

INFLUENCE OF VARIOUS SOURCES OF ORGANIC NITROGEN AS A PARTIAL SUBSTITUTE FOR MINERAL NITROGEN FERTILIZER ON YIELD, FRUIT QUALITY AND LEAF MINERAL CONTENTS OF ZEBDA MANGO TREES

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ABSTRACT

This investigation was conducted during three seasons (2008/2009, 2009/2010 and 2010/2011) on Zebda mango trees grown in sandy soil under flood irrigation condition. The recommended rate of nitrogen namely 700 gms N/tree/year was added either, completely *via* mineral source (ammonium sulphate 20.6%) or at various ratios from organic fertilizer (town refuse and cattle manure). The study focused on the effect of these treatments on yield, physical and chemical properties of fruits and leaf mineral contents, to determine the maximum substitution proportion of organic nitrogen source (with best yield and fruit quality) instead of mineral nitrogen fertilizer.

The obtained results showed that all the used treatments of various sources of organic nitrogen were effective in improving yield, fruit quality and leaf mineral contents in comparison with mineral N 100% (control). It was also noticed that the positive effect of the superior treatments on yield/tree, fruit weight and diameter, seed/pulp ratio, TSS, TSS/acid ratio, total sugars and fruit carotinoids could be arranged in the descending order with significant differences; mineral N 20% + cattle manure 80%; mineral N 50% + town refuse 50% and mineral N 80% + cattle manure 20%. Moreover, both of mineral N 20% + cattle manure 80% or mineral N 50% + town refuse 50% significantly increased reducing sugars of fruits and leaf P, Mn and Zn than those of other treatments.

Hence, it could be concluded that under the condition of this study, using mineral N 20% + cattle manure 80% is very useful for minimizing the use of mineral N fertilizer, reducing environmental pollution and obtaining an economical yield with high quality of Zebda mango fruits and considered a good recommendation for fertilizing mango trees under resembling conditions.

Key words: *fruit quality, leaf mineral content, mango trees, mineral fertilizer, organic fertilizer, yield.*

1. INTRODUCTION

Mango trees are considered one of the main fruits in Egypt. It ranks the fourth after citrus, grapes and olives. The total acreage of mango in Egypt reached 184204 feddans, producing about 532422 tons (Ministry of Agric., ARE, 2008).

Fertilization is the most important factor which affect mango yield and fruit quality. Growers add high quantities of chemical fertilizers to increase the yield of their trees, but the efficiency of nitrogen fertilizers practically under field conditions and surface irrigation rarely exceeds 50% and it is usually only 30-40% (Englestad and Russel, 1975 and Sahrawat, 1979).

Such low efficiency may be due to the losses of N by leaching of nitrate, or reduction of nitrate resulting in the formation of nitrogen gas that is lost by volatilization (Goring, 1962). Leaching of

nitrate and down word movement below the rooting zone with flowing water causes many problems such as nitrate pollution of ground water and growing crops (Gambrell *et al.*, 1975).

Nowadays, great attention has been focused on the possibility of using organic fertilizers for enhancing growth and fruit quality, consequently depress the pollution occurred in the Egyptian environment due to the exaggeration in the application of chemical fertilizers.

Organic fertilization has many advantages, it improves soil structure and reduces soil pH, results in better root growth and more efficient use of water and nutrients. It also provides slow release of nitrogen and other nutrients. In addition, organic fertilization increases the nutrient-holding properties of soil which lead to the lowering the need for excessive applications of nitrogen

fertilizer, hence decrease nitrate contamination of ground water (El-Sayed, 1994; Casale *et al.*, 1995; Ahmed *et al.*, 1996; El-Kassas *et al.*, 1997; Nassar, 1998 and Harhash & Abd El-Nesser, 2000).

The results of many studies reviewed the

The selected trees were treated by the recommended rate of actual nitrogen *i.e.*, 700 gms/tree/year from different amounts of the studied sources (according to their chemical analysis (Table 2) represented in the following treatments :

Treatments	Amounts of fertilizer (Kg/tree/year)		
	2008/2009	2009/2010	2010/2011
1- Mineral nitrogen only "MN" 100% (control).	3.4	3.4	3.4
2- Mineral nitrogen "MN" 80%+Town refuse "TR" 20%.	2.7+16.3	2.7+15.1	2.7+15.9
3- Mineral nitrogen "MN" 50%+Town refuse "TR" 50%.	1.7+40.7	1.7+37.6	1.7+39.8
4- Mineral nitrogen "MN" 20%+Town refuse "TR" 80%.	0.7+65.1	0.7+60.2	0.7+63.6
5- Mineral nitrogen "MN" 80%+Cattle manure "CM" 20%.	2.7+12.4	2.7+12.7	2.7+12.8
6- Mineral nitrogen "MN" 50%+Cattle manure "CM" 50%.	1.7+31.0	1.7+31.8	1.7+32.1
7- Mineral nitrogen "MN" 20%+Cattle manure "CM" 80%.	0.7+49.6	0.7+50.9	0.7+51.3

importance of organic manures for stimulating growth and productivity of some fruit crops ; Smith, 1998; Joo *et al.*, 1999; Tiwary *et al.*, 1999; Abd El-Naby & Gomaa, 2000; Geetha & Nair, 2000; Shahein *et al.*, 2003; Chatzitheodorou *et al.*, 2004; El-Assar, 2005; Omar & Belal, 2007; Al-Wasfy & El-Khawaga, 2008; Abd El-Salam *et al.*, 2009 and Shaheen *et al.*, 2009.

In addition, the application of organic N sources with a mineral N was accompanied with an obvious promotion on fruit quality of many cultivars of fruit trees (Gouda, 1984; Salem, 1986; Cole *et al.*, 1987; Dahdoh & El- Hassanin, 1993; Li *et al.*, 1998; Abd El-Nasser & Harhash, 2000; Abd El-Hameed & Ragab, 2004; Mansour *et al.*, 2004; Mohamed & Gobara, 2004; Diab, 2006; Abd El-Rahman, 2007; Saad & Saad, 2007 and Hossam El-Deen & Boshra, 2008).

Therefore, this study aimed to examine the beneficial effect of two forms of organic nitrogen sources namely; town refuse and cattle manure in combination with a mineral nitrogen source on yield, fruit quality and leaf mineral contents of Zebda mango trees.

2.MATERIALS AND METHODS

This study was carried out in a private orchard situated at Edko region, El-Behira Governorate, during the three successive seasons of 2008/2009, 2009/2010 and 2010/2011 on Zebda mango trees. All trees were 10 year old and grafted on a seedling rootstalk, grown in sandy soil and planted at 5×5 meters apart. Soil analysis was carried out and listed in Table (1).

Twenty eight trees, as uniform as possible were chosen. Regular agricultural practices such as hoeing, irrigation and pest management were done as usual to all the studied trees.

The treatments were arranged in Randomized Complete Blocks Design, in which each treatment was replicated four times, with one tree for each replicate; *i.e.*, 7 treatments × 4 replicates = 28 trees in total.

The amounts of mineral nitrogen source (ammonium sulphate 20.6% N) were applied broadcasted at 3 equal batches in February, May and July. However, the amounts of organic nitrogen sources (town refuse and cattle manure) were mixed with the surface of the soil and applied once under the tree canopy in trenches (50 cm width × 50 cm depth) around the tree in the beginning of December of each season. Town refuse fertilizer used was produced by Abees factory for organic fertilizers (belong to Alex. Governorate). In addition, each experimental tree received 1.5 kgms/year of superphosphate (45.5% P₂O₅) in December and 1.25 kgms/year of potassium sulphate (50% K₂O₂) at 2 equal batches in April and June in each season.

The following topics were studied :

- 1- Flowering indices :** At full bloom (at the end of April), the number of panicles per tree and the number of flowers per panicle were counted (32 panicles from each replicate were randomly chosen and labeled for this purpose).
- 2-Yield indices :** After fruit set (in the mid of May), the number of fruit set at initial fruit set and at harvest were recorded. Fruit set percentage was calculated as the following equation:

$$\text{Fruit set \%} = \frac{\text{No. of fruits set / panicle}}{\text{Total No. of flowers / panicle}}$$

Table (1): Chemical and physical characteristics of the experimental soil.

Character	Value	Character	Value
EC (dsm ⁻¹)	1.53	Soluble anions (meq/L)	
pH (1 : 2.5)	8.11	SO ₄ ²⁻	10.37
CaCO ₃ (%)	6.32	Cl ⁻	5.98
Organic matter (%)	0.21	HCO ₃ ⁻	7.45
Total N (%)	0.03		
Soluble cations (meq/L)		Particle size distribution (%)	
Ca ²⁺	7.10	Sand	82.46
Mg ²⁺	3.39	Silt	2.51
Na ⁺	13.20	Clay	15.03
K ⁺	0.08	Texture class	Sandy

Table(2): Chemical analysis of the tested organic fertilizers.

Constituents	Town refuse (TR)			Cattle manure (CM)		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
%						
Moisture content	5.5	5.2	4.8	19.3	17.6	18.2
Organic matter	29.8	25.17	24.12	20.55	22.16	21.48
Organic carbon	21.53	20.91	18.10	17.51	18.14	19.05
Total N	0.86	0.93	0.88	1.13	1.10	1.09
P	0.29	0.31	0.36	0.71	0.59	0.67
K	1.34	1.36	1.25	1.15	1.30	1.19
Ca	4.33	4.07	3.91	1.37	1.28	1.45
Mg	0.29	0.31	0.20	0.69	0.73	0.82
C/N ratio	25 : 1	22 : 1	21 : 1	16 : 1	16 : 1	17 : 1
ppm						
Fe	513	396	401	149	151	158
Zn	580	677	562	125	90	131
Mn	401	329	388	74	89	120
Cu	205	310	276	38	19	26

Yield was calculated as the weight of fruit × number of fruits per tree at harvest time (mid September).

3- Fruit physical and chemical properties

Samples of 16 fruits from each replicate (tree) were used to determine the physical and chemical properties. In this respect, fruit dimensions and weight of the fruit, pulp, seed and peel were recorded, also seed/pulp ratio was calculated. Chemical properties, included total soluble solid percentage (T.S.S.%) was determined by a hand refractometer, total acidity percentage (expressed as gm citric acid/100 gm pulp) (A.O.A.C., 1995). TSS/acid ratio was calculated, total and reducing sugars and carotenoids were determined according to Malik & Singh (1980) and Roy (1973), respectively.

4- Leaf mineral content Samples comprised of twenty mature leaves were collected " mid July of each season" from the middle of vegetative shoots around each of the chosen tree. For mineral content determination, nitrogen (N) and phosphorus (P) were determined according to

venhuis (1976) and Murphy & Riley (1962), respectively. Potassium (K) was determined by Flame photometer, iron (Fe), manganese (Mn) and zinc (Zn) were determined by Perkin Elmer Atomic Absorption Spectrophotometer. The obtained data were statistically analyzed according to Mead *et al.* (1993) using New L.S.D test for examining the significant differences between the studied treatments.

3. RESULTS AND DISCUSSION

3.1. Effect of different organic nitrogen sources on yield components

Data presented in Table (3) revealed that yield components of Zebda mango trees namely; number of panicle/tree, number of flowers/panicle, number of set fruits/panicle at initial fruit set, fruit set percentage, number of fruits/tree and yield/tree were improved by different organic nitrogen sources as compared with mineral nitrogen only. The obtained results showed that the treatment of MN 20%+CM 80% significantly increased the number of panicle/tree, the number of set fruits at

Table (3): Effect of different organic nitrogen sources on yield components of Zebda mango trees in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	No. of panicles/tree			No. of flowers/panicle			No. of set fruits/panicle at initial fruit set		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	67.69 ^c	35.55 ^d	64.67 ^d	963.7	791.3 ^b	975.0 ^c	154.0 ^e	132.1 ^{de}	158.4 ^d
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	71.27 ^{ab}	43.11 ^c	68.72 ^{cd}	990.3	817.0 ^{ab}	991.5 ^{abc}	172.8 ^d	148.8 ^c	171.4 ^c
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	78.02 ^a	48.36 ^a	77.37 ^a	994.5	829.8 ^{ab}	1005.6 ^a	201.5 ^b	168.0 ^{ab}	204.1 ^a
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	73.50 ^b	45.47 ^{bc}	72.86 ^{bc}	991.7	822.2 ^{ab}	1000.9 ^a	189.1 ^c	159.4 ^b	184.7 ^b
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	67.98 ^c	44.24 ^c	71.95 ^{bc}	987.2	826.0 ^a	997.9 ^{ab}	177.7 ^d	141.6 ^{cd}	180.3 ^b
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	72.61 ^b	43.81 ^c	70.59 ^c	994.0	814.6 ^{ab}	978.3 ^{bc}	156.4 ^e	168.0 ^{ab}	161.1 ^d
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	79.23 ^a	48.81 ^a	79.60 ^a	999.7	843.7 ^a	1010.3 ^a	209.9 ^a	176.3 ^a	205.6 ^a
New L.S.D. at 5%	4.53	2.88	4.50	N.S.	39.5	21.5	5.1	9.8	6.6

Cont.Table (3): Effect of different organic nitrogen sources on yield components of Zebda mango trees in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	Fruit set %			No. of fruits/tree			Yield/tree (Kg)		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	15.99 ^d	16.70 ^d	16.28 ^{cd}	49.68 ^e	18.78 ^f	54.26 ^e	20.83 ^g	7.90 ^g	22.74 ^g
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	18.42 ^c	18.26 ^{bc}	17.17 ^c	53.47 ^d	22.64 ^e	56.20 ^e	23.13 ^f	9.93 ^f	24.31 ^f
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	20.27 ^{ab}	20.63 ^a	20.87 ^a	75.13 ^a	43.48 ^a	76.45 ^b	35.66 ^b	21.00 ^b	36.31 ^b
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	19.03 ^{bc}	19.31 ^b	18.32 ^b	70.48 ^b	39.18 ^c	71.40 ^c	31.86 ^d	17.90 ^d	32.28 ^d
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	18.00 ^c	17.47 ^{cd}	18.22 ^b	71.71 ^b	41.15 ^b	73.65 ^c	33.90 ^c	19.36 ^c	34.39 ^c
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	15.79 ^d	15.29 ^e	16.04 ^d	62.07 ^c	32.87 ^d	64.27 ^d	26.43 ^e	14.81 ^e	29.22 ^e
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	21.00 ^a	21.44 ^a	20.99 ^a	76.88 ^a	44.96 ^a	79.87 ^a	36.76 ^a	21.80 ^a	38.18 ^a
New L.S.D. at 5%	1.30	1.19	1.00	2.23	1.83	2.38	1.06	0.97	1.02

The values per column followed by the same letter do not differ at 5% level of significance.

MN = Mineral nitrogen ; TR = Town refuse ; CM = Cattle manure.

initial fruit set, fruit set percentage and the number of fruits/tree than those of the control and other treatments, except those of the treatment (MN 50%+TR 50%) which ranked the second effective treatment. In meantime, the promising treatment of MN 20%+CM 80% significantly gave the highest yield/tree than those of all treatments. On the other hand, treatment of MN 100% "control" significantly gave the lowest values for all yield components, meanwhile the other treatments revealed an intermediate values of the studied yield components.

The positive effect of organic manures plus mineral nitrogen fertilizers on yield components *i.e.*, no. of panicle/tree; no. of flowers/panicle; no. of set fruits/panicle, fruit set %; no. of fruit/tree and yield/tree could be attributed to its role in increasing amino acid contents, which are considered as constituents of protein and other compounds that share in the development of new tissues (Smith, 1998 and Tiwary *et al.*, 1999). Additionally, this pronounced effect of organic manures plus mineral N fertilizers on yield components may be due to an increase in cell division and enlargement and consequently increase in vegetative growth which is reflected on increasing yield components as a final result of the physiological processes (Abd El-Naby & Gomma, 2000; Geetha & Nair, 2000 and Shaheen *et al.*, 2009). The obtained results are in harmony with those obtained by Omar & Belal (2007) on mango trees and Shahein *et al.* (2003); El-Assar (2005); Al-Wasfy & El-Khawaga (2008) on date palms.

3.2. Effect of different organic nitrogen sources on physical properties of Zebda mango fruits :

Data presented in Table (4) clearly showed that the two organic nitrogen sources used plus mineral nitrogen fertilizer significantly affected the physical properties of fruits. The maximum values of fruit weight, fruit length, fruit diameter and pulp weight were recorded for trees received (MN 20%+ CM 80%) treatment in most cases. Such treatment also significantly produced the lowest values of seed weight and seed/pulp ratio. These results were true in the three experimental seasons.

The promotion effect of organic nitrogen source (cattle manure) plus mineral nitrogen fertilizer on fruit weight, fruit length, fruit diameter and pulp weight could be attributed to its role on the availability of elements as constituents of protein and other compounds which produce the new tissues through their role as constituents

of the nucleic acids DNA and RNA, in addition to the role of organic manure on increase the soil content of IAA and cytokines which stimulated the plant growth (Li *et al.*, 1998). These results are in line with those of Geetha & Nair (2000); Chatzitheodorou *et al.* (2004); Abd El-Rahman (2007); Saad & Saad (2007) and Hossam & Boshra (2008).

3.3. Effect of different organic nitrogen sources on the chemical characteristics of Zebda mango fruits

Data presented in Table (5) showed that the application of the studied organic nitrogen sources plus mineral nitrogen fertilizers significantly improved the chemical characteristics of Zebda mango fruits in terms of total soluble solids (TSS%), TSS/acid ratio, reducing & total sugars and carotinoids as compared with the application of the mineral nitrogen source. The present treatments could be arranged according to their significant effect on such chemical parameters in the following descending order; treatment of (MN 20%+CM 80%) and (MN 50%+TR 50%), (MN 80%+CM 20%), (MN 20% + TR 80%), (MN 80% + TR 20%), (MN 50% + CM 50%) and (MN 100%, control). In meantime, there was no significant difference between the effect of (MN 20%+CM 80%) treatment (MN 50%+TR 50%) on reducing sugars. However, treatment (MN 100%, control) gave significantly the highest total acidity content of fruit jounce as compared with the other treatments. These obtained results were true in the three seasons.

Such findings might be due to the effect of organic nitrogen sources which ascribed a good balance between growth and fruiting resulting in accumulation of more carbohydrates and make them much available for enhancing chemical constituents of fruits.

The above mentioned results are in accordance with those obtained by Joo *et al.* (1999); Abd El-Hameed & Ragab (2004); Mohamed & Gobara (2004); Mansour *et al.* (2004); Abd El-Salam *et al.* (2009) on different fruit crops. Diab (2006) indicated that increasing the organic nitrogen level substantially from 12.5% to 75% of recommended nitrogen improved the fruit quality of sewy date palms.

3.4. Effect of different organic nitrogen sources on leaf mineral content of Zebda mango trees :

The data in Table (6) clearly indicated that amending Zebda mango trees with the two organic nitrogen sources namely town refuse (TR) and cattle manure (CM) combined with mineral

Table (4): Effect of different organic nitrogen sources on physical properties of Zebda mango fruits in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	Fruit weight (gms)			Fruit length (cm)			Fruit diameter (cm)		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	419.0 ^g	421.9 ^g	419.1 ^g	12.333 ^e	12.036 ^g	12.063 ^g	7.320 ^g	7.273 ^g	7.346 ^g
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	432.6 ^e	438.6 ^f	432.6 ^f	13.983 ^d	14.031 ^f	13.913 ^f	7.520 ^f	7.672 ^f	7.643 ^f
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	474.6 ^b	482.9 ^b	475.0 ^b	14.683 ^a	14.691 ^b	14.803 ^b	7.670 ^b	7.873 ^b	8.130 ^b
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	452.0 ^d	456.8 ^d	452.1 ^e	14.223 ^c	14.235 ^d	14.273 ^d	7.580 ^d	7.753 ^d	7.713 ^d
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	472.7 ^c	470.5 ^c	466.9 ^c	14.453 ^b	14.470 ^c	14.423 ^c	7.630 ^c	7.821 ^c	7.735 ^c
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	425.8 ^f	450.6 ^e	654.6 ^d	14.203 ^c	14.205 ^e	14.233 ^e	7.560 ^e	7.730 ^e	7.670 ^e
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	477.9 ^a	484.9 ^a	478.1 ^a	14.693 ^a	14.869 ^a	14.993 ^a	7.690 ^a	7.886 ^a	8.183 ^a
New L.S.D. at 5%	1.4	1.2	1.5	0.176	0.174	0.181	0.019	0.012	0.017

Cont. Table (4): Effect of different organic nitrogen sources on physical properties of Zebda mango fruits in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	Pulp weight (gms)			Seed weight (gms)			Peel weight (gms)			Seed/pulp ratio		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	306.7 ^g	315.3 ^f	312.6 ^g	65.43 ^a	67.06 ^a	65.13 ^a	46.86 ^f	39.51 ^e	41.36 ^e	0.213 ^a	0.212 ^a	0.208 ^a
2- Mineral nitrogen "MN" 80%+Town refuse "TR" 20%	330.8 ^e	341.8 ^d	337.4 ^e	54.00 ^c	58.10 ^c	53.90 ^c	62.86 ^d	53.83 ^c	56.55 ^c	0.163 ^c	0.170 ^c	0.759 ^c
3- Mineral nitrogen "MN" 50%+Town refuse "TR" 50%	356.2 ^b	368.7 ^a	363.8 ^b	49.33 ^e	51.50 ^f	49.20 ^e	69.50 ^a	63.46 ^a	60.90 ^a	0.138 ^f	0.139 ^f	0.135 ^f
4- Mineral nitrogen "MN" 20%+Town refuse "TR" 80%	334.3 ^d	345.1 ^c	341.2 ^d	52.73 ^d	57.56 ^d	52.83 ^d	64.66 ^c	54.23 ^c	58.43 ^b	0.158 ^d	0.166 ^d	0.154 ^d
5- Mineral nitrogen "MN" 80% + Cattle manure "CM" 20%	346.8 ^c	357.6 ^b	353.7 ^c	52.62 ^d	54.73 ^e	52.60 ^d	67.03 ^b	58.20 ^b	60.40 ^a	0.152 ^e	0.153 ^e	0.149 ^e
6- Mineral nitrogen "MN" 50% + Cattle manure "CM" 50%	318.2 ^f	328.0 ^e	324.3 ^f	57.60 ^b	59.40 ^b	57.16 ^b	56.76 ^e	49.40 ^d	51.16 ^d	0.181 ^b	0.181 ^b	0.176 ^b
7- Mineral nitrogen "MN" 20% + Cattle manure "CM" 80%	358.8 ^a	370.1 ^a	368.0 ^a	49.23 ^e	49.73 ^g	49.00 ^e	69.76 ^a	65.10 ^a	60.91 ^a	0.137 ^g	0.134 ^g	0.133 ^g
New L.S.D. at 5%	1.6	2.2	1.5	0.42	0.38	0.50	1.19	2.56	1.88	0.001	0.002	0.002

The values per column followed by the same letter do not differ at 5% level of significance.

MN = Mineral nitrogen ; TR = Town refuse ; CM = Cattle manure.

Table (5): Effect of different organic nitrogen sources on chemical characteristics of Zebda mango fruits in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	TSS %			Acidity			TSS/acid ratio		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	12.56 ^g	14.33 ^f	13.45 ^g	0.380 ^a	0.348 ^a	0.372 ^a	33.05 ^g	41.17 ^g	36.15 ^f
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	13.16 ^e	15.10 ^d	14.06 ^e	0.300 ^c	0.273 ^{bc}	0.293 ^{bc}	43.86 ^e	55.31 ^e	47.98 ^d
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	14.43 ^b	16.26 ^b	15.44 ^b	0.220 ^e	0.213 ^d	0.215 ^d	65.59 ^b	76.33 ^b	71.81 ^b
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	13.26 ^d	15.16 ^d	14.17 ^d	0.296 ^c	0.272 ^{bc}	0.289 ^{bc}	44.19 ^d	55.73 ^e	49.03 ^d
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	13.90 ^c	15.56 ^c	14.93 ^c	0.259 ^e	0.238 ^{cd}	0.253 ^{cd}	53.66 ^c	65.37 ^c	59.01 ^c
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	12.90 ^f	14.70 ^e	13.89 ^f	0.337 ^b	0.308 ^b	0.328 ^b	38.27 ^f	47.72 ^f	42.34 ^e
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	14.50 ^a	16.40 ^a	15.56 ^a	0.217 ^e	0.211 ^d	0.212 ^d	66.82 ^a	77.72 ^a	73.39 ^a
New L.S.D. at 5%	0.06	0.09	0.05	0.035	0.040	0.043	0.82	1.04	1.91

Cont. Table (5): Effect of different organic nitrogen sources on chemical characteristics of Zebda mango fruits in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	Reducing sugars %			Total sugars %			Carotinoids mg/100 gm		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	4.896 ^f	3.660 ^f	4.800 ^f	12.874 ^g	12.450 ^g	12.746 ^g	1.908 ^g	1.935 ^g	1.923 ^g
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	6.043 ^d	4.610 ^d	6.180 ^d	13.110 ^e	13.433 ^e	13.943 ^e	2.076 ^e	2.050 ^e	2.093 ^e
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	6.850 ^a	5.126 ^a	7.000 ^a	14.020 ^b	14.196 ^b	14.660 ^b	2.226 ^b	2.200 ^b	2.247 ^b
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	6.133 ^c	4.693 ^c	6.270 ^c	13.330 ^d	13.540 ^d	14.060 ^d	2.083 ^d	2.066 ^d	2.105 ^d
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	6.496 ^b	4.920 ^b	6.643 ^b	13.416 ^c	13.870 ^c	14.420 ^c	2.156 ^c	2.130 ^c	2.173 ^c
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	5.696 ^e	3.990 ^e	5.683 ^e	13.221 ^f	13.213 ^f	13.573 ^f	2.005 ^f	1.990 ^f	2.020 ^f
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	6.866 ^a	5.160 ^a	7.020 ^a	14.426 ^a	14.303 ^a	14.780 ^a	2.236 ^a	2.223 ^a	2.253 ^a
New L.S.D. at 5%	0.069	0.051	0.033	0.012	0.009	0.015	0.006	0.008	0.004

The values per column followed by the same letter do not differ at 5% level of significance.

MN = Mineral nitrogen ; TR = Town refuse ; CM = Cattle manure.

Table (6): Effect of different organic nitrogen sources on leaf mineral content of Zebda mango trees in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	Nitrogen %			Phosphorus %			Potassium %		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	0.840 ^g	0.798 ^g	0.849 ^g	0.159 ^c	0.117 ^d	0.175 ^c	0.870 ^c	0.849 ^b	0.853 ^b
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	1.523 ^e	1.459 ^e	1.535 ^e	0.198 ^b	0.163 ^b	0.217 ^b	1.123 ^{bc}	1.194 ^{ab}	1.160 ^{ab}
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	1.896 ^b	1.773 ^b	1.914 ^b	0.235 ^a	0.206 ^a	0.244 ^a	1.283 ^{ab}	1.236 ^a	1.324 ^a
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	1.560 ^d	1.470 ^d	1.573 ^d	0.224 ^a	0.185 ^a	0.203 ^b	1.233 ^{abc}	1.197 ^{ab}	1.283 ^a
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	1.723 ^c	1.615 ^c	1.736 ^c	0.225 ^a	0.203 ^a	0.226 ^a	1.236 ^{abc}	1.210 ^{ab}	1.303 ^a
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	1.320 ^f	1.267 ^f	1.330 ^f	0.177 ^c	0.139 ^c	0.180 ^c	1.233 ^{bc}	1.055 ^{ab}	1.082 ^{ab}
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	1.920 ^a	1.806 ^a	1.935 ^a	0.237 ^a	0.218 ^a	0.246 ^a	1.515 ^a	1.413 ^a	1.335 ^a
New L.S.D. at 5%	0.007	0.008	0.01	0.023	0.020	0.022	0.390	0.384	0.367

Cont. Table (6): Effect of different organic nitrogen sources on leaf mineral content of Zebda mango trees in 2008/2009, 2009/2010 and 2010/2011 seasons.

Treatments	Iron (ppm)			Manganese (ppm)			Zinc (ppm)		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
1-Mineral nitrogen "MN" 100% (control)	55.3 ^g	57.6 ^f	56.6 ^e	41.4 ^f	40.3 ^f	43.0 ^f	47.5 ^g	58.0 ^g	50.6 ^g
2- Mineral nitrogen "MN" 80%+ Town refuse "TR" 20%	67.2 ^e	69.0 ^d	68.8 ^c	46.3 ^d	45.8 ^e	48.1 ^d	51.8 ^d	67.4 ^e	55.0 ^e
3- Mineral nitrogen "MN" 50%+ Town refuse "TR" 50%	80.3 ^b	81.9 ^a	82.2 ^a	57.4 ^b	70.2 ^b	59.4 ^b	64.1 ^b	71.8 ^b	68.0 ^b
4- Mineral nitrogen "MN" 20%+ Town refuse "TR" 80%	69.5 ^d	70.0 ^c	71.3 ^b	53.4 ^c	56.1 ^d	55.7 ^c	58.9 ^c	70.6 ^d	63.1 ^d
5- Mineral nitrogen "MN" 80%+ Cattle manure "CM" 20%	70.1 ^c	72.0 ^b	71.8 ^b	57.0 ^b	59.6 ^c	59.2 ^b	60.0 ^b	71.2 ^c	63.7 ^c
6- Mineral nitrogen "MN" 50%+ Cattle manure "CM" 50%	61.0 ^f	64.8 ^e	62.4 ^d	42.7 ^e	45.5 ^e	44.3 ^e	51.3 ^e	61.7 ^f	54.4 ^f
7- Mineral nitrogen "MN" 20%+ Cattle manure "CM" 80%	80.9 ^a	82.4 ^a	82.8 ^a	64.1 ^a	73.6 ^a	66.6 ^a	64.6 ^a	72.5 ^a	68.6 ^a
New L.S.D. at 5%	0.5	0.6	0.6	0.7	0.4	0.3	0.5	0.2	0.3

The values per column followed by the same letter do not differ at 5% level of significance. MN = Mineral nitrogen ; TR = Town refuse ; CM = Cattle manure.

nitrogen source (MN) significantly improved leaf mineral contents compared with the application of nitrogen mineral source only. Treatment of (MN 20% + CM 80%) significantly increased nitrogen, manganese and zinc leaf contents more than those of the other treatments and the control. At the same time, either treatments, (MN 20% + CM 80%) or (MN 50% + TR 50%) significantly increased phosphorus, potassium and iron leaf contents than those of the remained treatments in most cases.

On the other hand, the least leaf mineral contents were recorded for treatment of (MN 100%, control). These results were true in the three experimental seasons.

The beneficial effect of the organic N sources on reducing soil pH may be responsible for facilitating the availability of most nutrients and this could be explained by the present results. In addition, the studied organic N source (cattle manure and town refuse) contained high amounts of other nutrients (Table 2). Also, the increase in leaf mineral contents may be explained on the basis that the organic materials increased the soil water holding capacity which encourage the solubility and consequently the available nutrients (Zaid & Kariem, 1992; El-Kassas *et al.*, 1997 and Nassar, 1998). When organic and conventional chemical fertilizer N were applied together, nutrients uptake was higher than with organic N or mineral N alone as shown in Table (6). This may be explained on the basis that the combined addition of organic and inorganic N maintains continuous satisfactory increase of the efficiency of nutrient utilization and reduced nutrient losses (Harhash & Abdel-Nasser, 2000). These results are in agreement with those obtained by El-Sayed (1994); Ahmed *et al.* (1996); Mansour & Ahmed (1998); Hammam *et al.* (2003); Saad & Saad (2007) and Al-Wasfy & El-Khawaga (2008).

In general, the improvement in yield and fruit quality of Zebda mango trees due to the application of organic manures were reflecting soil properties *i.e.*, soil aggregation, soil water retention and lowering pH which leads to volatilization of nutrients and increase their availability and supply to trees (Gouda, 1984; Salem, 1986 and Dahdoh & El-Hassanin, 1993) also, organic matter as complexing agent, minimizes the loss of nutrients by leaching (Abdel-Nasser and Harhash, 2000). In meantime, using organic manures as a fraction of N requirements reduced the fertilization costs and decreasing the losses in NO_3^- that causes the

groundwater pollution which caused by excess of chemical fertilizers (Cole *et al.*, 1987).

Finally, it can be recommended from the present data that partially replacing of mineral N fertilizer requirement by organic manures such as cattle manure or town refuse was useful, whereas annual application of mineral nitrogen 20% plus cattle manure 80% or mineral nitrogen 50% plus town refuse 50% per tree produced the highest yield with fairly good quality of Zebda mango fruits.

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تأثير مصادر مختلفة للنيتروجين العضوي كبديل جزئي للنيتروجين المعدني على كل من المحصول وجودة الثمار والمحتوى المعدني للأوراق في المانجو صنف زبدة

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ملخص

تم تنفيذ هذه الدراسة خلال ثلاثة مواسم (2009/2008 ، 2010/2009 و 2011/2010) على أشجار مانجو صنف زبدة نامية في أرض رملية تحت ظروف الري السطحي، حيث كانت تضاف الكمية الموصى بها من النيتروجين وهي 700 جم / شجرة / سنة إما على صورة نيتروجين معدني خالص (سلفات أمونيوم 20.6%) أو بتوليفات مختلفة من السماد المعدني مع مصادر مختلفة للنيتروجين العضوي (سماد مخلفات المدن أو سماد مخلفات الماشية) .

كان الهدف من هذه الدراسة هو معرفة تأثير هذه المعاملات المختلفة على كل من المحصول والخواص الطبيعية والكيميائية للثمار والمحتوى المعدني للأوراق. وذلك لإلقاء الضوء على أكبر نسبة إحلال ممكنة للنيتروجين العضوي بدلاً من النيتروجين المعدني و التي يمكن أن تحقق أعلى محصول مع أفضل جودة للثمار.

أوضحت النتائج أن جميع معاملات الصور المستخدمة من مصادر النيتروجين العضوي كانت مؤثرة في تحسين كل من المحصول وجودة الثمار والمحتوى المعدني للأوراق مقارنة بمعاملة استخدام النيتروجين المعدني فقط (المقارنة). فمن حيث التأثير الإيجابي على كل من محصول الشجرة ووزن وقطر الثمار ونسبة البذرة إلى اللب ونسبة المواد الصلبة الذائبة الكلية إلى الحموضة ومحتوى الثمار من السكريات الكلية والكاروتينات فإنه يمكن ترتيب المعاملات المؤثرة تنازلياً كما يلي :- معاملة نيتروجين معدني 20% + سماد الماشية 80% ، معاملة نيتروجين معدني 50% + سماد مخلفات المدن 50% ، معاملة نيتروجين معدني 80% + سماد الماشية 20% .

و علاوة على ذلك فإن كل من المعاملتين : نيتروجين معدني 20% + سماد الماشية 80% و معاملة نيتروجين معدني 50% + سماد مخلفات المدن 50% كان لهما تأثير معنوي في زيادة كل من محتوى الثمار من السكريات المختزلة ومحتوى الأوراق من عناصر الفوسفور والمنجنيز والزنك منسوبا إلى المقارنة وبقية المعاملات الأخرى .

يتضح من النتائج المتحصل عليها تحت ظروف هذه الدراسة أن استخدام معاملة النيتروجين المعدني 20% + سماد الماشية 80% كانت مفيدة في تقليل استخدام النيتروجين المعدني وبالتالي تقليل التلوث البيئي مع تحقيق أفضل محصول إقتصادي بأعلى جودة ثمار وتقتصر هذه المعاملة كتوصية جيدة لتسميد أشجار المانجو تحت الظروف المماثلة .

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