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Comparative Study on the Npk Fertilization Sources of Young Manfalouty Pomegranate Trees

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ABSTRACT

This work was conducted during 2014&2015 seasons on young Manfalouty pomegranate trees grown in reclaimed sandy soil under drip irrigation (National Research Center orchard) at Nobaria region, Behara Governorate to investigate the possibility of replacing the expensive mineral NPK fertilizers commonly adopted in the region with other cheaper and environment friendly alternative sources. In this regard organic N and some natural raw PK materials mixtures used at 3 doses (500,1000,1500 and 2000 g/tree) either solely or combined with bio NPK fertilizers mixture were evaluated through the response of vegetative growth and nutritional status measurements. Data obtained displayed that the investigated growth measurements (plant height, stem thickness, shoot length, No. of both shoots per tree & leaves /shoot, average leaf area and total assimilation area), as well as nutritional status (leaf chlorophyll, N, P, K, Fe, Mn and Zn contents) responded obviously to investigated fertilization treatments and followed to great extent the same trend. Herein, control, organo NPK rocky materials only at 500 g/tree and bio NPK fertilizers mixture solely at 300 ml/tree seemed to be equally the same, ascendly followed by (T_3- 1000g of alter. organo. Rocky mix. Only, T_6 - (T_2 + 300 ml bio NPK mix.), (T4- 1500g of alter. organo. Rocky mix. Only &T_7-(T_3 + 300 ml bio NPK mix.), (T_5- 2000g of alter. organo. Rocky mix. Only) and T_8 - (T_4 + 300 ml bio NPK mix.)/ T_9 - (T_5 + 300 ml bio NPK mix.). Consequently, mixture of organic N and rocky PK materials at either 1000 or 1500 g/tree combined with bio-NPK mixture at 300ml/ tree could be safely recommended, as their beneficial effects on both growth & nutritional status measurements were concerned.

Keywords: Manfalouty pomegranate, natural raw PK, organic N, bio NPK, vegetative growth and nutritional status

INTRODUCTION

Pomegranate "*Punica granatum* L." is one of the oldest known edible fruits species mentioned in the Quran. It is belonging to the Family Punicaceae, its fruits considered as a popular desirable rich sources for providing the local consumer with vitamin C, K, fibers and juice low in calories (Fuhrman & Avirman, 2007 and Fawole & Opara, 2013). Moreover, it has also its own great importance in the human medicine purposes as its components have a wide range of available worth clinical applications, (Lanky & Newman, 2007).

Due to the lower water requirement and relative higher tolerance of pomegranate to many unfavorable environmental conditions compared to most fruit species, so it grows successfully in the arid and semi-arid areas around the world, particularly those situated within the tropical and sub-tropical zones.

Because, the principle hoped target by pomegranate growers is usually similar to that of other fruits producer, as well as any of the industrial production processes all are concentrated towards increasing the net grower's or producer's income. Such goal could be practically achieved through increasing productivity associated with higher fruit quality from one hand and lowering or minimizing cost of the needed horticultural practices especially those related to fertilization from the other. Accordingly, building of a well strong tree canopy structure especially through the earlier orchard establishment stage i.e., growth/juvenile phase of pomegranate tress is a real guaranty for realizing such aimed/hoped main factors "reasons" closely related to increasing productively and finally pomegranate grower's income could be realized certainly. Besides, decreasing cost of pomegranate production though using other NPK cheaper source/s particularly those having availed option as being economical and environment friendly mineral or bio-fertilizers substances is the second wing/ reason by which the expected final goal could be achieved.

Consequently, the present work is mainly directed towards investigating the possibility of replacing the expensive, highly dispersible soluble three major commercial concentrated mineral NPK fertilizers usually adopted by an alternative cheaper and environment friendly ones either those of organic or mineral rocky nature, as well as some bio-sources. Since, all alternative sources are characterized by their slow releasing ability of their nutrients content which representative as a continuous gradual supply along the growing season around for the fruit trees. So, the mineral NPK fertilization program adopted in the region after the recommendation of the Minis. of Agric. in comparison with three other NPK sources i.e., (granulated organic N fertilizer of 18-20% actual N), (granulated natural mineral rocky material phosphor source of 18-20% actual P_2O_5) and (granulated natural mineral rocky material potassium source of 10-12% actual K_2O), besides three NPK bio-fertilizers sources either as an amendment/addenda practical together with the three alternate NPK fertilizers or alone as an independent treatment (a-Nitrobein, b-Phosphorene and c-Potassein)were investigated in this concern.

MATERIALS AND METHODS

The present experiment was conducted during two consecutive 2014 & 2015 experimental seasons on young Manfalouty pomegranate *Punica granatum* L." trees (one-year-old) planted at 3x5 meters apart in new reclaimed sandy soil under drip irrigation system using Nile river water at the Experimental Station Farm of National Research Center located at Nobaria district, El-Behara Governorate, Egypt.

Before starting 1st season (2014) mechanical and chemical analysis of orchard soil surface (0.40cm. depth) were determined after the methods described by Piper, (1958) and Jackson, (1967) as shown in Table (1).

Table 1. Physical and chemical properties of the experimental soil

Properties	Value	Properties	Value
Clay %	5.00	P %	0.44
Silt %	5.00	K %	0.57
sand %	90	Ca mg/L	2.65
Texture	Sandy	Mg mg/L	2.40
PH	8.2	HCO_3 mg/L	3.85
EC	1.5	Cl mg/L	53
N%	Trace	SO_4 mg/L	55.65

The main goal was directed towards increasing Manfalouty pomegranate productivity associated with lower its production cost and consequently net growers income of such favorable cultivar through investigating the possibility of replacing the major three expensive mineral concentrated NPK fertilizers with other cheaper and environment friendly natural NPK sources having either mineral, organic or bio nature.

So, the ordinary, common mineral NPK fertilization regime adopted in the region in the form of ammonium sulphate, superphosphate and potassium sulphate yearly added at the rate of 0.400,0.400 and 0.200 Kg per tree, respectively was also included as control in this experiment. However, other investigated alternate NPK fertilizers sources were: 1- granulated organic N fertilizer of 18-20% actual N*., 2- two natural raw rocky materials, 1st as P fertilizer of 18-20 % actual P_2O_5 *, while 2nd as K fertilizer of 10-12% actual K_2O* and 3- three bio fertilizers ** i.e., a)- Nitrobein: - is a commercial nitrogenous bio-fertilizer contain specialized bacterial strains for free N fixation, b)- phosphorene: is a commercial phosphorus bio-fertilizer containing some active bacterial strains which facilate P uptake through changing the insoluble tri-calcium phosphate (unavailable form) into available soluble one (mono- Calcium phosphate), and C) – Potassiem: is a commercial potassium bio-fertilizer that facilitates potassium releasing from clay complex components or between their mineral platelets layers.

Taking in to consideration that three alternate NPK sources i.e., granulated organic N fertilizer and granulated natural raw mineral rocky materials for either P or K fertilizers were mixed together at an equal proportion (1:1:1by weight) for being used as a composite fertilizer mixture. soil applied at four doses (500, 1000, 1500 and 2000 g/tree) either solely or combined with three bio-fertilizers mixture, moreover three bio-fertilizers (Nitrobein, Phosphorene and Potassein) were also mixed together at equal proportions (1:1:1by volume) for being soil drench applied at the rate of 300 ml / tree either solely or combined to the four investigated doses of the three alternative NPK sources. Accordingly, 10 fertilization treatments were investigated in this experiment were as follows:

1- Control (the ordinary mineral NPK fertilization program adopted at 400,400 200g/tree from$(NH_4)_2SO_4$, superphosphate and K_2SO_4, respectively) after the Minst. of Agric. recommendation.
2- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 500 g per tree.
3- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 1000g per tree.
4- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 1500g per tree.
5- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 2000g per tree.
6- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 500g plus NPK bio-fertilizations mixture at 300 ml. per tree.
7- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 1000g plus NPK bio-fertilizations mixture at 300 ml. per tree.
8- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 1500g plus NPK bio-fertilizations mixture at 300 ml. per tree.
9- Natural alternative NPK fertilizations mixture (organic N and PK raw mineral rocky materials) at 1000g plus NPK bio-fertilizations mixture at 300 ml. per tree.
10- NPK bio-fertilizations mixture solely at 300 ml. per tree.

All trees in this the experiment were subjected to the same horticultural practices adopted in the farm concerning irrigation regime, micro-elements addenda weed and insect controlling.

The complete randomized block design with three replications was used for arranging the abovementioned ten fertilization treatments and each replicate was represented by two trees. Besides, the corresponding fertilizations amount of every treatment was fractionated into three equal doses for being soil applied during each season at one month interval i.e., mid of Feb., March and April for 1st, 2nd and 3rd portions, respectively.

Influence of investigated ten fertilization treatments was evaluated as each experimental season had been terminated on late October through determining differences exhibited in the following vegetative growth and nutritional status measurements:

1- Vegetative growth:

(plant height, trunk diameter at 10.0 cm above soil surface, average shoot length in cm.), (No. of

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*** Prepared, purified and salad by AL AHRAM MINNING COMPONY.**

**** Prepared and marketing by Ministry of Agriculture.**

shoots/plant &leaves / shoot) and (area of individual leaf & total assimilation surface/shoot) were determined. Whereas average leaf area was estimated according to the following formula after Ahmed and Morsy (1999): Leaf area =0.41(leaf length x its width) + 1.83.

2- Nutritional status:

In this regard leaf total chlorophyll, N, P, K, Fe, Mn and Zn contents were determined as follows: -

a- Leaf total chlorophyll contents were determined in fresh leaves by using Minolta meter SPAD-502.

b- Leaf total (N) was determined by the modified micro Keldahl method mentioned by Pregl, (1945).

c- leaf Total P, K, Fe, Mn and Zn were determined after Chapman and Pratt, (1961**).**

Statistical analysis:

All data obtained during both seasons were subjected to analysis of variance according to Snedecor and Cochran, (1980) and significant differences among means were distinguishing according to the Duncan's, multiple test range Duncan, (1955).

RESULTS AND DISCUSSION

1- Vegetative growth measurements:

Concerning the response of young Manfalouty pomegranate trees growth measurements to the differential investigated NPK fertilization treatments, data obtained during both 2014& 2015 experimental seasons are presented in Tables (2) and (3). It was quite evident that all 10 NPK fertilization treatments varied considerably, however the rate of their effectiveness differed obviously from one treatment to another. Anyhow it could be generally observed that the response of all evaluated growth measurements to a given investigated fertilization treatment of such 10 studied ones followed approximately the same trend with a relative few exceptions differed slightly from one growth measurements to the other. Herein, investigated ten fertilization treatments could be generally classified according to their effectiveness for stimulating the young Manfalouty pomegranate trees growth into the following four categories: -

A- The most effective treatment/s (superior category) by which the greatest values of all or most growth measurements were resulted. Both 8^{th} & 9^{th} fertilization treatments i.e., providing with alternative NPK sources (mixture of granulated organic N and raw rocky PK materials) at either 1500 or 2000 g rates each combined with 300ml bio NPK fertilizer mixture per tree.

B- Second effective category included three fertilization treatments (4^{th}, 5^{th} and 7^{th} ones), whereas alternative NPK fertilizers mixture either it was applied only at 1500 &2000 g/tree (T_4&T_5) or at 1000 g combined with 300ml bio NPK fertilizers mixture/tree (T_7). Three treatments of such group having nearly the same efficiency in spite of T_5 (alternative NPK fertilizers mixture only at 2000 g/tree) tended to be relatively more effective than to other members of this category.

C-Both T_3 &T_6 NPK fertilization treatments, whereas each individual Manfalouty pomegranate tree was supplied with alternative NPK fertilizers mixture either at 1000g solely or 500g combined with 300ml bio NPK fertilizers mixture were representative of the third effective category (in a descending order) as their influence on investigated growth measurements were concerned.

D- The fourth category which included the least effective NPK fertilization treatments (T_1, T_2 and T_{10}). Herein, T_1(control) i.e., the common mineral NPK fertilizations regime adopted in the region after the recommendation of Minst. of Agric. at (from 400g $(NH_4)_2SO_4$, 400g superphosphate and 200g K_2SO_4), T_2(alternate NPK fertilizations mixture only at 500g/tree) and T_{10} (bio-NPK fertilizers at 300ml./tree) ranked generally the inferior one from one hand, differences in their efficiency were in most cases too few to be considered either data of each season or an average of two seasons were concerned. Such trend dealing with the response of the differential evaluated growth measurements of Manfalouty pomegranate trees to the investigated ten fertilization treatments was true to great extent during both seasons and differences between the aforesaid discussed four categories were so pronounced from one hand associated with too slight or absent variations as members of each category were statistically compared each other.

The present results regarding the great beneficence of NPK bio-fertilizers application on stimulating different growth parameters of Manfalouty pomegranate trees go in line with those found by several investigators i.e., Fawzia-Eissa, (2003) on Canino apricot cv., Kabeel *et al.,* (2005) on Canino apricot cv., Kabeel *et al.,* (2007) on Anna apple trees, Stino *et al.,* (2009) on Canino apricot cv., Osman and Abd El-Rahman, (2010) on Fig trees and Darwesh, (2012) on costata persimmon trees. All pointed out the suitability of some bio NPK fertilizers.

However, the advancement of natural rocky nutritive materials detected in this work goes partially with that found by Gawad *et al.,* (2012) on Crimson seedless grapevines, who indicated that suitability, importance and favoring of two natural rocks (phosphate and feldspar) applied solely or combined with bio NPK fertilizers above others. Moreover, preference of the investigated alternative NPK fertilizers mixture (granulated organic N and natural rocky PK materials) above the ordinary highly soluble mineral NPK sources could be logically explained depending upon nature of either investigated NPK source or plant species under study. Herein, slow releasing nature of organo-rocky NPK fertilizer mixture keep the released NPK nutrients elements from quick leaching from one hand, and saves a real guaranty of gradual continuous supply for pomegranate tree (perennial plant) with the required nutrient elements along the growing season (nearly the year around)

Table 2. plant height, trunk diameter, shoot length and No. of shoots of young Manfalouty pomegranate trees in response to NPK fertilization treatments with adopted common* alternate natural-rocky mixture and bio-NPK sources*** during 2014&2015 seasons**

NPK fertilization treatments (source & dose per trees)	Vegetative growth measurements during two experimental seasons 2014&2015							
	Plant height (cm)		Trunk diameter (cm)		Shoot length (cm)		NO. of shoots/tree	
	2014	2015	2014	2015	2014	2015	2014	2015
T_1- Adopted NPK fert. in region (control)	110.8e	131.3f	1.45d	1.980i	28.0h	32.0de	5.85de	9.850f
T_2- 500g of alter. organo. Rocky mix. Only	109.0e	130.6f	1.50d	2.090h	29.0g	33.0d	5.95de	9.900ef
T_3- 1000g of alter. organo. Rocky mix. Only	130.0d	155.6e	1.66c	2.365g	30.7f	34.7c	6.50de	11.20de
T_4- 1500g of alter. organo. Rocky mix. Only	141.0c	167.0d	1.81bc	2.530e	32.90d	36.8b	7.90c	12.10bcd
T_5- 2000g of alter. organo. Rocky mix. Only	148.0b	176.1c	1.90b	2.695c	34.9b	39.23a	8.40c	12.77b
T_6 - (T_2 + 300 ml bio NPK mix.)	128.9d	154.9e	1.70c	2.420f	31.6e	34.47c	6.80d	11.40cd
T_7 - (T_3 + 300 ml bio NPK mix.)	148.0b	174.9c	1.88b	2.640d	34.0c	37.50b	8.10c	12.60bc
T_8 - (T_4 + 300 ml bio NPK mix.)	155.0a	184.8b	2.06a	2.860b	36.1a	40.0a	10.40b	14.60a
T_9 - (T_5 + 300 ml bio NPK mix.)	161.0a	192.5a	2.15a	2.970a	36.5a	40.50a	11.60a	15.00a
T_{10}- 300 ml bio NPK mixture only	108.5e	128.7g	1.40d	1.925j	27.2h	31.30e	5.65e	9.20f

Means followed by the same letter/s within each column didn't significantly differ at 5% level
***refers to the ordinary adopted NPK fertilizers after recommendation of Min. of Agric.**
****refers to alternative NPK mixture (orange N and natural rocky PK materials at 1:1:1 by weight.**
*****refers to bio NPK fertilizers (Nitrobein, phosphorene and potassein) mix. at 1:1:1 by volume.**

Table 3. No. of leaves/shoot, Leaf area (cm^2) and Assimilation area (cm^2) of young Manfalouty pomegranate trees in response to NPK fertilization treatments with adopted common* alternate natural-rocky mixture and bio-NPK sources*** during 2014&2015 season**

NPK fertilization treatments (source & dose per trees)	Vegetative growth measurements during two experimental seasons 2014&2015					
	No. of leaves/shoot		Leaf area (cm^2)		Assimilation area (cm^2)	
	2014	2015	2014	2015	2014	2015
T_1- Adopted NPK fert. in region (control)	23.30ef	26.70h	4.35d	4.66h	101.5e	124.5h
T_2- 500g of alter. organo. Rocky mix. Only	22.30fg	25.32i	4.30d	4.55i	96.02ef	115.3i
T_3- 1000g of alter. organo. Rocky mix. Only	24.70de	27.90g	4.44cd	4.75g	109.7df	132.6g
T_4- 1500g of alter. organo. Rocky mix. Only	26.40cd	31.10e	4.83b	5.13e	127.4c	159.6e
T_5- 2000g of alter. organo. Rocky mix. Only	29.10b	33.40c	5.03ab	5.39d	146.4b	180.1d
T_6 - (T_2 + 300 ml bio NPK mix.)	25.80cd	29.20f	4.73bc	5.06f	122.1cd	147.8f
T_7 - (T_3 + 300 ml bio NPK mix.)	27.60bc	32.10d	5.18a	5.90c	142.9b	189.5c
T_8 - (T_4 + 300 ml bio NPK mix.)	32.80a	35.90b	5.25a	6.20b	172.2a	222.7b
T_9 - (T_5 + 300 ml bio NPK mix.)	34.10a	38.10a	5.33a	6.70a	181.2a	255.4a
T_{10}- 300 ml bio NPK mixture only	20.80g	24.67j	4.10d	4.60i	85.22f	113.5i

Means followed by the same letter/s within each column didn't significantly differ at 5% level
***refers to the ordinary adopted NPK fertilizers after recommendation of Min. of Agric.**
****refers to alternative NPK mixture (orange N and natural rocky PK materials at 1:1:1 by weight.**
*****refers to bio NPK fertilizers (Nitrobein, phosphorene and potassein) mix. at 1:1:1 by volume.**

2- Nutritional status measurements:

Leaf total chlorophyll, N, P, K, Fe, Mn and Zn contents were the studied nutritional status measurements of young Manfalouty pomegranate trees pertaining their response to differential investigated NPK fertilization treatments. Data obtained during both 2014& 2015 experimental seasons are tabulated in Tables (4) and (5). It is quite clear that all leaf chemical constituents of various nutritional status measurements were influenced by the investigated NPK fertilization treatments. However, differences between treatments were relatively not so acute as compared to the aforesaid discussed ones of the vegetative growth measurements from one hand. On the other side, it could be safely demonstrated that three fertilization treatments (T_1, T_2 and T_{10}) i.e., the adopted NPK fertilizations regime after the recommendation of Minst. of Agric., alternative NPK fertilizations mixture (organic N & natural PK rocky materials) only at 500g/tree and the bio-NPK fertilizers mixture only at 300ml./tree were still the inferior from statistical standpoint as they induced significantly the poorest leaf total chlorophyll, N, P, K, Fe, Mn and Zn contents. On the contrary, four fertilization treatments (T_9, T_8, T_7, T_5) i.e., providing a single pomegranate tree with the alternative NPK fertilizers mixture (organic N & natural PK rocky materials) at 2000, 1500 or 1000g each combined with 300ml. bio NPK fertilizers mixture (T_9, T_8, T_7) and alternative NPK organic-rocky mixture only at 2000g/tree (T_5) seemed in the most cases to be significantly the superior as showed the highest values, especially leaf total chlorophyll, K and Fe contents. Herein, three other investigated NPK fertilization (T3, T_4, T_6) i.e., alternative NPK organic-rocky materials mixture either only (at 1000/ 1500g per tree) or 500g but combined with 300ml bio NPK fertilizers mixture were in between the aforesaid two extremes.

The present results are in general accordance with those previously found by Fawzia-Eissa, (2003) on Canino apricot cv., Kabeel *et al.,* (2005) on Canino apricot cv., Stino *et al.,* (2009) on Canino apricot cv., Osman and Abd El-Rahman, (2010) on Fig trees and Darwesh, (2012) on costata persimmon trees and Baiea, *et al.,* (2015) on Banana cv. Grande Naine.

The shift (no coincidence) in ranking of the investigated NPK fertilization treatments pertaining

their influence on nutritional status measurements when compared to the analogous one previously discussed with growth measurements could be considered as a real reflection of the unparalleled rates of increase exhibited in measurements of both vegetative growth and nutritional status particularly those resulted by the more effective fertilization treatments. In other words, the rate of increase in most nutritional status measurements by the effective fertilization treatments was usually lower than the corresponding ones of the vegetative growth measurements. So, such trend could be logically explained as an expected dilution effect resulted by the relative higher accumulation rate of assimilated dry matter corresponding to the lower rate of increase in most nutrient elements.

Table 4. N%, P% and K% of young Manfalouty pomegranate trees in response to NPK fertilization treatments with adopted common* alternate natural-rocky mixture and bio-NPK sources*** during 2014&2015 seasons**

NPK fertilization treatments (source & dose per trees)	Nutritional status measurements during two experimental seasons 2014&2015							
	Total chlorophyll (mg/g F.W)		N%		P%		K%	
	2014	2015	2014	2015	2014	2015		
T_1- Adopted NPK fert. in region (control)	50.40d	52.70d	1.18d	1.25e	0.30d	0.35c	0.69e	0.75d
T_2- 500g of alter. organo. Rocky mix. Only	50.60d	52.00d	1.15d	1.21e	0.35cd	0.25d	0.67e	0.78d
T_3- 1000g of alter. organo. Rocky mix. Only	51.90c	54.70c	1.30c	1.35d	0.39c	0.42bc	0.85d	0.90c
T_4- 1500g of alter. organo. Rocky mix. Only	52.30bc	55.30bc	1.39bc	1.40cd	0.44b	0.51ab	1.00c	1.10b
T_5- 2000g of alter. organo. Rocky mix. Only	53.10ab	56.10ab	1.45b	1.51b	0.49b	0.55a	0.90d	1.20a
T_6 - (T_2 + 300 ml bio NPK mix.)	52.30b	54.20c	1.34c	1.45bc	0.42bc	0.50ab	1.08bc	1.02bc
T_7 - (T_3 + 300 ml bio NPK mix.)	53.00b	55.90ab	1.41b	1.50b	0.50ab	0.52a	1.10ab	1.20a
T_8 - (T_4 + 300 ml bio NPK mix.)	54.00ab	56.20ab	1.53a	1.63a	0.54a	0.50ab	1.15a	1.25a
T_9 - (T_5 + 300 ml bio NPK mix.)	54.10a	57.10a	1.56a	1.71a	0.58a	0.50ab	1.20a	1.29a
T_{10}- 300 ml bio NPK mixture only	49.9d	53.33d	1.10d	1.20e	0.25e	0.27d	0.65e	0.78d

Means followed by the same letter/s within each column didn't significantly differ at 5% level
***refers to the ordinary adopted NPK fertilizers after recommendation of Min. of Agric.**
****refers to alternative NPK mixture (orange N and natural rocky PK materials at 1:1:1 by weight.**
*****refers to bio NPK fertilizers (Nitrobein, phosphorene and potassein) mix. at 1:1:1 by volume.**

Table 5. Fe ppm, Mn ppm and Zn ppm of young Manfalouty pomegranate trees in response to NPK fertilization treatments with adopted common* alternate natural-rocky mixture and bio-NPK sources*** during 2014&2015 seasons**

NPK fertilization treatments (source & dose per trees)	Nutritional status measurements during two experimental seasons 2014&2015					
	Fe ppm		Mn ppm		Zn ppm	
	2014	2015	2014	2015	2014	2015
T_1- Adopted NPK fert. in region (control)	89.8e	93.0d	61.55f	62.86f	20.80e	22.62e
T_2- 500g of alter. organo. Rocky mix. Only	90.0e	93.0d	64.19ef	65.15ef	21.0e	20.90e
T_3- 1000g of alter. organo. Rocky mix. Only	93.0de	97.0cd	66.75e	68.44e	24.0d	26.50d
T_4- 1500g of alter. organo. Rocky mix. Only	100.0bc	110.0bc	70.72d	71.28de	27.0c	29.50b
T_5- 2000g of alter. organo. Rocky mix. Only	104.0ab	114.0b	78.55bc	81.16b	28.0bc	30.70b
T_6 - (T_2 + 300 ml bio NPK mix.)	96.80cd	108.0d	75.05c	77.13c	25.0e	27.00cd
T_7 - (T_3 + 300 ml bio NPK mix.)	105.0a	116.0ab	80.46b	82.80b	27.8b	30.80b
T_8 - (T_4 + 300 ml bio NPK mix.)	108.0a	120.0a	88.00a	88.76ab	29.0ab	32.90a
T_9 - (T_5 + 300 ml bio NPK mix.)	110.0a	121.0a	90.36a	92.56a	30.0a	33.80a
T_{10}- 300 ml bio NPK mixture only	91.0e	94.0d	63.05f	63.81f	20.1e	21.80e

Means followed by the same letter/s within each column didn't significantly differ at 5% level
***refers to the ordinary adopted NPK fertilizers after recommendation of Min. of Agric.**
****refers to alternative NPK mixture (orange N and natural rocky PK materials at 1:1:1 by weight.**
*****refers to bio NPK fertilizers (Nitrobein, phosphorene and potassein) mix. at 1:1:1 by volume.**

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دراسة مقارنة علي مصادر التسميد النيتروجيني والفوسفاتي والبوتاسي لاشجار الرمان المنفلوطي حديثة العمر

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أجري هذا البحث خلال موسمي ٢٠١٤, ٢٠١٥ علي أشجار رمان منفلوطي حديثة العمر نامية في اراضي رملية حديثة الأستصلاح تحت نظام الري بالتنقيط (مزرعة المركز القومي للبحوث) بمنطقة النوبارية محافظة البحيرة لدراسة مدي امكانية احلال الأسمدة النيتروجينية – الفوسفاتية – البوتاسية المعدنية المركزه باهظة الثمن وشائعة الأستخدام في مصر (سلفات امونيوم , سوبر فوسفات , سلفات البوتاسيوم) بأخري بديلة رخيصة الثمن وصديقة للبيئة. وفي هذا الصدد فإن خليطا من السماد النيتروجيني العضوي المحبب وبعض المواد الصخرية الأولية لكل من البوتاسيوم والفسفور بنسب متساوية بالوزن) قد جربت بأربعة مستويات سواء بمفردها كخليط أو مع غيرة من مصادر النيتروجين والفسفور والبوتاسيوم الحيوية بمعدل ٣٠٠ مل/ شجرة وقد تم التقييم من خلال استجابة بعض قياسات النمو الخضري والحالة الغذائية. أظهرت النتائج المتحصل عليها خلال موسمي الدراسة أن جميع قياسات النمو المختبرة (ارتفاع النبات – سمك الساق – طول الفرخ – عدد الأفرخ / شجرة – عدد الأوراق / فرخ – متوسط مساحة الورقة – المساحة الكلية لأوراق الفرخ) وبالمثل قياسات الحالة الغذائية والتي تمثل محتوى الأوراق من (الكلورفيل الكلي – النيتروجين – الفوسفور – البوتاسيوم – الحديد – المنجنيز – الزنك) قد استجابت بشكل واضح لمعاملات التسميد العشرة المختلفة وقد سلكت جميعها و الي حد كبير نفس الأتجاة حيث كانت المعاملات الثلاثه (الكونترول وكل من التسميد الحيوي بمفردة أو التسميد بالحد الأدني من مخلوط السماد النيتروجيني العضوي والصخري المعدني لكل من الفوسفور والبوتاسيوم أي٥٠٠جم/شجرة) هي الأقل فعالية يليها في ترتيب تصاعدي المعاملة الثالثة (١٠٠٠جم من السماد العضوي الصخري فقط) و المعامله السادسة (٥٠٠جم من السماد العضوي الصخري+٣٠٠مل من السماد الحيوي) ثم المعاملة الرابعة (١٥٠٠جم من السماد العضوي الصخري فقط) والسابعة (١٠٠٠جم من السماد العضوي الصخري+٣٠٠مل من السماد الحيوي) ثم المعاملة الخامسة (٢٠٠٠جم من السماد العضوي الصخري فقط) واخيرا المعاملة الثامنة (١٥٠٠جم من السماد العضوي الصخري+٣٠٠مل من السماد الحيوي) ثم التاسعة (٢٠٠٠جم من السماد العضوي الصخري+٣٠٠مل من السماد الحيوي) وبرغم ان المعاملتين الثامنة والتاسعة كانتا الأكثر تفوقا معنويا الا اننا ولأسباب اقتصادية يمكن ان نوصي بأستخدام المعاملتين (الثالثة والرابعة) مخلوط السماد NPK العضوي – الصخري بمعدل ١٠٠٠ أو ١٥٠٠ جم/شجرة مضافاً لكل منهما مخلوط السماد الحيوي بمعدل ٣٠٠ مل/شجرة.