Partial Replacement of Inorganic N Fertilizer in Balady Mandarin Orchards by Using Organic and Biofertilization

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Abstract: This study was carried out during 2011 and 2012 seasons to adjust the best N management for Balady mandarin trees grown under Minia region. Using the suitable N through 60 to 80 % inorganic N + 10 to 20 % organic N + 50 to 200 ml Minia Azotene biofertilizer + 50 to 100 ml EM per tree resulted in an obvious promotion on all growth characters and plant pigments, nutrients namely N, P, K and Mg, yield and fruit quality in relative to the other N management. The promotion on fruit quality and the reduction on nitrite in the juice were associated with reducing percentages of inorganic N and at the same time increasing percentages of organic fertilizer, Minia Azotene and EM biofertilizers. A great decline on the yield was observed with using inorganic N at percentages lower than 60 % even with the application of organic and biofertilization. The best results with regard to yield and fruit quality of Balady mandarin trees were obtained due to fertilizing of the trees with the suitable N (1000 g N/ tree/ year) through 60 % inorganic N + 20 % organic N + 100 ml Minia Azotene + 100 ml EM/ tree per tree. Thus it can be replaced 40 % of the inorganic N with 20 % organic N + 100 ml Minia Azotene biofertilizer + 100 ml EM/ tree to reduce nitrite pollution and produce healthy and higher fruit quality.

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1.Introduction

Yield decline is suggested to be a major problem that faces Balady mandarin trees grown under Minia region. The main causes for poor cropping are the unbalancing or malnutrion of nutrients particularly N **(Mengel, 1984)**. The efficiency of N fertilization under field conditions and surface irrigated soil rarely exceeds 50 % and is usually ranging from 30 to 40 % **(Yagodin, 1990).** Such low efficiency may be du to the great leaching. Partial replacement of mineral N fertilizers by using organic and biofertilization especially EM proved to be very effective for controlling the release of N from soil to plants **(Wani and Lee, 1995 and Kannaiyan, 2002).**

Previous studies emphasized the beneficial of organic and biofertilization as a partial replacement for inorganic N in fruit crop orchards for avoiding pollution and promoting yield and fruit quality **(Wassel *et al*., 2000; Roshdy, 2004; Gobara and Ahmed 2004; Sharawy, 2005; El- Sawy, 2005; Gamal, 2006; Ragab, 2006; Mouftah, 2007; Wassel *et al*., 2007a and 2007b; Mahmoud- Sara, 2008; Abdo, 2008; El- Salhy, 2008; Mahfouz, 2011; Ibrahim, 2012 and Mahmoud, 2012).**

The goal of this study was finding out the best N management for Balady mandarin orchards grown under minia region for promoting yield and fruit quality and at the same time avoiding the pollution in our environment.

2.Material and Methods

This study was conducted during 2011 and 2012 seasons on thirty– three uniform in vigour 16- years old Balady mandarin trees (*Citrus reticulata*) Blanco budded on sour orange rootstock in a private orchard situated at Abo Gerg village, Bany Mazar district, Minia Governorate where the soil is clay and well drained and with a water table not less than two meters deep. Tree spacing is 5 × 5 meters apart. Surface irrigation system was followed. Soil analysis was done according to the procedures of **Wilde *et al.* (1985)** and the data are given in Table (1).

Table (1): analysis of the tested soil.

Constituents	values
Particle size distribution:	
Sand %	: 6.10
Silt %	: 12.11
Clay %	: 81.79
Texture	: Clay
pH (1:2.5 extract)	: 7.71
E.C (1:2.5 extract) (mmhos/ cm/ 25° C)	: 0.70
O.M. %	: 2.29
$CaCO_3$ %	: 1.33
Total N %	: 0.09
Available P (ppm, Olsen)	: 4.1
Available K (ppm) (ammonium acetate)	: 445.3

The present experiment included the following eleven treatments from various inorganic, organic and biofertilization treatments:

1- Application of the recommended rate of N (1000 g N/ tree for all selected trees) (according to **Ragab, 2006)** completely via inorganic N source (3.0 kg ammonium nitrate/ tree).
2- Application of the suitable N through 80 % inorganic N (2.4 kg ammonium nitrate/ tree) + 10 % organic N (13.3 kg F.Y.M/ tree) + 100 ml Minia Azotene biofertilizer/ tree.
3- Application of the suitable N through 60 % inorganic N (1.8 kg ammonium nitrate/ tree) + 20 % organic N (26.6 kg F.Y.M/ tree) + 200 ml Minia Azotene biofertilizer / tree.
4- Application of the suitable N through 40 % inorganic N (1.2 kg ammonium nitrate/ tree) + 30 % organic N (39.3 kg F.Y.M/ tree) + 300 ml Minia Azotene biofertilizer/ tree.
5- Application of the suitable N through 20 % inorganic N (0.6 kg ammonium nitrate/ tree) + 40 % organic N (53.2 kg F.Y.M/ tree) + 400 ml Minia Azotene biofertilizer/ tree.
6- Application of the suitable N through 0.0 % inorganic N (0.0 kg ammonium nitrate/ tree) + 50 % organic N (66.5 kg F.Y.M/ tree) + 500 ml Minia Azotene biofertilizer/ tree.
7- Application of the suitable N through 80 % inorganic N (2.4 kg ammonium nitrate/ tree) + 10 % organic N (13.3 kg F.Y.M/ tree) + 50 ml Minia Azotene + 50 ml EM/ tree.
8- Application of the suitable N through 60 % inorganic N (1.8 kg ammonium nitrate/ tree) + 20 % organic N (26.6 kg F.Y.M/ tree) + 100 ml Minia Azotene + 100 ml EM/ tree.
9- Application of the suitable N through 40 % inorganic N (1.2 kg ammonium nitrate/ tree) + 30 % organic N (39.3 kg F.Y.M/ tree) + 150 ml Minia Azotene + 150 ml EM/ tree.
10- Application of the suitable N through 20 % inorganic N (0.6 kg ammonium nitrate/ tree) + 40 % organic N (53.2 kg F.Y.M/ tree) + 200 ml Minia Azotene + 200 ml EM/ tree.
11- Application of the suitable N through 0.0 % inorganic N (0.0 kg ammonium nitrate/ tree) + 50 % organic N (66.5 kg F.Y.M/ tree) + 250 ml Minia Azotene + 250 ml EM/ tree.

Each treatment was replicated three times, one tree per each. All the selected trees fertilized with N at fixed rate namely 1000 g/ tree). The source of inorganic N fertilizer was ammonium nitrate (33.5 % N). It was splitted into three equal batches and added on the first week of March, May and July. Farmyard manure (0.75 % N) (Table 2) organic fertilizer was added once at the middle of January in four digs in the four directions around each tree and the digs were immediately covered with moist soil. The amount of the two biofertilizers namely Minia Azotene (was a source of *Azotobacter sp*) and Effective microorganisms (EM) were added once in the same digs filled previously with F.Y.M on the last week of February.

Parameter	Values
M^3 weight (kg.)	: 650
Moisture %	: 37.0
O.M. %	: 24.0
O. Carbon %	: 21.4
pH (1: 10)	: 8.66
E.C (1:2.5 extract) (mmhos/ cm/ 25° C)	: 4.88
C/N	: 28.5
Total N %	: 0.75
Total P %	: 0.35
Total K %	: 1.00
Total Ca %	: 2.00
Total Mg %	: 1.00
Total Fe (ppm)	: 1100
Total Mn (ppm)	: 250
Total Zn (ppm)	: 75

Randomized complete block design was followed for statistical analysis of the present investigation.

The following parameters were recoded during both seasons. Leaf area (**Ahmed and Morsy, 1999)**, number of leaves/ shoot, plant pigments namely chlorophylls a & b, total carotenoids, total chlorophylls (as mg/ g^{-1} F.W) (according to **Hiscox and Isralstam, 1979)**; percentages of N, P, K and Mg in the leaves (according to **Wilde *et al*., 1985)**, total carbohydrates % **(A.O.A.C., 1995)**, C/N; initial and final fruit setting %, yield (kg.), number of fruits/ tree, fruit weight and dimensions (height and diameter), fruit shape, thickness and percentage of fruit peel, T.S.S %, total acidity, T.S.S/ acid, total sugars %, reducing and non- reducing sugars **(A.O.A.C., 1995)**, vitamin C (mg/ 100 ml juice) **(A.O.A.C., 1995)** and juice nitrite content (ppm) (according to **Ridnour-Lisa *et al*., 2000**).

Statistical analysis was initiated using new L.S.D at 5 % parameter for elucidating the differences between various treatments means **(Mead *et al*., 1993)**

3. Results and Discussion

Growth characters:-

It is clear from the data in Table (3) that fertilization with the suitable N (1000 g/ tree/ year) through 60 to 80 % inorganic N + 10 to 20 % inorganic N + 50 to 200 ml Minia Azotene

biofertilization + 50 to 100 ml EM/ tree significantly stimulated the leaf area and number of leaves/ shoot in relative to using N through inorganic N at percentages lower than 60 % even with the application of organic and biofertilization or when N was completely added via inorganic N. using the suitable N completely via inorganic form was significantly superior than using N via inorganic form at 0.0 to 40 % plus organic N at 10 to 50 % + Minia Azotene at 100 to 500 ml without EM or at 50 to 250 ml Minia Azotene with the same amount of EM. The addition of EM at 50 to 250 ml/ tree to inorganic, organic and biofertilization significantly resulted in promoting the two growth characters in relative to carrying out inorganic, organic and biofertilization without the addition of EM. A significant reduction on such two growth characters was observed with reducing percentages of inorganic N from 60 to 0.0 % even with the application of organic and biofertilization of the highest values were recorded on the trees that fertilized with N through 60 % inorganic + 20 % organic + 100 ml Minia Azotene biofertilizer + 100 ml EM/ tree. Fertilizing the trees with N as 0.0 % inorganic + 50 % organic + 500 ml Minia Azotene biofertilizer/ tree gave the lowest values. These results were true during both seasons.

Leaf chemical composition:-

Data presented in Tables (3 & 4 & 5) revealed that supplying Balady mandarin trees with the suitable N (1000 g/ tree/ year) through 60 to 80 % inorganic N + 10 % organic N + 100 ml Minia Azotene alone or 50 ml Minia Azotene + 50 ml EM per tree significantly was responsible for enhancing all plant pigments (chlorophylls a & b, total carotenoids & total chlorophylls) as well as percentages of N, P, K, Mg and total carbohydrates comparing with using N completely via inorganic N. The promotion was significantly associated with reducing percentages of inorganic N from 100 to 0.0 % and at the same time increasing organic and biofertilizer percentages and EM levels from 50 to 250 ml/ tree. Using EM at 50 to 250 ml/ tree along with inorganic, organic and biofertilization caused a significant promotion on these parameters than using inorganic, organic and biofertilization alone (without EM). The investigated N management had no significant effect on C/N. The maximum plant pigments total carbohydrates and nutrients in the leaves was observed on the trees that fertilized with N as 50 % organic N + 250 ml Minia Azotene biofertilizer + 250 ml EM/ tree. The lowest values were recorded on the trees that fertilized with N through 100 % inorganic N. These results were true during both seasons.

Initial and final fruit setting % & yield:

It is clear from the data in Tables (5 & 6) that supplying Balady mandarin trees with the suitable N (1000 g/ tree) through 60 to 80 % inorganic N + 10 to 20 % organic N + 100 to 200 ml Minia Azotene without EM or 50 to 100 ml Minia Azotene + 50 to 100 ml EM/ tree significantly improved the percentages of initial and final fruit setting as well as yield expressed in weight and number of fruits/ tree in relative to the other N management treatments. Using EM to organic and biofertilization significantly enhanced the efficiency of these fertilizers on improving fruit setting and yield. A significant decline on fruit setting and yield was observed with using inorganic N at percentages ranging from 0.0 to 40 % even with the application of organic and biofertilization. The maximum values were recorded on the trees that fertilized with N as 60 % inorganic N + 20 % organic N + 100 ml Minia Azotene + 100 ml EM/ tree. Under such promised treatment, yield reached 65.5 and 63.5 kg during 2011 and 2012 seasons, respectively. The minimum yield (31.9 and 30.8 kg during both seasons, respectively) were recorded on the trees that fertilized with N through 50 % organic N + 500 ml Minia Azotene biofertilizer (without inorganic fertilization). These results were true during both seasons.

Fruit quality:

It is evident from the data in Tables (6 & 7 & 8) that using the suitable N via various combinations from inorganic, organic and biofertilization significantly varied both physical and chemical characteristics of the fruits of Balady mandarin trees. Supplying the trees with N via all sources namely inorganic, organic, Minia Azotene and EM significantly was accompanied with improving fruit quality in terms of increasing fruit weight and dimensions, T.S.S %, total and reducing sugars %, T.S.S/ acid and vitamin c and reducing fruit peel weight and thickness, total acidity % and nitrite content rather than application of N completely via inorganic form. The promotion on fruit quality was significantly associated with reducing percentages of inorganic N and at the same time increasing percentages of organic N as well as levels of both Minia Azotene and EM. The investigated N management treatments had no significant effect on fruit shape and non- reducing sugars %. The best results with regard to fruit quality were obtained with fertilizing of the trees with N as 50 % organic N + 250 ml Minia Azotene + 250 ml EM/ tree (unfertilization with inorganic N). Unfavourable effects on fruit quality were observed owing to supplying the trees with N as 100 % inorganic. Similar results were announced during both seasons.

4. Discussion

The previous beneficial effects of organic and biofertilization especially EM on growth, nutritional status, yield and fruit weight might be attributed to their positive action on enhancing soil fertility, the activity of microflora, availability of most nutrients, uptake of water, secretion of hormones such as IAA, GA_3 and cytokinins, vitamins B and the resistance of the trees to different diseases (**Mengel, 1984; Yagodin, 1990 and Wani and Lee, 1995).**

These results are in agreement with those obtained by **Abdo (2008); El- Salhy (2008); Mahfouz (2011); Ibrahim (2012) and Mahmoud (2012).**

Table (3): Effect of inorganic, organic and biofertilization of N on the leaf area, number of leaves/ shoot, chlorophyll a & b and total chlorophylls of Balady mandarin trees during 2010 and 2011 seasons.

Treatments	Leaf area (cm^2)		No. of leaves/ Spring shoot		Chlorophyll a (mg/ g^{-1} F.W)		Chlorophyll b (mg/ g^{-1} F.W)		Total chlorophylls (mg/ g^{-1} F.W)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
100 % inorg. N	9.2	9.5	23.4	24.1	5.11	5.20	2.14	2.25	7.25	7.45
N as 80 % inorg. N + 10 % org. N + 100 ml bio/ tree	10.3	10.6	24.5	25.2	5.62	5.71	2.30	2.41	7.92	8.12
N as 60 % inorg. N + 20 % org. N + 200 ml bio/ tree	11.6	11.9	27.0	27.7	6.11	6.20	2.46	2.58	8.57	8.78
N as 40 % inorg. N + 30 % org. N + 300 ml bio/ tree	8.5	8.9	20.3	21.0	6.50	6.59	2.61	2.73	9.11	9.32
N as 20 % inorg. N + 40 % org. N + 400 ml bio/ tree	7.8	8.1	17.5	18.2	7.11	7.21	2.76	2.91	9.87	10.12
N as 0.0% inorg. N + 50 % org. N + 500 ml bio/ tree	7.1	7.4	15.0	15.8	8.00	8.10	2.91	3.11	10.91	11.21
N as 80 % inorg. N + 10 % org. N + 50 ml bio + 50 ml EM/ tree	11.0	11.3	25.6	26.3	8.41	8.50	3.11	3.41	11.52	11.91
N as 60 % inorg. N + 20 % org. N + 100 ml bio + 100 ml EM/ tree	12.2	12.5	28.3	29.0	8.82	8.91	3.41	3.67	12.23	12.58
N as 40 % inorg. N + 30 % org. N + 150 ml bio + 150 ml EM/ tree	8.8	9.1	22.0	22.7	9.11	9.20	3.95	4.11	13.06	13.31
N as 20 % inorg. N + 40 % org. N + 200 ml bio + 200 ml EM/ tree	8.1	8.4	18.9	19.7	9.60	9.71	4.19	4.41	13.79	14.12
N as 0.0 % inorg. N + 60 % org. N + 250 ml bio + 250 ml EM/ tree	7.5	7.8	16.3	17.0	10.11	10.21	5.61	5.61	15.72	15.82
New L.S.D at 5 %	**0.4**	**0.3**	**1.0**	**0.8**	**0.29**	**0.33**	**0.12**	**0.11**	**0.39**	**0.40**

inorg = Inorganic N (Ammonium nitrate, 33.5 % N). org = Organic N (Farmyard manure, 0.75 % N). bio = Bioferilizer (Minia Azotene).

Table (4): Effect of inorganic, organic and biofertilization of N on total carotenoids as well as percentages of total carbohydrates, N, P and K in the leaves of Balady mandarin trees during 2010 and 2011 seasons.

Treatments	Total carotenoids (mg/ g-1 F.W)		Total carbohydrates%		Leaf N %		Leaf P %		Leaf K %	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
100 % inorg. N	1.11	1.18	14.11	14.00	1.41	1.42	0.09	0.10	1.31	1.34
N as 80 % inorg. N + 10 % org. N + 100 ml bio/ tree	1.29	1.36	14.61	14.50	1.48	1.52	0.13	0.14	1.36	1.40
N as 60 % inorg. N + 20 % org. N	1.45	1.52	15.11	15.01	1.55	1.58	0.17	0.18	1.41	1.45

+ 200 ml bio/ tree										
N as 40 % inorg. N + 30 % org. N + 300 ml bio/ tree	1.61	1.71	15.55	15.44	1.63	1.63	0.21	0.21	1.45	1.48
N as 20 % inorg. N + 40 % org. N + 400 ml bio/ tree	1.76	1.84	16.00	15.89	1.71	1.74	0.22	0.24	1.50	1.52
N as 0.0% inorg. N + 50 % org. N + 500 ml bio/ tree	1.99	2.09	16.41	16.30	1.80	1.82	0.27	0.30	1.55	1.57
N as 80 % inorg. N + 10 % org. N + 50 ml bio + 50 ml EM/ tree	2.20	2.29	16.85	16.74	1.89	1.91	0.30	0.34	1.60	1.62
N as 60 % inorg. N + 20 % org. N + 100 ml bio + 100 ml EM/ tree	2.51	2.60	17.41	17.31	1.95	1.99	0.34	0.37	1.66	1.67
N as 40 % inorg. N + 30 % org. N + 150 ml bio + 150 ml EM/ tree	2.71	2.81	18.30	18.19	2.05	2.08	0.37	0.41	1.71	1.71
N as 20 % inorg. N + 40 % org. N + 200 ml bio + 200 ml EM/ tree	2.92	3.00	18.71	18.60	2.11	2.14	0.41	0.46	1.75	1.82
N as 0.0 % inorg. N + 60 % org. N + 250 ml bio + 250 ml EM/ tree	3.11	3.20	19.40	19.30	2.18	2.22	0.46	0.50	1.80	1.90
New L.S.D at 5 %	**0.11**	**0.10**	**0.41**	**0.37**	**0.06**	**0.04**	**0.03**	**0.04**	**0.05**	**0.06**

inorg = Inorganic N (Ammonium nitrate, 33.5 % N). org = Organic N (Farmyard manure, 0.75 % N). bio = Bioferilizer (Minia Azotene).

Table (5): Effect of inorganic, organic and biofertilization of N on the percentage of Mg in the leaves, C/ N, percentages of initial and final fruit setting and number of fruits per tree of Balady mandarin trees during 2010 and 2011 seasons.

Treatments	Leaf Mg %		C/N		Initial fruit setting %		Final fruit setting %		No. of fruits/ tree	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
100 % inorg. N	0.41	0.43	10.0	9.9	12.2	12.5	0.70	0.71	490	478
N as 80 % inorg. N + 10 % org. N + 100 ml bio/ tree	0.44	0.45	9.9	9.5	12.9	13.1	0.75	0.79	502	490
N as 60 % inorg. N + 20 % org. N + 200 ml bio/ tree	0.50	0.50	9.8	9.5	14.0	14.4	0.86	0.90	531	520
N as 40 % inorg. N + 30 % org. N + 300 ml bio/ tree	0.54	0.56	9.5	9.5	11.0	11.3	0.61	0.65	355	341
N as 20 % inorg. N + 40 % org. N + 400 ml bio/ tree	0.58	0.60	9.4	9.1	9.7	10.0	0.50	0.54	325	314
N as 0.0% inorg. N + 50 % org. N + 500 ml bio/ tree	0.62	0.65	9.1	9.0	9.1	9.4	0.41	0.45	296	284
N as 80 % inorg. N + 10 % org. N + 50 ml bio + 50 ml EM/ tree	0.67	0.71	8.9	8.8	13.4	13.7	0.82	0.85	515	502
N as 60 % inorg. N + 20 % org. N + 100 ml bio + 100 ml EM/ tree	0.71	0.75	8.9	8.7	14.5	15.0	0.91	0.95	542	531
N as 40 % inorg. N + 30 % org. N + 150 ml bio + 150 ml EM/ tree	0.75	0.81	8.9	8.7	11.4	11.9	0.64	0.67	371	359
N as 20 % inorg. N + 40 % org. N + 200 ml bio + 200 ml EM/ tree	0.81	0.87	8.9	8.7	10.2	10.6	0.55	0.58	342	330
N as 0.0 % inorg. N + 60 % org. N + 250 ml bio + 250 ml EM/ tree	0.91	0.91	8.9	8.7	9.4	9.8	0.45	0.48	311	297
New L.S.D at 5 %	**0.03**	**0.04**	**NS**	**NS**	**0.2**	**0.3**	**0.04**	**0.05**	**11.0**	**12.0**

inorg = Inorganic N (Ammonium nitrate, 33.5 % N). org = Organic N (Farmyard manure, 0.75 % N). bio = Bioferilizer (Minia Azotene).

Table (6): Effect of inorganic, organic and biofertilization of N on the yield per tree and some physical characters of the fruits of Balady mandarin trees during 2010 and 2011 seasons.

Treatments	Yield/ tree (kg.)		Fruit weight (g.)		Fruit height (cm.)		Fruit diameter (cm.)		Fruit shape	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
100 % inorg. N	41.9	41.2	85.5	86.2	5.01	5.07	5.35	5.43	0.94	0.93
N as 80 % inorg. N + 10 % org. N + 100 ml bio/ tree	45.1	44.5	90.0	90.8	5.09	5.15	5.44	5.52	0.94	0.93
N as 60 % inorg. N + 20 % org. N + 200 ml bio/ tree	49.9	49.2	94.0	94.7	5.15	5.21	5.45	5.53	0.94	0.94
N as 40 % inorg. N + 30 % org. N + 300 ml bio/ tree	35.0	33.8	98.5	99.2	5.22	5.28	5.55	5.63	0.94	0.94
N as 20 % inorg. N + 40 % org. N + 400 ml bio/ tree	33.5	32.6	103.0	103.8	5.30	5.36	5.65	5.73	0.94	0.94
N as 0.0% inorg. N + 50 % org. N + 500 ml bio/ tree	31.9	30.8	107.9	108.6	5.40	5.45	5.75	5.83	0.94	0.93
N as 80 % inorg. N + 10 % org. N + 50 ml bio + 50 ml EM/ tree	58.7	57.7	114.0	114.9	5.82	5.87	6.19	6.26	0.94	0.94
N as 60 % inorg. N + 20 % org. N + 100 ml bio + 100 ml EM/ tree	65.5	63.5	119.0	119.5	6.01	6.06	6.37	6.45	0.94	0.94
N as 40 % inorg. N + 30 % org. N + 150 ml bio + 150 ml EM/ tree	46.0	44.7	123.9	124.5	6.11	6.14	6.50	6.59	0.94	0.93
N as 20 % inorg. N + 40 % org. N + 200 ml bio + 200 ml EM/ tree	43.8	42.6	128.0	129.0	6.22	6.29	6.62	6.71	0.94	0.94
N as 0.0 % inorg. N + 60 % org. N + 250 ml bio + 250 ml EM/ tree	41.4	39.8	133.0	134.0	6.30	6.37	6.66	6.80	0.95	0.94
New L.S.D at 5 %	**1.1**	**1.0**	**3.3**	**2.9**	**0.05**	**0.06**	**0.06**	**0.05**	**NS**	**NS**

inorg = Inorganic N (Ammonium nitrate, 33.5 % N). org = Organic N (Farmyard manure, 0.75 % N). bio = Bioferilizer (Minia Azotene).

Table (7): Effect of inorganic, organic and biofertilization of N on some physical and chemical characteristics of the fruits of Balady mandarin trees during 2010 and 2011 seasons.

Treatments	Fruit peel %		Fruit peel thickness (cm.)		T.S.S %		Total acidity %		T.S.S/ acid	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
100 % inorg. N	30.0	29.9	0.43	0.41	11.3	11.1	1.450	1.444	7.8	7.8
N as 80 % inorg. N + 10 % org. N + 100 ml bio/ tree	29.1	29.0	0.39	0.37	11.4	11.2	1.449	1.441	7.9	7.8
N as 60 % inorg. N + 20 % org. N + 200 ml bio/ tree	28.4	28.3	0.35	0.34	11.7	11.5	1.431	1.421	8.2	8.1
N as 40 % inorg. N + 30 % org. N + 300 ml bio/ tree	27.3	27.2	0.31	0.30	12.0	11.5	1.400	1.389	8.6	8.5
N as 20 % inorg. N + 40 % org. N + 400 ml bio/ tree	26.5	26.4	0.29	0.28	12.4	12.1	1.371	1.361	9.0	8.9
N as 0.0% inorg. N + 50 % org. N + 500 ml bio/ tree	25.3	25.2	0.25	0.24	12.8	12.4	1.340	1.329	9.6	9.3
N as 80 % inorg. N + 10 % org. N + 50 ml bio + 50 ml EM/ tree	24.6	24.5	0.24	0.23	13.1	12.6	1.300	1.291	10.1	9.8
N as 60 % inorg. N + 20 % org. N + 100 ml bio + 100 ml EM/ tree	23.0	22.9	0.20	0.19	13.3	12.9	1.271	1.261	10.5	10.2

N as 40 % inorg. N + 30 % org. N + 150 ml bio + 150 ml EM/ tree	22.2	22.1	0.18	0.17	13.4	13.0	1.201	1.191	11.2	10.9
N as 20 % inorg. N + 40 % org. N + 200 ml bio + 200 ml EM/ tree	21.3	21.2	0.16	0.15	13.6	13.3	1.160	1.150	11.7	11.6
N as 0.0 % inorg. N + 60 % org. N + 250 ml bio + 250 ml EM/ tree	20.4	20.3	0.14	0.13	13.7	13.6	1.110	1.101	12.3	12.4
New L.S.D at 5 %	**0.8**	**0.7**	**0.4**	**0.4**	**0.2**	**0.3**	**0.018**	**0.019**	**0.3**	**0.2**

inorg = Inorganic N (Ammonium nitrate, 33.5 % N). org = Organic N (Farmyard manure, 0.75 % N). bio = Bioferilizer (Minia Azotene).

Table (8): Effect of inorganic, organic and biofertilization of N on some chemical characteristics of the fruits of Balady mandarin trees during 2010 and 2011 seasons.

Treatments	Total sugars %		Reducing sugars %		Non-reducing sugars %		Vitamin C (mg/ 100 ml juice)		Juice nitrite (ppm)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
100 % inorg. N	6.9	7.5	2.9	3.0	4.0	4.5	28.8	29.0	1.95	1.88
N as 80 % inorg. N + 10 % org. N + 100 ml bio/ tree	7.2	7.8	3.2	3.3	4.0	4.5	29.3	30.5	1.81	1.74
N as 60 % inorg. N + 20 % org. N + 200 ml bio/ tree	7.5	8.1	3.5	3.6	4.0	4.5	30.0	31.2	1.41	1.34
N as 40 % inorg. N + 30 % org. N + 300 ml bio/ tree	7.8	8.4	3.7	3.9	4.1	4.5	30.6	31.9	1.27	1.20
N as 20 % inorg. N + 40 % org. N + 400 ml bio/ tree	8.1	8.7	4.1	4.3	4.0	4.4	31.1	32.3	1.15	1.08
N as 0.0% inorg. N + 50 % org. N + 500 ml bio/ tree	8.3	8.9	4.4	4.6	3.9	4.3	31.5	32.7	1.00	0.93
N as 80 % inorg. N + 10 % org. N + 50 ml bio + 50 ml EM/ tree	8.5	9.1	4.6	4.8	3.9	4.3	32.0	33.3	0.90	0.81
N as 60 % inorg. N + 20 % org. N + 100 ml bio + 100 ml EM/ tree	8.7	9.3	5.0	5.2	3.7	4.1	32.4	33.5	0.18	0.73
N as 40 % inorg. N + 30 % org. N + 150 ml bio + 150 ml EM/ tree	8.9	9.6	5.2	5.4	3.7	4.2	33.0	34.2	0.68	0.59
N as 20 % inorg. N + 40 % org. N + 200 ml bio + 200 ml EM/ tree	9.4	10.3	5.3	5.5	4.1	4.8	33.5	34.6	0.50	0.43
N as 0.0 % inorg. N + 60 % org. N + 250 ml bio + 250 ml EM/ tree	9.9	10.9	5.5	5.7	4.4	5.2	34.9	36.0	0.41	0.33
New L.S.D at 5 %	0.2	0.3	0.2	0.2	NS	NS	0.4	0.3	0.05	0.06

inorg = Inorganic N (Ammonium nitrate, 33.5 % N). org = Organic N (Farmyard manure, 0.75 % N). bio = Bioferilizer (Minia Azotene**).**

Conclusion

Supplying Balady mandarin trees grown under Minia region conditions with N as 60 % inorganic + 20 % organic + 100 ml Minia Azotene + 100 ml EM/ tree is suggested for avoiding environmental pollution and improving yield quantitively and qualitatively.

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