect of mineral fertilizers and organic manure on leaves chlorophyll (A,B) mg/g Wt. of the studied pecan cultivars during 2002& 2003 seasons.

Treatments	Chlorophyll (A) mg/g F.W.											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	0.98 n	1.26 i	1.43 d	1.38 e	1.32 fg	1.27 B	1.08 m	1.36 e	1.53 b	1.44 c	1.18 ij	1.32 B
75% organic man. + 25% mineral fert.	0.94 o	1.18 k	1.49 b	1.33 f	1.27 i	1.24 B	1.01 n	1.28 gh	1.19 i	1.41 d	1.16 kl	1.21 C
50% organic man. + 50% mineral fert.	0.93 o	1.10 m	1.31 g	1.29 h	1.14 l	1.15 C	0.91 p	1.17 jk	1.15 l	1.29 gh	0.96 o	1.09 D
25% organic man. + 75% mineral fert.	1.11 m	1.32 fg	1.61 a	1.45 c	1.38 e	1.37 A	1.18 l-j	1.30 g	1.59 a	1.60 a	1.28 h	1.39 A
100% mineral fertilizer	0.88 q	0.90 p	1.25 i	1.23 j	0.98 n	1.05 D	0.98 o	1.19 i	1.37 e	1.32 f	1.07 m	1.18 C
Mean**	0.97 E	1.15 D	1.42 A	1.34 B	1.22 C		1.03 E	1.26 C	1.36 B	1.41 A	1.13 D	
Treatments	Chlorophyll (B) mg/g F.W.											
100% organic manure	0.65 j	0.98 a	0.86 d	0.91 c	0.67 i	0.81 A	0.69 l	0.92 a	0.81 e	0.87 c	0.72 ij	0.80 A
75% organic man. + 25% mineral fert.	0.61 k	0.94 b	0.84 e	0.87 d	0.61 k	0.78 A	0.68 l	0.90 b	0.77 f	0.85 d	0.71 jk	0.78 A
50% organic man. + 50% mineral fert.	0.55 m	0.83 e	0.71 h	0.84 e	0.55 m	0.69 B	0.61 no	0.80 e	0.64 m	0.75 gh	0.63 mn	0.68 B
25% organic man. + 75% mineral fert.	0.49 o	0.78 g	0.65 j	0.72 h	0.51 n	0.63 C	0.57 p	0.73 hi	0.60 o	0.70 kl	0.54 q	0.63 C
100% mineral fertilizer	0.51 no	0.80 f	0.78 g	0.78 fg	0.57 l	0.69 B	0.64 m	0.76 fg	0.71 jk	0.75 g	0.61 o	0.69 B
Mean**	0.56 D	0.86 A	0.77 C	0.82 B	0.58 D		0.64 C	0.82 A	0.71 B	0.78 A	0.64 C	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

*, ** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

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Table (8): Effect of mineral fertilizers and organic manure on leaves N, P&K contents of the studied pecan cultivars during 2002 & 2003 seasons.

Treatments	N (%)											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	2.43 lm	2.95 b	2.44 l	2.30 o	2.43 l	2.51 D	2.49 n	2.82 c	2.39 q	2.21 s	2.47 o	2.48 D
75% organic man. + 25% mineral fert.	2.79 d	2.71 ef	2.81 c	2.70 f	2.66 g	2.73 A	2.86 b	2.78 e-g	2.79 d-f	2.63 i	2.77 f-h	2.76 A
50% organic man.. + 50% mineral fert.	2.59 i	2.64 h	2.34 n	2.63 h	2.58 i	2.55 C	2.61 j	2.50 mn	2.34 r	2.59 k	2.65 i	2.54 C
25% organic man. + 75% mineral fert.	2.64 h	2.78 d	2.44 l	2.53 j	2.73 e	2.62 B	2.76 h	2.76 gh	2.41 p	2.55 l	2.79 de	2.65 B
100% mineral fertilizer	2.50 k	2.99 a	2.78 d	2.41 m	2.44 l	2.62 B	2.51 in	2.93 a	2.80 d	2.38 q	2.50 mn	2.63 B
Mean**	2.59 B	2.81 A	2.56 B	2.51 C	2.57 B		2.65 B	2.76 A	2.54 C	2.47 D	2.64 B	
	P (%)											
100% organic manure	0.380 b-f	0.356 g	0.370 e-g	0.386 a-f	0.366 fg	0.37 A	0.366 de	0.370 c-d	0.390 a-c	0.360 e	0.383 a-d	0.37 A
75% organic man. + 25% mineral fert.	0.403 a	0.356 g	0.400 ab	0.380 b-f	0.400 ab	0.38 A	0.386 a-d	0.366 de	0.393 ab	0.390 a-c	0.396 a	0.39 A
50% organic man.. + 50% mineral fert.	0.380 b-f	0.390 a-e	0.390 a-e	0.390 a-e	0.386 a-f	0.38 A	0.386 a-d	0.380 a-e	0.400 a	0.380 a-e	0.396 a	0.39 A
25% organic man. + 75% mineral fert.	0.396 a-c	0.376 c-g	0.396 a-c	0.393 a-d	0.400 ab	0.39 A	0.400 a	0.386 a-d	0.400 a	0.383 a-d	0.390 a-c	0.39 A
100% mineral fertilizer	0.380 b-f	0.370 e-f	0.373 d-g	0.400 ab	0.370 e-g	0.37 A	0.373 b-e	0.380 a-e	0.383 a-d	0.366 de	0.380 a-e	0.38 A
Mean**	0.37 A	0.38 A	0.38 A	0.39 A	0.38 A		0.38 A	0.38 A	0.39 A	0.38 A	0.39 A	
	K (%)											
100% organic manure	1.03 j-l	1.00 mn	1.00 m-o	1.03 j-l	0.99 no	1.01 B	1.02 h	1.01 h	1.00 hi	0.99 i	1.01 h	1.00 B
75% organic man. + 25% mineral fert.	1.12 bc	1.10 de	1.11 cd	1.06 gh	1.10 de	1.10 A	1.11 bc	1.08 e	1.13 a	1.06 f	1.08 e	1.09 A
50% organic man.. + 50% mineral fert.	1.08 ef	1.13 ab	1.05 hi	1.10 cd	1.08 ef	1.09 A	1.09 de	1.11 cd	1.08 e	1.09 de	1.09 de	1.09 A
25% organic man. + 75% mineral fert.	1.11 cd	1.15 a	1.08 fg	1.12 bc	1.12 bc	1.11 A	1.13 a	1.13 ab	1.10 c-e	1.10 c-e	1.10 c-e	1.11 A
100% mineral fertilizer	1.02 k-m	1.04 h-j	0.98 o	1.01 lm	1.03 i-k	1.02 B	1.05 fg	0.99 i	1.02 h	1.00 hi	1.04 g	1.02 B
Mean**	1.07 A	1.08 A	1.04 A	1.06 A	1.06 A		1.08 A	1.06 A	1.06 A	1.04 A	1.06 A	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

*,** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

Table (9): Effect of mineral fertilizers and organic manure on leaves Zn, Mn & Fe contents of the studied pecan cultivars during 2002 & 2003 seasons.

Treatments	Zn (%)											
	2002						2003					
	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*	Cv1	Cv2	Cv3	Cv4	Cv5	Mean*
100% organic manure	63.33 w	81.33 t	86.67 r	85.00 s	89.00 q	81.0 E	57.00 p	54.00 q	77.00 l	86.00 k	86.67 k	72.13 E
75% organic man. + 25% mineral fert.	109.3 i	111.0 g	107.3 j	124.7 a	124.7 a	115.5 A	107.0 f	95.00 j	100.0 hi	120.0 a	120.3 a	108.5 B
50% organic man.. + 50% mineral fert.	103.3 l	114.0 e	112.7 f	110.0 h	123.0 b	112.6 B	102.3 g	110.0 d	115.7 b	114.7 c	110.0 d	110.5 A
25% organic man. + 75% mineral fert.	105.0 k	97.00 m	94.00 n	119.0 d	121.0 c	107.2 C	101.7 g	69.67 n	108.0 e	99.67 i	114.0 c	98.60 C
100% mineral fertilizer	79.00 u	76.67 v	90.33 p	91.00 o	109.3 i	89.07 E	86.33 k	67.00 o	86.00 k	71.00 m	100.7 h	82.20 D
Mean**	92.0 E	96.0 D	98.2 C	105.9 B	113.4 A		90.87 C	79.13 D	97.33 B	98.27 B	106.3 A	

Mn (%)												
100% organic manure	81.33 s	93.33 p	68.33 u	189.0 e	84.33 r	103.3 D	187.0 o	195.0 n	203.3 j	202.0 k	197.0 m	196.9 C
75% organic man. + 25% mineral fert.	117.3 i	115.0 j	111.0 k	219.0 b	122.7 f	137.0 A	203.3 j	222.7 d	227.3 c	212.0 g	220.3 e	217.1 A
50% organic man.. + 50% mineral fert.	101.0 o	120.3 g	118.0 i	235.0 a	119.3 h	138.7 A	211.3 g	236.7 a	215.0 f	229.0 b	203.3 j	219.1 A
25% organic man. + 75% mineral fert.	110.0 l	106.7 m	90.00 q	213.0 c	118.0 i	127.5 B	196.0 mn	200.0 l	220.7 e	204.3 j	210.0 h	206.2 B
100% mineral fertilizer	94.00 f	80.33 t	82.00 s	193.7 d	104.7 n	110.9 C	182.3 p	195.7 n	207.3 i	200.3 l	200.0 l	197.1 C
Mean**	100.7 D	103.1 C	93.87 E	209.9 A	109.8 B		196.0 D	210.0 B	214.7 A	209.5 B	206.1 C	

Fe (%)												
100% organic manure	87.67 s	88.67 qr	88.33 r	89.00 q	99.00 m	90.53 D	85.00 r	91.00 p	95.00 n	93.00 o	101.7 j	93.13 C
75% organic man. + 25% mineral fert.	110.0 f	104.3 i	110.3 f	98.67 m	119.3 b	108.5 B	110.0 d	103.3 i	103.7 i	96.33 m	110.7 c	104.8 A
50% organic man.. + 50% mineral fert.	115.0 d	116.0 c	113.3 e	104.3 l	109.0 g	111.5 A	100.0 k	115.7 b	108.0 e	100.0 k	106.0 g	105.9 A
25% organic man. + 75% mineral fert.	102.0 j	98.00 n	105.0 h	101.0 k	110.0 f	103.2 C	105.0 h	100.0 k	100.0 k	103.3 i	105.0 h	102.7 B
100% mineral fertilizer	95.00 o	121.0 a	91.67 t	109.0 g	100.0 l	103.3 C	90.00 q	118.3 a	100.0 k	106.7 f	99.00 l	102.8 B
Mean**	101.9 C	105.6 B	101.7 C	100.4 D	107.5 B		98.00 D	105.7 A	101.3 B	99.87 C	104.5 A	

Means of each factor (cultivars & fertilization treatments) and their combinations in each season having the same letter / s are not significantly different at 5% level.

Cv1, Cv2, Cv3, Cv4, Cv5 refer to Cape Fear cv; Choctaw cv; Desirable cv; Graking cv and Grazona cv, respectively.

*, ** refer to specific effect of fertilization treatments and pecan cultivar, respectively.

highest level of N content was observed in 75% (O.M.) + 25% (NPK) treatment in the first season and 25% (O.M.) + 75% (NPK) in the second one. However, P in leaves of pecan trees didn't significantly respond to fertilizer treatments. In addition, all combinations between OM & mineral fertilizers resulted in a positive remarkably effect on leaf K content. Leaf Zn significantly increased with increasing the levels of OM (except for 100% organic manure treatment) in 1st season and with 50% (O.M.) + 50% (NPK) treatment in 2nd season. On the other hand, high Mn & Fe levels were obtained from fertilizing pecan trees with either 50% OM + 50% mineral fertilizer or 25% OM + 75% mineral fertilizer. It is worth to mention here that the lowest N, Zn, Mn & Fe contents were obtained from treated plants with 100% organic manure in the two seasons of the experiment. Regarding the interaction between cvs. and tested treatments, Choct. trees treated with the recommended dose of mineral fertilizers had the highest N & Fe contents, whereas 25% of OM + 75% NPK when applied to Choct. trees recorded the highest K values. Moreover, Grak. or Graz. cvs. were the richest in Zn content when treated with 75% (O.M.) + 25% (NPK) fertilizers in both seasons. On the other hand, Grak. (in 1st season) and Choct. (in 2nd season) trees provided with 50% of both OM & NPK exhibited the highest values of Mn content.

From the above results it might be concluded that organic manure is an important source of macro and micronutrients. Moreover, adding organic manure as fertilizer led to decreasing soil pH which results in increasing solubility of nutrients and nutrients availability to the plants.

These results are in accordance with Youssef *et al.*, (2001); Fuad *et al.*, (2002); Kassem & Marzouk, (2002); Tayeh, (2003) and Helail *et al.*, (2003).

Generally it could be conclude that, applying organic manure at 15 or 5 kg. /tree and combined with mineral NPK fertilizer at 3.75, 1.5 & 1.5 or 1.25, 0.5 & 0.5 kg. /tree, respectively, could be safely recommended to improve pecan productivity and quality under the same conditions of our study.

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تأثير التسميد العضوى و خفض الأسمدة المعدنية على نمو، جودة الثمار والمحتوى المعدني لأشجار الليمون

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أجريت تجربة حقلية فى مزرعة قها البحثية (محافظة القليوبية) خلال موسمى ٢٠٠٢، ٢٠٠٣ لدراسة تأثير الأسمدة المختلفة: المعدنية (سلفات الأمونيوم، سلفات البوتاسيوم، سوپر فوسفات الكالسيوم) أو العضوية و الخليط بينهما على نمو، جودة الثمار والمحتوى المعدنى للأوراق لخمس أصناف من أشجار الليمون (كيب فير، شيكتاوا، ديزايرابل، جراكنج، جرازونا). أظهرت النتائج المتحصل عليها أن أعلى قيم لأطوال الأفرع، الوزن الجاف للأوراق فى صنفى شيكتاوا، جراكنج، بينما أظهر صنف ديزايرابل أعلى قيم لعدد الأوراق/الفرع، بالنسبة لمساحة الورقة فقد سجلت أعلى قيم لها فى صنفى شيكتاوا، جرازونا، كذلك أعطت أفرع كيب فير، ديزايرابل أعلى عددا للثمار/الأفرع. بالنسبة لصفات النمو (عدد الأوراق/الفرع، مساحة الورقة، الوزن الجاف للأوراق) فقد سجلت أعلى قيم لها عند المعاملة ب ٧٥ % سماد عضوى + ٢٥ % سماد معدنى ، ومن جهة أخرى فقد تفوقت معاملة ٢٥ % سماد عضوى + ٧٥ % سماد معدنى بالنسبة لعدد الثمار/الأفرع، طول الأفرع. كذلك فقد حققت إضافة السماد العضوى تحسین صفات الثمار وخاصة عند إضافة ٢٥ %، ٧٥ % من السماد المعدنى. كانت قياسات طول الثمرة، عرضها، شكلها وكذلك % للزيت فى اللحم أعلى معدلاتها فى صنف جراكنج. أما أعلى زيادة فى وزن اللحم ، % اللحم بالنسبة للثمرة كانت فى صنف شيكتاوا. أدت إضافة مخلوط نصف المعدل الموصى به لكلا من السماد العضوى والسماد المعدنى إلى زيادة معنوية فى % للزيت فى اللحم. إضافة التسميد العضوى بنسبة ٢٥ % + ٧٥ % من السماد المعدنى أعطت أعلى زيادة فى محتوى الأوراق من كلوروفيل (أ). كانت أعلى قيم للنيتروجين، المنجنيز، كلوروفيل (ب) فى أوراق صنف شيكتاوا، كما تميزت أوراق صنف جرازونا بمحتواها الأعلى من عنصرى الحديد والزنك. تفوقت معاملة ٧٥ % تسميد عضوى + ٢٥ % تسميد معدنى بمحتواها الأعلى من النيتروجين (الموسم الأول)، كلوروفيل (ب)، أما عنصر الفوسفور فلم يستجيب معنويا لمعاملات التسميد المختلفة. كانت هناك زيادة معنوية ملحوظة فى معاملات الخلط بين التسميد العضوى والمعدنى. أدت زيادة معدل التسميد العضوى (فيما عدا معاملة ١٠٠ %) فى الموسم الأول، ٥٠ % تسميد عضوى + تسميد معدنى إلى زيادة محتوى الأوراق من عنصر الزنك. كذلك تميزت معاملتى ٥٠ % لكلا من التسميد العضوى والمعدنى ، وكذلك ٢٥ % التسميد العضوى + ٧٥ % التسميد المعدنى بالمحتوى الأعلى من عنصرى المنجنيز والحديد.