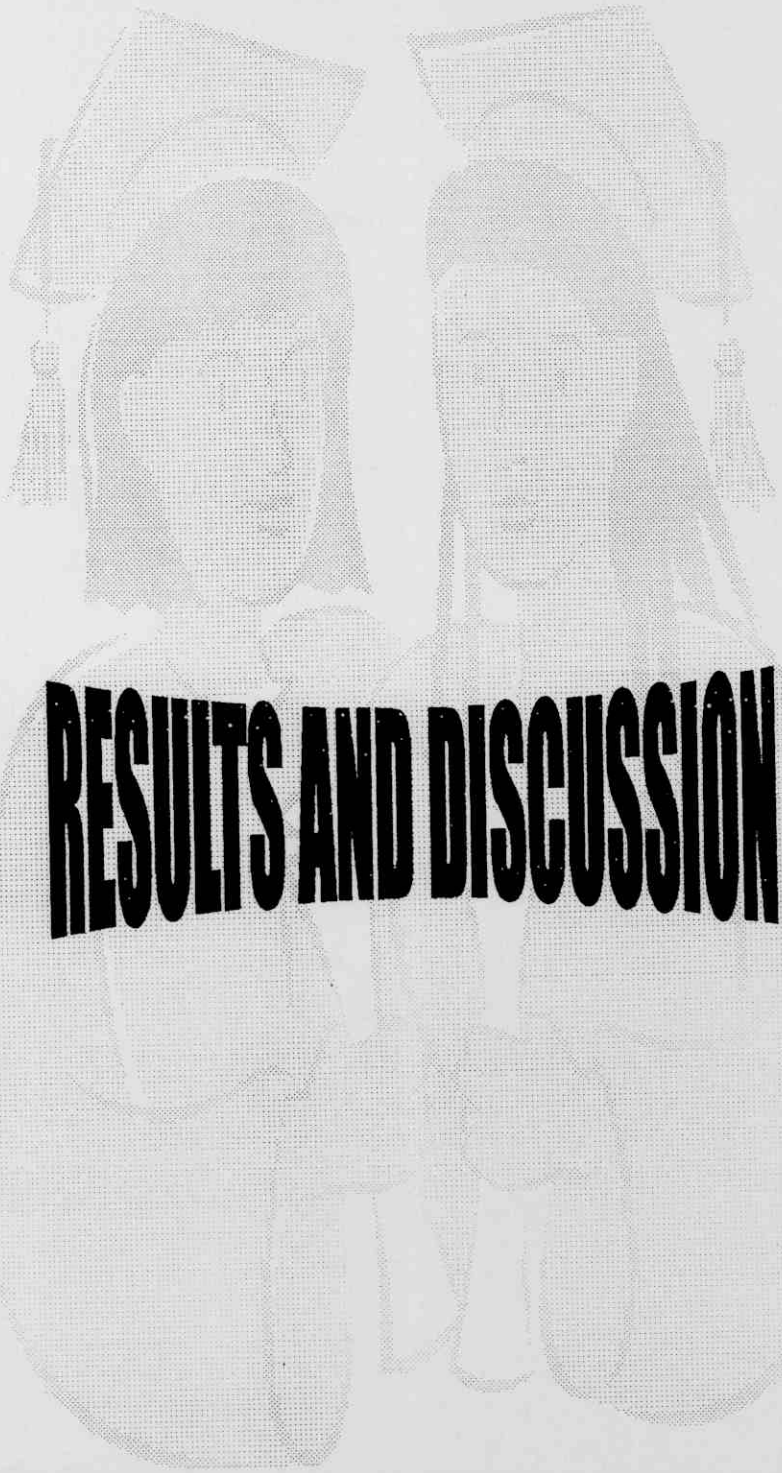

RESULTS AND DISCUSSION

4-RESULTS and DISCUSSION

Experiment I

Effect of nitrogen fertilizer source, form and rate on tree growth, leaf nutrient content, fruiting and fruit quality of Manzanillo olive trees during "Off" years.

4.1.1. Tree Growth

The effect of nitrogen fertilizer source, form and rate on some growth parameters i.e shoot length increase, number of leaves per shoot, leaf surface area, leaf shape index and dry weight of Manzanillo olive trees during an expected "Off" years (1999 & 2001) is reported in Tables (4, 5 and 6).

4.1.1.1. Shoot length increase

It is quite evident from Table (4) that fertilizing Manzanillo olive trees with different forms of slow release nitrogen fertilizers succeeded in enhancing shoot growth (8.98&8.75cm) as compared with those fertilized with different forms of fast release nitrogen fertilizers (7.91 & 7.84cm) in 1999 and 2001 seasons, respectively.

Furthermore, the higher rate of nitrogen fertilizers(300g N/ tree/ year) surpassed the lower one (200g N/tree/year) in increasing shoot length, hence shoot length of high rate fertilized trees recorded (8.66&8.59cm) against (8.23 & 7.99cm) for those fertilized with lower rate in 1999 and 2001 seasons, respectively.

Table (4): Specfic effect of nitrogen fertilizer source and rate on some growth parameters of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	Shoot length (cm)		No. of leaves/ shoot		Leaf area (cm)²		Leaf index (L/D)		chlorophyll (mg)100g fresh wt. (a)		(b)		Leaf dry wt. (mg)	
	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source														
Fast release N. fertilizers	7.91 b	7.84 b	13.7 b	13.5 b	2.26 b	2.36 b	4.27 a	4.28 a	5.86 b	5.97 b	2.29 b	2.31 b	141 b	148 b
Slow releae N. fertilizers	8.98 a	8.75 a	14.6 a	14.5 a	2.38 a	2.48 a	4.28 a	4.28 a	6.10 a	6.21 a	2.32 a	2.36 a	153 a	158 a
Effect of nitrogen fertilizer rate														
200 g / tree / year	8.23 b	7.99 b	13.2 b	13.1 b	2.29 b	2.40 b	4.27 a	4.28 a	5.79 b	5.90 b	2.29 b	2.32 b	132 b	139 b
300 g / tree / year	8.66 a	8.59 a	15.1 a	15.0 a	2.36 a	2.44 a	4.28 a	4.28 a	6.17 a	6.28 a	2.32 a	2.35 a	162 a	168 a

Means within each column for eacch factor followed by the same letter (s) are not significantly different at 5% level.

As for the interaction between nitrogen fertilizer source and nitrogen rate, Table (5) shows that the source of nitrogen fertilizer was responsible for the net effect of the interaction on shoot length increase of Manzanillo olive trees. Consequently, olive trees fertilized with the higher nitrogen fertilizer rate as a slow release fertilizers recorded the highest values of shoot length increments (9.26&9.19 cm), followed descendingly by those fertilized with the lower rate of the same source (slow release N- fertilizers) (8.70 & 8.31 cm) in 1999 and 2001 seasons, respectively. On the other hand, the higher rate of fast release N- fertilizers induced more positive effect than the lower one of the same nitrogen fertilizer source (fast release N fertilizers).

In addetion, Table (6) reveals that the higher rates (300g N/tree / year) of slow release N- fertilizers i-e phosphorus coated urea (PCU), urea formaldehyde (UF) and Bentonite coated urea (BCU) induced descendingly the highest values of shoot length increments. Besides, the lower rate of the aforementioned slow release nitrogen fertilizers (PCU, UF and BCU) came next in their positive effect on shoot length increment and took the similar trend of the higher rate of these fertilizers. Moreover, the higher and lower rates of fast release N- fertilizers (ammonium sulphate, ammonium nitrate and urea) took the same pattern of the analogous ones of slow release N-fertilizers regarding shoot length increment during 1999 and 2001 seasons.

4.1.1.2. No. of leaves/shoot

It is clear from Table (4) that slow release N fertilized trees produced higher number of leaves (14.5&14.6 leaves/shoot) as compared with the corresponding ones fertilized with fast release N.

Table (5): Effect of interaction between nitrogen fertilizer source form and rate on some growth parameters of Manzanillo olive trees during "Off" years (1999 & 2001).

N. fertilizer source	N. rate	Shoot length (cm)		No. of leaves/ shoot		Leaf area (cm)		Leaf index (L/D)		chlorophyll (mg)100g fresh wt. (a)		(b)		Leaf dry wt. (mg)	
		1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N. fertilizers	200g	7.57 d	7.68 d	12.9 d	12.9 c	2.26 c	2.37 c	4.27 a	4.28 a	5.70 d	5.81 d	2.29 b	2.31 b	127 d	133 d
	300g	8.07 c	7.99 c	14.4 b	14.2 b	2.26 c	2.36 c	4.27 a	4.28 a	6.01 b	6.12 b	2.28 b	2.31 b	155 b	163 b
Slow release N. fertilizers	200g	8.70 b	8.31 b	13.4 c	13.3 c	2.31 b	2.42 b	4.28 a	4.28 a	5.87 c	5.98 c	2.29 b	2.32 b	137 c	144 c
	300g	9.26 b	9.19 a	15.8 a	15.8 a	2.45 a	2.53 a	4.28 a	4.28 a	6.33 a	6.43 a	2.36 a	2.39 a	170 a	178 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table(6): Effect of interaction between nitrogen fertilizer source form and rate on some growth parameters of Manzanillo olive trees during "Off" year (1999 & 2001).

Treatment			Shoot length (cm)		No. of leaves/ shoot		Leaf area (cm)		Leaf index (L/D)		chlorophyll (mg)100g fresh wt. (a)		(b)		Leaf dry wt. (mg)	
N. source	N. form	N. rate	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	7.75 j	7.69 j	13.0 i	13.1 i	2.25 c	2.36 c	4.28 a	4.29 a	5.70 h	5.81 h	2.29 b	2.31 b	130 j	137 j
		300g	8.25 g	8.18 g	14.8 d	14.6 d	2.27 c	2.35 c	4.26 a	4.28 a	6.10 d	6.21 h	2.28 b	2.32 b	159 d	165 c
	NH_4NO_3	200g	7.90 i	7.80 i	13.0 i	13.0 i	2.26 c	2.37 c	4.26 a	4.27 a	5.72 h	5.83 h	2.30 b	2.31 b	125 k	131 l
		300g	8.05 h	7.98 h	14.4 e	14.2 e	2.27 c	2.36 c	4.28 a	4.28 a	6.02 e	6.12 e	2.28 b	2.30 b	155 e	162 c
	$(NH_2)_2CO$	200g	7.60 k	7.54 k	12.7 j	12.5 i	2.27 c	2.38 c	4.27 a	4.27 a	5.69 h	5.80 h	2.30 b	2.32 b	125 k	132 l
		300g	7.90 i	7.82 i	14.0 f	13.7 f	2.25 c	2.36 c	4.29 a	4.27 a	5.93 f	6.04 f	2.29 b	2.31 b	150 f	161 l
Slow release N fertilizers	PCU	200g	8.91 d	8.85 d	13.7 g	13.4 g	2.32 b	2.43 b	4.28 a	4.28 a	5.89 g	6.00 g	2.28 b	2.31 b	141 g	148 j
		300g	9.46 a	9.40 a	16.3 a	16.2 a	2.46 a	2.57 a	4.27 a	4.30 a	6.46 a	6.57 a	2.36 a	2.39 a	175 a	182 i
	UF	200g	8.70 e	7.64 e	13.4 h	13.5 h	2.31 b	2.43 b	4.26 a	4.28 a	5.87 g	5.98 g	2.29 b	2.32 b	137 h	144 l
		300g	9.22 b	9.15 b	15.8 b	16.9 b	2.44 a	2.54 a	4.27 a	4.27 a	6.33 b	6.42 b	2.35 a	2.39 a	170 b	177 l
	BCU	200g	8.50 f	8.43 f	13.1 i	13.0 i	2.30 b	2.41 b	4.28 a	4.28 a	5.86 g	5.97 g	2.30 b	2.33 b	133 I	140 i
		300g	9.10 c	9.02 c	15.3 c	15.4 c	2.46a	2.47 b	4.29 a	4.27 a	6.20 c	6.31 c	2.36 a	2.39 a	164 c	161 c

Means within each column, followed by the same letter (s) are not significant different at 5% level.

fertilizers (13.7 & 13.5 leaves/shoot) in 1999 and 2001 seasons, respectively.

Moreover, Manzanillo olive trees fertilized with higher nitrogen rate (300g/tree/year) gave comparatively higher number of leaves per shoot (15.1 & 15.0 leaves/shoot) than the analogous ones received the lower rate (200g/tree/year) of nitrogen fertilizer (13.2 & 13.1 leaves/ shoot) in 1999 and 2001 seasons, respectively, (Table, 4).

Furthermore, Table (5) demonstrates that number of produced leaves per shoot responded significantly to the interaction between nitrogen fertilizer source and nitrogen fertilizer rate, hence the higher rate of slow release N fertilizers caused a material increment in number of produced leaves per shoot, followed descendingly by the same rate of fast release N fertilizers. Besides, the lower rate of slow release N fertilizer induced higher positive effect on number of leaves per shoot than did the analogous rate of fast release N fertilizers in the first season, only.

Finaly, the interaction between the different nitrogen fertilizer sources, forms and rate shows that the higher rate of slow release N fertilizers (PCU, UF and BCU), followed descendingly by the higher rate of fast release N fertilizers (ammonium sulphate, ammonium nitrate and urea) gave the highest number of leaves per shoot. However, significant differences were pronounced between the previously mentioned combinations. Additionally, the lower rate of both slow and fast release N. fertilizers took the same pattern of the high rate of both nitrogen fertilizer sources in both seasona of study, (Table, 6).

4.1.1.3. Leaf surface area

It is obvious from Table (4) that slow release N fertilized trees produced leaves with larger surface area (2.38 & 2.48cm²) than those produced by fast release N fertilized trees (2.26 & 2.36cm²) in 1999 and 2001 seasons, respectively.

Furthermore, leaves of Manzanillo olive trees received higher N fertilizer rates had larger surface area (2.36 & 2.44cm²) than the corresponding ones of olive trees fertilized with the lower rate (2.29 & 2.40 cm²) in 1999 and 2001 seasons, respectively.

As for the interaction between nitrogen fertilizer source and rate, Table (5) reveals that nitrogen fertilizer source was responsible for the announce of the final interaction results in this respect. Thereupon, the higher rate of slow release N fertilizers caused a remarkable increment in leaf area, followed descendingly by the lower rate of the same nitrogen fertilizer source (slow release N fertilizers). On the other hand, both lower and higher rates of fast release N fertilizers induced similar lower positive effect on leaf surface area from the statistical standpoint.

Lastly, the interaction between the different nitrogen fertilizer sources, forms and rates exerted that the higher rate of PCU and UF (slow release N. fertilizers) induced similarly the highest values of leaf surface area. Besides, the lower rate of PCU and UF as well as both rates of BCU came next in this descending order and produced statistically similar effect in this respect. Moreover, the lower and higher rates of fast release N.

fertilizers(ammonium sulphate, ammonium nitrate and urea) produced similar effect in this concern,(Table, 6).

4.1.1.4. Leaf shape index

Tables (4, 5 and 6) demonstrate that nitrogen fertilizer source (fast and slow release N. fertilizers), nitrogen fertilizer forms (ammonium sulphate, ammonium nitrate and urea) and (PCU, UF and BCU) as well as their combinations induced meaningless effect on leaf shape index (L/D) of Manzanillo olive trees during an expected "Off" years (1999 and 2001).

4.1.1.5. Leaf chlorophyll (a&b)

Table (4) shows that leaves of slow release N. fertilized trees were richer in their chlorophyll content (a&b) than the analogous ones of fast release N. fertilized trees in 1999 and 2001 seasons. However, the differences were obvious to be significant.

Furthermore, Manzanillo olive trees enriched with higher rate of nitrogen fertilizers (300g/tree/year) produced leaves higher in their chlorophyll content (a&b) than did those received lower rate of nitrogen fertilizer.

In addition, the interaction between nitrogen fertilizer source and rate induced a remarkable effect on leaf chlorophyll content (a&b), (Table, 5). However, higher rate of slow release N. fertilizer significantly increased leaf chlorophyll content , followed descendingly by the same rate of fast release N. fertilizer in 1999 and 2001 seasons. Besides lower rate of slow release nitrogen fertilizer surpassed the same rate of fast release N. fertilizer in enhancing leaf chlorophyll content of Manzanillo olive trees.

Finaly, out of all combinations resulted from interaction between different nitrogen fertilizer source and rate, the higher rate of PCU, UF and BCU (slow release N. fertilizer) induced statistically similar higher values of leaf chlorophyll content (a & b) in 1999 and 2001 seasons. The other tested combination exerted similar effect on leaf chlorophyll content from the statistical standpoint.

4.1.1.6. Leaf dry weight

It is clear from Table (4) that leaves of slow release N. fertilized trees were heavier in their dry weight than the corresponding ones of fast release N. fertilized ones. The differences were more obvious to be significant.

Additionally, Manzanillo olive trees fertilized with higher rate of nitrogen fertilizer produced heavier leaves in their dry weight than those produced by trees fertilized with lower rate of nitrogen fertilizer (Table,4).

Furthermore, the interaction between nitrogen fertilizer source and rate reveals that higher rate of slow release N. fertilizers induced higher positive effect on leaf dry weight followed descendingly by higher rate of fast release N. fertilizers. On the other hand, the lower rate of slow release N. fertilizers surpassed the lower rate of fast release N. ferttilizers in enhancing leaf dry weight, (Table, 5).

Lastly, the interaction between the different nitrogen fertilizer sources, forms and rates reveals that the higher rate of PCU, FU and BCU (slow release N. fertilizers) exerted statistically the highest positive effect in descending order, followed by the higher

rate of fast release N. fertilizers (ammonium sulphate, ammonium nitrate and urea) in the same descending order. Besides, lower and higher rates of slow and fast release N. fertilizers followed the same pattern of higher rate of both slow and fast release N. fertilizers, (Table, 6).

The effect of slow release N. fertilizers in improving growth of olive trees might be attributed to their effect on regulating the release of their own nitrogen at the proper time as the plant need. Also, they gave the highest values of residual N. due to their low acidity index, while soluble ones gave the lowest values of available N. left in the soil. In addition, the role of N. as a constituent of amino acids and protein as well as its importance in cell division and development of meristematic tissues (Mengel and Kirkby, 1987).

4.1.2. Leaf mineral content

Tables (7,8 and 9) show the response of leaf N, P, K, Ca, Mg, S,Fe, Mn, Zn and Cu content of Manzanillo olive trees during Off years (1999 & 2001) to nitrogen fertilizer source and rate as well as their interactions.

4.1.2.1. Nitrogen

It is obvious from Table (7) that leaves of slow release N fertilized trees had higher values of nitrogen content (1.63 & 1.70%) against (1.51 & 1.56%) for fast release N- fertilized trees in 1999 and 2001 seasons, respectively.

Furthermore, Manzanillo olive trees received higher rate of nitrogen fertilizer(300g/tree/year) scored higher values of leaf nitrogen content as compared with those received lower rate of

Table (7): Specfic effect of nitrogen fertilizer source and rate on leaf N, P, K, Ca and Mg content of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	Elements concentration in dried leaves (%)									
	Nitrogen		Phosphorus		Potassium		Calcium		Magnesium	
	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source										
Fast release N. fertilizers	1.51 b	1.56 b	0.15 b	0.18 b	1.02 b	1.11 b	1.08 b	1.11 b	0.11 b	0.11 b
Slow releae N. fertilizers	1.63 a	1.70 a	0.25 a	0.27 a	1.29 a	1.37 a	1.70 a	1.75 a	0.15 a	0.14 a
Effect of nitrogen fertilizer rate										
200 g / tree / year	1.54 b	1.60 b	0.18 b	0.21 b	1.10 b	1.20 b	1.32 b	1.36 b	0.13 a	0.13 a
300 g / tree / year	1.61 a	1.66 a	0.22 a	0.25 a	1.22 a	1.28 a	1.45 a	1.49 a	0.14 a	0.13 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

nitrogen fertilizer in both seasons.

On the other hand, Table (8) shows that the interaction between slow release N- fertilizer with nitrogen rate exerted higher positive effect on leaf nitrogen content than did the interaction between fast release N- fertilizer and nitrogen rate. Thereupon, the higher rate of slow release N- fertilizer induced the highest values of leaf nitrogen content, followed descendingly by the lower rate of slow release N- fertilizer. On the contrary, the two tested rate of fast release N- fertilizer scored statistically similar and lower values of leaf nitrogen content in 1999 and 2001 seasons.

Finally, Table (9) demonstrates that the interaction between nitrogen fertilizer source, form and rate exerted a material effect on leaf nitrogen content in both seasons. Shortly, the combinations of slow release N- fertilizers sarpassed the corresponding ones of fast release N- fertilizers. In general, the higher rate of PCU recorded the highest values of leaf nitrogen content, followed in descending order by the higher rate of UF and BCU. The lower rate of slow release N-fertilizers followed the same pattern of effect to that of higher rate of fast release N- fertilizers on leaf nitrogen content. On the other side, all the studied combinations of fast release N- fertilizers showed statistically similar and lower values of leaf nitrogen content in 1999 and 2001 seasons.

4.1.2.2. Phosphorus

Table (7) reveals that that leaf phosphorus content of slow release N- fertilized trees was comparatively higher than that of fast release N- fertilized ones in 1999 and 2001 seasons.

Table (8): Effect of interaction between nitrogen fertilizer source and rate on leaf N, P, K, Ca, and Mg content of Manzanillo olive trees during "Off" seasons (1999 & 2001).

N. source	N. rate	Elements concentrationin in dried leaves (%)									
		Nitrogen		Phosphorus		Potassium		Calcium		Magnesium	
		1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N. fertilizers	200g	1.51 c	1.56 c	0.13 d	0.16 d	0.99 d	1.08 d	1.03 d	1.05 d	0.11 b	0.12 b
	300g	1.51 c	1.56 c	0.15 c	0.19 c	1.06 c	1.15 c	1.11 c	1.16 c	0.12 b	0.11 b
Slow release N. fertilizers	200g	1.57 b	1.63 b	0.22 b	0.26 b	1.22 b	1.35 b	1.61 b	1.67 b	0.15 a	0.14 a
	300g	1.70 a	1.76 a	0.28 a	0.29 a	1.37 a	1.40 a	1.79 a	1.81 a	0.15 a	0.14 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (9): Effect of interaction between nitrogen fertilizer source, form and rate on leaf N, P, K, Ca and Mg content of Manzanillo olive trees during "Off" year (1999 & 2001).

Treatment			Element concentrations in dried leaves (%)									
N. source	N. form	N. rate	Nitrogen		Phosphorus		Potassium		Calcium		Magnesium	
			1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	1.50 f	1.56 f	0.15 fg	0.20 e	1.05 i	1.18 g	1.39 i	1.35 h	0.11 b	0.12 b
		300g	1.51 f	1.56 f	0.17 ef	0.22 d	1.13 g	1.24 f	1.48 g	1.51 f	0.12 b	0.11 b
	NH_4NO_3	200g	1.52 f	1.57 f	0.15 fg	0.18 f	1.02 j	1.13 h	1.31 j	1.29 i	0.11 b	0.12 b
		300g	1.52 f	1.56 f	0.16 efg	0.21 de	1.11 h	1.23 f	1.44 h	1.43 g	0.12 b	0.11 b
	$(NH_2)_2CO$	200g	1.50 f	1.55 f	0.11 h	0.12 h	0.89 l	0.92 j	1.09 k	1.10 k	0.11 b	0.11 b
		300g	1.50 f	1.55 f	0.13 gh	0.14 g	0.94 k	0.97 i	1.11 k	1.12 k	0.11 b	0.11 b
Slow release N fertilizers	PCU	200g	1.60 d	1.66 d	0.24 bc	0.26 c	1.25 d	1.35 d	1.65 d	1.72 c	0.15 a	0.14 a
		300g	1.75 a	1.81 a	0.29 a	0.30 a	1.40 a	1.43 a	1.82 a	1.87 a	0.15 a	0.14 a
	UF	200g	1.55 e	1.61 e	0.22 cd	0.26 c	1.23 e	1.34 d	1.61 e	1.67 d	0.15 a	0.14 a
		300g	1.70 b	1.76 b	0.27 ab	0.30 a	1.37 b	1.40 b	1.79 b	1.80 b	0.15 a	0.14 a
	BCU	200g	1.55 e	1.62 e	0.19 de	0.25 c	1.17 f	1.30 e	1.57 f	1.62 e	0.15 a	0.14 a
		300g	1.65 c	1.72 c	0.26 b	0.28 b	1.34 c	1.37 c	1.75 c	1.77 b	0.15 a	0.14 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Additionally, leaves of Manzanillo trees received higher rate of nitrogen scored higher values of phosphorus than the analogous ones of those fertilized with lower rate of phosphorus in both seasons.(Table, 7).

On the other hand, Table (8) demonstrates that the interaction between nitrogen source and nitrogen rate caused a pronounced effect on leaf phosphorus content in both seasons. In this respect, the higher rate of slow release N- fertilizers gave higher values of leaf phosphorus content, followed descendingly by higher rate of fast release N- fertilizers. On the other side, the lower rate of slow and fast release N- fertilizers took the same trend of higher rate of both nitrogen fertilizer sources in this respect.

The interaction between nitrogen source, form and rate, Table (9) illustrates that the interactions of slow release N- fertilizers surpassed the analogous ones in enhancing leaf phosphorus content in 1999 and 2001 seasons. Briefly, the higher rate of PCU and UF scored the highest values of leaf phosphorus content, followed by the higher rate of BCU, the lower rate of PCU, UF and BCU in descending order in both seasons of study. Besides, the higher rate of ammonium sulphate, ammonium nitrate and urea scored in descending order higher positive effect on leaf phosphorus content than the corresponding ones lower nitrogen rate in 1999 and 2001 seasons.

4.1.2.3. Potassium

It is quite evident from table (7) that in 1999 and 2001 seasons, the highest leaf potassium content values were observed on

slow release N- fertilized trees than those produced by fast release N-fertilized trees.

Additionally, Manzanillo olive trees received higher rate of nitrogen fertilizer surpassed the corresponding ones fertilized with the lower rate of nitrogen fertilizers regarding leaf potassium content in 1999 and 2001 seasons.

As for the interaction between nitrogen source and rate, Table (8) demonstrates that the interactions of slow release N-fertilizers recorded higher values of leaf potassium content. Thereupon, higher rate of slow release N- fertilizers, followed by the lower rate of the same N- fertilizer source scored higher values of leaf potassium content as compared with those of fast release N-fertilizers. Besides, the higher and low rates of fast release N-fertilizers took the same trend of both high and low rates of slow release N- fertilizers in this concept.

Finally, the interaction between nitrogen source, form and rate illustrates that leaves of slow release N- fertilizers combinations recorded higher values of potassium content than the corresponding ones of fast release N- fertilizers in both seasons (Table, 9). Shortly, the higher rate of slow release N- fertilizers i-e PCU, UF and BCU proved to be the superior combinations in enhancing leaf potassium in descending order. Moreover, the low rate of the previously mentioned slow release N- fertilizer forms took the same pattern of effect to that of high rate of same nitrogen fertilizer forms. On the other side, the higher and lower rates of fast release N- fertilizer forms showed the same trend of higher and lower rates of slow release N- fertilizer forms in both seasons.

4.1.2.4. Calcium

Table (7) reveals that slow release N- fertilized trees had higher values of leaf calcium content (1.70 & 1.75%) against (1.08 & 1.11%) for those resulted from fast release N- fertilized trees in 1999 and 2001 seasons, respectively.

On the other hand, the higher leaf calcium values were observed on Manzanillo olive trees received higher rate of nitrogen fertilizers as compared with those produced by low rate fertilized ones in both seasons.

Furthermore, Table (8) the higher rate of slow release N-fertilizers, followed descendingly by the lower rate of the same N-fertilizer source scored the highest values of leaf calcium content. Besides, the higher and lower rates of fast release N- fertilizers took the same pattern of effect to those of slow release N- fertilizers in both seasons.

As for the interaction between nitrogen fertilizer source or form and rate on leaf calcium content, Table (9) demonstrates that the combinations of nitrogen fertilizer source or form took the same pattern of effect similar to that of leaf calcium content in both seasons.

4.1.2.5. Magnesium

It is clear from Table (7) that slow release N- fertilizers caused significant increase in leaf magnesium content as compared with fast release N- fertilizers in 1999 and 2001 seasons.

On the other hand, the tested nitrogen fertilizer rates failed to induce a pronounced significant effect on leaf magnesium content in both seasons.

Furthermore, Tables (8&9) show that the interaction between nitrogen fertilizer source or form and rate exerted that the interaction of slow release N- fertilizer source or form induced similar and higher values of leaf magnesium than those of fast release N- fertilizer source or form in 1999 and 2001 seasons.

4.1.2.6. Sulphur, Iron, Manganese, Zinc and Cupper

The effect of nitrogen fertilizer source (fast release N-fertilizers and slow release N- fertilizers)or nitrogen fertilizer forms namely fast release N- fertilizers (ammonium sulphate, ammonium nitrate and urea), and slow release N- fertilizers [Phosphorus coated urea (PCU), Urea formaldehyde or urea form (UF) and Bentonite coated urea (BCU)] and nitrogen fertilizer rate (400g N/tree/year and 600 g N/tree/year) as well as their combinations on leaf S, Fe, Mn, Zn and Cu content of manzanillo olive during 1999 and 2001 seasons trees is reported in tables (10, 11 and 12).

Table (10) demonstrates that leaf Sulphur, Iron, Manganese, Zinc and Cupper content of slow release nitrogen fertilized trees was statistically higher than those of fast release N- fertilized trees in 1999 and 2001 seasons.

Furthermore, Manzanillo olive trees fertilized with higher nitrogen fertilizer rate (300g N/tree/year) had leaves ncher in their S, Fe, Mn, Zn and Cu content than those received the lower nitrogen fertilizer rate (200g N/tree/year) in 1999 and 2001 seasons.

Table (10): Specfic effect of nitrogen fertilizer source and rate on leaf S, Fe, Mn, Zn and Cu content of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	Elements concentration in dried leaves									
	Sulphur (%)		Iron (ppm)		Manganese (ppm)		Zinc (ppm)		Cupper (ppm)	
	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source										
Fast release N. fertilizers	0.32 b	0.33 b	93 b	86 b	22 b	25 b	24 b	27 b	12 b	13 b
Slow releae N. fertilizers	0.36 a	0.37 a	123 a	123 a	35 a	35 a	37 a	37 a	15 a	20 a
Effect of nitrogen fertilizer rate										
200 g / tree / year	0.32 b	0.32 b	100 b	98 b	26 b	28 b	28 b	30 b	14 b	16 b
300 g / tree / year	0.37 a	0.38 a	116 a	111 a	31 a	32 a	33 a	34 a	16 a	18 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

On the other hand, Table (11) reveals that the combinations (higher and lower rates of nitrogen fertilizer) of slow release N-fertilizers surpassed the corresponding ones of fast release N-fertilizers in enhancing leaf S, Fe, Mn, Zn and Cu content of Manzanillo olive trees in both seasons (1999 & 2001). Besides, the higher rate of nitrogen fertilizer of both nitrogen fertilizer sources took the superiority in exerting more positive effect on leaf S, Fe, Mn, Zn and Cu than did the lower rate of both nitrogen fertilizer sources.

Finally, Table (12) reveals that the interactions of slow release N- fertilizer forms (PCU, UF and BCU) particularly the higher rate of nitrogen fertilizer (300g N/tree/year) induced a remarkable positive effect on leaf Sulphur, Iron, Manganese, Zinc and Cupper content of Manzanillo olive trees in 1999 and 2001 seasons with the superiority for PCU, UF and BCU in descending order, followed in the same pattern with ammonium sulphate, ammonium nitrate and urea with the superiority of higher nitrogen rate on the expense of lower nitrogen fertilizer rate. On the other hand, the higher rate of ammonium sulphate, folowed descendingly by the lower rate of the same fast release N- fertilizer form and higher rate of PCU, UF and BCU scored higher leaf sulphur content in both seasons. Other combinations recorded in between values in this respect.

Generally, leaves of slow release N. fertilized trees had higher values of nitrogen, phosphorus, potasium, calcium, mangnesium, zinc, iron, manganese and cupper than those of fast release N. fertilized ones. Besides, increasing nitrogen fertilizer rate enhanced the previously mentioned leaf mineral content. Furthermore, the

Table (11): Effect of interaction between nitrogen fertilizer source and rate on leaf S, Fe, Mn, Zn and Cu content of Manzanillo olive trees during "Off" seasons (1999 & 2001).

N. source	N. rate	Elements concentrationin in dried leaves									
		Sulphur (%)		Iron (ppm)		Manganese (ppm)		Zinc (ppm)		Cupper (ppm)	
		1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N. fertilizers	200g	0.31 b	0.31 b	83 b	80 b	20d	23 d	22 d	25 c	12 c	12 c
	300g	0.34 b	0.35 b	103 ab	92 b	23 c	27 c	25 c	29 bc	13 c	14 c
Slow release N. fertilizers	200g	0.32 b	0.33 b	117 a	115 a	32 b	33 b	34 b	35 ab	17 b	19 b
	300g	0.39 a	0.40 a	129 a	131 a	38 a	38 a	40 a	40 a	20 a	22 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (12): Effect of interaction between nitrogen fertilizer source, form and rate on leaf S, Fe, Mn, Zn and Cu content of Manzanillo olive trees during "Off" year (1999 & 2001).

Treatment			Elements concentration in dried leaves									
N. source	N. form	N. rate	Sulphur (%)		Iron (ppm)		Manganese (ppm)		Zinc (ppm)		Cupper (ppm)	
			1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	0.46 b	0.49 b	100 h	93 i	23 i	28 h	25 i	30 h	13 h	14 h
		300g	0.51 a	0.53 a	122 d	109 g	27 g	33 e	29 g	35 e	15 f	16 f
	NH_4NO_3	200g	0.27 h	0.27 h	92 i	89 j	22 j	26 i	24 j	28 i	12 I	13 i
		300g	0.29 gh	0.30 g	119 e	102 h	25 h	30 g	27 h	32 g	14 g	15 g
	$(NH_2)_2CO$	200g	0.19 i	0.18 j	58 k	59 l	17 l	17 k	19 l	19 k	10 j	11 j
		300g	0.21 i	0.22 i	69 j	66 k	19 k	18 j	21 k	20 j	10 j	11 j
Slow release N fertilizers	PCU	200g	0.35 ef	0.36 e	119 e	120 d	35 d	34 d	37 d	36 d	17 d	20 c
		300g	0.41 c	0.43 c	133 a	134 a	40 a	40 a	42 a	42 a	22 a	22 a
	UF	200g	0.32 fg	0.33 f	117 f	115 e	33 e	33 e	35 e	35 e	17 d	19 d
		300g	0.40 cd	0.39 d	129 b	131 b	38 b	38 b	40 b	40 b	20 b	22 a
	BCU	200g	0.30 gh	0.31 g	114 g	110 f	29 f	32 f	31 f	34 f	16 e	18 e
		300g	0.37 de	0.38 d	125 c	128 c	37 c	36 c	39 c	38 c	18 c	21 b

Means within each column followed by the same letter (s) are not significantly different at 5% level.

tested forms of slow release N. fertilizers particularly PCU followed by UF and finally BCU exerted higher positive on the aforementioned leaf mineral content than did the tested forms of fast release N. fertilizer forms (ammonium sulphate, ammonium nitrate and urea). On the centrary, urea form induced the least positive effect in this concern.

4.1.3. Tree blooming

The effect of nitrogen fertilizer source (fast release or slow release N. Fertilizers), forms (ammonium sulphate, ammonium nitrate and urea) and (PCU, UF and BCU) and rate (200g N/tree/year or 300g N/tree/year) as well as their combinations on some blooming parameters i-e No. of inflorescences per meter, No. of flowers/ inflorescences and perfect flowers percentage (sex expression) of Manzanillo olive trees during "Off" years (1999&2001) is presented in Table (13, 14 and 15).

4.1.3.1. No. of inflorescences per meter

Table (13) declares that in 1999 and 2001 seasons, slow release N fertilized trees produced higher number of inflorescences per meter (32.60 & 34.60) against (15.96 & 20.30) for fast release N. fertilized trees in 1999 and 2001 seasons, respectively.

Furthermore, nitrogen fertilizer rate induced a pronounced effect on No. of inflorescences per meter of Manzanillo olive trees in both seasons, hence the trees received higher nitrogen fertilizer rate (300g N/tree/year) gave higher number of inflorescences per meter than the corresponding ones received the lower nitrogen fertilizer rate (200g N/tree/year).

Table (13): Specfic effect of nitrogen fertilizer source and rate on some blooming parameters of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	No. of inflorescences/ meter		No. of flwers / inflorescence		Perfect flowers (%)	
	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source						
Fast release N. fertilizers	15.96 b	20.30 b	06.8 b	05.7 b	13.17 b	14.15 b
Slow releae N. fertilizers	32.60 a	34.60 a	16.0 a	14.9 a	17.35 a	18.03 a
Effect of nitrogen fertilizer rate						
200 g / tree / year	19.93 b	24.67 b	10.0 b	08.9 b	14.33 b	15.28 b
300 g / tree / year	28.63 a	30.25 a	12.8 a	11.7 a	16.27 a	16.90 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

As for the interaction between nitrogen source and rate on number of inflorescences per meter, Table (14) illustrates that nitrogen fertilizer rate induced meaningless effect on No. of inflorescences per meter and the final result to the interaction between nitrogen source and rate was attributed to nitrogen source. Thereupon, the combinations of slow release N. fertilizers i.e higher and lower rates of nitrogen fertilizer exerted similarly higher positive effect on number of inflorescences per meter than did the interactions of fast release N. fertilizers.

Regarding the effect of interaction between nitrogen fertilizer source, form and rate on No. of inflorescences per meter, Table (15) reveals that, in general the combinations of slow release N. fertilizers surpassed the analogous ones of fast release N. fertilizers in exerting higher positive effect in this respect. The higher N. rates of PCU, UF and BCU induced higher values of number of inflorescences per meter in descending order, the lower N rate of the previously mentioned slow release N. fertilizers took the same pattern of effect of those of higher N rates in this concern. Also, the combination factors of fast release N. fertilizers took typically the same trend of those of slow release N. fertilizers .

4.1.3.2. No. of flowers/inflorescence

It is clear from Table (13) that inflorescence of slow release N. fertilized trees had higher number of flowers (16.0 & 14.9) against (6.8 & 5.7) for those arised from fast release N. fertilized trees in 1999 and 2001 seasons, respectively.

Table (14): Effect of interaction between nitrogen fertilizer source and rate on some blooming parameters of Manzanillo olive trees during "Off" seasons (1999 & 2001).

N. source	N. rate	No. of inflorescences/ meter		No. of flwers / inflorescence		Perfect flowers (%)	
		1999	2001	1999	2001	1999	2001
Fast release N. fertilizers	200g	11.20 c	17.67 b	05.40 d	04.30 d	12.63 c	13.77 c
	300g	20.73 b	22.93 b	08.13 c	07.03 c	13.70 c	14.53 c
Slow release N. fertilizers	200g	28.67 a	31.67 a	14.68 b	13.58 b	16.03 b	16.80 b
	300g	36.53 a	37.57 a	17.37 a	16.27 a	18.83 a	19.27 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (15): Effect of interaction between nitrogen fertilizer source, form and rate on some blooming parameters of Manzanillo olive trees during "Off" year (1999 & 2001).

N. source	N. form	N. rate	No. of inflorescences/ meter		No. of flwers / inflorescence		Perfect flowers (%)	
			1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	13.10 g	21.20 i	06.8 h	05.7 h	14.2 f	15.4 g
		300g	26.87 e	27.80 g	09.9 g	08.8 g	15.5 e	15.6 f
	NH_4NO_3	200g	12.20 h	19.70 j	06.2 i	05.1 i	13.2 g	14.3 h
		300g	26.20 f	27.10 h	09.8 g	08.7 g	14.3 f	15.5 fg
	$(NH_2)_2CO$	200g	08.30 j	12.10 i	03.2 k	02.1 k	10.5 i	11.6 j
		300g	09.10 i	13.90 k	04.7 j	03.6 j	11.3 h	12.5 i
Slow release N fertilizers	PCU	200g	29.80 c	36.20 d	15.9 d	14.8 d	16.7 c	17.8 c
		300g	37.10 a	38.10 a	18.3 a	17.2 a	19.7 a	19.8 a
	UF	200g	29.30 d	29.90 e	15.0 e	13.9 e	15.9 d	16.4 d
		300g	36.80 a	37.90 b	17.1 b	16.0 b	19.6 a	19.7 a
	BCU	200g	26.90 e	28.90 f	13.1 f	12.0 f	15.5 e	16.2 d
		300g	35.70 b	36.70 c	16.7 c	15.6 c	17.2 b	18.3 b

Means within each column followed by the same letter (s) are not significantly different at 5% level.

In addition, raising the nitrogen rate from 200g N/tree/year to 300gN/tree/year in "Off" years increased the number of produced flowers per inflorescence. The differences between the lower and higher N. fertilizer rate in this respect was remarkable to be significant, (Table,14).

On the other hand, the interaction between nitrogen fertilizer source and rate induced a pronounced effect on number of flowers per inflorescence (Table, 15). Generaly, the combinations of slow release N. fertilizers produced higher stinulative effect than did the corresponding ones of fast release N. fertilizers. Besides, the higher rate of slow release N. fertilizers exerted the highest values in this respect, followed descendingly by the lower rate of the same nitrogen fertilizer source. Also, the interactions of fast release N. fertilizers took the same trend of slow release N. fertilizer combinations in this concern.

As for the interaction between nitrogen fertilizer source, form and rate, Table (15) shows that the highest values of number of produced flowers per inflorescence were produced by the following treatments in descending order as follows: the higher N. rate of PCU, UF and BCU and the lower rate of PCU, UF and BCU. The higher and lower N. rates of fast release N. fertilizers showed the same pattern of effect to that of those of slow release N. fertilizers in this concern. The differences between all tested interaction were remarkable and pronounced to be significant at 5% level.

4.1.3.1. Sex expression (Perfect flowers %)

It is clear from Table (13) that high percentage of flowers of slow release N. fertilized trees were perfect (17.35 & 18.03) compared with the corresponding ones of fast release N. fertilized ones (13.17 & 14.15) in 1999 and 2001 seasons, respectively.

Furthermore, the higher nitrogen fertilizer rate (300g N/tree/year) induced higher stimulative effect on the percentage of perfect flowers (sex expression) than did the lower rate of nitrogen fertilizer in both seasons, (Table, 13).

Table (14) illustrates that the interactions of slow release N. fertilizers i.e the higher and lower rates of nitrogen fertilizers exerted higher positive effect on the percentage of perfect flowers than the corresponding ones of fast release N. fertilizers. Besides, the higher rate of nitrogen fertilizer recorded higher percentage of perfect flowers than its corresponding of the same nitrogen fertilizer source. Moreover, the higher and lower rates of nitrogen fertilizer of fast release N. fertilizers scored statistically similar values in this concern.

Finally, the interaction between nitrogen fertilizer source, form and rate demonstrates that the combinations of slow release N. fertilizers (PCU, UF and BCU with their N. rate) surpassed the analogous ones of fast release N. fertilizers in enhancing the percentage of perfect flowers in 1999 and 2001 seasons. Shortly, the higher N. rates of PCU and UF produced statistically similar and higher values of perfect flowers, followed descendingly by higher N. rate of BCU and lower N. rate of PCU, UF and BCU. On the other

hand, the two N. rates of ammonium sulphate gave the highest values as compared with those of ammonium nitrate or urea. On the contrary, the two N. rates of urea scored the lowest values in this concern.

In summary, slow release N. fertilized trees produced higher number of inflorescences per meter, higher number of flowers per inflorescence and higher perfedt flowers percentage than the analogous ones fertilized with fast release N. fertilizers. Besides, the studied blooming parameters responded significantly to the increase in nitrogen fertilizer rate, hence the higher N. fertilizer rate (300g N/tree/year) recorded the highest values of the previously mentioned blooming parameters than did the lower nitrogen fertilizer rate (200g N/tree/year). Furthermore, the tested forms of slow release nitrogen fertilizers (PCU, UF and BCU) surpassed the tested forms of fast release N. fertilizers (ammonium sulphate, ammonium nitrate and urea) in exerting higher positive effect on the studied tree blooming parameters. Briefly, PCU proved to be the superior slow release N. fertilizer form, followed descendingly by UF and BCU. On the contrary, urea showed to be the least efficient fast release N. fertilizer form in this respect.

The effect of slow release N. fertilizers on stimulating tree blooming may be due to their release of own nitrogen over a long period of time so that the nitrates will be absorbed by the roots during the entire growing period of the plant (Allen, 1984 and Travis, 1971). Such long duration of N supply throughout the growing season is reffected on adjusting and controlling the

nutritional status of the tree which resulted finally in better blooming (Winkler, 1965).

4.1.4. Tree fruiting

Table (16, 17 and 18) show the effect of nitrogen fertilizer source (fast or slow release N. fertilizers), nitrogen fertilizer form: ammonium sulphate, ammonium nitrate and urea (fast release N. fertilizer forms) and PCU, UF and BCU (slow release N. fertilizer forms) and nitrogen fertilizer rate (200 or 300g /tree/year) on some fruiting parameters i.e fruit set percentage, number of fruits per tree and yield (kg)per tree of Manzanillo olive trees during "Off" years (1999&2001).

4.1.4.1. Fruit set percentage

It is clear from Table (16) that flowers of slow release N. fertilized trees produced higher percentage of fruits than those of fast release N. fertilized ones in 1999 and 2001 seasons.

Furthermore, raising nitrogen fertilizer rate from 200 to 300g/tree/ year greatly enhanced fruit set percentage of Manzanillo olive trees.

In addition, Table (17) illustrates that the interactions of slow release N. fertilizers surpassed the corresponding ones of fast release N. fertilizers. Besides, the higher N. rate of both slow and fast release N. fertilizers induced higher positive effect than the lower rate of both nitrogen fertilizer source.

Lastly, the interaction between nitrogen fertilizer source, form and rate demonstrates that all interactions of slow release N. fertilizer forms induced higher positive effect on fruit set percentage

Table (16): Specfic effect of nitrogen fertilizer source and rate on some fruiting parameters of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	fruit set (%)		fruit shedding (%)		No. of fruit/ tree		yield (kg)/ tree	
	1999	2001	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source								
Fast release N. fertilizers	3.75 b	4.37 b	8.8 a	9.1 a	7794 a	8523 a	24.50 b	26.59 b
Slow releae N. fertilizers	6.93 a	6.61 a	5.2 b	5.5 b	6910 b	6176 b	31.50 a	29.71 a
Effect of nitrogen fertilizer rate								
200 g / tree / year	4.82 b	5.31 b	7.7 a	8.0 a	7152 b	7350 a	25.92 b	26.62 b
300 g / tree / year	5.86 a	5.67 a	6.3 b	6.6 b	7552 a	7349 a	30.08 a	29.67 a

Means within each column for each factor followed by the same letter (s) are not significantly different at 5% level.

Table (17): Effect of interaction between nitrogen fertilizer source and rate on some fruiting parameters of Manzanillo olive trees during "Off" seasons (1999 & 2001).

N. source	N. rate	fruit set (%)		fruit shedding (%)		No. of fruit/ tree		yield (kg)/ tree	
		1999	2001	1999	2001	1999	2001	1999	2001
Fast release N. fertilizers	200g	3.40 d	4.12 d	10.0 a	10.3 a	7286 a	8101 ab	22.33 c	24.00 a
	300g	4.09 c	4.62 c	7.6 b	7.9 b	8303 a	8946 a	26.67 b	29.17 a
Slow release N. fertilizers	200g	6.23 b	6.51 b	5.4 c	5.7 c	7018 a	6600 b	29.50 b	29.25 a
	300g	7.62 a	6.71 a	4.9 d	5.2 d	6802 a	5752 c	33.50 a	30.17 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

than the corresponding ones of fast release N. fertilizer forms. Briefly, the higher rate of PCU and UF gave the highest values of fruit set percentage followed descendingly by the lower rate of PCU and UF. Moreover, the combinations of fast release N. fertilizer forms recorded lower values of fruit set percentage particularly the two tested rates of urea.

4.1.4.2. Fruit shedding percentage

It is quite clear from Table (16) that fertilizing Manzanillo olive trees with nitrogen in the form of slow release succeeded in reducing fruit shedding percentage rather than in fast release form.

Moreover, raising nitrogen fertilizer rate induced a pronounced effect on reducing fruit shedding percentage.

In addition, Table (17) shows that the higher rate of slow release N. fertilizers, followed by the lower rate of the same nitrogen fertilizer sour exerted higher reducing effect on reducing fruit shedding percentage than both rates of fast release N. fertilizers.

Lastly, the interactions of slow release N. fertilizer forms succeeded in reducing fruit shedding percentage than the corresponding ones of fast release N. fertilizer forms. Briefly, the higher rate of PCU, UF and BCU scored the lowest values of fruit shedding percentage, followed ascendingly by the lower rate of the previously mentioned nitrogen fertilizer forms, followed the same pattern of effect of those of the higher rate of slow release N. fertilizer forms. Also, the lower and higher rate of the tested forms of ammonium sulphate, ammonium nitrate and urea took the same trend of slow release N. fertilizers, (Table, 18).

Table (18): Effect of interaction between nitrogen fertilizer source, form and rate on some fruiting parameters of Manzanillo olive trees during "Off" years (1999 & 2001).

Treatments			fruit set (%)		fruit shedding (%)		No. of fruit/ tree		yield (kg)/ tree	
N. source	N. form	N. rate	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	3.94 i	4.79 i	9.1 c	9.4 c	7367 e	9277 b	20.50 g	29.50 g
		300g	5.03 g	4.93 g	7.2 f	7.5 f	8735 b	9859 a	29.00 e	33.00 bc
	NH_4NO_3	200g	3.89 j	4.39 j	9.7 b	10.0 b	8414 c	7468 f	26.90 f	23.00 e
		300g	4.25 h	4.87 h	7.7 e	8.0 e	9394 a	8892 c	31.00 d	30.50 cd
	$(NH_2)_2CO$	200g	2.37 L	3.18 l	11.1 a	11.4 a	6076 h	7558 e	17.50 i	19.50 f
		300g	3.01 k	4.07 k	8.0 d	8.3 d	6780 f	8088 d	20.00 h	22.00 ef
Slow release N fertilizers	PCU	200g	6.65 c	6.89 c	5.1 i	5.4 i	7831 d	6445 i	32.50 c	31.00 cd
		300g	8.76 a	6.99 a	4.3 l	4.6 l	6394 g	6733 h	36.00 a	37.50 a
	UF	200g	6.39 d	6.73 d	5.4 h	5.7 h	6000 h	6250 j	30.00 e	28.25 d
		300g	7.87 b	6.95 b	4.6 k	4.9 k	6654 f	6483 i	35.00 b	35.00 ab
	BCU	200g	5.65 f	5.92 f	5.7 g	6.0 g	7222 e	7107g	26.00 f	28.50 d
		300g	6.24 e	6.20 e	4.9 j	5.2 j	7357 e	4040 e	29.50 d	20.00 f

Means within each column followed by the same letter (s) are not significantly different at 5% level.

4.1.4.3. No. of fruits/tree

It is clear from Table (16) that fast release N. fertilized trees produced higher number of fruits as compared with those received slow release N. fertilizers.

Moreover, raising nitrogen fertilizer rate succeeded in increasing number of produced fruits per tree in 1999 season only, (Table, 16).

As for the interaction between nitrogen fertilizer source and rate, Table (17) reveals that the combinations of fast release N. fertilizers induced statistically similar and higher positive effect on number of produced fruits per tree than those produced by the corresponding ones of slow release N. fertilizers.

Furthermore, Table (18) demonstrates the response of number of fruits per tree to nitrogen fertilizer source, form and rate. It is clear that the interactions of fast release N. fertilizer forms surpassed the analogous ones of slow release N. fertilizer forms in enhancing number of produced fruits per tree. However, there was no definite trend to any specific combination.

4.1.4.4. Yield (kg)/tree

Table (16) illustrates that slow release N. fertilized trees proved to be more productive trees than those received fast release N. fertilizers.

Furthermore, Manzanillo olive trees received higher nitrogen fertilizer rate (300g/tree/year) produced higher yield (kg)/tree as compared with those fertilized with (200g/tree/year) in 1999 and 2001 seasons.

Concerning the interaction between nitrogen fertilizer source, form and rate, Table (17) illustrates that the higer rate of slow release N. fertilizers induced the highest yield (kg)/tree, whereas the lower rate of fast release N. fertilizers exerted the lowest positive effect in this respect in 1999 season. Other combinations gave similar values in this concern in both seasons.

Finally, the interaction between nitrogen fertilizer source, form and rate, Table (18) reveals that in general the combinations of slow release N. fertilizer forms surpassed the corresponding ones of fast release N. fertilizers in enhancing tree yield. Briefly, the higher rate of PCU and UF recorded the highest tree yield values. On the contrery, the two rates of urea showed to be the least efficient combinations occupied an intermediate positions in this respect.

Shortly slow release N. fertilizers succeeded in enhancing fruit set percentage and tree yield (kg)/tree and reduced fruit shedding percentage. Besides, fast release N. fertilizers increased number of produced fruits per tree. Increasing nitrogen fertilization rate from 200g to 300g/tree/year induced to the wanted effects on tree fruiting parameters. In addition, the different forms of slow release N. fertilizers particularly PCU and UF enhanced the previously mentioned fruiting parameters except for number of fruits per tree, which responded positively to fast release N. fertilizers particularly ammonium sulphate combinations.

4.1.5. Fruit physical properties

Tables (19, 20 and 21) show the effect of nitrogen fertilizer source (fast or slow release N. fertilizers), nitrogen fertilizer form

ammonium sulphate, ammonium nitrate and urea and PCU, UF and BCU (slow release N. fertilizers) and nitrogen fertilizer rate (200 or 300g/tree/yea) on some fruit physical properties i.e fruit weight, size, length, diameter, shape index, flesh weight and stone weight of Manzanillo olive trees during "Off" years (1999&2001).

4.1.5.1. Fruit weight

It is quite evident from Table (19) that slow release N. fertilized trees produced heavier fruits than those resulted from fast release N. fertilized trees.

On the other hand, nitrogen fertilizer rate failed to induce any remarkable effect on fruit weight, hence the significant differences between the two tested nitrogen fertilizer rates in this respect were lacking.

Furthermore, the interaction between nitrogen fertilizer source and rate indicates that nitrogen fertilizer rate had meaningless effect in this interaction, hence both rate of slow release N. fertilizers scored statistically similar and higher values of fruit weight than the corresponding ones of fast release N. fertilizers. Besides, the two tested rates of fast release N. fertilizers gave statistically similar values in this respect.

Finally, the interaction between nitrogen fertilizer source, form and rate (Table,21) shows that the combinations of slow release nitrogen fertilizer forms surpassed the analogous ones of fast release N. fertilizer forms in enhancing fruit weight in both seasons of study. Briefly, the higher rate of PCU, followed by the higher rate of UF and lower rate of the previously mentioned two slow release N.

Table (19): Specfic effect of nitrogen fertilizer source and rate on some fruit physical properties of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	Fruit physical properties													
	weight (g)		size (cm)		length (cm)		diameter (cm)		shape index L/D		flesh weight (g)		stone weight (g)	
	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source														
Fast release N. fertilizers	3.2 b	3.1 b	2.6 b	2.5 b	1.8 b	1.6 a	1.5 a	1.5 a	1.20 b	1.07 a	2.4 b	2.3 b	0.8 a	0.8 a
Slow releae N. fertilizers	4.3 a	4.2 a	3.4 a	3.3 a	2.1 a	1.7 a	1.3 b	1.6 a	1.61 a	1.07 a	3.4 a	3.3 a	0.9 a	0.9 a
Effect of nitrogen fertilizer rate														
200 g / tree / year	3.7 a	3.6 a	2.9 a	2.8 a	1.9 a	1.7 a	1.4 a	1.5 a	1.35 a	1.13 a	2.8 b	2.7 a	0.9 a	0.9 a
300 g / tree / year	3.8 a	3.7 a	3.0 a	2.9 a	2.0 a	1.7 a	1.5 a	1.6 a	1.33 a	1.07 a	3.0 a	2.9 a	0.9 a	0.9 a

Means within each column for each factor, followed by the same letter (s) are not significantly different at 5% level.

Table (20): Effect of interaction between nitrogen fertilizer source and rate on some fruit physical properties of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Nitrogen source	Nitrogen rate	Fruit physical properties													
		weight (g)		size (cm)		length (cm)		diameter (cm)		shape index L/D		flesh weight (g)		stone weight (g)	
		1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N. fertilizers	200g	3.1 b	3.0 b	2.4 c	2.3 c	1.7 b	1.6 a	1.4 b	1.5 a	1.21 c	1.07 a	2.3 b	2.2 b	0.8 bc	0.8 bc
	300g	3.2 b	3.1 b	2.7 b	2.6 b	1.8 b	1.6 a	1.6 a	1.5 a	1.13 d	1.07 a	2.5 b	2.4 b	0.7 c	0.7 c
Slow release N. fertilizers	200g	4.2 a	4.1 a	3.4 a	3.3 a	2.0 a	1.7 a	1.3 b	1.5 a	1.53 b	1.13 a	3.3 a	3.2 a	0.9 ab	0.9 ab
	300g	4.4 a	4.3 a	3.3 a	3.2 a	2.1 a	1.7 a	1.3 b	1.6 a	1.61 a	1.07 a	3.4 a	3.3 a	1.0 a	1.0 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (21): Effect of interaction between nitrogen fertilizer source, form and rate on some fruit physical properties of Manzanillo olive trees during "Off" year (1999 & 2001).

Treatment			Fruit physical properties													
			weight (g)		size (cm)		length (cm)		diameter (cm)		shape index L/D		flesh weight (g)		stone weight (g)	
N. source	N. form	N. rate	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	3.2 ef	3.1 ef	2.4 h	2.3 h	1.9 b	1.6 a	1.5 b	1.5 a	1.26 d	1.07 a	2.3 gh	2.2 gh	0.9 bc	0.9 bc
		300g	3.3 e	3.2 e	2.9 f	2.8 f	2.0 ab	1.6 a	1.8 a	1.5 a	1.11 e	1.07 a	2.5 ef	2.4 ef	0.8 cd	0.8 cd
	NH_4NO_3	200g	3.1 fg	3.0 fg	2.5 g	2.4 g	1.7 c	1.6 a	1.4 b	1.5 a	1.21 d	1.07 a	2.4 fg	2.3 fg	0.7 d	0.7 d
		300g	3.3 e	3.2 e	2.7 f	2.8 f	1.9 b	1.6 a	1.5 b	1.5 a	1.26 d	1.07 a	2.6 de	2.5 de	0.7 d	0.7 d
	Urea	200g	3.0 g	2.9 g	2.3 i	2.2 i	1.5 d	1.5 a	1.3 cd	1.4 a	1.15 e	1.07 a	2.2 h	2.1 h	0.8 cd	0.8 cd
		300g	3.0 g	2.9 g	2.5 g	2.4 g	1.6 d	1.5 a	1.5 b	1.4 a	1.07 e	1.07 a	2.3 gh	2.2 gh	0.7 d	0.7 d
Slow release N fertilizers	PCU	200g	4.6 bc	4.5 bc	3.3 d	3.2 d	2.0 ab	1.7 a	1.3 c	1.5 a	1.53 c	1.13 a	3.6 bc	3.5 cd	1.0 ab	1.0 ab
		300g	5.0 a	4.9 a	3.4 c	3.3 c	2.1 a	1.7 a	1.4 bc	1.6 a	1.50 c	1.07 a	3.9 a	3.8 a	1.1 a	1.1 a
	UF	200g	4.5 c	4.4 c	3.4 c	3.3 c	2.0 ab	1.7 a	1.5 b	1.6 a	1.33 d	1.07 a	3.5 c	3.4 c	1.0 ab	1.0 ab
		300g	4.7 b	4.6 b	3.5 b	3.4 b	2.1 a	1.7 a	1.2 d	1.6 a	1.75 a	1.07 a	3.7 b	3.6 b	1.0 ab	1.0 ab
	BCU	200g	3.5 d	3.4 d	3.6 a	3.5 a	2.0 ab	1.6 a	1.2 d	1.5 a	1.67 b	1.07 a	2.7 d	2.6 d	0.8 cd	0.8 cd
		300g	3.5 d	3.4 d	3.1 e	3.0 e	2.1 a	1.6 a	1.2 d	1.5 a	1.75 a	1.07 a	2.7 d	2.6 d	0.8 cd	0.8 cd

Means within each column followed by the same letter (s) are not significantly different at 5% level.

fertilizer forms induced the highest positive effect in descending order. Lastly, both rates of BCU exerted statistically similar effect in this concern. On the other side, the combinations of ammonium sulphate and ammonium nitrate gave nearly more or less similar values in this respect. On the contrary, the two rates of urea induced statistically similar and lowest values of fruit weight in 1999 and 2001 seasons.

4.1.5.2. Fruit size

Table (19) shows that fruits of slow release N. fertilized trees scored higher values (3.4&3.3cm²) as compared with those produced by fast release N. fertilized trees (2.6&2.5cm²) in 1999 and 2001 seasons, respectively.

Furthermore, fruit size of Manzanillo olive trees did not show any significant response to nitrogen fertilizer rate in both seasons of study, hence the significant differences between the two tested nitrogen fertilizer rates in this respect were lacking.

As for the interaction between nitrogen fertilizer source and nitrogen fertilizer rate, Table (20) indicates that nitrogen source was the responsible for the final effect of the interaction, hence lower and higher rate of slow release N. fertilizers scored statistically similar and higher fruit size values than the analogous ones of fast release N. fertilizers. Moreover, the higher rate of fast release N. fertilizer induced higher positive effect on fruit size than did the lower rate of the same nitrogen fertilizer source.

Finally, Table (21) reveals that the interactions of slow release N. fertilizer forms showed more enhancing effect on fruit size than

those of fast release N. fertilizers. The lower rate of BCU, followed in descending order by the higher rate of UF, the lower rate of UF and the higher rate of PCU recorded the highest fruit size values in both seasons of study. The combinations of fast release N. fertilizers gave more or less similar effect in this respect.

4.1.5.3. Fruit length

Table (19) demonstrates that slow release N. fertilized trees succeeded in increasing fruit length in 1999 season, only as compared with fast release N. fertilizers.

On the other side, raising nitrogen fertilizer rate from 200g to 300g/tree/year failed to induce a pronounced effect in this respect.

Regarding the interaction between nitrogen fertilizer source and rate, Table (20) illustrates that both rates of slow release N. fertilizers exerted statistically similar and higher positive effect on fruit length than the corresponding ones of fast release N. fertilizers in 1999 season, only. On the other hand, the differences between the tested combination in this respect in 2001 season were lacking from the statistical standpoint.

Lastly, the interaction between nitrogen fertilizer source, form and rate illustrates that in general, the combinations of slow release N. fertilizers gave higher values of length than did the analogous ones of fast release N. fertilizers in 1999 season, only. Briefly, the combinations of slow release N. fertilizer forms induced statistically more or less similar effect in this respect. Moreover, in 2001 season, the different combinations failed to exert any remarkable effect in this respect, (Table,21)

4.1.5.4. Fruit diameter

Table (19) shows that fruits of fast release N. fertilized trees were wider than those produced by slow release N. fertilized ones in 1999 and 2001 seasons.

On the other hand, fruit diameter of Manzanillo olive trees did not show significant response to raising nitrogen fertilizer rate in 1999 and 2001 seasons, (Table, 20).

In addition, Table (21) demonstrates that out of all combinations between nitrogen fertilizer source and rate, the higher rate of fast release N. fertilizers gave higher positive effect on fruit diameter in 1999 season, only. Other combinations gave statistically similar values in this respect in 1999 and 2001 seasons.

Finally, the interaction between nitrogen fertilizer source, form and rate reveals that the combinations of fast release N. fertilizer forms surpassed the corresponding ones of slow release N. fertilizer forms in enhancing fruit diameter in 1999 season, only, (Table, 21). The higher rate of ammonium sulphate was the superior combination in enhancing fruit diameter. Other combination gave inbetween values in this sphere. Besides, the tested interaction failed to show any remarkable or pronounced effect on fruit diameter in 2001 season.

4.1.5.5. Fruit shape index

Table (19) illustrates that fruit of slow release N. fertilized trees were more oblong than those produced by fast release N. fertilized ones in 1999 season, only. The differences between the two

4.1.5.7. Stone weight

It is clear from Table (19) that in 1999 and 2001 seasons neither nitrogen fertilizer source nor nitrogen fertilizer rate succeeded in effecting stone weight of Manzanillo olive fruits.

In addition, the interaction between nitrogen fertilizer source and rate shows that the combinations of slow release N. fertilizers scored statically similar and higher stone weight values than the corresponding ones of fast release N. fertilizers. Also, the differences between the two tested rates in this concern were so small to reach the significance level in both seasons of study, (Table, 20).

Finally, the interaction between nitrogen fertilizer source, form and rate reveals that out of all tested combinations, the two rates of PCU and UF induced statistically similar and higher positive effect on stone weight in both seasons of study. Other studied combinations gave nearly more or less similar values in this respect from the statistical standpoint, (Table, 21).

5.1.5. Fruit chemical properties

5.1.5.1. Moisture, oil content and fatty acid fractions

The effect of nitrogen fertilizer source i.e fast release N. fertilizers or slow release N. fertilizers, nitrogen fertilizer form namely fast release N. fertilizers (ammonium sulphate, ammonium nitrate and urea) and slow release N. fertilizers (PCU, UF and BCU) and nitrogen fertilizer rate (200g N/tree/year or 300g N/tree/year) on Moisture, oil content and fatty acid fractions i.e Oleic acid (18:1), Palmitic acid (16:1), Linolenic acid (18:3), Linoleic acid (18:2) and

Arachidic acid (20:1) of Manzanillo olive fruits during 1999 and 2001 seasons (Off years) is reported in tables (22, 23 and 24).

It is quite clear from reported data in Tables (22, 23 and 24) that the tested nitrogen fertilizer sources, forms and rates as well as their combinations failed to induce any significant or remarkable effect on fruit moisture and oil content as well fatty acid fractions of Manzanillo olive during 1999 and 2001 seasons.

The studied fruit chemical properties i.e Moisture, oil content and fatty acid fractions i.e Oleic acid (18:1), Palmitic acid (16:1), Linolenic acid (18:3), Linoleic acid (18:2) and Arachidic acid (20:1) slow meaningless response to nitrogen fertilizer source (slow or fast release N. fertilizers), nitrogen fertilizer form i.e PCU, UF and BCU of slow release N. fertilizers and ammonium sulphate, ammonium nitrate and urea of fast release N. fertilizers and nitrogen fertilizer rate (200 or 300g N/tree/year in "Off" years) as well their combinations.

Briefly, slow release N. fertilizers succeeded in enhancing fruit weight, fruit size and flesh weight (in both seasons), fruit length and shape index (in 1999 season, only) and failed to affect stone weight. On the contrary, fruit diameter responded positively to fast release N. fertilizer rather than slow release N. fertilizers. On the other hand, the previously mentioned fruit physical properties showed meaningless response to nitrogen fertilizer rate. The different combinations of slow release N. fertilizer forms (particularly those of UF and PCU) enhanced the aforementioned fruit physical parameters particularly in 1999 season except for fruit diameter which responded positively to the combinations of fast

Table (22): Specfic effect of nitrogen fertilizer source and rate on fruit moisture, oil content and fatty acid fractions of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Factor	Moisture (%)		Oil content (%)		Fatty acid fractions									
					Oleic (18:1)		Palmtic (16:1)		Linolenic (18:3)		Linoleic (18:2)		Arachidic (20:1).	
	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Effect of nitrogen fertilizer source														
Fast release N. fertilizers	55.1a	54.6 a	23.7 a	22.7 a	52.8 a	53.2 a	24.9 a	25.8 a	10.2 a	10.0 a	8.5 a	8.4 a	3.9 a	3.8 a
Slow releae N. fertilizers	55.1a	54.6 a	24.2 a	22.6 a	53.2 a	53.6 a	24.9 a	25.4 a	10.1 a	10.1 a	8.4 a	8.4 a	3.9 a	3.9 a
Effect of nitrogen fertilizer rate														
200 g / tree / year	55.2a	54.7 a	23.9 a	22.6 a	52.8 a	53.3 a	24.8 a	25.5 a	10.1 a	10.1 a	8.5 a	8.4 a	3.9 a	3.9 a
300 g / tree / year	55.1a	54.6 a	24.0 a	22.6 a	53.3 a	53.5 a	25.0 a	25.7 a	10.2 a	10.0 a	8.4 a	8.4 a	3.9 a	3.9 a

Means within each column for each factor, followed by the same letter (s) are not significantly different at 5% level.

Table (23): Effect of interaction between nitrogen fertilizer source and rate on fruit moisture, oil content and fatty acid fractions of Manzanillo olive trees during "Off" seasons (1999 & 2001).

Nitrogen source	Nitrogen rate	Moisture (%)		Oil content (%)		Fatty acid fractions									
						Oleic (18:1)		Palmtic (16:1)		Linolenic (18:3)		Linoleic (18:2)		Arachidic (20:1) .	
		1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release	200g	55.3 a	54.8 a	23.6 a	22.7 a	52.6 a	53.1 a	24.7 a	25.6 a	10.1 a	10.0 a	8.5 a	8.4 a	3.9 a	3.8 a
N. fertilizers	300g	54.9 a	54.4 a	23.7 a	22.6 a	53.0 a	53.2 a	25.0 a	26.0 a	10.2 a	10.0 a	8.5 a	8.4 a	3.9 a	3.8 a
Slow release	200g	55.0 a	54.5 a	24.2 a	22.5 a	52.9 a	53.4 a	24.8 a	25.3 a	10.1 a	10.1 a	8.4 a	8.4 a	3.8 a	3.9 a
N. fertilizers	300g	55.2 a	54.7 a	24.2 a	22.6 a	53.6 a	53.9 a	25.0 a	25.4 a	10.1 a	10.0 a	8.4 a	8.4 a	3.9 a	3.9 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (24): Effect of interaction between nitrogen fertilizer source, form and rate on fruit moisture, oil content and fatty acid fractions of Manzanillo olive trees during "Off" year (1999 & 2001).

Treatment			Moisture (%)		Oil content (%)		Fatty acid fractions									
							Oleic (18:1)		Palmtic (16:1)		Linolenic (18:3)		Linoleic (18:2)		Arachidic (20:1)	
N. source	N. form	N. rate	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001	1999	2001
Fast release N fertilizers	$(NH_4)_2SO_4$	200g	55.2 a	54.7 a	23.8 a	22.8 a	52.3 a	52.4 a	24.4 a	25.6 a	10.1 a	09.9 a	8.5 a	8.4 a	4.0 a	3.9 a
		300g	54.9 a	54.4 a	23.7 a	22.5 a	53.2 a	52.8 a	25.1 a	25.8 a	10.2 a	09.8 a	8.6 a	8.5 a	3.9 a	3.8 a
	NH_4NO_3	200g	55.0 a	54.5 a	23.5 a	22.7 a	52.9 a	53.9 a	24.7 a	26.1 a	10.0 a	09.9 a	8.5 a	8.4 a	4.0 a	3.8 a
		300g	54.8 a	54.3 a	23.6 a	22.6 a	53.0 a	52.9 a	25.2 a	26.0 a	10.2 a	10.0 a	8.4 a	8.3 a	3.7 a	3.7 a
	$(NH_2)_2CO$	200g	55.7 a	55.2 a	23.5 a	22.5 a	52.7 a	53.2 a	25.0 a	25.0 a	10.1 a	10.1 a	8.5 a	8.3 a	3.8 a	3.8 a
		300g	55.1 a	54.6 a	23.9 a	22.7 a	52.8 a	53.8 a	24.8 a	26.3 a	10.2 a	10.1 a	8.4 a	8.4 a	4.0 a	3.9 a
Slow release N fertilizers	PCU	200g	55.0 a	54.5 a	24.9 a	22.5 a	52.8 a	53.7 a	24.7 a	25.1 a	10.1 a	09.9 a	8.4 a	8.3 a	3.8 a	3.8 a
		300g	54.7 a	54.2 a	24.8 a	22.9 a	53.7 a	54.8 a	25.1 a	25.2 a	10.2 a	09.9 a	8.4 a	8.4 a	3.9 a	4.0 a
	UF	200g	54.6 a	54.1 a	23.7 a	22.4 a	52.9 a	53.7 a	24.7 a	25.3 a	10.0 a	10.0 a	8.3 a	8.4 a	3.8 a	3.9 a
		300g	55.2 a	54.7 a	23.9 a	22.3 a	53.9 a	53.9 a	25.2 a	25.2 a	10.1 a	10.1 a	8.3 a	8.3 a	3.7 a	3.8 a
	BCU	200g	55.4 a	54.9 a	23.8 a	22.7 a	53.1 a	52.9 a	25.0 a	25.7 a	10.2 a	10.2 a	8.4 a	8.4 a	3.9 a	3.9 a
		300g	55.7 a	55.2 a	23.8 a	22.6 a	53.2 a	53.1 a	24.8 a	25.8 a	10.1 a	10.0 a	8.4 a	8.5 a	3.9 a	3.8 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

release N. fertilizers especially the higher rate of ammonium sulphate.

Experiment II

Effect of nitrogen fertilizer source, form and rate on tree growth, leaf nutrient content, fruiting and fruit quality of Manzanillo olive trees during "On" year.

4.2.1. Tree Growth

Some growth parameters of Manzanillo olive trees i-e shoot length increase, number of leaves per shoot, leaf surface area, leaf shape index and dry weight in response to nitrogen fertilizer source, form and rate as well as their interactions during an expected On year (2000) season are reported in Tables (25, 26 and 27).

4.2.1.1. Shoot length increase

Table (25) reveals that slow release N- fertilizers surpassed the fast release N- ones in enhancing shoot length increase during On year (2000) season.

In addition, the higher rate of nitrogen fertilizers (600gN/tree/year) succeeded in increasing shoot elongation than did the lower rate (400gN/tree/year) in On year (2000).

Referring to the interaction between nitrogen fertilizer source and rate, Table(26) shows that the source of nitrogen fertilizer was the resposible for the net effect of the interaction on shoot length

Table (25): Specfic effect of nitrogen fertilizer source and rate on some growth parameters of Manzanillo olive trees during "On" season (2000).

Factor	Shoot length increase (cm)	No. of leaves/ shoot	Leaf area (cm^2)	Leaf index (L/D)	Chlorophyll mg/100g fresh wt. (a)	Chlorophyll mg/100g fresh wt. (b)	Leaf dry weight (mg)
Effect of nitrogen fertilizer source							
Fast release N. fertilizers	5.91 b	09.7 b	2.06 b	4.26 a	5.56 b	2.09 b	121 b
Slow releae N. fertilizers	6.98 a	10.6 a	2.18 a	4.26 a	5.80 a	2.13 a	133 a
Effect of nitrogen fertilizer rate							
400 g / tree / year	6.23 b	09.2 b	2.09 b	4.26 a	5.49 b	2.09 b	112 b
600 g / tree / year	6.66 a	11.1 a	2.16 a	4.27 a	5.87 a	2.12 a	142 a

Means within each column for each factor followed by the same letter (s) are not significantly different at 5% level.

Table (26): Effect of interaction between nitrogen fertilizer source and rate on some growth parameters of Manzanillo olive trees during "On" season (2000).

N. source	N. rate	Shoot length increase (cm)	No. of leaves/ shoot	Leaf area (cm^2)	Leaf index (L/D)	Chlorophyll mg/100g fresh wt. (a)	Chlorophyll mg/100g fresh wt. (b)	Leaf dry weight (mg)
Fast release N. fertilizers	400g	5.57 d	08.9 d	2.06 c	4.26 a	5.40 d	2.09 b	107 d
	600g	6.07 c	10.4 b	2.06 c	4.27 a	5.81 b	2.08 b	135 b
Slow release N. fertilizers	400g	6.70 b	09.4 c	2.11 b	4.26 a	5.57 c	2.09 b	117 c
	600g	7.26 a	11.8 a	2.25 a	4.27 a	6.03 a	2.16 a	150 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

increase of Manzanillo olive trees. Thereupon, olive trees fertilized with higher fertilizer rate as a slow release N- fertilizer recorded higher value of shoot length increment , followed descendingly by those fertilized with the lower rate of the same source (slow release N- fertilizers). On the other side, the higher rate of fast release N-fertilizers exerted more positive effect than the lower one of the same nitrogen fertilizer source (fast release N- fertilizers).

Finally,Table(27) illustrates that the higher rates (600g N/tree/year) of slow release N- fertilizers (PCU, UF and BCU) exerted statistically the highest values of shoot length increments. Moreover, the lower rate of the aforementioned slow release N-fertilizers (PCU, UF and BCU) came next in their positive effect on shoot length increment and took similar trend of the higher rate of those fertilizers. Also, the higher and lower rates of fast release N-fertilizers (ammonium sulphate, ammonium nitrate and urea) took the same trend of the analogous ones of slow release N- fertilizers regarding shoot length increment during On year (2000).

4.2.1.2. No. of leaves/shoot

It is obvious from Table (25) that slow release N- fertilized trees produced higher number of leaves per shoot as compared with the analogous ones fertilized with fast release N- fertilizers in 2000 season.

Moreover, shoots of Manzanillo olive trees fertilized with higher nitrogen rate (600g N/tree/year) had comparatively higher number of leaves than the corresponding ones of olive trees received the lower nitrogen rate (400g N/tree/year) in 2000 season.

Table (27): Effect of interaction between nitrogen fertilizer source form and rate on some growth parameters of Manzanillo olive trees during "On" season (2000).

Treatment N. source	N. form	N. rate	Shoot length (cm)	No. of leaves/ shoot	Leaf area (cm^2)	Leaf index (L/D)	chlorophyll (mg)100g fresh wt. (a)	chlorophyll (mg)100g fresh wt. (b)	Leaf dry wt. (mg)
Fast release N fertilizers	$(NH_4)_2SO_4$	400g	5.75 j	09.0 i	2.05 c	4.26 a	5.40 h	2.09 b	110 j
		600g	6.25 g	10.8 d	2.07 c	4.26 a	5.80 d	2.08 b	139 d
	NH_4NO_3	400g	5.90 i	09.0 i	2.06 c	4.26 a	5.42 h	2.10 b	105 k
		600g	6.05 h	10.4 e	2.07 c	4.26 a	5.72 e	2.08 b	135 e
	$(NH_2)_2CO$	400g	5.60 k	08.7 j	2.07 c	4.27 a	5.39 h	2.10 b	105 k
		600g	5.90 i	10.0 f	2.05 c	4.27 a	5.63 f	2.09 b	130 f
Slow release N fertilizers	PCU	400g	6.91 d	09.7 g	2.12 b	4.26 a	5.59 g	2.08 b	121 g
		600g	7.46 a	12.3 a	2.26 a	4.27 a	6.16 a	2.16 a	155 a
	UF	400g	6.70 c	09.4 h	2.11 b	4.27 a	5.57 g	2.09 b	117 h
		600g	7.22 b	11.8 b	2.22 a	4.27 a	6.03 b	2.15 a	150 b
	BCU	400g	6.50 f	09.1 i	2.10 b	4.26 a	5.56 g	2.10 b	113 i
		600g	7.10 c	11.3 c	2.26 a	4.27 a	5.90 c	2.16 a	144 c

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Furthermore, Table (26) demonstrates that number of produced leaves per shoot responded significantly to the interaction between nitrogen fertilizer source and nitrogen fertilizer rate, hence the higher rate of slow release N- fertilizers caused a material increment in number of leaves per shoot, followed descendingly by the same rate of fast release N- fertilizers. Besides, the lower rate of slow release N- fertilizers induced higher positive effect on number of leaves per shoot than did the analogous rate of fast N- fertilizers.

Finally, the interaction between the different nitrogen fertilizer form and rate shows that the higher rate of slow release N-fertilizers (PCU, UF and BCU), followed descendingly by the higher rate of fast release N- fertilizers (ammonium sulphate, ammonium nitrate and urea) gave the highest number of leaves per shoot. However, the differences between the previously mentioned combinations were pronounced. Additionally, the lower rate of both slow and fast release N- fertilizers took the same trend of high rate of both nitrogen fertilizer sources (Table,27).

4.2.1.3. Leaf surface area

It is quite evident from Table (25) that slow release N-fertilized trees produced leaves with larger surface area than those produced by fast release N- fertilized trees in 2000 season.

Furthermore, leaves of Manzanillo olive trees received higher N- fertilizer rates had larger surface area than the corresponding ones of olive trees fertilized with the lower rate.

Regarding the interaction between nitrogen fertilizer source and rate, Table (26) shows that fertilizer source was responsible for

the announce of the final interaction results in this respect. Consequently, the higher rate of slow release N- fertilizers caused a remarkable increment in leaf area, followed descendingly by the lower rate of the same nitrogen fertilizer source (slow release N-fertilizers). On the other hand, both lower and higher rates of fast release N- fertilizers induced similar lower positive effect on leaf surface area from the statistical standpoint.

Lastly, the interaction between the different nitrogen fertilizer forms and rate indicates that the higher rate of PCU and UF (slow release N- fertilizers) induced similarly the highest values of leaf surface area. Besides, the lower rate of PCU and UF as well as both rates of BCU came next in this descending order and produced statistically similar effect in this respect. Moreover, the lower and higher rates of fast release N- fertilizers (ammonium sulphate, ammonium nitrate and urea) produced similar effect in this concern (Table, 27).

4.2.1.4. Leaf shape index

Table (25) illustrate that neither nitrogen fertilizer source, form and rate nor their interaction produced a pronounced effect on leaf shape index of Manzanillo olive trees in 2000 season.

In summary, slow release N- fertilizers surpassed fast release N. ones in enhancing the studied tree growth parameters i-e shoot growth increase, number of leaves/shoot, leaf surface area, leaf chlorophyll (a&b) and leaf dry weight. Besides, the higher nitrogen fertilizer rate (300g N/tree/year) in "Off" year and (600g N/tree/year) in "On" year exerted higher positive effect on the previously

mentioned tree growth traits than did the lower nitrogen rate (200g N/tree/year). In addition, PCU proved to be the superior form of slow release N. fertilizers, followed by UF and finally BCU. On the other hand, ammonium sulphate predominated the other two tested forms of fast release N. fertilizers (ammonium nitrate and urea) in inducing higher stimulative effect on the aforementioned tree growth parameters. Thereupon, the slow release N. fertilizers in the form of PCU at 300g N/tree (in "Off" years) and 600g N/tree (in "On" year) proved to be the superior treatment in enhancing growth parameters of Manzanillo olive trees.

4.2.1.5. Leaf chlorophyll (a&b)

Table (25) shows that leaves of slow release N. fertilized trees were richer in their chlorophyll (a&b) than the analogous ones of fast release N. fertilized trees. The difference was obvious to be significant.

Furthermore, Manzanillo olive trees enriched with higher rate of nitrogen fertilizer (600g N/tree/year) produced leaves higher in their chlorophyll (a&b) content than did those received lower rate of nitrogen fertilizer.

In addition, the interaction between nitrogen fertilizer source and rate induced a remarkable effect on leaf chlorophyll (a&b) content, (Table,26).However, higher rate of slow release N. fertilizers significantly increased leaf chlorophyll (a&b) content, followed descendingly by the same rate of fast release N. fertilizers. Besides, lower rate of slow release nitrogen fertilizers surpassed the same rate

of fast release N. fertilizers in enhancing leaf chlorophyll (a&b) content of Manzanillo olive trees.

Additionally, the interaction between nitrogen fertilizer source, form and rate (Table, 27) reveals that the combinations of slow release N. fertilizers induced higher positive effecton leaf chlorophyll (a&b) content than did those of fast release N. fertilizers. Besides, the higher nitrogen fertilizer of PCU, UF and BCU induced statistically similar and higher values of leaf chlorophyll content, followed descendingly by the lower nitrogen fertilizer rate of the previously mentioned slow release N. fertilizer form. Other combinations gave inbetween values in this concern.

4.2.1.6. Leaf dry weight

Table (25) show that leaves of slow release N. fertilized trees were heavier in their dry weight than the corresponding ones of fast release N. fertilized ones. The difference was pronounced to be significant.

Furthermore, Manzanillo olive trees fertilized with higher rate of nitrogen fertilizer produced leaves heavier in their dry weight than those produced by trees fertilized with lower rate of nitrogen fertilizer, (Table,26).

In addition, the interaction between nitrogen fertilizer source and rate of slow release N. fertilizers induced higher positive effect on leaf dry weight, followed descendingly by higher rate of fast release N. fertilizers. On the other hand, the lower rate of slow release N. fertilizers in enhancing leaf dry weight, (Table, 27).

Finally, the interaction between nitrogen fertilizer source, form and rate illustrates that the higher rate of PCU, UF and BCU (slow release N. fertilizers) induced statistically the highest positive effect in descending order, followed by the higher rate of fast release N. fertilizers (ammonium sulphate, ammonium nitrate and urea) in the same descending order. Besides, lower and higher rates of slow and fast release N. fertilizers followed the same pattern of both slow and fast release N. fertilizers, (Table, 27).

Generally, slow release N. fertilized trees produced longer shoots, higher number of leaves per shoot, larger leaf surface area, leaves richer in their chlorophyll (a&b) content and heavier leaf dry weight than the analogous ones fertilized with fast release N. fertilizers. Besides, the studied vegetative growth parameters responded significantly to the increase in nitrogen fertilizer rate, hence the higher N. fertilizer rate (600g N/tree/year) recorded the highest values of the previously mentioned vegetative growth parameters than did the lower nitrogen fertilizer rate (400g N/tree/year). Furthermore, the tested forms of slow release nitrogen fertilizers (PCU, UF and BCU) surpassed the tested forms of fast release N. fertilizers (ammonium sulphate, ammonium nitrate and urea) in exerting higher positive effect on the studied vegetative growth parameters. Briefly, PCU proved to be the superior slow release N. fertilizer form, followed descendingly by UF and BCU. On the contrary, urea showed to be the least efficient fast release N. fertilizer form in this respect. On the other hand leaf shape index showed meaningless response to nitrogen fertilizer source, form and rate as well as their interactions.

The obtained results regarding the effect of fast release N. fertilizers on tree growth are coincided with the findings of Milella and Deidda (1975) on certain olive seedlings cvs, Ferreira and Liamas (1982) on olive and Haggag (1996) on Picual olive trees. They mentioned that nitrogen fertilization enhanced the growth traits of olive trees. Moreover, the achieved results of slow release N. fertilizers in this respect are in harmony with the reports of Tavdgiridze (1979) on Satsuma mandarin, Jackson and Davis (1984) on citrus trees, Ferguson *et al* (1988) on Hamlin orange, Radwan and Debell (1989) on citrus trees, Bootsma (1990) on apple, Zekri and Koo (1991 a&b) on Valencia orange , Clark *et al* (1992) on blue berry, Zekri and Koo (1992) on Valencia orange, Alva *et al* (1993) on Pineapple orange, Alva and Tucker (1993) on Pineapple orange, Boman (1993) on grapefruit, Okada *et al* (1994) on Satsuma mandarin, Borkowska and Kubik (1995) on Sour cherry and Rombola *et al* (1997).They demonstrated that supplying fruit trees with slow release N. fertilizers affectively enhanced growth characters of the trees compared with the conventional soluble ones. They added that frequency and rate of nitrogen application could be reduced and NO_3 leaching could be minimized by using slow release N. fertilizers without adverse affect on tree growth.

On the other hand, the obtained result of nitrogen fertilizer rate in this concern are in agreement with the findings of Troncoso *et al* (1986) on Manzanillo olive and Amit-Jasrotia *et al* (1999) on

Frantoio olive. They reported that growth of olive tree was materially enhanced as the nitrogen application rate increased. On the contrery, Fernandez-Escobar *et al* (1999) on olive trees, mentioned that increasing nitrogen application from 0 to 1 kg/tree did not increase vegetative growth of two olive orchards.

4.2.2. Leaf mineral content

The effect of nitrogen fertilizer source, form and rate as well as their interactions on leaf N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu content during On year (2000) is reported in Tables (28, 29 and 30).

Briefly, Table (28) show that slow release N- fertilizers surpassed fast release N- fertilizers in enhancing leaf N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu content in 2000 season.

Moreover, Manzanillo olive trees received higher nitrogen fertilizer rate (600g N/tree/year) scored higher values of leaf N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu as compared with the corresponding ones fertilized with low rate (400g N/tree/year) of nitrogen fertilizer in On year (2000) season.

Additionally, the interactions of slow release N- fertilizers and slow release N- fertilizers forms,(Table,29) surpassed the corresponding ones of fast release N- fertilizer (source) or forms in enhancing leaf N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu content in 2000 season. Also, the higher rate of nitrogen fertilizer of both slow and fast release N- fertilizers recorded higher values of the previously mentioned leaf mineral content than the lower rate of both N- fertilizer sources or forms.

Table (28): Specfic effect of nitrogen fertilizer source and rate on leaf mineral content of Manzanillo olive trees during "On" season (2000).

Factor	Elements concentration in dried leaves .									
	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
Effect of nitrogen fertilizer source										
Fast release N. fertilizers	1.55 b	0.14 b	1.04 b	1.06 b	0.12 b	0.33 b	90 b	25 b	24 b	12 b
Slow releae N. Fertilizers	1.67 a	0.24 a	1.31 a	1.68 a	0.16 a	0.37 a	123 a	38 a	37 a	15 a
Effect of nitrogen fertilizer rate										
200 g / tree / year	1.58 b	0.17 b	1.12 b	1.30 b	0.14 a	0.32 b	99 b	29 b	28 b	14 b
300 g / tree / year	1.65 a	0.21 a	1.24 a	1.43 a	0.15 a	0.38 a	114 a	34 a	33 a	16 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (29): Effect of interaction between nitrogen fertilizer source and rate on leaf mineral content of Manzanillo olive trees during "On" season (2000).

N. source	N. rate	Elements concentrationin in dried leaves N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
Fast release N. fertilizers	200g	1.55 c	0.12 d	1.01 d	1.01 d	0.12 b	0.31 a	82 b	21 d	22 d	12 c
	300g	1.55 c	0.14 c	1.08 c	1.09 c	0.13 b	0.34 a	98 ab	24 c	25 c	13 c
Slow release N. fertilizers	200g	1.61 b	0.21 b	1.24 b	1.59 b	0.16 a	0.32 a	116 a	33 b	34 b	17 b
	300g	1.74 a	0.27 a	1.39 a	1.77 a	0.16 a	0.39 a	130 a	39 a	40 a	20 a

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Table (30): Effect of interaction between nitrogen fertilizer source form and rate on leaf mineral contentof Manzanillo olive trees during "On" year (2000).

N. source	N. form	N. rate	Elements concentrationin in dried leaves									
			N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
Fast release N fertilizers	$(NH_4)_2SO_4$	400g	1.54 f	0.14 fg	1.07 i	1.37 i	0.12 b	0.48 b	96 h	24 i	25 i	13 h
		600g	1.55 f	0.16 ef	1.15 g	1.46 g	0.13 b	0.52 a	118 d	28 g	29 g	15 f
	NH_4NO_3	400g	1.56 f	0.14 fg	1.04 j	1.29 j	0.12 b	0.27 h	88 i	23 j	24 j	12 i
		600g	1.56 f	0.15 efg	1.13 h	1.42 h	0.13 b	0.29 gh	115 e	26 h	27 h	14 g
	$(NH_2)_2CO$	400g	1.54 f	0.10 h	0.91 l	1.07 k	0.12 b	0.19 j	58 k	18 l	19 l	10 j
		600g	1.54 f	0.12 gh	0.96 k	1.09 k	0.12 b	0.21 i	65 j	20 l	21 k	10 j
Slow release N fertilizers	PCU	400g	1.64 d	0.23 bc	1.27 d	1.63 d	0.16 a	0.35 ef	115 e	36 d	37 d	17 d
		600g	1.79 a	0.28 a	1.42 a	1.80 a	0.16 a	0.41 c	129 a	41 a	42 a	22 a
	UF	400g	1.59 e	0.21 cd	1.25 e	1.59 e	0.16 a	0.32 fg	113 f	34 e	35 e	17 d
		600g	1.74 b	0.26 ab	1.39 b	1.77 b	0.16 a	0.40 cd	125 b	39 b	40 b	20 b
	BCU	400g	1.59 e	0.18 de	1.19 f	1.55 f	0.16 a	0.30 gh	110 g	30 f	31 f	16 e
		600g	1.69 c	0.25 b	1.36 c	1.73 c	0.16 a	0.37 de	121 c	38 c	39 c	18 c

Means within each column followed by the same letter (s) are not significantly different at 5% level.

Abstractly, the application of nitrogen fertilizer as slow release N. fertilizers showed a remarkable increment in leaf nitrogen, phosphorus, potassium, calcium, magnesium, iron, zinc, manganese and cupper content rather than fast release N. fertilizers. Besides, olive trees received higher rate of nitrogen fertilizer (600g N/tree/ year) in "On" year) exerted higher enhancing effect on leaf N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu the lower rate of nitrogen ferilizer (400g N/tree/year). Furthermore, the tested forms of slow release N. fertilizers particularly PCU increased leaf content of the aforementioned minerals as compared with the tested forms of fast release N. fertilizers. Briefly Pcu, the slow release N. fertilizer form applied at 600g N/tree/year in "On" year, proved to be the superior treatment in enriching leaf N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu content.

The obtained results of fast release N. fertilizer, and their rate go in line with the findings of Hartmann (1958), Milella and Deidda (1975), Klein and Lavee (1977), Domanskaya *et al* (1983), Fouad *et al* (1987), Jordao et al (1994), Perica *et al* (1994), Haggag (1996) and Fernandez- Escobar et al (1999) on olive cvs. They mentioned that increasing nitrogen fertilizer rate of ammonium sulphate or ammonium nitrate enhanced most of leaf nutrient content of olive trees. Besides, the results of slow release N. fertilizer in this concept are in agreement with the findings of Jackson and Davis (1984) on citrus trees, Clark *et al* (1989), on blueberry plants, Retamales and Hanson (1990) on blueberry, Zekri and Koo (1991) on Valencia orange, Ahmed and El-Dawwey

(1992) on Red Roomy grapevine and Obreza and Rousa (1992) on Hamlin orange trees. They reported that raising nitrogen fertilizer rate of slow fertilizer rate induced a remarkable and pronounced effect on leaf mineral content than those of fast release N. fertilizers.

4.2.3. Tree blooming

Tables (31, 32 and 33) show the effect of nitrogen fertilizer source, form and rate as well as their interactions on some blooming parameters of Manzanillo olive trees namely No. of inflorescences per meter, No. of flowers per inflorescences and perfect flowers percentage (sex expression) during On year (2000).

4.2.3.1. No. of inflorescences per meter

It is quite clear from Table (31) that slow release N. fertilized trees produced higher number of No. of inflorescences per meter as compared with those produced by fast release N. fertilized trees. The difference was remarkable to be significant.

On the other hand, raising N. fertilizer rate to 600g N/tree/year induced more pronounced effect on number of inflorescences per meter than did the lower N. fertilizer rate 200g N/tree/year.

Furthermore, Table (32) demonstrates that N. fertilizer source was responsible for the final effect resulted from the interaction between nitrogen fertilizer source and rate. In other words, olive trees fertilized slow release N. fertilizers whether at the rate of 400 or 600g N/tree/year produced statistically similar and higher values of No. of inflorescences per meter than did the combinations of fast release N. fertilizes. Besides, fast release N.

Table (31): Specfic effect of nitrogen fertilizer source and rate on some blooming parameters of Manzanillo olive trees during "On" year (2000).

Factor	No.of inflorescences/ meter	No. of flowers/ inflorescence	Perfect flowers (%)
		Effect of nitrogen fertilizer source	
Fast release N. fertilizers	30.96 b	11.8 b	17.17 b
Slow releae N. fertilizers	47.60 a	21.0 a	21.35 a
		Effect of nitrogen fertilizer rate	
400 g / tree / year	34.93 b	15.0 b	18.33 b
600 g / tree / year	43.63 a	17.8 a	20.27 a

Means within each column for each factor, followed by the same letter (s) are not significantly different at 5% level.

Table(32): Effect of interaction between nitrogen fertilizer source and rate on some blooming parameters of Manzanillo olive trees during "On" year (2000).

N. source	N. rate	No.of inflorescences/ meter	No. of flowers/ inflorescence	Perfect flowers (%)
Fast release N. fertilizers	400g	26.20 c	10.40 d	16.63 c
	600g	35.73 b	13.13 c	17.70 c
Slow release N. fertilizers	400g	43.67 a	19.68 b	20.03 b
	600g	51.53 a	22.37 a	22.83 a

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

Table (33): Effect of interaction between nitrogen fertilizer source form and rate on some blooming parameters of Manzanillo olive trees during "On" year (2000).

N. source	N. rate		No.of inflorescences/ meter	No. of flowers/ inflorescence	Perfect flowers (%)
Fast release N fertilizers	$(NH_4)_2SO_4$	400g	28.10 g	11.8 h	18.2 f
		600g	41.87 e	14.9 g	19.5 e
	NH_4NO_3	400g	27.20 h	11.2 i	17.2 g
		600g	41.20 f	14.8 g	18.3 f
	$(NH_2)_2CO$	400g	23.30 j	08.2 k	14.5 i
		600g	24.10 i	09.7 j	15.3 h
Slow release N fertilizers	PCU	400g	44.80 c	30.9 d	20.7 c
		600g	52.10 a	33.3 a	23.7 a
	UF	400g	41.30 d	30.0 e	19.9 d
		600g	51.80 a	32.1 b	23.6 a
	BCU	400g	41.90 e	28.1 f	19.5 e
		600g	50.70 b	31.7 c	21.2 b

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

fertilized trees received 600g N/tree/year induced higher positive effect on No. of flowers per meter than the lower N. fertilizer rate of the same N. fertilizer source.

As for the interaction between nitrogen fertilizer source, form and rate, Table (33) shows that all tested combination of slow release N. fertilizers surpassed the analogous ones of fast release N. fertilizers in increasing number of inflorescences per meter. Besides, the higher nitrogen fertilizer rate (600g N/tree/year) of PCU, UF and BCU recorded the highest values of number of inflorescences per meter. Also, the lower nitrogen fertilizer rate (400g N/tree/year) of PCU, UF and BCU induced similar trend to that of higher rate in the same descending order in this concern. On the other hand, the higher nitrogen fertilizer rate of ammonium sulphate exerted comparatively higher positive effect on number of inflorescences per meter, followed by the corresponding one of ammonium nitrate and urea in descending order. The lower nitrogen fertilizer rate of the aforementioned fast release N. fertilizer forms induced similar pattern of effect to that of higher nitrogen fertilizer rate of the same nitrogen fertilizer forms .

4.2.3.2. No. of flowers/inflorescence

Table (31) demonstrates that inflorescences of slow release N. fertilized trees had comparatively higher number of flowers as compared with the corresponding ones of fast release N. fertilized ones.

Furthermore, Manzanillo olive trees received higher nitrogen fertilizer rate (600g N/tree/year) produced significantly higher

number of flowers/inflorescence than did those received lower nitrogen fertilizer rate (400g N/tree/year).

On the other hand, the interaction between nitrogen fertilizer source and rate, demonstrates that number of flowers/inflorescence responded significantly to nitrogen fertilizer source, rather than nitrogen fertilizer rate. Thereupon, the higher rate of slow release N. fertilizer was the superroir in exerting the highest positive effect on number of flowers/inflorescence, followed by the lower rate of the same nitrogen fertilizer source. In addition, the higher and lower rate of fast release N. fertilizers took the same trend of slow release nitrogen fertilizer combination, Table (32).

Finally, the interaction between nitrogen fertilizer source, form and rate indicates that the interactions of slow release N. fertilizers surpassed the analogous ones of fast release N. fertilizers in enhancing number of flowers per inflorescence. In this respect, the higher rate of nitrogen fertilizer of PCU, UF and BCU scored the highest values of number of flowers per inflorescence in descending order. Also, the lower nitrogen fertilizer rate of PCU, UF and BCU recorded statistically higher values of number of flowers per inflorescence as compared with those of fast release N. fertilizers. On the contrary, the lower rate of urea, ammonium nitrate and ammonium sulphate induced the least positive effect on number of flowers per inflorescence in ascending order. Besides, the higher rate of ammonium sulphate, ammonium nitrate and urea gave inbetween values in this concern.

4.2.3.2. Perfect flowers percentage (Sex expression)

Table (31) indicates that higher percentage of produced flowers of slow release N. fertilized trees was perfect as compared with those produced by fast release N. fertilized trees.

Furthermore, Manzanillo olive trees received higher rate of nitrogen fertilizer produced higher percentage of their flowers in perfect form as compared with those received lower rate of nitrogen fertilizer.

On the other side, Table (32) shows that the combinations of slow release N. fertilizers scored higher percentage of perfect flowers than did those of fast release N. fertilizers. The higher rate of slow release N. fertilizer gave the higher percentage of perfect flowers, followed by the lower rate of the same nitrogen fertilizer source. Besides, the lower and higher nitrogen rates of fast release N. fertilizers induced statistically similar effect in this respect.

Lastly, the interaction between nitrogen fertilizer source, form and rate, Table (33) illustrates that nitrogen fertilizer rate had meaningless effect on the percentage of perfect flowers. Consequently, slow release N. fertilizers combinations scored higher percentages of perfect flowers than did fast release N. fertilizers. In this concern, higher rate of PCU and UF exerted statistically similar and higher positive effect on perfect flower percentages, followed by the higher rate of BCU. Besides, the lower rate of PCU, UF and BCU scored comparatively higher percentages of perfect flowers. On the contrary, the lower and higher rate of urea induced the lowest positive effect on perfect flowers percentage in ascending order.

Other tested combinations of fast release N. fertilizers took intermediate positions in this concern.

Abstractly, the studied tree blooming parameters i.e number of inflorescences per meter, number of flowers per inflorescences and perfect flowers percentage responded positively to slow release N. fertilizers rather than to fast release nitrogen fertilizers. Besides, the higher nitrogen fertilizer rate (600g N/tree/year) induced higher positive effect on the aforementioned blooming parameters than did lower nitrogen fertilizer (400g N/tree/year). Moreover, the tested forms of slow release nitrogen fertilizers (PCU, UF and BCU) and in particular, PCU showed superiority in enhancing the previously mentioned tree blooming parameters than those of fast release N. fertilizers. Thereupon, PCU the slow release nitrogen fertilizer form applied at 600g N/tree/year in "On" year proved to be the superior treatment in enhancing the studied tree blooming parameters.

The obtained results of fast release N. fertilizers and their rate regarding tree blooming are in harmony with the findings of Abdel-Hady (1990). Besides, the results of slow release N. fertilizers and their rate in this respect are in agreement with those reported earlier by Ahmed and El-Dawwey (1992).

4.2.4. Tree fruiting

The effect of nitrogen fertilizer source, form and rate as well as their interactions on some tree fruiting parameters i.e fruit set percentage, fruit shedding percentage, number of fruits per tree and yield (kg)/tree of Manzanillo olive trees during "On" year (2000) is reported in Tables (34, 35 and 36).

4.2.4.1 Fruit set percentage

Table (34) indicates that flowers of slow release N. fertilized trees set higher percentage of fruits than the corresponding ones of fast release N. fertilized ones.

Furthermore, raising nitrogen fertilizer rate succeeded in increasing the percentage of fruit set during "On" year, (Table, 34).

As for the interaction between nitrogen fertilizer source and rate, Table (35) demonstrates that the lower and higher rate of slow release N. fertilizers induced similarly higher positive effect on fruit set percentage than those of fast release N. fertilizers. Also, the two rates of fast release N. fertilizers scored similar values in this respect.

Finally, the interaction between nitrogen fertilizer source, form and rate shows that fruit set percentage responded positively to the interactions of slow release N. fertilizers rather than to the corresponding ones of fast release N. fertilizers. Briefly, the higher rate of PCU and UF and the lower rate of PCU recorded the highest fruit set percentage in descending order. The combinations of fast release N. fertilizer forms scored the lowest values in this respect, particularly the two tested rates of urea, (Table, 36).

4.2.4.2. Fruit shedding percentage

It is quite clear from Table (34) that fertilizing Manzanillo olive trees with slow release N. fertilizers succeeded in reducing fruit shedding percentage rather than fast release N. fertilizers.

Furthermore, the higher nitrogen rate induced higher negative effect on fruit shedding percentage rather than the lower rate of nitrogen fertilizer, (Table, 34).

Table (34): Specfic effect of nitrogen fertilizer source and rate on some Fruiting parameters of Manzanillo olive trees during "On" year (2000).

Factor	Fruiting parameters			yield (kg)/ tree
	fruit set (%)	fruit shedding (%)	No of fruits/ tree	
Effect of nitrogen fertilizer source				
Fast release N. fertilizers	3.40 b	8.8 a	15968 a	38.75 a
Slow releae N. fertilizers	6.63 a	6.4 b	9166 b	39.21 a
Effect of nitrogen fertilizer rate				
400 g / tree / year	5.81 b	8.4 a	11294 a	37.13 b
600 g / tree / year	6.21 a	6.8 b	11176 a	40.83 a

Means within each column for each factor, followed by the same letter (s) are not significantly different at 5% level.

Table(35): Effect of interaction between nitrogen fertilizer source and rate on some Fruiting parameters of Manzanillo olive trees during "On" year (2000).

Nitrogen source	Nitrogen rate	fruit physical properties: fruit set (%)	fruit shedding (%)	No of fruits/ tree	yield (kg)/ tree
Fast release N. fertilizers	400g	5.31 b	9.8 a	12877 ab	36.25 a
	600g	5.49 b	7.8 a	14264 a	91.19 a
Slow release N. fertilizers	400g	6.32 a	6.9 b	9712 bc	38.00 a
	600g	6.93 a	5.8 b	8087 c	40.36 a

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

Table (36): Effect of interaction between nitrogen fertilizer source form and rate on some Fruiting parameters of Manzanillo olive trees during "On" year (2000).

Treatment			Fruiting parameters			
N. source	N. form	N. rate	fruit set (%)	fruit shedding (%)	No of fruits/ tree	yield (kg)/ tree
Fast release N. fertilizers	$(NH_4)_2SO_4$	400g	5.90 i	8.7 c	10908 f	40.25 b
		600g	5.99 g	7.4 f	14627 c	49.80 a
	NH_4NO_3	400g	5.80 j	9.6 b	12376 d	37.50 bcd
		600g	5.95 h	7.7 e	11578 e	39.25 bc
	$(NH_2)_2CO$	400g	4.23 L	11.2 a	15347 b	31.00 e
		600g	4.54 k	8.2 d	16587 a	35.33 d
Slow release N fertilizers	PCU	400g	6.85 c	6.6 i	11491 e	47.00 a
		600g	7.15 a	5.3 L	8564 i	49.50 a
	UF	400g	6.03 f	6.9 h	9429 g	38.00 bcd
		600g	7.10 b	6.0 k	6768 k	35.33 d
	BCU	400g	6.09 e	7.1 g	8215 j	29.00 e
		600g	6.55 d	6.3 j	8929 h	36.25 cd

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

In addition, the interaction between nitrogen fertilizer source and rate reveals that the higher and lower rate of slow release N. fertilizer induced statistically similar reducing effect on fruit shedding percentage as compared with those of fast release N. fertilizers. However, significant differences were lacking between the two tested rates of fast release N. fertilizers, (Table, 35).

Regarding the interactions between nitrogen fertilizer source, form and rate, Table (36) illustrates that the interactions of slow release N. fertilizers surpassed the analogous ones of fast release N. fertilizers in reducing fruit shedding percentage. Briefly, the higher rate of PCU, UF and BCU scored the lowest values of fruit shedding percentage in an ascending order. The lower rate of the previously mentioned nitrogen form took the same trend of the higher ones. Besides, the combinations of fast release N. fertilizers scored higher fruit shedding percentage particularly those of urea.

4.2.4.3. No. of fruits/tree

It is clear from Table (34) that slow release N. fertilized trees produced higher number of fruits as compared with those received fast release N. fertilizers.

Moreover, raising nitrogen fertilizer rate failed to affect number of produced fruits per tree during "On" year, (Table, 34).

As for the interaction between nitrogen fertilizer source and rate, Table (35) reveals that the combinations of fast release N. fertilizers induced statistically similar and higher positive effect on number of produced fruits per tree than those produced by the corresponding ones of slow release N. fertilizers.

Furthermore, Table (36) demonstrates the response of number of fruits per tree to nitrogen fertilizer source, form and rate. It is clear that the interactions of fast release N. fertilizer forms surpassed the analogous ones of slow release N. fertilizer forms in enhancing number of produced fruits per tree. However, the higher rate of urea scored the higher values in this respect.

4.2.4.4. Yield (kg)/tree

Table (34) illustrates that nitrogen fertilizer source i.e slow or fast release N. fertilizers failed to induce a remarkable effect on tree productivity.

Furthermore, Manzanillo olive trees received higher nitrogen fertilizer rate (300g /tree/year) produced higher yield as compared with those fertilized with (200g /tree/year).

Concerning the interaction between nitrogen fertilizer source and rate, Table (35) illustrates that the tested interaction failed to exert any pronounced effect on tree yield, hence the significant differences between the different combinations were lacking.

Finally, the interaction between fertilizer source, form and rate, Table (36) reveals that the higher rate of ammonium sulphate and both rates of PCU scored statistically similar and higher values in this concern. On the contrary the lower rate of urea showed to be the lease efficient combination induced intermediate effect in this respect.

Briefly, slow release N. fertilizers increased fruit set percentage and tree yield (kg)/tree and reduced fruit shedding percentage. On the other hand, fast release N. fertilizers increased

number of produced fruits per tree. Increasing nitrogen fertilization rate from 400 to 600g/tree/year induced the prospective effect on tree fruiting parameters. In addition, the different forms of slow release N. fertilizers particularly PCU and UF enhanced the previously mentioned fruiting parameters except for number of fruits per tree which showed better response to fast release N. fertilizers particularly urea combinations.

The obtained results of fast release N. fertilizers and their rate regarding tree fruiting go in line with the findings of Loupassaki *et al* (1993) on Manzanillo olive, Marcelo *et al* (1994) on olive, Amit-Jasrotia *et al* (1999) on olive and Fernandez-Escobar *et al* (1999) on olive. On the other hand, the prospective results of fruiting are in harmony with the findings of Shawa (1979) , Ui-Tanova and Popasko (1983), Noack (1984), Nijjar (1985), Brown *et al* (1988), Paydas *et al* (1988), Clark *et al* (1992), Kotze *et al* (1992), Zekri and Koo (1992), Obreza and Rouse (1992), Boman (1993), Alva and Tucker (1993), Monastra *et al* (1995), Salas *et al* (1995) and Rombola *et al* (1997). They mentioned that the use of slow release N. fertilizers was benefical in improving the yield than the soluble ones.

4.2.5. Fruit physical properties

Effect of nitrogen fertilizer source (slow or fast release N. fertilizers), nitrogen fertilizer form PCU, UF and BCU (slow release N. fertilizer forms), ammonium sulphate, ammonium nitrate and urea (fast release N. fertilizer form) and nitrogen fertilizer rate (400 or 600g N/tree/year in "On" year) as well as their interaction on

some fruit physical properties i.e fruit weight, size, length, diameter, shape index, flesh weight and stone weight during "On" year (2000) is reported in Table (37, 38 and 39).

4.2.5.1. Fruit weight

It is obvious from Table (37) that slow release N. fertilized trees produced heavier fruits than those received fast release N. fertilizers.

Furthermore, the two tested nitrogen fertilizer rates failed to induce any significant effect on fruit weight of Manzanillo olive trees.

In addition, Table (38) illustrates that the interaction between nitrogen fertilizer source and nitrogen fertilizer rate showed that nitrogen fertilizer rate had meaningless effect on fruit weight and nitrogen fertilizer source was the responsible on the final result of the interaction. Thereupon, both rates of slow release N. fertilizers induced statistically similar and higher values of fruit weight than those of fast release N. fertilizers. Moreover, both rates of fast release N. fertilizers exerted similar values in this concern.

In addition, the interaction between nitrogen fertilizer source, form and rate (Table,39) shows that the combinations of slow release N. fertilizers induced statistically higher positive effect than did those of fast release N. fertilizers. Besides, the higher rate of PCU, followed descendingly by the higher rate of UF, lower rate of both PCU and UF and both rates of BCU scored the highest values of fruit weight. The interactions of fast release N. fertilizers induced nearly more or less similar effect in this concern.

Table (37): Specfic effect of nitrogen fertilizer source and rate on some fruit physical properties of Manzanillo olive trees during "On" year (2000).

Factor	weight (g)	Fruit physical properties					
		size (cm)	length (cm)	diameter (cm)	shape index (L/D)	flesh weight (g)	stone weight (g)
Effect of nitrogen fertilizer source							
Fast release N. fertilizers	3.0 b	2.4 b	1.5 a	1.4 a	1.07 a	2.2 b	0.8 a
Slow releae N. fertilizers	4.1 a	3.2 a	1.6 a	1.5 a	1.07 a	3.2 a	0.9 a
Effect of nitrogen fertilizer rate							
400 g / tree / year	3.5 a	2.7 a	1.6 a	1.4 a	1.14 a	2.6 b	0.9 a
600 g / tree / year	3.6 a	2.8 a	1.6 a	1.5 a	1.07 a	2.8 a	0.8 a

Means within each column for each factor, followed by the same letter (s) are not significantly different at 5% level.

Table(38): Effect of interaction between nitrogen fertilizer source and rate on some fruit physical properties of Manzanillo olive trees during "On" year (2000).

Nitrogen source	Nitrogen rate	Fruit physical properties: weight (g)	size (cm)	length (cm)	diameter (cm)	shape index (L/D)	flesh weight (g)	stone weight (g)
Fast release N. fertilizers	400g	2.9 b	2.2 c	1.5 a	1.4 a	1.07 a	2.1 b	0.8 bc
	600g	3.0 b	2.5 b	1.5 a	1.4 a	1.07 a	2.3 b	0.7 c
Slow release N. fertilizers	400g	4.0 a	3.2 a	1.6 a	1.4 a	1.14 a	3.1 a	0.9 ab
	600g	4.2 a	3.1 a	1.6 a	1.5 a	1.07 a	3.2 a	1.0 a

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

Table (39): Effect of interaction between nitrogen fertilizer source form and rate on some fruit physical properties of Manzanillo olive trees during "On" year (2000).

Treatment			Fruit physical properties						
N. source	N. form	N. rate	weight (g)	size (cm)	length (cm)	diameter (cm)	shape index (L/D)	flesh weight (g)	stone weight (g)
Fast release N. fertilizers	$(NH_4)_2SO_4$	400g	3.0 ef	2.2 h	1.5 a	1.4 a	1.07 a	2.1 gh	0.9 bc
		600g	3.1 e	2.7 f	1.5 a	1.4 a	1.07 a	2.3 ef	0.8 cd
	NH_4NO_3	400g	2.9 fg	2.3 g	1.5 a	1.4 a	1.07 a	2.2 fg	0.7 d
		600g	3.1 e	2.7 f	1.5 a	1.4 a	1.07 a	2.4 de	0.7 d
	$(NH_2)_2CO$	400g	2.8 g	2.1 i	1.4 a	1.3 a	1.07 a	2.0 h	0.8 cd
		600g	2.8 g	2.3 g	1.4 a	1.3 a	1.07 a	2.1 gh	0.7 d
Slow release N fertilizers	PCU	400g	4.4 bc	3.1 d	1.6 a	1.4 a	1.14 a	3.4 cd	1.0 ab
		600g	4.8 a	3.2 c	1.6 a	1.5 a	1.07 a	3.7 a	1.1 a
	UF	400g	4.3 c	3.2 c	1.6 a	1.5 a	1.07 a	3.3 c	1.0 ab
		600g	4.5 b	3.3 b	1.6 a	1.5 a	1.07 a	3.5 b	1.0 ab
	BCU	400g	3.3 d	3.4 a	1.5 a	1.4 a	1.07 a	2.5 d	0.8 cd
		600g	3.3 d	3.0 e	1.5 a	1.4 a	1.07 a	2.5 d	0.8 cd

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

4.2.5.2. Fruit size

It is clear that slow release N. fertilizers significantly increased fruit size as compared with fast release N. fertilizers (Table, 37).

Moreover, raising nitrogen fertilizer rate from 400g /tree/year in "On" year to 600g /tree/year failed to affect fruit size of Manzanillo olive trees.

Concerning the interaction between nitrogen fertilizer source and rate, Table (38) demonstrates that both rates of slow release N. fertilizers exerted similarly higher positive effect on fruit size than did the tested rates of fast release N. fertilizers. Furthermore, the higher rate of fast release N. fertilizers scored higher fruit size values than the lower rate of the same nitrogen fertilizer source.

Finally, the interactions of slow release N. fertilizers scored higher values of fruit size than the corresponding ones of fast release N. fertilizers. Shortly, the lower rate of BCU, followed by the higher rate of UF and both rates of PCU recorded the highest values of fruit size in descending order. On the other hand, the interactions of fast release N. fertilizers induced nearly similar values in this concern.

4.2.5.3. Fruit length, diameter and shape index

It is quite clear from Tables (37, 38 and 39) that nitrogen fertilizer source (fast or slow release N. fertilizers), nitrogen fertilizer form: ammonium sulphate, ammonium nitrate and urea (fast release N. fertilizer forms) and PCU, UF and BCU (slow release N. fertilizer forms) and nitrogen fertilizzer rate (400 or 600g /tree/year) as well as their combinations induced meaningless effect on Fruit length,

diameter and shape index of Manzanillo olive during the studied season.

4.2.5.4. Flesh weight

Table(37) demonstrates that fruits of slow release N. fertilized trees had heavier Flesh than those produced by fast release N. fertilized trees.

Furthermore, raising nitrogen fertilizer rate from 400g/tree/year to 600g/tree/year showed an enhancing effect of Flesh weight of Manzanillo olive fruits (Table, 38).

Regarding the interaction between nitrogen fertilizer source and rate, Table (39) illustrates that nitrogen fertilizer source proved to be the responsible for the final result of the previously mentioned interaction. Thereon, the two tested rates of slow release N. fertilizers induced similarly higher positive effect on Flesh weight than those of fast release N. fertilizerss. Also, the two rates of fast release N. fertilizers gave similar values in this concern from the statistical standpoint.

In addition, the interaction between nitrogen fertilizer source, form and rate (Table,39) demonstrates that the highest values of Flesh weight were scored by the interactions of slow release N. fertilizers as compared with those of fast release N. fertilizers. Besides, the higher rate of PCU, followed by the higher rate of UF, lower rate of UF and PCU as well as the two rates of BCU recorded higher Flesh weight values from the statistical standpoint. Besides, the combinations of fast release N. fertilizers induced nearly more or less similar effect in this concern.

4.2.5.5. Stone weight

Table (37) reveals that nitrogen fertilizer source (fast or slow release N. fertilizers) and nitrogen fertilizer rate (400 or 600g/tree/year) failed to induced any remarkable effect on Stone weight of Manzanillo olive fruits.

Additionlly, the two rates of slow release N. fertilizers induced statistically similar and higher positive effect on Stone weight than those of fast release N. fertilizers. Besides, significant differences between the two tested rates of fast release N. fertilizers in this respect were lacking.

Finally, the interaction between nitrogen fertilizer source, form and rate (Table,38) demonstrates that the interactions of slow release N. fertilizer forms recorded higher values of Stone weight than the analogous ones of fast release N. fertilizers. Besides, both rates of PCU and UF gave statistically similar and higher values of Stone weight. Other tested combinations gave nearly similar effect in this concern.

Conclusively, slow release N. fertilizers enhanced fruit weight, flesh weight and stone weight, but failed to affect fruit length, diameter and shape index in comparison with fast release N. fertilizers. On the other hand, nitrogen fertilizer rate failed to affect the previously mentioned fruit physical parameters. Briefly, the higher rate of PCU, UF and BCU induced the highest positive effect on the aforementioned fruit physical properties, followed descendingly by the lower rate of the previously mentioned slow release N. fertilizer forms. The combinations of fast release N.

fertilizer forms particularly those of lower nitrogen fertilizer rate exerted the lowest positive effect in this respect.

4.2.5. Fruit chemical properies

4.2.1.Fruit moisture and oil content and fatty acid fractions

Table (40, 41 and 42) illustrate the effect of nitrogen fertilizer source (fast release N. fertilizers and slow release N. fertilizers) and nitrogen fertilizer form fast release N. fertilizer forms (ammonium sulphate, ammonium nitrate and urea) and slow release N. fertilizer form (PCU, UF and BCU) and nitrogen fertilizer rate (400 or 600g N/tree/year) as well as their interaction on Fruit moisture and oil content and fatty acid fractions namely Oleic acid(18:1),Palmatic acid (16:0), Linoleic acid (18:2), Linolenic acid (18:3) and Arachidic acid (20:1) of Manzanillo olive trees during an expected "On" year (2000).

Briefly, all tested nitrogen fertilizer sources, forms and rates failed to induce any significant effect on Fruit moisture and oil content and fatty acid fractions namely Oleic, Palmatic, Linoleic, Linolenic and Arachidic of Manzanillo olive trees during an expected "On" year.

Conclusively, nitrogen fertilizer source (slow or fast release N. fertilizers), nitrogen fertilizer form i.e PCU, UF and BCU of slow release N. fertilizers and ammonium sulphate, ammonium nitrate and urea of fast release N. fertilizers and nitrogen fertilizer rate (400 or 600g N/tree/year) in "On" year failed to induce any remarkable or pronounced effect on the studied fruit chemical properties namely

Table (40): Specfic effect of nitrogen fertilizer source and rate on fruit moisture and oil content and fatty acid fractions of Manzanillo olive trees during "On" year (2000).

Factor	Moisture (%)	Oil content (%)	Fatty acid fractions				
			Oleic (18:1)	Palmtic (16:1)	Linolenic (18:3)	Linoleic (18:2)	Arachidic (20:1)
Effect of nitrogen fertilizer source							
Fast release N. fertilizer	55.3 a	25.3 a	52.0 a	24.3 a	8.2 a	10.1 a	3.8 a
Slow releae N. fertilizer	55.2 a	25.3 a	52.4 a	24.3 a	8.2 a	10.2 a	3.8 a
Effect of nitrogen fertilizer rate							
400 g / tree / year	55.3 a	25.2 a	52.1 a	24.3 a	8.2 a	10.1 a	3.8 a
600 g / tree / year	55.3 a	25.4 a	52.4 a	24.3 a	8.2 a	10.2 a	3.8

Means within each column for each factor, followed by the same letter (s) are not significantly different at 5% level.

Table(41): Effect of interaction between nitrogen fertilizer source and rate on fruit moisture and oil content and fatty acid fractions of Manzanillo olive trees during "On" year (2000).

Nitrogen source	Nitrogen rate	Moisture (%)	Oil content (%)	Fatty acid fractions				
				Oleic (18:1)	Palmtic (16:1)	Linolenic (18:3)	Linoleic (18:2)	Arachidic (20:1)
Fast release N. fertilizers	400g	55.3 a	25.1 a	51.8 a	24.3 a	8.2 a	10.1 a	3.8 a
	600g	55.4 a	25.4 a	52.2 a	24.2 a	8.1 a	10.1 a	3.8 a
Slow release N. fertilizers	400g	55.2 a	25.2 a	52.3 a	24.2 a	8.2 a	10.1 a	3.8 a
	600g	55.2 a	25.3 a	52.5 a	24.3 a	8.2 a	10.2 a	3.8 a

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

Table (42): Effect of interaction between nitrogen fertilizer source form and rate on fruit moisture and oil content and fatty acid fractions of Manzanillo olive trees during "On" year (2000).

Treatment			Moisture (%)	Oil content (%)	Fatty acid fractions				
N. source	N. form	N. rate			Oleic (18:1)	Palmtic (16:1)	Linolenic (18:3)	Linoleic (18:2)	Arachidic (20:1)
Fast release N fertilizers	$(NH_4)_2SO_4$	400g	55.1 a	25.2 a	51.2 a	24.1 a	8.2 a	10.1 a	3.9 a
		600g	54.7 a	25.6 a	52.1 a	24.2 a	8.0 a	10.0 a	3.8 a
	NH_4NO_3	400g	55.5 a	24.9 a	52.2 a	24.5 a	8.3 a	10.2 a	3.7 a
		600g	55.2 a	25.2 a	52.1 a	24.3 a	8.1 a	10.2 a	3.9 a
	$(NH_2)_2CO$	400g	55.4 a	25.3 a	52.1 a	24.2 a	8.2 a	10.1 a	3.8 a
		600g	55.2 a	25.4 a	52.2 a	24.1 a	8.1 a	10.2 a	3.7 a
Slow release N fertilizers	PCU	400g	55.2 a	25.0 a	52.0 a	24.2 a	8.4 a	10.1 a	3.9 a
		600g	55.1 a	25.2 a	52.5 a	24.5 a	8.2 a	10.2 a	3.8 a
	UF	400g	55.3 a	25.5 a	52.3 a	24.2 a	8.1 a	10.1 a	3.7 a
		600g	55.2 a	25.1 a	52.4 a	24.3 a	8.3 a	10.2 a	3.8 a
	BCU	400g	55.1 a	25.2 a	52.5 a	24.1 a	8.2 a	10.0 a	3.7 a
		600g	55.2 a	25.5 a	51.7 a	24.2 a	8.1 a	10.2 a	3.9 a

Means within each column, followed by the same letter (s) are not significantly different at 5% level.

fruit moisture and oil content and fatty acid fractions namely Oleic acid (18:1), Palmatic acid (16:0), Linoleic acid (18:2), Linolenic acid (18:3) and Arachidic acid (20:1).

The obtained results of fast release N. fertilizers and their rates regarding fruit quality of olive trees are in agreement with the findings of Tavdgiridze (1979) on Satsuma, Loupassaki *et al* (1993) on Manzanillo olive, Marcelo *et al* (1994) on olive, Haggag (1996) on Picual olive and Amit-Jasrotia *et al* (1999) on olive. They mentioned that increasing the rate of traditional nitrogen fertilizers enhanced some fruit quality traits. Besides, Fernandez-Escobar *et al* (1999) on olive reported that increasing the N. application rate from 0 to 1 kg/tree did not affect fruit size and fruit oil content.

Furthermore, the obtained results of slow release N. fertilizers and their rates, regarding fruit quality traits are in harmony with the findings of Tavdgiridze and Putkaradze (1976) on Satsumas, Noack (1984) on apple, Brown *et al* (1988) on blueberries, Ferguson *et al* (1988) on carambola trees, Paydas *et al* (1988) on banana, Clark *et al* (1992) on blueberry, Obreza and Rouse (1992) on Hamlin orange, Zekri and Koo (1992) on Valencia orange, Alva and Tueker (1993) on citrus and Boman (1993) on Marsh grapefruit. They mentioned that fruit quality traits were greatly enhanced due to the use of slow release N. fertilizers rather than soluble N. fertilizers.