Effect of Using Plant Compost Enriched With *Spirulina Platensis* Algae as a Partial Replacement of Inorganic N Fertilization on Fruiting of Ewaise Mangoes

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Abstract: This study was carried out during 2013 and 2014 seasons to examine the effect of replacing 25 to 75% inorganic N partially by using plant compost enriched with *Spirulina platensis* algae at 25 to 75% on fruiting of Ewaise mango trees grown under Upper Egypt conditions. Using the suitable N (1000 g N / tree year) via 50% inorganic N + 50% plant compost enriched with *Spirulina platensis* algae gave the best results with regard to growth aspects, fruit retention % and yield. There was a gradual promotion on leaf pigments, total carbohydrates % and nutrients namely N, P, K, Mg, Fe and Mn and fruit quality with reducing the percentages of inorganic N from 100 to 25% and at the same time increasing percentages of plant compost enriched with *Spirulina platensis* algae from 0.0 to 75%. In all cases combined application of inorganic N plus plant compost enriched with *Spirulina platensis* algae was Superior than using inorganic N alone. For promoting yield and fruit quality of Ewaise mango trees grown under Upper Egypt conditions and at the same time reducing pollution with nitrite in the fruit pulp, it is suggested to use N as 50% inorganic N plus 50% plant compost enriched with *Spirulina platensis*.
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1. Introduction

Ewaise mango is considered a prime, outstanding and popular mango cv in the local and foreign markets (**Singh *et al.*, 1997, Reyad, 1997 and Reyad *et al.*, 1997**).

Poor yield of Ewaise mango cv grown under Upper Egypt conditions is suggested to be a major problem that faces growers of mango is this region. The main cause of this problem is the over application of N in the form of inorganic that causes more, growth at the expense of fruiting (**Devline and Withdam, 1983**). Adjusting inorganic N partially by using organic manures enriched with biofertilizers such as *Spirulina plateneis* algae is necessary for overcoming this problem (**Wolstenholme and Robert, 1991; Colyn, 1992; and Galan- Sauco, 1993, 1996 and 1997**).

Organic farming agriculture is a unique production management system which promotes and enhances agro- co system of health including bio diversity, biological cycles and soil biological activity (**Nijjar, 1985**). It has been systematically followed on a large scale in the developed countries including Egypt. (**Kannaiyan, 2002**).

Organic and biofertilization of N are responsible for reducing problem of salinity, soil pH. and pathogens and enhancing organic matter, soil fertility, microbial activity nutrient uptake, fixation of N and production of hormones, vitamins B and antibiotics(**Nijjar, 1985**).

Spirulina is rich in polyunsaturated fatty acids like linolenic, pigments such as phycocyanin, myxoxanthophyl and zeaxanthin, proteins, amino acids, antioxidants, vitamins like vitamins A, B_{12} and B-carotene, lipids carotenoids, chlorophylls and sugars (**Koru *et al.*, 2008; Koru, 2009 and Diraman *et al.*, 2009**).

The results of **Abdo (2008); Roshdy *et al.* (2011); Mahmoud (2012); Wassel *et al.* (2012); Mabrouk (2013), Refaai and Ahmed (2013); Al-Khawaga and Meklad (2013); Faraag (2013) and Hassan – Huda (2014)** emphasized the beneficial effects of organic and biofertilization on growth and fruiting of mango and citrus fruits.

The target of this study was examining the impact of using plant compost enriched with *Spirulina platensis* algae as a partial replacement of inorganic N fertilizer in Ewaise mango orchard grown under Aswan environmental conditions.

2. Material and Methods

This investigation was conducted during the two successive experimental seasons 2013 and 2014 on twenty one uniform in vigour and regular in bearing 15 years old Ewaise mango trees onto seedling rootstock. The trees are grown in a private orchard situated at El-Biara region, Kom Ombo district. Aswan Governorate. The selected trees are planted at 7 x 7 meters apart (7 meters between rows and 7 meters between trees). The

selected trees were irrigated through furrow (surface) irrigation system using Nile water. The soil texture of the tested orchard is silty clay with a water table depth not less than two meters.

Soil samples were taken (four samples) from a depth of 0.0 to 90 cm from soil surface and were physically and chemically analyzed before study start according to the procedure outlined by **Wilde *et al.*, (1985)** and the obtained data are shown in Table(1).

Table (1): Analysis of the tested soil

Characters	**Values**
Praticle size distribution	
Sand %	10.60
Clay %	31.40
Silt %	58.00
Texture grade	Silty clay
pH(1 : 2.5 extract)	8.00
E.C. (1 : 2.5 extract((mmhos/ 1 cm)	.91
Organic matter %	2.09
$CaCO_3$ %	2.00
Macronutrients values	
Total N %	0.11
P (ppm, Olsen method)	20.00
K (ppm, ammonium acetate)	419.00
Mg (ppm)	79.00
S (ppm)	6.90
B (hot water extractable)	0.27
BTA extractable (ppm)	
Zn	1.31
Fe	11.00
Mn	10.18
Cu	1.60

The selected trees were kept under the normal horticultural practices except for the treatments of this investigation.

This study included the following seven inorganic N as well as the application of plant compost enriched with *Spirulina platensis* algae treatments:-

1- Application of the suitable N (1000 g N/ tree/ year) completely via inorganic N form namely ammonium nitrate (33.5 % N) (2985.1 g / tree/ year)
2- Application of the suitable N through 75 % inorganic N (2238.8 g ammonium nitrate / tree/ year) alone.
3- Application of the suitable N through 75 % inorganic N + 25% plant compost enriched with *Spirulina platensis* algae (12.5 kg/ tree/ year).
4- Application of the suitable N through 50% inorganic N (1492.6 g ammonium nitrate / tree/ year) alone.
5- Application of the suitable N through 50 % inorganic N + 50% plant compost enriched with *Spirulina platensis* algae (25 kg/ tree/ year).
6- Application of the suitable N through 25 % inorganic N (746.3 g ammonium nitrate / tree/ year) alone.
7- Application of the suitable N through 25 % inorganic N + 75% plant compost enriched with *Spirulina platensis* algae (37.5 kg/ tree/ year).

Each treatment was replicated three times, one tree per each. Nitrogen was applied at fixed rate namely 1000 g N / tree / year (according to **Faraag, 2013**) Inorganic N fertilizer source namely ammonium nitrate (33.5 % N) was splitted into three equal batches and added at growth start (last week of Feb.), just after fruit setting (1st week of Mar.) and at one month later (1st week of Apr.). It was broadcasted around the trees 25 cm far from trunk and under tree canopy. *Spirulina platensis* algae (Table 3) was added to plant compost (Table 2) as 5 ml / kg plant compost (**Ciferri, 1983**). Plant compost enriched with *Spirulina platensis* was added once at the middle of Jan. during both seasons, in holes 25 cm length x 25 cm width X 50 cm depth dimensions under tree canopes in all sides of the trees and just covered with moist soil.

Table (2): Analysis of the soil mature compost (**Wilde *et al.*, 1985**)

Parameters	**Values**
Moisture %	29.0
Organic matter %	30.7
Organic carbon %	31.25
pH	8.5
E.C. (ds. M)	6.5
C/N raito	18.82
Total N %	2.0
Total P %	0.52
Total K %	1.12
Total Ca %	1.25
Total Mg %	1.21
Total Fe (ppm)	320.0
Total Mn (ppm)	45.0
Total Zn (ppm)	34.0
Total Cu (ppm)	42.0

Table (3) chemical analysis of *Spirulina platensis* (according to Koru *et al.*, 2008 and Baron *et al.*, 2008).

Parameters	Values
General composition (100 g)	
Moisture	3.5 g.
Protein	63.5 g.
Fat (Lipids)	9.5 g.
Fibre	3.00 g.
Ash	6.70 g.
N- free extract	15. g.
Colorants	
Phycocyanin	15.6 g.
Carotenoids	456.00 mg.
Chlorophyll- a	1.30 g.
Vitamins	
Provitamin A	213.00 mg.
Thiamin ($V.B_1$)	1.92 mg.
Riboflavin ($V. B_2$)	3.44 mg.
Vitamin B_6	0.49 mg.
Vitamin B_{12}	0.12 mg.
Vitamin E	10.40 mg.
Niacin	11.30 mg.
Folic acid	40 mg.
Panthothenic acid	0.94 mg.
Inositol	76.00 mg.
Minerals	
Phosphorus	916.00 mg.
Iron	53.60 mg.
Calcium	168 mg.
Potassium	1.83 g.
Sodium	1.09 g.
Magnesium	250 mg.

Randomized complete block design (RCBD) was followed where this experiment included seven treatments and each treatment was replicated three times, one tree ore each. During both seasons, the following parameters were recorded:

1- Shoot length (cm.) and thickness, number of leaves / shoot and leaf area in the Spring growth cycle (**Ahmed and Morsy, 1999**).
2- Leaf pigments namely chlorophylls a, b, total chlorophylls and total carotenoids (as mg / 100 g F.W.) (**Von- Wettstein, 1957**).
3- Total carbohydrates % (**A.O.A.C., 2000**) and percentages of N, P, K, Mg, and Mn, Zn and Fe (as ppm) in the leaves (**Summer, 1985 and Wilde *et al.*, 1985**).
4- Percentage of fruit retention and yield expressed in weight (kg.) and number of fruits / tree.
5- Weight (g.), length, width and thickness (cm.) of fruit, percentages of pulp, peels and seeds, T.S.S. %, total and reducing sugars **(A.O.A.C., 2000)**, total acidity % (as g citric acid/ 100 ml juice, (**A.O.A.C., 2000**), vitamin C (mg/ 100 ml juice **(A.O.A.C., 2000)** and nitrite (as ppm) (**Sen and Donaldson, 1978**).

Statistical analysis was done using new L.S.D. at 5% (**Mead *et al.*, 1993**).

3. Results and Discussion

1- Effect of using plant compost enriched with *Spriulina platensis* algae on some vegetative growth characters.

It is clear from the obtained data in Table (4) that supplying Ewaise mango trees with N as 50 to 100 % inorganic N with or without using plus compost enriched with *Spirulina platensis* algae at 25 to 50% significantly stimulated shoot length, number of leaves/ shoot, shoot thickness and leaf area over the application of N as 25% inorganic N with or without using plant compost enriched with *Spirulina platensis* algae at 75%. The stimulation on these growth characters significantly was associated with reducing percentages of inorganic N from 100 to 50% an at the same times increasing the percentages of pant compost enriched with *Spirulina platensis* algae from 0.0 to 50%. Using N completely via inorganic N significantly was superior than using N as 25% inorganic N with or without plant compost enriched with *Spirulina platensis*. A significant decline on these growth characters was attributed to using N as 25% inorganic N even with the application of plant compost enriched with *Spirulina platensis* algae. The maximum shoot length (15.7 & 16.1 cm); number of leaves/ shoot (15.6 & 16.3 leaf), shoot thickness (0.92 & 0.94 cm) and leaf area (98.1 & 98.0 cm^2) were recorded on the trees that fertilized with N as 50% inorganic N + 50 % plant compost enriched with *Spirulina platensis* algae during both seasons, respectively. The lowest values were recorded on the trees that fertilized with N as 25% inorganic N without plant compost enriched with *Spirulina platensis* algae. These results were true during both seasons.

The promoting effect of plant compost on growth characters was mainly attributed to its positive action on lowering soil pH and enhancing soil fertility, the availability of most nutrients, the production of growth promoting substances like IAA, GA_3 and cytokinins, root development, organic matter, microbial activity, nutrient translocation, water retention, fixation of N, antibiotics and vitamins B (**Mengel, 1984; Nijjar, 1985; Mengel and Kirkby, 1987; Miller *et al.*, 1990; Obreza and Ozores, 2000 and Wang *et al.*, 2000**).

The higher content of *Spirulina platensis* algae from polynsaturated fatty acids, pigments, proteins, amino acids, vitamins and sugars (**Barron *et al.*, 2008 and Koru, 2009**).

These results are in agreement with those obtained by **Ibrahiem (2012)** on Taimour mangoes, **Mabrouk (2013)** on Zebda mangoes; **Refaai and Ahmed (2013)** on Ewaise mango cvs, **Al- Khawaga and Meklad (2013)** on Valencia oranges and **Farag (2013)** on Balady mandarins.

2-Effect of using plant compost enriched with *Spriulina platensis* algae on the leaf chemical composition

It is evident from the obtained data in Tables (4 & 5) that fertilizing the trees with N as 25 to 75% inorganic N with or without using plant compost enriched with *Spirulina platensis* algae at 25 to 75% significantly was accompanied with enhancing leaf pigments namely chlorophylls a & b, total chlorophylls and total carotenoids as well as carbohydrates, N, P, K, Mg, Zn, Fe and Mn in the leaves rather than application of N completely inorganic N. Gradual and significant differences on these leaf components were observed with reducing the percentages of inorganic N fertilizer from 100 to 25% and at the same time increasing the percentages of plant compost enriched with *Spirulina platensis* algae from 0.0 to 75%. Using 25 to 75% inorganic N plus 25 to 75% enriched plant compost significantly was responsible for enhancing these chemical components rather than using inorganic N at 25 to 75% alone. The maximum values of chlorophyll a (9.2 & 9.6 mg / 100 g F.W.), total chlorophylls (16.2 & 17.2 mg / 100 g F.W.), chlorophylls b (7.0 & 7.6 mg / 100 g F.W.); total carotenoids (6.6 & 7.2 mg / 100 g F.W.), total carbohydrates (20.7 & 20.2 %), N (1.44 & 1.55 %), P (0.36 & 0.38 %), K (1.67 & 1.66 %), Mg (0.79 & 0.81 %), Zn (63.0 & 63.7 ppm), Fe (60.9 & 61.0 ppm) and Mn (59.9 & 60.2 ppm) were recorded on the trees that received N as 25% inorganic N + 75% plant compost enriched with *Spirulina platensis* algae. The minimum values were recorded on the trees that fertilized with N as 100% inorganic N. These results were true during both seasons.

The beneficial effects of organic manures on nutritional status of the trees might be attributed to their essential roles on lowering soil pH and salinity and enhancing organic matter, water retention, root development, nutrients transport and availability of nutrients **(Goramnagar *et al.*, 2000 and Irizar- Garza *et al.*, 2003**).

The outstanding effect of *Spirulina platensis* on enhancing N fixation, water retention, microbial activity, organic matter, and soil fertility surely reflected on enhancing the availability of most nutrients (**Ciferri, 1983 and Backer and Venkataraman, 1984 and Belay, 2002**).

These results are in agreement with those obtained by **Roshdy *et al.*, (2011) and Ibrahiem (2012)** on Taimour mangoes, **Refaai and Ahmed (2013)** on Ewaise mangoes, **Mabrouk (2013)** on Zebda Mangoes; **Mahmoud (2012)** on Balady mandarins and **Hassan – Huda (2014)** on Valencia oranges.

3- Effect of using plant compost enriched with *Spriulina platensis* algae on the percentage of fruit retention and yield/ tree

It is obvious from the obtained data in Table (6) that supplying Ewaise mango trees with N as 50 to 100% inorganic N with or without plant compost enriched with *Spirulina platensis* algae at 25 to 50% significantly improved the percentage of fruit retention and yield expressed in number of fruits/ tree and yield (kg.) comparing to using N as 25% inorganic N either alone or in combined with 75% plant compost enriched with *Spirulina platensis* algae. There was a gradual and significant promotion on these parameters with reducing the percentages of inorganic N from 100 to 50% and at the same time increasing the percentages of enriched plant compost from 0.00 to 50%. Using N as 100% inorganic N was significantly preferable than using N as 25% inorganic N even with the application of enriched plant compost at 75% in improving the percentage of fruit retention and yield/ tree. A significant, reduction on the fruit retention and yield/ tree was observed owing due to reducing the percentage of inorganic N from 50 to 25% even with the application of plant compost enriched with, *Spirulina platensis* algae at 75%. All treatments included the application of inorganic N plus plant compost enriched with *Spirulina platensis* significantly was superior than using inorganic N alone in this connection. The best treatment in this respect was fertilizing the trees with N as 50% inorganic N plus 50% plant compost enriched with *Spirulina platensis* algae. Under such promised treatment, yield per tree reached 50.6 and 51.4 kg during both seasons, respectively. The yield of the trees that received N as 100% inorganic N reached 36.1 and 36.5 kg during 2013 and 2014 seasons, respectively. These results were true during both seasons.

The previous positive action of organic manures namely plant compost and *Spirulina platensis* on growth and nutritional status of the trees and fruit retention surely reflected on improving the yield.

These results are in concordance with those obtained by **Ibrahim (2012)** on Taimour mangoes, **Mabrouk (2013)** on Zebda mangoes, **Refaai and Ahmed(2013)** on Ewaise mangoes, **Wassel *et al.* (2012)** on Balady mandarin, **Al- Khawaga and Meklad (2013) and Hassan- Huda (2014)** on Valencia oranges.

4- Effect of using plant compost enriched with *Spriulina platensis* algae on some physical and chemical characteristics of the fruits.

It is worth to mention from the data in Tables (6 & 7) that using the suitable N via 25 to 75% inorganic N with or without application of plant compost

enriched with *Spirulina platensis* algae at 25 to 75% significantly was very effective in improving fruit quality in terms of increasing weight, length, width and thickness of fruit, pulp %, T.S.S. %, total and reducing sugars % and vitamin C and decreasing percentages of peels and seeds, total acidity % and nitrite in the juice over the application of N completely via, inorganic N. The promotion on fruit quality significantly depended on the reduction of percentages of inorganic N from 100 to 25% and the increase on the percentage of plant compost enriched with *Spirulina platensis* algae from 0.0 to 75%. Using inorganic N besides enriched plant compost with *Spirulina platensis* significantly was favourable than using N as inorganic N alone in enhancing fruit quality. The best results with regard to fruit quality were obtained due to supplying the trees with N as 25% inorganic N plus 75% plant compost enriched with *Spirulina platensis* algae. Worst results on fruit quality were obtained on the trees received N as 100% inorganic N. Similar results were announced during both seasons.

The promoting effect of plant compost and *Spirulina platensis* algae on fruit quality might be attributed to their positive effects on enhancing plant pigments, photosynthesis and uptake of Mg which could reflect on advancing maturity.

These results are in agreement with those obtained by **Roshdy *et al.* (2011) and Ibrahim (2012)** on Taimour mangoes, **Refaai and Ahmed (2013)** on Ewaise mangoes; **Mabroul (2013)** on Zebda mangoes, **Abdo (2008)** on Balady mandarins and **Hassna- Huda (2014)** on Valencia oranges.

Table (4): Effect of using plant compost enriched with *Spirulina platensis* algae as a partial replacement of inorganic N fertilizer on some negative growth characters and leaf pigments of Ewaise mango trees during 2013 & 2014 seasons.

Different N management treatments	Shoot length (cm.)		No. of leaves / shoot		Shoot thickness (cm.)		Leaf area (cm)^2	
	2013	2014	2013	2014	2013	2014	2013	2014
N as 100% inorganic N	10.6	10.9	9.0	9.6	0.59	0.60	90.0	89.9
N as 75 % inorganic N alone	11.9	12.2	11.0	11.7	0.66	0.67	92.6	92.4
N as 75 % inorganic N + 25 % P. Com. Spr.	13.4	13.7	12.0	12.8	0.73	0.75	95.0	94.8
N as 50 % inorganic N alone	14.4	14.7	13.0	13.8	0.85	0.82	96.9	96.8
N as 50 % inorganic N + 50 % P. Com. Spr.	15.7	16.1	15.6	16.3	0.92	0.94	98.1	98.0
N as 25 % inorganic N alone	8.0	8.3	5.0	5.8	0.41	0.39	84.9	83.9
N as 25 % inorganic N + 75 % P. Com. Spr	9.1	9.4	7.0	7.8	0.51	0.48	86.9	86.8
New L.S.D. at 5%	1.0	0.9	2.0	2.0	0.05	0.04	1.3	1.3
Character	Chlorophyll a (mg / 100 g F.W.)		Chlorophyll b (mg / 100 g F.W.)		Total Chlorophylls (mg / 100 g F.W.)		Total carotenoids (mg / 100 g F.W.)	
N as 100% inorganic N	4.1	4.4	1.9	2.4	6.0	6.3	1.1	1.2
N as 75 % inorganic N alone	5.0	5.3	2.8	3.3	7.8	6.1	2.4	2.0
N as 75 % inorganic N + 25 % P. Com. Spr.	5.7	6.0	3.5	4.0	9.2	10.0	3.1	3.6
N as 50 % inorganic N alone	6.8	7.1	4.6	5.1	11.4	11.7	4.2	4.6
N as 50 % inorganic N + 50 % P. Com. Spr.	7.9	8.2	5.7	6.2	13.6	14.4	5.3	5.8
N as 25 % inorganic N alone	8.5	8.8	6.3	6.6	14.8	15.4	5.9	6.2
N as 25 % inorganic N + 75 % P. Com. Spr.	9.2	9.6	7.0	7.6	16.2	17.2	6.6	7.2
New L.S.D. at 5%	0.4	0.4	0.3	0.4	0.4	0.4	0.3	0.3

Plant composed enriched with *Spirulina platensis* algae (P. Com. Spr.)

Table (5): Effect of using plant compost enriched with *Spirulina platensis* algae as a partial replacement of inorganic N fertilizer on the percentages of total carbohydrates, N, P, K and Mg in the leaves and leaf content of Zn, Fe and Mn (ppm) of Ewaise mango trees during 2013 & 2014 seasons.

Different N management treatments	Total carbohydrates %		Leaf N %		Leaf P %		Leaf K %	
	2013	2014	2013	2014	2013	2014	2013	2014
N as 100% inorganic N	14.1	13.9	1.61	1.69	0.18	0.18	1.17	1.18
N as 75 % inorganic N alone	15.3	15.1	1.51	1..61	0.22	0.23	1.25	1.29
N as 75 % inorganic N + 25 % P. Com. Spr.	16.4	16.1	1.72	1.80	0.26	0.27	1.33	1.34
N as 50 % inorganic N alone	17.5	17.3	1.46	1.53	0.29	0.30	1.41	1.42
N as 50 % inorganic N + 50 % P. Com. Spr.	18.6	18.4	1.84	1.89	0.31	0.33	1.50	1.49
N as 25 % inorganic N alone	19.6	19.4	1.39	1.50	0.34	0.35	1.60	1.59
N as 25 % inorganic N + 75 % P. Com. Spr	20.7	20.2	1.44	1.55	0.36	0.38	1.67	1.66

New L.S.D. at 5%	1.0	0.8	0.05	0.06	0.02	0.02	0.04	0.04
Character	**Leaf Mg %**		**Leaf Zn (ppm)**		**Leaf Fe (ppm)**		**Leaf Mn (ppm)**	
N as 100% inorganic N	0.50	0.49	39.3	40.0	40.9	41.0	37.4	38.0
N as 75 % inorganic N alone	0.55	0.56	42.3	43.0	42.9	43.0	41.5	42.1
N as 75 % inorganic N + 25 % P. Com. Spr.	0.60	0.61	46.1	46.8	47.0	47.1	44.6	45.2
N as 50 % inorganic N alone	0.64	0.65	51.0	51.7	50.0	50.1	48.9	49.5
N as 50 % inorganic N + 50 % P. Com. Spr.	0.69	0.70	54.7	55.5	52.9	53.0	52.9	54.6
N as 25 % inorganic N alone	0.74	0.75	58.9	59.6	57.9	58.0	56.0	56.9
N as 25 % inorganic N + 75 % P. Com. Spr.	0.79	0.81	63.0	63.7	60.9	61.0	59.9	60.2
New L.S.D. at 5%	0.3	0.3	1.9	2.0	2.0	1.8	2.1	2.0

Plant composed enriched with *Spirulina platensis* algae (P. Com. Spr.)

Table (6): Effect of using plant compost enriched with *Spirulina platensis* algae as a partial replacement of inorganic N fertilizer on the percentage of fruit retention, number of fruits / tree, yield and some physical characters of fruits of Ewaise mango trees during 2013 & 2014 seasons.

Different N management treatments	**Fruit retention %**		**No. of fruit / tree**		**Yield/ tree (kg.)**		**Fruit weight (g.)**	
	2013	2014	2013	2014	2013	2014	2013	2014
N as 100% inorganic N	0.53	0.55	220.0	221.0	36.1	36.5	164.0	115.0
N as 75 % inorganic N alone	0.61	0.63	231.0	231.0	39.5	39.7	171.0	172.0
N as 75 % inorganic N + 25 % P. Com. Spr.	0.69	0.71	240.0	241.0	43.2	43.7	180.0	181.5
N as 50 % inorganic N alone	0.77	0.79	251.0	255.0	46.9	48.1	187.0	188.7
N as 50 % inorganic N + 50 % P. Com. Spr.	0.83	0.86	261.0	263.0	50.6	51.4	194.0	195.6
N as 25 % inorganic N alone	0.42	0.45	161.0	155.0	32.0	31.2	199.0	201.0
N as 25 % inorganic N + 75 % P. Com. Spr	0.43	0.50	171.0	163.0	34.9	33.7	204.0	207.0
New L.S.D. at 5%	0.05	0.04	8.0	8.0	1.9	2.0	5.0	5.8
Character	**Fruit length (cm.)**		**Fruit width (cm.)**		**Fruit thickness (cm.)**		**Pulp %**	
N as 100% inorganic N	8.11	8.20	6.31	6.29	4.82	4.85	70.5	71.2
N as 75 % inorganic N alone	8.41	8.50	6.40	6.38	4.90	4.93	72.9	73.6
N as 75 % inorganic N + 25 % P. Com. Spr.	8.71	8.80	6.50	6.49	4.97	5.00	76.0	76.8
N as 50 % inorganic N alone	8.91	9.00	6.61	6.60	5.10	5.14	79.0	79.8
N as 50 % inorganic N + 50 % P. Com. Spr.	9.41	9.50	6.72	6.71	5.21	5.25	81.9	82.9
N as 25 % inorganic N alone	9.55	9.64	1.83	6.82	5.29	5.32	84.5	85.9
N as 25 % inorganic N + 75 % P. Com. Spr.	9.71	9.80	6.95	6.93	5.40	5.44	86.0	87.3
New L.S.D. at 5%	0.11	0.11	0.07	0.06	0.06	0.06	1.8	2.0

Plant composed enriched with *Spirulina platensis* algae (P. Com. Spr.)

Table (7): Effect of using plant compost enriched with *Spirulina platensis* algae as a partial replacement of inorganic N fertilizer on some physical and chemical characteristics of the fruits of Ewaise mango trees during 2013 & 2014 seasons.

Different N management treatments	**Seeds %**		**Peels %**		**T.S.S. %**		**Total acidity %**	
	2013	2014	2013	2014	2013	2014	2013	2014
N as 100% inorganic N	11.5	11.0	18.0	17.8	15.9	16.0	0.355	0.350
N as 75 % inorganic N alone	10.0	9.6	17.1	16.8	16.4	16.5	0.315	0.320
N as 75 % inorganic N + 25 % P. Com. Spr.	9.1	8.5	14.9	14.7	16.9	17.0	0.280	0.291
N as 50 % inorganic N alone	8.0	7.5	13.0	12.7	17.5	17.5	0.247	0.261
N as 50 % inorganic N + 50 % P. Com. Spr.	7.2	6.5	10.9	10.6	18.0	18.1	0.212	0.230
N as 25 % inorganic N alone	6.5	5.0	9.0	9.1	18.4	18.5	0.180	0.200
N as 25 % inorganic N + 75 % P. Com. Spr	5.0	4.2	9.0	8.5	18.8	18.9	0.149	0.172
New L.S.D. at 5%	0.8	0.8	1.0	1.0	0.3	0.3	0.030	0.029

Character	Total sugars %		Reducing sugars %		Vitamin V (mg / 100 ml juice)		Nitrite in the juice (ppm)	
N as 100% inorganic N	14.1	13.9	6.9	7.0	31.0	32.9	1.92	1.90
N as 75 % inorganic N alone	14.5	14.4	7.3	7.4	32.9	33.9	1.71	1.61
N as 75 % inorganic N + 25 % P. Com. Spr.	15.1	15.1	7.5	7.8	34.0	35.2	1.51	1.41
N as 50 % inorganic N alone	15.8	15.9	7.8	8.2	36.0	37.0	1.30	1.19
N as 50 % inorganic N + 50 % P. Com. Spr.	16.4	16.5	8.1	8.6	38.0	38.2	1.10	1.00
N as 25 % inorganic N alone	17.0	17.0	8.6	8.8	39.6	40.0	0.94	0.83
N as 25 % inorganic N + 75 % P. Com. Spr.	17.3	17.4	8.9	9.1	41.9	41.3	0.55	0.42
New L.S.D. at 5%	0.3	0.3	0.2	0.2	1.1	1.0	0.05	0.04

Plant composed enriched with *Spirulina platensis* algae (P. Com. Spr.)

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