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Response of Valencia orange trees to some biofertilization treatments

1- Yield component and vegetative growth density

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Abstract

The present investigation has been carried out on Valencia orange (***Citrus sinenses***) trees budded on sour orange rootstock during the successive seasons of 2010 and 2011. Thirty six trees, fifteen years old, were used in this investigation.. Each treatment was represented by 9 trees (3 replicates each of 3 trees).

Biofertilization treatments gave promising effects and significant increases by treatment No.(3) which involved combination of three biofertilizers namely (Microbein + Phosphorein+ Potassein) .This treatment was the leader one and occupied the first rank in this respect and significantly improved the following features (fruit set, fruit weight and total gained yield/tree) and enhanced the vegetative growth activities (shoot length and thickness, new leaves production and increased the tree canopy volume), as well as, increased the leaf mineral contents(N,P,K and Fe). The treatment No.(2) is a combination of (Nitrobein +Microbein+Potassein) came in the second rank and gave significant effect on the (fruit set , fruit weight,, and juice volume ,TSS,TSS/acid ratio and ascorbic acid contents ,also total gained yield /tree as compared with control) .Similarly, activated the vegetative growth vigor (shoot length and thickness ,leaf area and tree canopy volume) and recorded the uppermost values for (leaf N, P, K, Fe, Zn, and Mn concentrations). In the third rank, came treatment No. (1) (Nitrobein+Phosphorein+Potassein) which significantly increased some features such as (fruit set ,fruit number/tree ,fruit weight as well as ,total gained yield/tree) . Also, improved fruit juice volume, TSS, TSS/acid ratio and ascorbic acid content. Furthermore, vigorous vegetative growth (increased shoot length and thickness, new leaves number and tree canopy volume as compared by control. In addition more significant leaf minerals contents (N, P, K, Fe, Zn and Mn) was achieved

Key words: biofertilization - citrus - vegetative growth -fruit quality -fruit yeild

Introduction

The increasing impacts on the environment due to agricultural practices in the world have gradually affected the quality of the soil in terms of structure and biological equilibrium, which has required the development of alternative practices to minimize and mitigate those impacts, parallel to the improvement on the yield per cultivated area and economical benefits for producers and farmers. The creation of new option for agricultural practices, tending to be: i) less invasive to the environment, ii) cheaper than conventional techniques, iii) able to increase efficiency at low costs, iv) able to obtain better characteristics on harvests and, v) ease of use and implementation with no excessive technical requirements (**Canterino et al, 2012)**. Additionally, the use of bio-fertilizers can improve productivity per area in a relatively short time, consume smaller amounts of energy, mitigate contamination of soil and water, increase soil fertility, and promote antagonism and biological control of phytopathogenic organisms **(Chirinos et al 2006).**

Effect of biofertilization on yield components and fruit quality of citrus trees

Abou Sayed (1997) reported highest values of fruit weight average and total yield per tree on Balady mandarin from plants inoculated with biofertilizers. **Abou Taleb et al (2004)**showed that inoculation with Bacillus + $(NH_4)_2$ SO_4 at 500g N/ tree was most effective treatment on gained yield as kg / tree. **Bakr et al (2005**) Balady orange inoculated with combined biofertilizers solubilizing microorganisms were preformatted fruit set, fruit weight, yield/tree, TSS/acid ratio

Dhewar and Waghmar (2009) in sweet orange trees the application of biofertilizers with Azospirillum significantly increases the number of fruits per tree and average weight. **Eman et al (2008**) replaced organic nitrogen with or without *Saccharomyces cerevisae* (yeast) as a source of biofertilizer. , all treatments increased number of fruits and yield weight/tree than the control , improved fruit quality parameters especially treatment of 50% mineral N+50% organic N fertilizers. **El-Kobbia (1999)** fruit set, fruit weight and yield percentages were appreciably increased with increasing organic fertilizer "bio-humus" and cattle manure doses on Washington Navel orang. Moreover, increased juice volume and fruit juice TSS, acidity and ascorbic acid contents with increasing organic fertilizer doses

El-Migeed et al (2007) application of N and farmyard manure, with or without *Saccharomyces cerevisiae* and *Azospirillum* lipoferum (biofertilizers), on Washington Navel orange. increased the yield (fruit number and weight) and increased ascorbic acid content compared to treatments without biofertilizers. . **Hegab and Ahmed (1997)** used biofertilizer application on Navel orange trees in the presence of 50% of the recommended NPK produced the highest fruit yield comparing with NPK only. **Helail et al (2003)** adding poultry manure and Rhizobacterien inoculation improved fruit weight, juice weight, induced simulative effect on TSS and TSS/ acid ratio. **Huang et al (1995)** using biofertilizers with mineral nitrogen fertilizer increased total yield / ha.

Joo et al (1999) effective of microorganisms (EM) added to compost as diluted solution comparing with chemical NPK fertilizers , the orange yield was increased when the soil was treated with EM solution**.** Moreover, addition of filter mud (FM) in combined with mineral N source resulted in a great improvement in yield of Balady mandarin . **Mansour and Shaaban (2007)** combined application of N through mineral sources at 50% and compost El-Neel and Biogein each at 25% was effective in improving yield and fruit quality compared to using N completely.. . **Mohamedy and Ahmed (2009**). applying biological fertilizer (Cerealien) combined with humic acids increase productivity by 15% and improves physical characteristics of tangerine fruits.

Mostafa and El-Hosseiny (2000) biofertilizers treatments on Washington Navel orange in the presence of 50% of recommended N P K contained significant increments in fruit yield comparing with NPK only. . **Porcuna et al (2002)** application of EM technology to both plants and soil raised organic juice content by 17%and 11%, respectively as compared to the control treatment of oranges. **Tayeh et al (2003)**the application of organic manure + biofertilizers of Valencia orange trees gave the highest final fruit set per tree and the highest fruit weight and the highest juice TSS.. **Wu et al (2000)** reported that application of bio- organic fertilizer to Navel orange trees increase productivity by 8-25% and improve fruit quality

Effect of biofertilization on vegetative growth of citrus trees

Boutros et al (1987) studied the effect of different treatments of rock phosphate and Phosphate Dissolving Bacteria (PDB), they found that the concentration of micronutrients (Fe, Mn and Zn) was increased within different plantorgans , **El-Kobbia (1999)** in Washington Navel orange organic fertilizer " bio-humus" and cattle manure application. caused an increase in the shoot length as compared with cattle manure. Also, significant increases in leaves Mg, Fe, Zn, and Mn contents were found.

Eman et al (2008) replacing mineral nitrogen fertilization by organic nitrogen source with (yeast) or without biofertilizers added to Washington Navel orange trees,. Treatment of 50% mineral N+50% organic N and treatment of 100% organic N as well as the control (100% mineral nitrogen) recorded the higher values of N in the leaves especially in the second season. Treatments included organic fertilization raised N% in the second season. Phosphorus percentage in the leaves did not differ by treatments in both seasons. All treatments enhanced K content in the leaves especially in the second season. On the other hand, adding biofertilizers treatments improved N, P and K content in the leaves

Hegab and Ahmed (1997) on Navel orange using biofertilizers increased vegetative growth and increased leaf N and P contents. **Huang et al (1995**) on Satsuma mandarin, the application of biofertilizers with different strains of bacteria induced significant increase in the number of leaves and plant growth on Temple orange .Also, the use of biofertilizers with mineral nitrogen fertilizer increased the plant height , number of leaves and number of branches per plant .In addition to increased leaf N and P contents

Motskbili (1984) the application of biofertilizers had significantly increased leaf area and shoot length of Satsuma mandarin trees. **Mostafa and El-Hosseiny (2000)** all biofertilizers treatments on Washington Navel orange trees in the presence of 50% of recommended N P K contained significant increments in N and P contents comparing with NPK only.

Rivera-Cruz et al (2010) sour orange trees growth increased with increasing doses of biofertilizers population density of bacteria of the genera Azospirillum, Azotobacter and P solubilizers . **Tayeh et al (2003)** concluded that the highest number of leaves, shoot length and leaf area was recorded with the application of organic manure in combination with biofertilizers on Valencia . Also, the highest leaf N and P contents were achieved with the application of organic manure alone or in combination with the biofertilizers.

Material and methods

The present investigation has been carried out on Valencia orange trees planted at 5*5m2 apart (400 trees /ha.) budded on sour orange rootstock and grown in a newly reclaimed area with loamy sand texture soil. The concerned citrus grove was at El-Kassasin Horticultural Research Station farm, Ismaillia Governorate during the successive seasons of 2010 and 2011. Thirty six, fifteen years old, trees were used in this investigation. The trees were equally shared between 4 treatments. Each treatment was represented by 9 trees (3 replicates and each replicate 3 trees). The experimental trees have nearly the same height, volume, diameter and received

uniform horticultural practices except for soil biofertilization application treatments

Soil microorganism's inoculation

Inoculums are a mixture of some biofertilizers namely Nitrobein, Microbein, Phosphorein. The addition of mixed biofertilizers was carried out three times/year at Feb.,Jun.and Augest . Biofertilizers were injected in wetted area a part 100-150 cm from tree trunk in 30 cm depth around each tree. The properties of tested materials were as follow;

Nitrobein

The compound is nitrogenous biofertilizer , containing fixing nitrogen bacteria. (**GOAEF Ministry of Agric bulletin, 1999**). Dose of application were 300g/4L water/ tree well mixed and distributed (inoculated soil) in trench 30 cm depth around the periphery of the tree canopy (1-1.5m from tree trunk).. Time of application was three times; Feb., June. and August every year.

Microbein

Compound affecting as fixing atmospheric nitrogen, convert tri-phosphate and minor elements to available forms. Dose of application; 150 g/ 2Lwater/tree well mixed and distributed (inoculated soil) in trench 30 cm depth around the periphery of the tree canopy (1-1.5m from tree trunk). Time of application was three times; Feb., June. and august **(GOAEF, Ministry of Agric bulletin,1999).**

Phosphorein

It is a bacterial biofertilizer,that converts the unavailable tri-calcium phosphate to available mono-calcium phosphate.. Dose of application was; 150 g/tree well mixed with soil and distributed (inoculated soil) in trench 30 cm depths around the periphery of the tree canopy (1-1.5m from tree trunk). .Time of application was three times; as follow: Feb., June. and August (**GOAEF, Ministry of Agric bulletin,1999**).

Potassein

It is a plant nutrient used with all vegetables and fruit crops, contains potassium combined with phosphorus ($30\%K_2O+10\%P_2O_5$). Used as foliar and soil fertilization. Dose of application: one liter of potassien/ 400 liters water/ 15 trees. Time of application: the first spray has been done before flowering stage , the second after fruit set while the third one at fruit mature stage **(GOAEF Ministry of Agric bulletin) .**

Tested treatments of biofertilizers applications

Treatment No.(1)combined from three biofertilizers namely (Nitrobein 300g/ tree+ Phosphorein 150g/tree +Potassein 1L/400L water/15 tree),treatment No.(2) included (Nitrobein 300g/tree+ Microbein 150g/tree+ Potassein 1L/400L water/ 15 tree) and treatment No.(3) contained (Microbein 150g/tree +Phosphorein 150g/tree+ Potassein 1L/400L water/15 tree). In each season, the experimental trees received 10 kg/tree organic manure added in rounded trenches (30 cm depth) close to the root system (100-150 cm from tree trunk) around the tree.

and control treatment without biofertilizers application .

control treatment In each season, trees of control treatment received 1.00 kg mono – calcium phosphate / tree mixed with 10 kg/tree organic manure added in rounded trenches(30 cm depth) close to the root system (100-150 cm from tree trunk) around the tree canopy. In addition, nitrogen (N) and potassium (K) were added as fertigation .The amount added / fed. / Year of N was 100 kg (equal doses from Feb. to Oct.) while the amount of K2O was 90 kg. (Three doses: March, June and Oct.). Moreover, micronutrients (Fe 500 ppm, Mn 250 ppm & Zn 250 ppm) were applied as foliar sprays 4 times / year i.e. in Apr. June, Aug. and Oct.

The tested treatments were evaluated through the following parameters

Fruit characteristics and yield component

At harvesting time in April-May, number of harvested fruits, per tree were recorded, the total fruit weight per tree (the yield/tree, in kg) was determined . Samples of 30 fruits per replicate were randomly taken, the studied parameters involved: average fruit weight (g), and juice volume / fruit (ml) were estimated. Some chemical constituents were considered in the fruit juice: the total soluble solids TSS) was determined using a hand refract meter, total titratable acidity (%) was determined by titration against 0.1 N sodium hydroxide in presence of phenolphthalein as an indicator, the TSS /acid ratio was calculated, ascorbic acid content (mg / 100 ml of juice) was determined by titration against 2,6-dichlorophenol indophenols following the method illustrated in the **A.O.A.C. (1975).**

Vegetative growth and Leaf parameters

The tree height (m), tree diameter (m), tree circumference (m) and tree canopy volume (m^3) were determined in each of 2010 and 2011 seasons. The tree canopy volume was calculated according to the following equation: canopy volume (m^3) =1.33 x 0.5 x circumference (m) x 3.14 x 0.5 x height (m) (**Turell**, 1965). In addition, annually increments percent of shoot length was calculated at the end of each growing season. Four main branches / tree were selected and ten shoots on each were tagged for this purpose.

Leaf number, leaf area and leaf dry weight content:

The number of new leaves per shoot grown during the current season in spring and summer were counted on each of 10 shoots, the average number and percent was calculated.

Samples of mature leaves of the spring growth cycle were collected in August from unfruitful shoots; 30 leaves were sampled / replicate. The sampled leaves were subjected to the following measurements: leaf area (cm^2) was determined according to **Bremner and Taha (1966**). Leaf samples were cleaned and fresh weighted, then dried in an oven under 105 up to a constant dry weight; the leaf dry weight was recorded and the dry matter percentage was calculated. (%) estimated, following the method stated by **Gosov** (1960).

. Leaf chemical composition

The dried leaves were finely grinded and digested using microckeildahl unit. The percentage of nitrogen content was determined according to **Naguib** (1969). Phosphorus percentage was determined according to **A.O.A.C**. (1975). Potassium percentage was determined according to **Brown and Lilliland** (1964). In addition zinc (ppm), manganese (ppm) and iron (ppm) were determined by the Atomic Absorption apparatus **(Jackson,** 1967).

Statistical Analysis

The experimental design was factorial within a complete randomized block design. The obtained data were statistically analyzed according **Snedecor & Cochran (1972)**

Result and Discussion

From Table (1) all tested treatments increased the average of fruit set percentages in comparable with control treatment. The data reveals that the fruit set percent gave insignificant differences between seasons. The interaction effect between biofertilization treatments in the two studied seasons showed highest fruit set percent by treatment No. (3) in the first and second seasons, followed by treatment No.(2) , then the lowest fruit set percentage recorded by treatment No.(1).

Regards to the average of fruit weight, the obtained date generally, show greater weights of fruits for all biofertilization treatments compared with control . Application with treatment No. (3) gained the heaviest fruits, this was true in both seasons .Average of produced fruits weight in the second season were significantly more that in the first one. The highest yield per tree came always from the treatment No.(3) , followed by treatments No.(2) and that treated with treatment No.(1) came latest. This trend, similarly detected in the two seasons of study by significant differences with control. Worthwhile, the yield per tree was gradually increased with advancing of experimental seasons from first to the second one . The height production may be due to the better and improving horticultural practices and accumulative effects of nutrients during the course of investigation, of , These results were in harmony with that mentioned by **Bakr et al**, 2005 on balady orange; **Tayeh et al**,2003.; **Abou Sayed (1997); Abou Taleb et al (2004) ;** . **Eman et al (2008**) and **Mohamedy & Ahmed (2009**) for yield and . **Bakr et al (20050; Eman et al (2008**) and . **Tayeh et al (2003) for fruit set and Dhewar & Waghmar(2009) ; El-Migeed et al (2007)and** . **Helail et al (2003) for the fruit weight per .**

Table(2) showed that all tested treatments as mentioned above significantly increased fruit set percent, meanwhile the retained number of fruits per tree were significantly leading only in treatment No. (3),thus the right combination of some biofertilizers sources witch work together in same direction and integrated each other showed a positive effects on the gained fruits number per tree as treatment No.(3).

All tested biofertilization treatments significantly increased the average juice volume per fruit as compared to control. Treatment No. (3) occupied the first rank , followed by treatment No. (2) and treatment No. (1) came latter .Comparing interaction effect, in both seasons, showed obvious leading for treatment No. (3) .It is worth to mention that second season obviously increased the average of volume of juice per fruit, this was true especially with treatment No.(3), followed by treatments No.(2) and No.(1).

The average of ascorbic acid content increased with applying treatment No.(3) followed by treatment No.(2) , the differences compared to control were always significant .Worthwhile, the treatment No. (1) was statistically equal to the control in both seasons. Comparing season's effects data indicated that uppermost average of vitamin. C contents came from second season

The obtained data was in harmony with those mentioned by **Dhewar&Waghmar**, 2009.; **Eman et al**, 2008 for the fruit number/tree and **El-Migeed et al**, 2007; **El-Kobbia (1999) for juice ascorbic acid content**

According to Table (3) treatment No. (3) was the superior one followed by treatment No. (2) as it gave the highest TSS values . On the other hand, the least TSS values came from treatment No. (1) and control without significant differences between them . Second season data appeared significant increases in an average of TSS% compared with the first season. Present data clearly showed obvious reduction in average of acidity as a result of all biofertilization treatments compared with control . This conclusion greatly noticed in both seasons and with all tested treatments. Repeating application induced more reduction in the second season comparing with the first one.

All tested treatments significantly increased the values of juice TSS/ acidity ratio in relation with control This behavior was detected in both seasons of study with clear superioity for treatment No. (3) especially in the first season.As a general view, data

revealed that,the second season effectes was surpassed the first one.

The presented data is in a general accordance with those mentioned by **Bakr et al**, 2005; .; **Eman et al**, 2008 ; **El-Kobbia (1999) ; Mansour & Shaaban (2007) ; . Tayeh et al (2003) and Wu et al (2000) for good fruit quality, TSS and TSS/ acid ratio**

Vegetative growth of shoots, tree canopy and leave characteristics

Table (4) all tested treatments significantly increased average of shoot length as compared with control, .Shoot growth responded positively to the treatment No. (3) The same response was achieved with treatment No. (2) . Also, treatment No. (1) followed the same trend by least percentages .

Differences between two studied seasons showed significant effect for annual increments of shoot growth. Treatment No. (3) was most effective for increasing of shoot thickness and produced the thicken shoot . Treatment No. (2) came in the second rank . Meanwhile, treatment No. (1) obtained the least thickness increments .All tested treatments significantly increased shoot thickness as compared with control. The second season data was significantly surpassed the first one. It is worth to mention that, all applications of biofertilization treatments affected positively on both shoot increments of length and thickness in parallel way at the same time.

Data in present investigation insured, in both seasons of study, obvious activation of vegetation growth witch measured as increments of the tree canopy volume in comparable to control treatment. Tested trees were responded to biofertilizers treatments in high intensity and were leading in this respect as treatment No. (3), descendingly, followed by treatment No. (2), and treatment No. (1) came in latest rank.. Worthy to note here that, average of tree canopy volume was increased significantly and it is became bigger in the second season than that in the first season. Biofertilizers used significantly activated shoot thickness as well as shoot growth, previous behavior similarly detected in many investigation; The related litluter noticed by some investigators insured those obtained results ; **Huang,F.S. et al (1995); El-Kobbia (1999) and Motskobili. .(1984) for shoot growth vigor , shoot long and thickness .And Hegab& Ahmed (1997) ; Huang et al (1995)and Rivera-Cruz et al.(2010) for trees canopy volume and growth density.** Table (5) indicated that the percent of new leaves per shoot greatly affected significantly by biofertilization treatments incomparable to control, so treatment No. (3) was leading in this respect. In the same manner treatment No. (2) showed relatively moderate increases of new leaves/shoot. Also, treatments No.(1) attained the minimum significant increases It is worth to mention that second season increments were always significantly higher than those reported in the first one, this trend was insured in the first, second and an average of two seasons.

Effect of biofertilization treatments on leaf area (cm2) were generally rare and constricted only in fertilizers combination used in treatment no. (3) Which significantly increased leaf area comparing with control .On the other hand, another two treatments i.e. T1&T2 failed to induce significant effect. It is worth to mention that, differences between two studied seasons were significant; this behavior was detected in both seasons' data.

As respect of leaf dray matter content. ,the data indicated that treatment No. (3) significantly reduced leaf dray weight percent in compared with control . Other two treatments i.e. T1&T2 showed insignificant effect regards to control. As for, the interaction effect between treatments and seasons of study, nearly similar data was detected in the first season. Meanwhile, all three biofertilization treatments failed to induce significant effect in the second season , there is no significant differences were noticed between averages of dray weight percent in two seasons of study.

. Most available literature goes with increasing leaf dray matter contents combined with increasing addition of fertilizers **Huang et al (1995); Motskobili. (1984) and Tayeh et al (2003) for leaf number per shoot and leaf area .**

From Table (6) all biofertilization treatments significantly increased the leaf nitrogen percentages as compared with control. The treatment No. (3) occupied the first rank followed by treatment No. (2) in the second rank ,while treatment No. (1) came in the third rank .Generally , second season slightly increased average of leaf nitrogen percent against leaf nitrogen in the first season. Concerning leaf phosphorus content, trees received combined biofertilizers in treatment No. (3) showed significant differences with control , followed by those treated with combined fertilizers in treatment No.(2) , than those treated with combined biofertilizers in treatment No, (1). As interaction effect , the previous behavior similarly repeated in both seasons of study. Data showed insignificant differences in average of leaf phosphorus content between two studied seasons. Biofertilization treatments, generally, significantly increased average of leaf potassium contents in comparable with control . Uppermost value of leaf potassium content was reported by treatment No.(3) .Moderate significant increment was gained by treatment No.(2) with equal values in both seasons .The lowermost significant increment obtained by treatment No.(1) .Meanwhile, control treatment recorded significant lower value compared with all tested treatments. The previous resulted data were in the same manner with those reported by .; **Eman et al**, 2008; **Hegab& Ahmed (1997); Huang et al (1995); Mostafa & El-Hosseiny (2001) and Porcuna et al.(2002)**.

Table 1. Effect of biofertilization treatments on some fruit parameters and gained yield of Valencia orange trees during 2010& 2011 seasons .

Biofertilization treatments	Fruit set percentages			Fruit weight (g)			Yield weight (kg) /tree		
(T)	Frist season(s)	Second season(s)	Average (T)	Frist season(s)	Second season(s)	Average (T)	Frist season(s)	Second season(s)	Average (T)
T(1)	32.4	32.62	32.51	191.13	222.55	206.84	37.07	44.73	40.87
T(2)	35.73	35.7	35.72	194.96	223.13	209.05	38.4	46.18	42.31
T(3)	36.21	36.54	36.38	197.57	235.6	216.59	41.68	53.71	47.73
Control	29.63	29.65	29.64	174.79	205.53	190.16	34.78	40.7	37.16
Average	33.5	33.63	33.57	189.61	221.7	205.66	37.68	46.36	42.02
LSD 5%	(S)= ns	(T*S)=.67	(T)=.19	(s)=5.37	(T*S)10.7	(T)=7.44	(S)= 1.37	(T*S)=2.75	(T)= 3.62

T (1)Nitrobein+Phosophorein+Potassien T (2)Nitrobein+Microbein+Potassein T (3)Microbein+phosphorein+Potassein

Table 2. Effect of biofertilization treatments on fruit number/ tree and juice ascorbic acid of Valencia orange trees during 2010 & 2011 seasons.

Biofertilization treatments	Fruit number / tree			Fruit juice volume (ml)			Fruit juice ascorbic acid mg)/100 ml		
(T)	Frist season(s)	Second season(s)	Average (T)	Frist season(s)	Second season(s)	Average (T)	Frist season(s)	Second season(s)	Average (T)
T(1)	194	201	197.5	72.5	73.83	73.17	45.96	48.8	47.38
T(2)	197	207	202	85.08	85.13	85.11	48.62	51.22	49.92
T(3)	211	228	219.5	79.22	96.5	87.86	52.69	53.32	53.01
Control	199	198	198.5	59.81	68.43	64.12	44.89	48.18	46.54
Average	200.3	208.5	204.4	74.15	80.98	77.57	48.04	50.38	49.21
LSD 5%	(S)= 3.27	(T*S)=3.52	(T)= 2.7	(S)= 1.25	(T*S)=2.28	(T)=2.63	(S)=1.36	(T*S)=2.1	(T)=2.02

T (1)Nitrobein+Phosophorein+Potassien T (2)Nitrobein+Microbein+Potassein T (3)Microbein+phosphorein+Potassein

Table 3. Effect of biofertilization treatments on some fruit juice chemicals constituents of Valencia orange trees during 2010 & 2011 seasons .

Biofertilization treatments	Fruit juice TSS (%)			Fruit juice acidity (%)			Fruit juice TSS/acid ratio		
(T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)
T(1)	9.9	10.1	10	0.69	0.61	0.65	14.11	19.16	16.64
T(2)	10.4	10.7	10.55	0.62	0.56	0.59	16.82	20.92	18.87
T(3)	11.33	11.57	11.45	0.55	0.55	0.55	20.69	16.85	18.77
Control	9.53	9.87	9.7	0.76	0.59	0.68	12.49	16.4	14.45
Average	10.29	10.56	10.43	0.66	0.58	0.62	16.03	18.4	17.18
LSD 5%	(S)=.2	(T*S)=1.3	(T)=0.55	(S)=0.03	(T*S)=0.06	(T)=0.04	(S)=1.17	(T*S)=2.2	(T)=1.33

T (1)Nitrobein+Phosophorein+Potassien T(2)Nitrobein+Microbein+Potassein T(3)Microbein+phosphorein+Potassein

Table 4. Effect of biofertilization treatments on some vegetative growthparameters of Valencia orange trees during 2010 & 2011 seasons

Biofertilization treatments	Shoot length increment (%)			Shoot thickness increment (%)			canopy volume increment (m3)		
(T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)
T(1)	202.19	193.21	197.7	40.82	52.17	46.5	1.61	1.7	1.66
T(2)	239.79	246.72	243.46	46.65	61.6	54.13	2.33	2.61	2.47
T(3)	248.3	266.9	257.6	73.32	103.42	88.37	2.93	3.1	3.02
Control	145.71	163.9	154.81	27.86	37.76	32.81	1.44	1.53	1.49
Average	209	217.68	213.43	47.16	63.74	55.46	2.08	2.23	2.16
LSD 5%	(S)=6.3	(T*S)=12.5	(T)=14.46	(S)=4.01	(T*S)=8.02	(T)=5.56	(S)=0.07	(T*S)=0.12	(T)=0.07

T (1)Nitrobein+Phosophorein+Potassien T (2)Nitrobein+Microbein+Potassein T (3)Microbein+phosphorein+Potassein

Table 5. Effect of biofertilization treatments on some leaf physical and chemical parameters of Valencia orange trees during 2010 & 2011 seasons

Biofertilization treatments	New leaf number/shoot(%)			Average of leaf area (cm2)			Leaf dray weight (%)		
(T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)
T(1)	73.97	82.32	78.15	24.84	27.27	26.06	41.54	40.57	41.06
T(2)	83.48	109.47	96.48	26.83	28.03	27.43	41.14	41.82	41.48
T(3)	96.04	132.47	114.26	32.92	36.93	34.93	38.48	40.23	39.36
Control	55.25	62.02	58,64	24.04	26.16	25.1	43.62	40.13	41.88
Average	77.18	96.57	86.88	27.16	29.6	28.38	41.19	40.69	40.94
LSD 5%	(S)=8.85	(T*S)=17,7	(T)=10.45	(S)=1.3	(T*S)=3.2	(T)=3.38	(S)=ns	(T*S)=2.4	(T)=1.62

T (1)Nitrobein+Phosophorein+Potassien T(2)Nitrobein+Microbein+Potassein T(3)Microbein+phosphorein+Potassein

Table 6. Effect of biofertilization treatments on some leaf macro nutrient elements content of Valencia orange trees during 2010 &2011 seasons.

Biofertilization treatments	Leaf nitrogen content (%)			Leaf phosphorus content (%)			Leaf potassium content (%)		
(T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)
T(1)	2.37	2.41	2.39	0.29	0.26	0.28	1.57	1.55	1.56
T(2)	2.45	2.48	2.47	0.31	0.31	0.31	1,78	1.78	1.78
T(3)	2.63	2.71	2.67	0.36	0.36	0.36	1.84	1.85	1.85
Control	2.16	2.18	2.17	0.13	0.13	0.13	1.06	1.1	1.08
Average	2.4	2.44	2.42	0.27	0.27	0.27	1.56	1.57	1.57
LSD 5%	(S)=0.02	(T*S)=0.03	(T)=0.05	(S)=ns	(T*S)=0.03	(T)=0.02	(S)=ns	(T*S)=0.03	(T)=0.05

T (1)Nitrobein+Phosophorein+Potassien T(2)Nitrobein+Microbein+Potassein T(3)Microbein+phosphorein+Potassein

Table 7. Effect of biofertilization treatments on some leaf micro nutrient elements content of Valencia orange trees during 2010 &2011 seasons.

Biofertilization treatments	Leaf iron content (ppm)			Leaf zinc content (ppm)			Leaf manganese content (ppm)		
(T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)	First season(s)	Second season(s)	Average (T)
T(1)	83	85.33	84.17	45	47.67	46.34	40.33	41.67	41
T(2)	89	92	90.5	47.33	56.33	51.83	44.67	42.33	43.57
T(3)	112	110	111	53.33	62.67	58	46.33	55	50.67
Control	70.33	72	71.17	43.33	45.33	44.33	35.67	37.33	36.5
Average	88.58	89.83	89.21	47.25	53	50.13	41.75	44.08	42.92
LSD 5%	(S)=0.42	(T*S)=7.17	(T)=8.28	(S)=2.73	(T*S)=2.1	(T)=2.49	(S)=1.36	(T*S)=4.72	(T)=4.56

(1)Nitrobein+Phosophorein+Potassien T (2)Nitrobein+Microbein+Potassein T (3)Microbein+phosphorein+Potassein

Table (7) concerning average of leaf iron in two seasons data, data clearly pronounced great significant effect of biofertilizers on leaf iron contents compared with control, thus the treatment No. (3) was leading in this respect and always recorded higher contents. Similarly with relative lower content came treatment No. (2) followed by, treatment No. (1) insured this trend.

Leaves of trees treated with treatments No.(3) and No.(2) contained higher significant leaf zinc contents ., meanwhile treatment No.(1) appeared insignificant effect compared with control ..Generally, second season data induced more average of leaf zinc content than the first . Application with mixture of biofertilizers represented treatment No, (3) significantly increased leaf manganese content followed by mixture represented treatment No, (2) . .Previous conclusion was insured in both seasons of study. Repeated soil biofertilization induced accumulation of positive effect and raised average of leaf manganese content in the second season more than that in the first one. **Boutrous &Saber** (1987) and **El-Kobi**a (1999) supported the present results, using biofertilizers increasing micro elements in citrus leaves.

LITERATURE CITED

A.O.A.C. (1975). Official Methods of Analysis of the Association of Official Agricultural Chemists. Twelfth edition, Washington, D. C., USA

Abou Sayed,A.T. (1997) Growth and fruiting of Balady mandarin trees in relation to some soil fertilization treatments in sandy soil, 2 – Leaf and root responses to the applied treatments. Zagazig J.Agric. Res., 24 (6):1049 – 1063. Egypt.

Abou Taleb ,S.; Abou – El – Khashab and Saeed, W.T.(2004)Growth and productivity of olives trees as affected by some bio and mineral nitrogen fertilizers .Minufiya J. Agric. Res.:29 (4): 933 – 963. Egypt

Bakr, M, S. Nadia, A.A. and Saber, M.A. **(2003**) Responses of Balady orange trees grown in newly reclaimed soil to biofertilization treatments. Eleventh Conference of Microbiology ,Egypt; oct. 12-14

Boutros ,N.B.; Azazy ,A. and Saber, M.S.(1987) Influence of rock phosphate and PDB on Iron, Manganese and Zinc uptake by sour orange seedling grown in apot experiment using sand soil treated with PAMG.Egypt. J. Soil., 27 (3): 331 – 346.

Bremner, P. M. and Taha. M. A. (1966). Studies in potato agronomy 1- The effects of variety, seed size and spacing on growth, development and yield. J. Agric. Sci., 66:241-252

Brown, J. D. and Lilliland. O. (1964). Rapid determination of potassium and sodium in plant material and soil extracts by flame-photometry. Proc. Amer. Soc. Hort. Sci., 48: 341-346.

Canterino, S.; Donno, D.; Mellano, M. G.; Beccaro, G. L.; Bounous, G (2012). Nutritional and sensory survey of Citrus sinensis (L.) cultivars grown at the most northern limit of the Mediterranean latitude. Journal of Food Quality; 2012. 35: 2, 108-118.

Chirinos ,J.; Leal, A. y. and Montilla, J. (2006). Uso de insumos biológicos como alternativa para la agricultura sostenible en la zona sur del Estado Anzoátegui. Revista Digital Ceniap Hoy 11: 1-7. Available online at

Dheware, R. M.; Waghmare, M. S. (2009) Influence of organic-inorganic and biofertilizers and their interactions on number of fruits per tree and average weight of fruit of sweet orange (Citrus sinensis Osbeck L.). International Journal of Agricultural Sciences; 2009. 5: 1, 251-253.

El-Kobbia ,A.M. (1999). Response of Washington Navel orange to organic fertilizer " biohumus and cattle manure application .Alexandria Journal of Agric. Res. (44) 2: 199-207 .

Eman, A. A. .; Abd-Allah, A. S. and Sanaa, S. E. (2008). Effect of some organic and biofertilizer treatments on minimizing mineral nitrogen fertilization of Washington Navel orange trees. Arab Universities Journal of Agricultural Sciences; 2008. 16: 2, 451-457. . Faculty of Agriculture, Ain Shams University

El-Migeed, M. M. .; Saleh, M. M. and Mostafa, E. A. (2007). The beneficial effect of minimizing mineral nitrogen fertilization on Washington navel orange trees by using organic and biofertilizers World Journal of Agricultural Sciences; 2007. 3: 1, 80-85.

GOAEF, General Organization for Agriculture Equalization Fund (1999), Ministry of Agric. Biogen, phosphorien, nitrobien and potassien bulletins.

Gosov, N. A. (1960). Some Methods in Studying Plant Water Relations. Leningrad. Acad. of Science, USSR

Hegab, M.Y. and Ahmed,A.H. (1997). Influence of spraying active dry yeast on growth and productivity of Navel orange trees (Citrus sinensis).First Sci.Conf.Assiut ,Fac. Of Agric. Egypt.

Helail, B.M.; Gobran,Y.N. and Moustafa,M.H. (2003a) .Study on the effect of organic manure source, method of organic manure application and bio-fertilizers on 1 – tree growth and leaf mineral content of Washington Navel orange trees. Egypt. J.Apl.Sci.,18(4A):270-296.

Helail, B.M.; Gobran,Y.N. and Moustafa,M.H. (2003b) .Study on the effect of organic manure source, method of organic manure application and bio-fertilizers on 2- fruiting and fruit

quality of Washington Navel orange trees. Egypt. J.Apl.Sci., 18(4A): 297-320.

Huang,F.S.; Zhang, H.S. and Qian, FYI (1995). Study on the effect of organic manure and leaf, spraying P and K on the fruit quality of extra early Satsuma mandarin . China Citrus, 24 (2): 31 -32.

Jackson ,W. R. (1993) Humic, Fulvic and Microbial Balance: Organic Soil Conditioning:

Mansour, A. E. M. and Shaaban, E. A. (2007). Effect of different sources of mineral N applied with organic and bio fertilizers on fruiting of Washington Navel orange trees. Journal of Applied Sciences Research; 2007. August, 764-769.

Mohamedy ,E. and Ahmed, M. A. (2009). Effect of bio-fertilizer s and humic acid on control of dry root rot disease and improvement yield quality of mandarin (*Citrus reticulate* Blanco). Research Journal of Agriculture and Biologic Sciences 5(2):127-137.

Mostafa, M.F. and El-Hosseiny (2001). Influence of spraying active dry yeast solution on growth , yield fruit, quality and leaf NPK contents of Washington Navel orange trees .J. Agric. Sci. Mansoura Univ., 26 (10):6293-6305.Egypt.

Motskobili. N.A.(1984). Assimilation area of Satsuma in relation to mineral nutrients and its effect on productivity. Subtropicheskie Kultury,No. 5, 83 -90.

Naguib, M. L. (1969). Colorimetric determination of nitrogen components of plant tissues. Bull. Fac. Agric. Sci., Cairo Univ.,43:1.

Porcuna, J. L.; Arnau, J.; Jímenez, A.; Ocon, C. and Zacares, V. (2002). Agroecología y agricultura ecológica: Hacia una reconstrucción de la soberanía alimentaria. Valencia, España. 3p.

Rivera-Cruz, M. del C.; Trujillo-Narcia, A.and Alejo Pereyra, D. E.(2010). Biofertilizers integrated with N-fixing and P solubilizing bacteria, and organic substrates in sour orange. Interciencia; 2010. 35: 2, 113-119. 39

Plaster, E. (2000). La ciencia del suelo y su manejo. Madrid: Thompson Editores p.248.

Snedecor, G. W. and W. G. Corchran. (1972). Statistical Methods, 6th Ed. lowa State Univ., Amess. lowa.

Tayeh, E.A.; El-Ffangary,M.A. and Hegab, M.Y.(2003). Effect of som sources of nitrogen fertilizers on pre- bearing and bearing Valencia orange trees. Annals of Agric. Sci. Moshtohor. 41 (41) 1655-1680 .Egypt.

Turell, F. M. (1965). Comparative on cturnal thermal budgets of large and small citrus trees. Ecology, 46:25-34.

Wu, X.M. ; Hua, J. and Xing,Z.Y.(2000). Experiment of applying Jinduanken Bio – organic fertilizer for citrus trees .South China . Fruit . 29 (6) :20 .

استجابة أشجار البرتقال الفالنشيا لبعض معاملات التسميد الحيوي
مكونات المحصول و قوة النمو الخضري

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نفذت هذه التجربة على أشجار برتقال فالنشا مطعومة على أصل النارنج خلال موسمي الدراسة 2010 , 2011 على 36 شجرة عمر 15 سنه استخدمت في تنفيذ هذه التجربة . الأشجار كانت متماثلة في قوة النمو و الحجم و موزعه على أربعة معاملات و كل معامله تتكون من 9 أشجار. (موزعه على3 مكررات
المعاملة رقم (1) تتكون من (نيتروبين+فوسفورين+بوتاسين)
المعاملة رقم (2) تتكون من (نيتروبين+ميكروبين+بوتاسين)
المعاملة رقم (3) تتكون من ميكروبين+فوسفورين+بوتاسين)
بالأضافه إلى معاملة المقارنه (الكونترول)
و كانت أهم النتائج المتحصل عليها هى: المعاملة رقم (3) كانت متفوقة و احتلت المرتبة الأولى من حيث تأثيرها الايجابي على الصفات التأليه للمحصول (النسبة المئوية لعقد الثمار متوسط –وزن الثمرة- المحصول / للشجرة) و بالنسبة للأنشطة الخضرية (زيادة طول وسمك الفرع – زيادة إنتاج الأوراق الجديدة- زيادة حجم الأشجار – زيادة محتوى الأوراق من عناصر النيتروجين-الفسفور- البوتاسيوم-الحديد.)
اتت في المرتبة الثانية المعاملة رقم (2) حيث أظهرت نتائج ايجابيه معنوية عل صفات المحصول (%عقد الثمار – وزن الثمار-حجم العصير- المادة ألصلبه الذائبة الكلية- -حمض الاسكوربيك مع زيادة اجمالى محصول الشجرة) و كذلك حفزت النمو الخضري (طول وسمك الفرع – مساحه الورقة و حجم الأشجار – و زيادة محتوى الأوراق من عناصر نيتروجين- الفسفور- البوتاسيوم –الحديد-الزنك و المنجنيز)
اما ألمرتبه الثالثة فاحتلتها المعاملة رقم (1) بأقل النتائج الايجابية و المعنوية على صفات المحصول (% عقد الثمار –عدد الثمار/ شجرة – وزن الثمرة- لجمالي المحصول /للشجرة- زادت من حجم العصير- المادة ألصلبه الذائبة الكلية و نسبتها إلى الحموضة- كميه حمض الاسكوربك) و بالنسبة النمو الخضري (زيادة طول وسمك الفرع – زيادة عدد الأوراق الجديدة و حجم الأشجار مع زيادة محتوى الأوراق من العناصر الكبرى و الصغرى التي درست)