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Effect of Natural Minerals Compound, Organic and Some Biofertilizers Application on Yield, Fruit Quality and Leaf Mineral Content of Balady Mandarin Trees

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THIS investigation was carried out in a private orchard belonging to Mr. Husain Saber, located at El Kalubia governorate, Egypt, on Balady mandarin (*citrus reticulata*) trees budded on sour orange rootstock .Trees were under flood irrigation system, grown in a clay loamy soil. The investigation aimed to verify the response of Balady mandarin to compost, some biofertilizers and raw Natural Minerals Compound (N.M.C) in silicon represents the major component. The study contained 10 treatments (three levels of compost at 50, 75 and 100% of the amount of actual nitrogen required to mandarin tree, three levels of (N.M.C) at 4, 5 and 6 kg /tree/ year with some biofertilizers and control treatment (compost at 25% N + recommended mineral fertilizers). Trees were treated by all different treatments which used under study during three seasons, "on year" 2011, off year" 2012 ", and "on year" 2013, and data collection were done during two seasons on year "heavy load yield" (2011 and 2013). The obtained results cleared that, application of (50% compost + biofertilizer + 6 or 5 kg N.M.C) / tree / year was the best combination for resulting in maximum yield and improving fruit quality (increased fruit size, peel thickness, juice weight % , T.S.S/acid ratio , Vit.C and to decrease fruit acidity, fruit nitrite and nitrate contents). Using the high level of compost decreased leaf mineral contents this may be attributed to the increase of soil salinity as a result of application of compost which it's high EC (3.73mmhos/cm). All treatments enhanced soil biological activity in terms of increasing the total count bacteria (*Bacillus circulans*, *Bacillus megaterium* and *Azotobacter* chroococcum) compared with control treatment. Based on the economic study it could be concluded that, there was an increase in the final cost of organic production as compared with the conventional production (control treatment), nevertheless, the price of organic farming production is usually much higher than the price of conventional fruit production because it has safety food and high fruit quality especially for

reducing nitrite and nitrate in fruit juice which is considered as one of the main reasons causing harmful to human health.

Keywords: Compost, Bio-fertilizers, Natural minerals compound, Yield, Fruit quality, Nitrite, Human health and Balady mandarin trees.

Mandarins rank second after oranges in Egyptian citrus industry. Total area of mandarin groves amounted to 124663 feddans producing around 936755 Tons (Ministry of Agriculture and Land Reclamation of Egypt, 2013). The major mandarin production, in Egypt, is confined to the local variety "Balady" which belongs to common Mediterranean mandarin, (*Citrus reticulata* Blanco). Soil fertility management and the use of organic fertilization as alternatives of chemical fertilization are major concern in organic agriculture. The benefits of such organic fertilization sources are obvious. They add organic matter, improve soil texture by aggregating the soil particles using some organic molecules such as polysaccharides and Increase the activities of soil microorganisms that enhance the bio – chemical cycling, resulting in more elements availability. Moreover, they work as soil born and plant pathogens suppression through the antagonistic of microorganisms Pal and McFadden, (2006). The organic matter content of compost is high and its addition to soil often improves soil physical and chemical properties and enhances biological activities. Most agricultural benefits from compost application to soil are derived from improved physical properties related to increasing organic matter content rather than its value as a fertilizer. Compost provides a stabilized form of organic matter that improves the physical properties of soil by increasing nutrient and water holding capacity, total pore space, aggregate stability, erosion resistance, temperature insulation and decreasing apparent soil density. Application of compost improves the chemical properties by increasing irrigation cation exchange capacity and soil nutrient content Shiralipour, *et al*., (1992). Biofertilizers are microbial inoculants (preparations containing living micro organisms) which enhance production by improving the nutrient supplies and their crop availability. There are a number of inoculants with possible practical application in crops where they can serve as useful components of integrated plant nutrient supply systems, may help in increasing crop productivity by increasing biological N fixation availability or uptake of nutrients through convert insoluble P in the soil into forms available to plants or increasing absorption, stimulation of plant growth through hormonal action or antibiosis or by decomposition of organic residues Wani and Lee (1995). Recently, bio-fertilization is considered as an important tool to enhance the yield and fruit quality of citrus and it becomes, as positive alternative to chemical fertilizers. It is safe for human and environmental and using them was accompanied with reducing the great pollution occurred on our environment as well as for producing organic foods for export. Application of organic fertilizers in citrus orchard is a production system avoids or largely excludes the use of synthetic chemical fertilizers Abdelaal *et al*. (2010). Also, Natural Minerals Compound ore (N.M.C) as a raw material contains a lot of essential elements which are Ca, K, Mg, P, Al, Fe, Mn, Na, S, Ti and Silicon

(Si) which is considered as a major component in this ore. Silicon soil amendments influence plant growth in at least two ways. First, the role of improved Si nutrition in plant growth must be considered. Second, soil treatment with bio-geochemically active Si substances optimizes soil fertility through improved water, physical and chemical soil properties while maintaining nutrients in plant – available from Matichenkov *et al.* (1995). Also, grove studies conducted in Russia on citrus responses to Si fertilizers showed 30 - 80 % accelerated growth, 2, 4 week earlier maturation of fruit, and increased fruit yield Taranovskaia (1939). Wutscher (1939) demonstrated in a laboratory experiment that optimization of Si nutrition for 1- year – old and 2 year – old orange trees increased fresh weight of shoots by 30 - 40 % during a 6 – month period. The trees treated with Si absorbed more nutrients than the untreated trees Wutscher (1989). Also , treating Valencia orange trees grown under Minia region conditions four times with a mixture of boric acid at 0.05% + potassium sulphate at 0.5% + potassium silicate (as a source of Si) at 0.1% sodium selenite (as a source of selenium) at 50 ppm gave the best results with regard yield and fruit quality Ibrahim and AL – Wasfy (2014). Moreover, Hoda *et al.*, (2013) indicated that diatoms as a source of silicon increased tree canopy volume of Valencia orange trees, and improved fruit peel quality, earlier the harvest date by increasing fruit TSS / acid ratio and V.C and to decreasing acidity. In this respect Abdel Rahman *et al*. (2009) indicated that Natural Minerals Compound increased vegetative growth, fruit set, yield, fruit quality and leaf mineral contents on Navel orange trees. Also, it increased yield, improved fruit quality, N, P, K and Fe concentrations in both soil and grapevine leaves of superior and Thompson seedless berries Ismail *et al*. (2010). Moreover, Natural nraw material mixture increased leaf Mn, and Zn on "Leconte" pear trees planted in calcareous soil Eman *et al* . (2010).

The aim of this study is to evaluate using of organic fertilizer (compost) and Natural Minerals Compound with some biofertilizers on yield, fruit quality and leaf mineral contents of Balady mandarin trees instead of chemical fertilizers to produce safety food, reduce environmental pollution and alleviate the dependence on imported or costly commercial fertilizers.

Materials and Methods

This study was conducted in a private orchard located at El Kalubia Governorate, Egypt, to evaluate the response of Balady mandarin trees to addition of compost, some biofertilizers and Natural Minerals Compound applications. Twenty years old of Balady mandarin (*citrus reticulata*) trees budded on sour orange rootstock (*citrus aurantium*) and planted at 5x5 meters a part under flood irrigation system, grown in a clay loamy soil were devoted for this investigation. Sixty healthy vigorous trees were selected and treated by all different treatments used during three seasons, “on year” 2011, off year” 2012 “, and “on year” 2013 and data collection were done during two seasons on year “heavy load yield” (2011 and 2013).

Different materials were used in the experiment as follow: 1) compost EL Neil (1.78% N, 0.5% P, 0.7% K, 35.68% O.C, 34.12% O.M, 27.22% moisture content, 20.04 C/N ratio, 458kg/m^3 Density, 7.35 pH, 3.73 mmhos/cm at 25^{o}C E.C) , obtained from EL Neil company . 2) Natural Minerals Compound ore (N.M.C) as a raw material consists of a lot of essential elements ,especially silicon element (Si) which considered the major component in this ore (28.5% SiO_2, 1.22% TiO_2 , 5.7% Al_2O_3 , 4.13% Fe_2O_3 , 1.02% MnO , 3.03%MgO ,20.46 CaO , 0.28% Na_2O , 3.93% K_2O , 9.56% P_2O_5 and 7.22% SO_3) ,obtained from EL –Ahram company for mining and natural fertilizers , Giza , Egypt . 3) some biofertilizers consists of mixture of three bacteria , *Bacillus circulans* which dissolving K, *Bacillus megaterium* which dissolving P and *Azotobacter chrococcum* which increasing biloigcal N fixation availabilty , and were obtained from the unit of biofertilizers , Faculty of Agriculture , Ain Shams University . Each organism was grown separately in batch culture to the late exponential phase of each microorganism (Gomaa , 1995) to give a cell suspension of $4x10^7$, $6x10^7$, and $5x10^5$ Cell / ml for *Bacillus circulans*, *Bacillus megaterium* and *Azotobacter chroococcum* , respectively . Cultures were mixed on site then each replicate of mandarin tree received 250 ml of the mix , and this treatment was repeated every three months for three times during the season . The experiment comprised (10) treatments. Each treatment was represented by two trees plot replicated three times in a randomized complete block design. The treatments as follows:

- Compost at 25% N + mineral fertilizers (Control)
- Compost at 50% N + biofertilizers + (N.M.C) at 4 Kg / tree/ year
- Compost at 50% N + biofertilizers + (N.M.C) at 5 Kg / tree/ year
- Compost at 50% N + biofertilizers + (N.M.C) at 6Kg / tree/ year
- Compost at 75% N + biofertilizers + (N.M.C) at 4 Kg / tree/ year
- Compost at 75% N + biofertilizers + (N.M.C) at 5 Kg / tree/ year
- Compost at 75% N + biofertilizers + (N.M.C) at 6 Kg / tree/ year
- Compost at 100% N + biofertilizers + (N.M.C) at 4 Kg / tree/ year
- Compost at 100% N + biofertilizers + (N.M.C) at 5 Kg / tree/ year
- Compost at 100% N + biofertilizers + (N.M.C) at 6 Kg / tree/ year

According to the recommendation of Horticulture Research Institute, Ministry of Agriculture and Land Reclamation of Egypt, the amount of actual nitrogen required to mandarin tree equal (1000g/ tree / year). Thereupon, the total required nitrogen was suggested to be satisfied through the compost according to its content of nitrogen. In Mid December of each season organic fertilizer (compost), Natural Minerals Compound and bio fertilizers rates were individually added in the soil at two trenches (100cm length × 20 cm width × 20cm depth) in both sides of the tree which was done at the end of the tree shadow and in the direction of irrigation furrows. Both organic fertilizer (compost) and Natural Minerals Compound (N.M.C) were added only one time at Mid December, while, biofertilizers were added at three times (Mid December, Mid February and Mid June). Table 1 shows the main physical and chemical analysis of the experimental soil.

TABLE 1. Physical and Chemical analysis of the Experimental Soil.

Physical analysis						
Soil depth(cm)	Sand %		Silt %	Clay %	$Caco_3$ %	Texture class
	Coarse	Fine				
0 – 30	0.58	36.41	3.30	59.71	6.3101	Clay loam
30 – 60	0.50	29.55	12.61	57.34	3.5214	
Chemical analysis						
Soil depth (cm)	E.C (m.m)		pH	Available		
				N%	P%	K%
0 - 30	0.32		7.97	0.008	0.00071	0.0914
30 – 60	0.29		8.08	0.005	0.00032	0.0632

The following parameters were approached

Yield. The number of fruits per tree was counted at the harvesting time (mid February). The yield per tree (kg) was determined and the theoretical yield (ton/ fed.) was calculated.

Fruit quality

Ten fruits of Balady mandarin were randomly taken from the yield in two seasons for each replicate and the following determinations were carried out: Average of fruit weight (gm.), fruit size (ml) was determined from the volume of water displaced by immersing the fruit sample in graduated jar filled with water and average volume was calculated, fruit length, diameter and peel thickness (mm) in each individual fruit were measured by using a digital vernier caliper. Juice weight percentage was calculated and recorded. Total soluble solids (T.S.S %) was determined by using Zeiss hand refractometer. Total acidity (%) was determined in fruit juice according to A.O.A.C, (1995). Total soluble solids/acid ratio was calculated from the values of total soluble solids divided by values of total acids. Ascorbic acid (Vitamin C) was calculated as mg/100 ml juice according to Horwitz, (1972).

Leaf mineral content

Leaf samples were collected according to Jones and Embleton, (1960) to determine leaf content of N, P, K, Ca, Mg, Fe, Zn and Mn on leaf dry weight basis. Total nitrogen (%) was determined by using microkjeldahl method according to Pregl, (1945). Phosphorus (%) was determined calorimetrically according to Troug and Meyer, (1939). Potassium (%) was determined using the flame photometric method according to Brown and Lilliland, (1966). Ca and Mg were determined according to Page *et al*. (1982). Iron, Manganese and Zinc were determined as ppm using atomic absorption according to Carter, (1993).

Nitrite and nitrate in fruit Juice content

A sample of (10) ml of fruit Juice was taken from each replicate to determine No_2 and No_3 by ppm according to the methods outlined by Sen and Donaldson, (1978).

Total count bacteria

Soil samples were taken two months after each addition by withdrawing about 500 g soil at a depth of 15 cm around the root of the mandarin trees. Total counts bacterial (*Bacillus circulans*, *Bacillus megaterium* and *Azotobacter* chroococcum) were determined in these samples at three times (February, April and August) using plate count technique on Nutrient agar according to the method of Low and Webley (1959). Plates were incubated at 30˚C for 3days and cell concentration was calculated by counting the grown colonies.

Data recorded in both seasons were subjected to analysis of variance according to Clarke and Kempson, (1997) and means were differentiated using Duncan multiple range test (Duncan, 1955).

Results and Discussion

Yield

It is obvious from Table 2 that, the differences between the use of compost fertilizer and different combinations with Natural Minerals Compound ore (N.M.C) and biofertilizer on fruit weight of Balady mandarin trees were significant. The results revealed that, the application of T_9 (100%compost + bio + 5Kg N.M.C) in the first season and T_4 (50%compost + bio + 6Kg N.M.C) in the second season produced the maximum averages (126.7, 155.6 gm), respectively, for fruit weight. While, T_3 (50%compost + bio + 5Kg N.M.C) in the first season and control treatment in the second season recorded the lowest significant values (108.0, 128.9 gm), respectively .Anyhow, the differences between the other treatments were high to be significant in the first and second seasons (2011 and 2013), respectively.

Concerning fruit number the results showed that, control treatment gave the highest significant values (793.3 and 713.3) in the first and second seasons, respectively. While, trees treated by T_{10} (100%compost + bio + 5Kg N.M.C) in the first season and T_8 (100%compost + bio + 4Kg N.M.C) in the second one scored the lowest significant values (565 and 401.7), respectively. While, the other treatments gave the intermediate values in this regard. Also, it is clear from Table 2 that, there are reverse correlation between the rate of compost applications and yield, whereas, Balady mandarin trees treated byT_1 (control treatment) and T_4 (50%compost + bio + 6Kg N.M.C) in the first and second seasons gave the maximum averages for yield (15.07, 15.00 ton feddan) and (14.72, 12.53 ton feddan), respectively. Also, it could be noticed that yield decreased with increasing the rate of compost application this may be attributed to the increase of soil salinity as a result of application of compost which its EC was 3.73 mmhos / cm whereas, trees treated by 100% compost with biofertilizer and N.M.C (T_8 – T_{10}) gave the lowest yield in both seasons of study, (2011, 2013).

From the above mentioned results it could be concluded that, the improvement of fruit yield due to the use of compost, biofertilizer and natural elements component could be related to silicon element (Si) which is considered the major component in this raw material. Soil treatment with silicon optimizes soil fertility through improved water, physical, and chemical soil properties

while maintaining nutrient in plant-available form which is reflected on fruit yield Matichenkov, *et al*. (1995). Results in hand are in line with those reported by Abdel Rahman, (2009) who found that the use of Natural Minerals Compound as a soil application increased the yield of navel orange trees. In this respect Hoda, *et al*. (2013) working on Diatoms as a source of silicon, Ibrahim and Al-Wasfy (2014) working on potassium silicate reported that these treatments can result in good growth, consequently increased the yield of Valencia orange trees. Also, these results may be attributed to the fact that organic and biofertilizers help to facilitating the availability and uptake of most nutrient to the trees, consequently increased fruit yield. These results are in harmony with those reported, by Rabeh *et al*. (1993) on Balady mandarin, Haung *et al*. (1995) on Satsuma mandarin trees. They reported that treating trees with biofertilizers alone or mixture with organic manure stimulated plant root, absorption of nutrient and photosynthesis process which led to producing higher yield.

TABLE 2. Effect of Natural Minerals Compound, organic and biofertilizer applications on yield of Balady mandarin trees.

Treatments	Fruit Weight (gm.)		Fruit NO./ tree		Yield kg/tree		Yield ton/fed.	
	"On year"		"On year"		"On year"		"On year"	
	2011	2013	2011	2013	2011	2013	2011	2013
(T_1)25% Comp. + 75% M.F (control)	118.67abc	128.89d	793.3 a	713.3 a	94.16a	92.00a	15.07a	14.72a
(T_2)50% Comp. + bio+ 4kg N.M.C	112.00cd	135.56cd	716.7ab	530 bc	80.13b	71.82cd	12.82b	11.50cd
(T_3) 50% Comp. + bio+ 5kg N.M.C	108.00d	134.44cd	750.03ab	550 b	80.60b	73.50bc	12.90b	11.76bc
(T_4)50% Comp. + bio+ 6kg N.M.C	117.33abcd	155.56a	800.0 a	505 bcd	93.73a	78.31b	15.00a	12.53b
(T_5)75% Comp. + bio+ 4kg N.M.C	116.00bcd	143.33bc	673.3bc	476.7cd	78.05bc	67.32de	12.49bc	10.77de
(T_6)75% Comp. + bio+ 5kg N.M.C	108.00d	142.22bc	666.7bc	466.7de	72.13bc	66.17ef	11.54bc	10.59ef
(T_7)75% Comp. + bio+ 6kg N.M.C	118.67abc	150.00ab	626.7cd	413.33ef	74.12bc	61.31f	11.86bc	9.81f
(T_8)100% Comp. + bio+ 4kg N.M.C	116.00bcd	154.44a	616.7cd	401.7 f	71.2 c	61.93f	11.39c	9.91f
(T_9)100% Comp. + bio+ 5kg N.M.C	126.67a	133.33cd	566.7 d	470 de	71.35 c	62.08f	11.41c	9.93f
(T_{10})100% Comp. + bio+ 6kg N.M.C	126.00ab	148.89ab	565.0. d	415 ef	71.24 c	61.75f	11.40c	9.88f

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.
Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.

Fruit quality

Data presented in Table 3 showed the effect of organic, biofertilizer and Natural Minerals Compound ore (N.M.C) on fruit quality of Balady mandarin trees. As for fruit length and diameter, no constant trend in both seasons (2011 and 2013) due to different treatments was noticed. On the other hand, it could be noticed that, all treatments increased fruit size and fruit peel thickness as compared with control treatment during two seasons. Data of juice weight (%) Table 3 showed that, trees treated by (50%compost + bio + 5 or 6Kg N.M.C**)** gave the best results compared to control treatment, while the other treatments gave the intermediate values in this regard in the first and second seasons (2011 and 2013).

TABLE 3. Effect of Natural Minerals Compound, organic and biofertilizer applications on fruit physical characters of Balady mandarin trees.

Treatments	Season, 2011 "On year"				
	Fruit length (mm)	Fruit diameter (mm)	Fruit Size (ml)	Peel thickness (mm)	Juice weight (%)
T_1)25% Comp. + 75% M.F (control)	52.47bc	67.97 a	132.0 f	2.51 d	34.86 d
(T_2)50% Comp. + bio+ 4kg N.M.C	49.83 d	63.96bc	137.33ef	3.81 a	39.25abc
(T_3) 50% Comp. + bio+ 5kg N.M.C	51.77 c	64..01bc	146.67de	3.31 c	41.65 a
(T_4)50% Comp. + bio+ 6kg N.M.C	53.22bc	67.52 a	156.0bcd	3.38 bc	41.17a
(T_5)75% Comp. + bio+ 4kg N.M.C	53.37bc	64.70bc	148.0cde	3.41 bc	35.74d
(T_6)75% Comp. + bio+ 5kg N.M.C	49.67 d	62.46 c	160.0abc	3.43 bc	38.88abc
(T_7)75% Comp. + bio+ 6kg N.M.C	55.09 a	65.46ab	148.67cd	3.39 bc	39.56ab
T_8)100% Comp. + bio+ 4kg N.M.C	52.94bc	65.56ab	156.0bcd	3.36 bc	36.79bcd
T_9)100% Comp. + bio+ 5kg N.M.C	53.89ab	67.24 a	169.33 a	3.62 ab	36.50cd
T_{10})100% Comp. + bio+ 6kg N.M.C	53.24bc	67.95 a	164.0ab	3.55 abc	36.51cd
Season, 2013 " On year"					
T_1)25% Comp. + 75% M.F (control)	54.79 d	64.75 c	145.56d	3.76f	46.52d
(T_2)50% Comp. + bio+ 4kg N.M.C	55.69cd	69.84ab	150.0d	4.92a	51.15ab
(T_3) 50% Comp. + bio+ 5kg N.M.C	54.98 d	68.45 b	160.0bc	4.46cd	53.91a
(T_4)50% Comp. + bio+ 6kg N.M.C	60.46ab	70.60ab	175.0 a	4.49cd	50.8abc
(T_5)75% Comp. + bio+ 4kg N.M.C	58.79 b	68.97 b	161.11 b	4.36de	49.67bcd
(T_6)75% Comp. + bio+ 5kg N.M.C	58.04bc	70.06ab	160.56 b	4.78ab	50.91ab
(T_7)75% Comp. + bio+ 6kg N.M.C	62.21 a	70.54ab	167.22ab	4.34de	47.75bcd
(T_8)100% Comp. + bio+ 4kg N.M.C	63.00 a	72.63 a	171.67 a	4.11e	46.70cd
T_9)100% Comp. + bio+ 5kg N.M.C	60.46ab	68.78 b	150.56cd	4.74abc	50.46abc
T_{10})100% Comp. + bio+ 6kg N.M.C	58 21bc	71.91 a	171.7 a	4.55bcd	48.68bcd

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.
Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.

Concerning fruit total soluble solids (T.S.S) data tabulated in Table 4 indicated that, fertilizing mandarin trees with (50% compost +bio +5 or 6 Kg N.M.C) recorded the highest significant values for fruit T.S.S ,while, the lowest values were obtained by control treatment in the first and second seasons and all treatments tended to slightly increase T.S.S values during two seasons (2011,2013) .As for acidity, it's clear from Table 4 that T_{10} had the lowest values in the first season and there are no significant values between other treatments

while control treatment scored the highest value in the second season meanwhile the other treatments were in between in this regard. T.S.S/acid ratio is an important characteristic for fruits exportation. Moreover, results in Table 4 showed that, all treatments increased T.S.S /acid ratio and V.C as compared with control treatment while the difference between other treatments were low to be significant in both seasons of study (2011 and 2013).Generally, results indicated that, Balady mandarin trees treated by 50% compost+ biofertilizer with 6 or 5 Kg Natural Mineral Compound were superior in its effects on fruit quality. On the other hand, from the previous results it could be noticed that all treatments increased fruit peel thickness as compared to control treatments, this may be attributed to silicon (Si) which represent the major component of the natural elements compounds, this led to reduce insect damage, improving the fruits handling and increasing storage period. These results are in harmony with those reported by Waterkeyn *et al*. (1982), who mentioned that, silicon is accumulated primarily in epidermal tissue both in roots and leaves as polymerized Silica-gel and is associated with pectin and calcium ions. Moreover, the thickening epidermal silicon-Cellulose layer support mechanical stability of plants and can increase plants resistance against insects, disease, salt and drought stress Epstein (1999). In addition, Natural Minerals Compound treatments increased fruit size which may be attributed to that silicon increase the absorption of potassium which maintains the plant water status. In this respect, Kaya *et al*. (2006) reported that, the presence of silicon may result in better supply of potassium. Also, silicon could earlier the harvest date by increasing fruit TSS/ acid ratio and Vitamin C and to decrease fruit acidity. These results were in the same line with finding by Taranovskaia (1939), who found that, silicon fertilizers showed 30 to 80% accelerated growth, 2-4 week earlier maturation of fruit, also, these results are in agreement with those obtained by Hoda *et al*. (2013) who used Diatoms as a source of silicon which increasing fruit TSS/ acid ratio and Vitamin C on Valencia orange trees.

Nitrite and nitrate

As shown in the Table 5 results revealed that nitrate and nitrite contents in fruit juice were significantly decreased by different treatments in the two studied seasons (2011 and 2013) as compared with control treatment. This means that fertilizing of Balady mandarin trees with compost +bio+ N.M.C had a beneficial effect on reducing nitrate and nitrite in fruit juice, data also revealed that, the lowest significant values were obtained by trees treated by 50% compost +bio+ 6Kg N.M.C during two seasons. It is clear from the above results that, over use of chemical N fertilizer increased fruit juice nitrite and nitrate contents. Similar results were reported by Blackmer, (1987) who indicated that, over use of chemical N fertilizer has been associated with increased levels of nitrate – nitrogen (NO_3 – N) in ground and surface water Blackmer (1987) which influences the nitrate content of plants Dapoigny *et al*. (2000). A high nitrate accumulation in plants results in nitrite production, which is converted into nitric oxide (NO) which, together with O_2^-, could be rapidly catalyzed by nitrate reductase into peroxynitrite (ONOO–) which is highly toxic to plants Durner and

Klessig (1999), Lamattina *et al*. (2003). Therefore, high nitrate accumulation in plants is harmful to human health Ikemoto *et al*. (2002), Ishiwata *et al*. (2002). The Joint Expert Committee of the Food and Agriculture (JECFA) Organization of the United Nations/World Health Organization (WHO) established the Acceptable Daily Intake of nitrate as 0 – 3.7 mg kg^{-1} body weight Speijers, (1996). The USA's Environmental Protection Agency (EPA)'s Reference Dose (RfD) for nitrate is equivalent to about 7.0 mg NO3 kg^{-1} body weight per day Mensinga *et al*. (2003). For these reasons, development of a better system for recommending fertilizer rates is a major goal of agricultural research. In this respect Ibraheem, (1994) mentioned that mineral nitrogen fertilization easily forms nitrate, whereas organic fertilizers slowly form nitrate. Also, the beneficial effect of organic and biofertilizer on reducing nitrate and nitrite is supported by the results reported by Rizk-Allah (2006) and Farag (2006) on grapevines. Anyhow, the optimum level of nitrite (No_2) in oranges is (less than 1 ppm) as reported by Harada *et al*. (1972).

TABLE 4. Effect of Natural Minerals Compound, organic and biofertilizer applications on fruit chemical characters of Balady mandarin tree.

Treatments	T.S.S %		Acidity %		T.S.S/ acid ratio		Vit.C mg/100 ml	
	2011	2013	2011	2013	2011	2013	2011	2013
(T_1)25% Comp. + 75% M.F (control)	11.17 e	10.33d	1.30 ab	1.39 a	8.31 c	7.68 c	29.45 b	28.17 b
(T_2)50% Comp. + bio+ 4kg N.M.C	12.00bc	11.33 a	1.18 ab	1.30 abc	10.25 a	8.85 ab	31.20ab	30.17ab
(T_3) 50% Comp. + bio+ 5kg N.M.C	12.17ab	11.33 a	1.27 ab	1.35 ab	9.96 ab	8.66abc	31.63ab	30.33 a
(T_4)50% Comp. + bio+ 6kg N.M.C	12.50 a	11.17ab	1.31 a	1.29abc	9.77 ab	8.71 ab	33.37 a	32.17 a
(T_5)75% Comp. + bio+ 4kg N.M.C	11.83bc	10.83bc	1.33 a	1.21 c	9.17abc	9.12 ab	33.58 a	31.83 a
(T_6)75% Comp. + bio+ 5kg N.M.C	11.17 e	11.oabc	1.28 ab	1.20 c	8.90 bc	9.22 a	31.85ab	31.17 a
(T_7)75% Comp. + bio+ 6kg N.M.C	11.67cd	10.83bc	1.32 a	1.30 abc	9.03 bc	8.45abc	31.85ab	31.50 a
(T_8)100% Comp. + bio+ 4kg N.M.C	11.17 e	10.83bc	1.18 ab	1.36 ab	9.53 ab	8.13 bc	31.63ab	31.17 a
(T_9)100% Comp. + bio+ 5kg N.M.C	11.33de	10.67cd	1.22 ab	1.26 bc	9.38abc	8.57abc	31.20ab	30.17ab
(T_{10})100% Comp. + bio+ 6kg N.M.C	11.17 e	10.83bc	1.15 b	1.22 c	9.75 ab	8.93 ab	31.42ab	31.67 a

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.

Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.

TABLE 5. Effect of Natural Minerals Compound, organic and biofertilizer applications on fruit juice nitrite and nitrate of Balady mandarin tree.

Treatments	No_2 (ppm)		No_3 (ppm)	
	2011	2013	2011	2013
(T_1)25% Comp. + 75% M.F (control)	2.50 a	2.90 a	50.30 a	54.21 a
(T_2)50% Comp. + bio+ 4kg N.M.C	1.3bc	0.90 f	46.41 bc	40.49 f
(T_3) 50% Comp. + bio+ 5kg N.M.C	1.11de	0.81 f	41.44 f	37.47 g
(T_4)50% Comp. + bio+ 6kg N.M.C	0.80 e	0.51 g	38.55 g	35.37 h
(T_5)75% Comp. + bio+ 4kg N.M.C	1.5bcd	1.20 e	43.35de	47.38bc
(T_6)75% Comp. + bio+ 5kg N.M.C	1.2cde	1.53 d	41.21 f	45.45 d
(T_7)75% Comp. + bio+ 6kg N.M.C	1.41bc	1.81 b	45.36bc	42.48 e
(T_8)100% Comp. + bio+ 4kg N.M.C	1.5bc	1.50 d	47.37 b	46.33cd
(T_9)100% Comp. + bio+ 5kg N.M.C	1.70 b	1.61cd	44.59cd	48.92 b
(T_{10})100% Comp. + bio+ 6kg N.M.C	1.61bc	1.70bc	42.52 ef	48.76 b

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.
Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.

Leaf mineral content

The concentration of some macro and micro elements in leaf tissues of Balady mandarin trees in response to organic, biofertilizer and Natural Minerals Compound (N.M.C) treatments were presented in Table (6 & 7). In general, it could be noticed that, the use of 50% compost+ biofertilizers with 6Kg or 5Kg Natural Minerals Compound (N.M.C) which contained different essential elements especially silicon (Si) were the best combinations for improving leaf mineral content on Balady mandarin trees. These results are in agreement with those obtained by Wutsher *et al*. (1989) who revealed that, trees treated with silicon (Si) absorbed more nutrient than the untreated trees. Also, application of (Si) influenced not only silicon nutrition of the citrus trees, but also, optimized other plant micronutrient nutrition aspects, Matichenkov *et al*. (2001). Moreover, addition of (Si) may increase concentration of (Ca) in plant tissues and hence restore membrane integrity in water stressed plants, also, the presence of Si may result in better of supply of (K), Kaya *et al*. (2006). On the other hand, this improvement on leaf mineral contents may be the fact that it induces positive effect on physical condition of the soil, creates favorable conditions for root growth and nutrient absorption it supplies much nutrient and it facilitates the trees of fixed nutrients to be absorb as a result of application of organic and biofertilizers Cook (1982). These results were in harmony with those reported by Haung *et al*. (1995) and El-Kobbia (1999) they concluded that using biofertilizers or organic or mixture between them reduce soil pH and may be mineral were available to absorption by citrus plants. Also, Stoffella *et al*. (1996) reported that, leaf N and Ca content were higher for seedlings produced in compost application on sour orange and Cleopatra mandarin. On the other hand, it could be noticed

that, leaf mineral content decreased from the optimum levels with increasing level of compost application. This may be attributed to the increasing of soil salinity as a result of compost application which its EC was 3.73mmhos/cm, and that is led to inhibition of mineral nutrient uptake as reported by Mesut *et al*. (2010).

TABLE 6. Effect of Natural Minerals Compound, organic and biofertilizer applications on leaf macro elements content of Balady mandarin tree.

Treatments	N (%)		P (%)		K (%)		Ca (%)	
	Season		Season		Season		Season	
	2011	2013	2011	2013	2011	2013	2011	2013
(T_1)25% Comp. + 75% M.F (control)	2.54 a	2.56 a	0.15 a	0.16 a	0.99 a	0.97a	4.60 a	4.45 a
(T_2)50% Comp. + bio+ 4kg N.M.C	2.41b	2.46cd	0.14ab	0.13abc	0.82bc	0.75cd	3.80 bc	4.29 ab
(T_3) 50% Comp. + bio+ 5kg N.M.C	2.42 b	2.5bc	0.14ab	0.14abc	0.83 b	0.79bc	4.28 ab	4.24abc
(T_4)50% Comp. + bio+ 6kg N.M.C	2.48 a	2.55ab	0.15ab	0.15ab	0.94 a	0.84 b	4.35 ab	4.43 a
(T_5)75% Comp. + bio+ 4kg N.M.C	2.42 b	2.41de	0.13ab	0.13abc	0.76cd	0.70de	3.04 de	2.80 e
(T_6)75% Comp. + bio+ 5kg N.M.C	2.40 b	2.4 e	0.13ab	0.12abc	0.72de	0.69def	3.46 cd	3.56 cd
(T_7)75% Comp. + bio+ 6kg N.M.C	2.40 b	2.4 e	0.12ab	0.12abc	0.75 d	0.68ef	3.55 cd	3.38 de
(T_8)100% Comp. + bio+ 4kg N.M.C	2.22 d	2.28 f	0.11ab	0.01 d	0.66 f	0.68ef	2.75 e	2.97 de
(T_9)100% Comp. + bio+ 5kg N.M.C	2.27cd	2.24fg	0.11ab	0.10 bc	0.68ef	0.64 f	3.29cde	3.23 de
(T_{10})100% Comp. + bio+ 6kg N.M.C	2.28 c	2.21g	0.09 b	0.09 c	0.67ef	0.69ef	3.61 cd	3.62bcd

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.
Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.
Optimum level of (N, P, K, and Ca %) are (2.4- 2.6, 0.12- 0.16, 0.70- 1.09 and 3-5.5 %), respectively. (Chapman, 1960).

Total count bacteria

The soil was analyzed at three times (February, April and August) during two seasons (2011&2013) to spot the changes in soil regarding biological conditions, Table 8 due to the different compost, Natural Minerals Compound (N.M.C) and biofertilizer applications. These Changes in root rhizosphere could give anapproximate vision to the ability of different applications to enhance crop production . However, all treatments significantly affected on biological activity of the soil compared with control treatment in two seasons. The maximum microbial activity was achieved by the combined effect of biofertilizer with 50% compost with 6k g or 5kg Natural Minerals Compound (T_4 and T_3), followed by T_2 50%compost + bio + 4Kg N.M.C), while, the changes of biological activity in root rhizosphere were greatly fluctuated among the other treatments, with no obvious trend could be observed during two seasons (2011&2013).Also, it could be noticed that, increasing the level of compost applications generally had negative effect of the yield and therefore decreased

microbial activity, this may be attributed to the increase of soil salinity. These results are in harmony with those obtained by Dick and Crist (1995) they reported that, adding organic wastes to soil can increase total Na, organic matter, microbial population, enzyme activity, moisture retention, pH buffering capacity and crop yield. Also, Bibhuti *et al*. (2010) indicated that, the application of organic amendment at different combinations favorably influence the microbial population, and physicochemical properties of rhizosphere compared to soil where no organic amendment were applied .Also Nadia *et al*. (2007) used different organic amendments and revealed that, there is an increase in total bacteria and Azotobacter count on Valencia orange seedlings. The same trend was observed by Moharram *et al*. (1998) who showed that, applying organic matter to the soil has a beneficial effect in improving its productivity by several mechanisms, one of them is improving the soil biological condition, especially with the benefit of N_2-fixing bacteria, Table 8.

TABLE 7. Effect of Natural Minerals Compound, organic and biofertilizer applications on leaf micro elements content of Balady mandarin tree.

Treatments	Mg (%)		Fe (ppm)		Zn (ppm)		Mn (ppm)	
	Season		Season		Season		Season	
	2011	2013	2011	2013	2011	2013	2011	2013
(T_1)25% Comp. + 75% M.F (control)	0.51 a	0.52 a	84.94 b	94.21 a	74.28 a	74.95 a	151.7 a	165.8 a
(T_2)50% Comp. + bio+ 4kg N.M.C	0.33 c	0.30 d	76.60 c	74.13 c	46.17 d	48.90 d	83.76 d	89.27 d
(T_3) 50% Comp. + bio+ 5kg N.M.C	0.40 b	0.37 c	75.70 c	83.93 b	56.71 c	55.28 c	108.3 c	119.2 c
(T_4)50% Comp. + bio+ 6kg N.M.C	0.44 b	0.43 b	89.63 a	94.14 a	66.06 b	67.65 b	124.4 b	145.3 b
(T_5)75% Comp. + bio+ 4kg N.M.C	0.29 cd	0.26 def	62.75 d	65.08 d	28.02 e	27.06 f	65.35 g	61.02 g
(T_6)75% Comp. + bio+ 5kg N.M.C	0.26de	0.26 def	61.72 d	62.53 d	27.12 e	31.29 ef	72.07 fg	67.66 f
(T_7)75% Comp. + bio+ 6kg N.M.C	0.27 d	0.27 de	58.50 e	70.58 c	28.25 e	33.54 e	76.89def	75.75 e
(T_8)100% Comp. + bio+ 4kg N.M.C	0.20 f	0.21 f	44.58 g	45.09 f	19.74 f	18.56 g	73.59 ef	74.22 e
(T_9)100% Comp. + bio+ 5kg N.M.C	0.19 f	0.21 ef	45.92 g	50.39 e	20.68 f	19.31 g	80.03 de	74.67 e
(T_{10})100% Comp. + bio+ 6kg N.M.C	0.21ef	0.25 def	51.15 f	53.95 e	22.09 ef	21.08 g	71.55 fg	73.48 e

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.

Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.

Optimum level of (Mg, Fe, Zn and Mn) are (0.26- 0.6 %, 60- 120, 25- 100 and 25- 200 ppm), respectively. (Chapman, 1960).

Environmental side

It is clear from this study that, there is a high possibility for using organic fertilizers (compost), Natural Minerals Compound as a raw material and bio fertilizer as the mineral fertilizer alternative at the rate of 50% compost from the recommended rate for fertilizer with biofertilizer and 6kg or 5kg Natural Minerals Compound for fertilizer of Balady mandarin trees to reduce environmental pollution (soil and underground water) and to produce safety food and high fruit

quality especially for reducing nitrite and nitrate in fruit juice which considered the one of main reasons of cancer disease in human body. In this concern Sarasua & Savitz (1994) and Pogoda & Preston_Martin (2001) indicated that, exposure to higher levels of nitrate or nitrite has been associated with increased incidence of cancer in adults and possible increased incidence of brain Tumors, Leukemia and nasopharyngeal (nose and throat) tumors in children in some studies.

TABLE 8. Effect of Natural Minerals Compound, organic and biofertilizer applications on total count bacteria of Balady mandarin tree.

Treatments	Total count bacteria cfu (10^6 g soil $^{-1}$)					
	February		April		August	
	2011	2013	2011	2013	2011	2013
(T_1)25% Comp. + 75% M.F (control)	32.00 g	45.00 i	70.00 i	62.00 j	21.00 i	32.00 g
(T_2)50% Comp. + bio+ 4kg N.M.C	113.0 b	120.0 c	155.0 c	186.0 c	300.0 c	290.0 b
(T_3) 50% Comp. + bio+ 5kg N.M.C	164.0 a	170.0 b	220.0 b	272.0 b	320.0 b	493.0 a
(T_4)50% Comp. + bio+ 6kg N.M.C	168.0 a	181.0 a	248.0 a	292.0 a	490.0 a	510.0 a
(T_5)75% Comp. + bio+ 4kg N.M.C	62.00 d	73.00 f	100.0 f	119.0 f	155.0 f	162.0 de
(T_6)75% Comp. + bio+ 5kg N.M.C	64.00 d	86.00 e	115.0 e	142.0 e	160.0 e	171.0 cd
(T_7)75% Comp. + bio+ 6kg N.M.C	72.00 c	99.00 d	143.0 d	165.0 d	168.0 d	189.0 c
(T_8)100% Comp. + bio+ 4kg N.M.C	48.00 f	47.00 i	61.00 j	66.00 i	120.0 h	118.0 f
(T_9)100% Comp. + bio+ 5kg N.M.C	52.0 ef	56.00 h	78.00 h	78.00 h	140.0 g	130.0 ef
(T_{10})100% Comp. + bio+ 6kg N.M.C	55.00 e	67.00 g	85.00 g	101.0 g	155.0 f	143.0def

Mean separation within columns by Duncan's multiple range test, 5% level. Values that don't share the same letter are significantly different.
Where: Com. Refers to compost, N.M.C. refers to Natural Minerals compound and M.F refers to mineral fertilizer.

Economic study

In economic study of yield production, the main economic criteria were cost of each substance (Compost, biofertilizer and Natural Minerals Compound) that used under study (L.E / fed.), cost of labor and mineral fertilizer that used in control treatment (L.E / fed.). Results are given in Table 9. Other expenses such as the costs of supervision and royalties were not taken into consideration in this study. In more details unite price of Compost was (200 L.E/ton.), biofertilizer was (10 L.E / Liter.) and unite price of Natural Minerals Compound was (1.10 L.E / kg) taking into account of biofertilizer was applied at three times under study. The study also revealed that the cost of labor that were used per treatment and thus the total costs were calculated. And finally the cost over control for each treatment / fed. was calculated. From this economic study it

could be noticed that, increasing the final cost of organic production as comparison with the conventional production (control treatment), while, the price of organic farming production is usually much higher than the price of conventional fruit production because it has more safe food and high fruit quality.

TABLE 9. Economic study for using Compost, N.M.C. and biofertilizers applications on yield of Mandarin trees.

Treatments	Amount / tree	Total Q . of eachTrea./ fed.	Unit price (L.E)	Cost of each Trea./fed. (L.E)	NO. Labor/ year	Labor fees (L.E)	Labor Cost (L.E)	Total cost trea./fed. (L.E)	cost over contol trea./fed. (%)
(T1) 25% compost + 75% mineral fertilizer (control)	14 kg compost +	2240 kg	0.20	448	2	50	100	2658	.....
	(1)1.25 kg ammonium Sulphate (2 times)	400 kg	1.5	600	2	50	100		
	(2) 0.750 kg Ammonium nitrate	120 kg	1.75	210	2	50	100		
	(3) 1.25 kg potassium Sulphate	200 kg	4.00	800					
	(4) 2 kg Super phosphate	200	1.5	300					
(T2) 50% compost + 4 kg (N.M.C) + biofertilizer	28 kg compst +	4480	0.20	896	2	50	100	3200	20.39
	4 kg (N.M.C)	640	1.10	704					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T3) 50% compost + 5 kg (N.M.C) + biofertilizer	28 kg compst +	4480 kg	0.20	896	2	50	100	3376	27.01
	5kg (N.M.C)	800 kg	1.10	880					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T4) 50% compost + 6 kg (N.M.C) + biofertilizer	28 kg compst +	4480 kg	0.20	896	2	50	100	3552	33.63
	6 kg (N.M.C)	960 kg	1.10	1056					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T5) 75% compost + 4 kg (N.M.C) + biofertilizer	42 kg compost +	6720 kg	0.20	1344	2	50	100	3648	37.25
	4 kg (N.M.C)	640	1.10	704					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T6) 75% compost + 5 kg (N.M.C) + biofertilizer	42 kg compost +	6720 kg	0.20	1344	2	50	100	3824	43.87
	5kg (N.M.C)	800 kg	1.10	880					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T7) 75% compost + 6 kg (N.M.C) + Biofertilizer	42 kg compost +	6720 kg	0.20	1344	2	50	100	4000	50.49
	6 kg (N.M.C)	960 kg	1.10	1056					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T8)100% compost + 4 kg (N.M.C) + Biofertilizer	56 kg compost +	8960 kg	0.20	1792	2	50	100	4096	54.10
	4 kg (N.M.C)	640	1.10	704					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T9) 100% compost + 5 kg (N.M.C) + Biofertilizer	56 kg compost +	8960 kg	0.20	1792	2	50	100	4272	60.72
	5kg (N.M.C)	800 kg	1.10	880					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		
(T10) 100% compost + 6 kg (N.M.C) + Biofertilizer	56 kg compost +	8960 kg	0.20	1792	2	50	100	4448	67.34
	6 kg (N.M.C)	960 kg	1.10	1056					
	250 mL x 3 time	120 L	10.00	1200	2 × 3 time	50	300		

Where: (N.M.C) refers to Natural Minerals Compound, 3 times refers to (December, February and June).

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تأثير إضافة مخلوط المعادن الطبيعية والتسميد العضوي وبعض المخصبات الحيوية علي المحصول وجودة الثمار والمحتوي المعدني للأوراق في أشجار اليوسفي البلدي

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أُجريت هذه الدراسة في مزرعة خاصة تابعة للسيد/ حسين صابر في محافظة القليوبية – مصر علي أشجار اليوسفي البلدي المطعوم علي أصل النارنج. الأشجار كانت تحت نظام الري بالغمر ، ونامية في تربة طميية طينية.

هدف الدراسة هو تقدير إستجابة أشجار اليوسفي البلدي للكمبُوست وبعض المخصبات الحيوية ومخلوط المعادن الطبيعية والذي يمثل عنصر السليكون المُكوِن الأكبر في هذة المادة الخام.

إشتملت الدراسة علي عشرة معاملات (ثلاثة مستويات كمبُوست ٥٠٪ ، ٧٥ ٪ ، ١٠٠ ٪) من إحتياجات شجرة اليوسفي من عنصر النيتروجين ، ثلاثة مستويات من مخلوط المعادن الطبيعية ٤ ، ٥ ، ٦ كجم للشجرة في السنة مع بعض المخصبات الحيوية بالإضافة لمعاملة الكنترول (٢٥ ٪ كمبُوست + التسميد المعدني المُوصي به) .

عُوملت الأشجار بالمعاملات المختلفة المستخدمة تحت الدراسة خلال ثلاثة مواسم (٢٠١١ موسم حمل غزير ، ٢٠١٢ موسم حمل خفيف، ٢٠١٣ موسم حمل غزير) ، وتم أخذ البيانات خلال موسمي الحمل الغزير (٢٠١١ ، ٢٠١٣).

أوضحت البيانات أن معاملة الـ٥٠ ٪ كمبُوست + المخصب الحيوي + ٦ أو ٥ كجم مخلوط المعادن الطبيعية كانت أفضل معاملة لإعطاء أعلي محصول وتحسين جودة الثمار (زيادة حجم الثمار ، زيادة سمك القشرة ، زيادة النسبة المئوية للعصير ، زيادة نسبة السكريات الكلية إلي الحموضة ، زيادة فيتامين ج ، ونقص حموضة الثمار ، نقص محتوي الثمار من النيتريت والنترات). كما أوضحت النتائج أيضا أن إستخدام المعدل العالي من الكمبُوست ٧٥ ٪ ، ١٠٠ ٪ أدي إلي نقص المحتوي المعدني من الأوراق ، وربما يرجع هذا إلي زيادة ملوحة التربة كنتيجة لإضافة الكمبُوست والذي يصل تركيز الملوحة فيه (ال E.C) إلي ٣,٧٣ مليموز. أيضا أدت جميع المعاملات إلي زيادة النشاط البيولوجي للتربة وذلك فيما يتعلق بزيادة العدد الكلي للبكتريا (باسيلاس سيركُيولانس ، باسيلاس ميجاتيريم ، أزوتو باكتر كُروكم) بالمقارنة بمعاملة الكنترول.

كما أوضحت الدراسة الإقتصادية للبحث زيادة التكلفة الإقتصادية النهائية للفدان للزراعة العضوية مقارنة بالزراعة التقليدية (معاملة الكنترول) ، ومع ذلك فإن سعر منتج الزراعات العضوية غالبا ما يكون أعلي من سعر منتج الزراعات التقليدية وذلك لأهميتها كغذاء آمن ، وجودة ثمار عالية خاصة فيما يتعلق بإنخفاض محتوي عصير الثمار من النيتريت والنترات واللذين يُعتبرا أحد الأسباب الرئيسية للضرر بصحة الإنسان.

الكلمات الكشافة: الكمبُوست ، المخصبات الحيوية ، مخلوط المعادن الطبيعية ، المحصول ، جودة الثمار ، النترات ، النيتريت، صحة الإنسان، أشجار اليوسفي البلدي.