

THE INFLUENCE OF SOME BIO AND ORGANIC NUTRITIVE ADDENDA ON GROWTH, PRODUCTIVITY, FRUIT QUALITY AND NUTRITIONAL STATUS OF WASHINGTON NAVEL ORANGE TREES

By

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ABSTRACT

The present study was conducted on fruitful Washington navel orange trees grown at Experimental Station of Faculty of Agriculture, Benha Uni. during 2009 & 2010 seasons to investigate the influence of some bio & organic substances as additional nutritive fertilizers i.e., Biomagic, peptone and Hammer (humic source) applied either each solely or combined to another (foliar &/or soil drench), besides water spray as control. All investigated six treatments improved all evaluated parameters dealing with 1- growth parameters (No. of shoots/ one meter limb, shoot length & thickness, No. of leaves per shoot and leaf area) 2- Fruiting measurements (fruit set & fruits retention % and yield) , 3- fruit quality either physical properties (fruit weight , dimensions , shape index , juice volume and peel thickness) or chemical properties (juice TSS % , acidity % , TSS/ acid ratio , total sugars and Vitamin C) and 4- nutritional status (leaf N, P ,K , Ca and Mg %) . However, the beneficial effect varied greatly from one investigated treatment to another. Anyhow, Biomagic 7.5g/L foliar spray + Hammer 1.5g/L soil drench (6th treatment) was statistically the superior, descendingly followed by foliar spray with Biomagic solely 7.5g/L and/or peptone 0.5g/L foliar spray +Hammer 1.5g/L soil drench . However, Hammer 1.5g/L applied solely either foliar or soil drench had the least efficiency, especially foliar application.

INTRODUCTION

Citrus one of the most important fruit crops grown in many tropical and subtropical countries. At the moment there is a bout 1.5 million hectares of Citrus species cultivated at a commercial scale in the world yielded nearly 40 million metric tons of oranges, lemons, limes, etc (**Anonymous, 2008**).

In Egypt, citrus has great attention due to its importance for local consumption or as a main source for foreign currencies by exportation to the European countries. The area of cultivated citrus orchards in Egypt was increased rapidly with the reclamation of new desert lands and reaches about 35.59 hectare (**Anonymous, 2008**).

Bio-fertilization are biological preparations containing primarily patent strains of micro-organisms in sufficient numbers. These micro-organisms have definite beneficial roles in the fertility of soil rhizospheres and the growth of plants. The multi-strain bio-fertilizers might contain different strains of symbiotic associative diazotrophes, phosphate-solubilizing micro-organisms, silicate dissolving micro-organisms, blue green algae and VAM (**Saber, 1993**).

Bio-fertilizers proved to eliminate the use of pesticides sometimes, and rebalance the ratio between plant nutrients in soils. They are easy and safe to handle with field applications that improved their efficiency in increasing crop yields and decreasing the costs of some agricultural practices. It is worthy to state that, biofertilizers do not replace mineral fertilizers, but significantly reduce their rate of application (**Ishac, 1989 and Saber, 1993**).

Bio-fertilizers are very safe for human, animal and environment. Since they reduce at the lower extent the great pollution happened in environment. Rhizobactrine as new biofertilizers have greater amount of symbiotic bacteria responsible of Symbiotic and no symbiotic bacteria responsible for fixation nitrogen.

Applications of bio-fertilizers are now available commercially. Specific strains are used as biological fertilizers, for nitrogen, phosphorus and silicate dissolving such as N-fixing bacteria and yeasts. The use of these materials encourages growth and flowering as well as reflected positively on tree productivity.

Humic acid (polymeric polyhydroxy acid) was the most dominant component of organic substances in aquatic system. Humic acid is highly beneficial to plants and soil, increase microbial activity, a plant growth bio-stimulant, an effective soil enhancer, promote nutrient uptake (chelating agent) and increase yield.

All organism even plant needs certain components for growth over and above soil, sun, rain and air. The basic component of living cells is proteins, with building block material, amino acids. proteins are formed by sequence of amino acids.

The requirement of amino acids in essential quantities is well known as a means to increase yield and overall quality of crops . The application of amino acids for foliar use is based on its requirement by plants in general and at critical stages of growth in particular. Plants absorb amino acids through stomata and are proportionate to environment temperature.

Amino acids are fundamental ingredients in the process of protein synthesis. A bout 20 important amino acids are involved in the process of each

function. Studies have proved that amino acids can directly or indirectly absorbed by leaves or roots and consequently influence the physiological activities of the plant.

Thus, this study aimed to investigate application of some bio and organic nutritive compounds on vegetative growth , nutritional status and productivity fruitful Washington navel orange trees .

MATERIALS AND METHODS

This study was conducted on fruitful Washington navel orange trees “*Citrus sinensis L.*” budded on sour orange rootstock grown in clay loamy soil at the Experimental Station of Faculty of Agriculture, Benha University at Moshtohor, Toukh region, Kaliobia Governorate during 2009 and 2010 experimental seasons. The main purpose of this work aimed to improve growth, yield, fruit quality and nutritional status of such important sweet orange cultivar through investigating the influence of some bio and organic compounds as a nutritive addenda/amendments (a-bio-stimulant / Biomagic, b-Hammer “humic source” and c-Piptone). In this regard these three nutritive addenda were investigated either solely or combined with other and applied as foliar spray or soil drench as follows:

- 1- Control (water spray).
- 2- Foliar spray with biostimulant (Biomagic) at 7.5g/liter.
- 3- Foliar spray with peptone at 0.5g/liter.
- 4- Foliar spray with Hammer at 1.5g/liter.
- 5- Soil drenche application with Hammer at 1.5g/liter.
- 6- Foliar spray with Biomagic (7.5g/L) + Hammer soil drench (1.5g/L).
- 7- Peptone foliar spray (0.5g/L) + Hammer soil drench (1.5g/L).

Taking into consideration that all investigated nutritive treatments of addenda/amendments even control (water spray)were applied 6 times at one month intervals (starting from early February up to July) after the N, P, K fertilizers program adopted in the farm had been provided during each season. Moreover, 3 liters proved to be sufficient for covering the whole foliage of tree canopy, consequently solution of a given nutritive substance applied either foliar or soil drench was provided at 3.0 liters/tree for each treatment 6 times / season.

The complete randomized block design with four replications was employed. The response of Washington navel orange trees to the differential

investigated nutritive compounds treatments was evaluated through determining the changes exhibited in the following characteristics:

A- Vegetative growth measurements:

In this regard number of developed shoots per one meter of every tagged limb, average shoot (length & thickness), number of leaves/shoot and average leaf areas were investigated.

B- Some fruiting measurements:

Fruit set %, fruits retention %, yield (estimated as weight in kg & number of harvested fruits per tree) and fruit quality (physical & chemical properties) in response to investigated treatments were concerned. Hence, average fruit weight, dimensions (Polar & equatorial diameters), shape index, juice volume and peel thickness, as well as fruit juice TSS, total acidity, TSS/Acid ratio, total sugars % and ascorbic acid (V.C.) were the investigated fruit physical and chemical properties, respectively.

C- Nutritional status:

In this regard leaf macro nutrient elements contents (N, P, K, Ca, Mg %) in response to the various bio and organic nutritive substances were investigated as an indicator of nutritional status for Washington navel trees.

Samples from the fourth and fifth leaves of base shoot were collected in October during both seasons. The samples were thoroughly washed with tap water, rinsed twice with distilled water and oven dried at 80°C till a constant weight and finely ground for determination of:

- a. Total Nitrogen: Total leaf (N) was determined by the modified micro Keldahl after **(Pregl, 1945)**.
- b. Total phosphorus: Total leaf (P) was determined by wet digestion of plant materials after the methods described by **(Piper, 1958)**.
- c. Total potassium: Total leaf (K) was determined photometrically after **(Brown and Lilliand, 1946)**.
- d. Calcium and Mg percentage were determined using the Atomic absorption spectrophotometer "Perkin Elmer -3300" after **Chapman and Pratt (1961)**.

Statistical analysis:

All data obtained during each season were subjected to analysis of variance according to **Snedecor and Cochran, 1977**. Differences among means were distinguished according to the Duncan, multiple test range **(Duncan, 1955)**.

RESULTS AND DISCUSSION

A- Vegetative growth measurements:

In this regard number of developed shoots per one meter length of each tagged limb (main branch/scaffold), average shoot (length & diameter), number of leaves per shoot and average leaf area were the investigated growth parameters of fruitful Washington navel orange trees as influenced by the differential Biomagic, Peptone and Hammer treatments. Data obtained during both 2009 & 2010 experimental seasons are presented in **Table (1)**.

It is quite evident as shown from **Table (1)** that all investigated bio & organic nutritive treatments increased significantly the abovementioned five growth parameters as compared to control (water spray). However, the response varied obviously from one treatment to another, in spite of all growth parameters followed in most cases the same trend during both experimental seasons. Anyhow, the Biomagic 7.5g/L foliar spray associated with Hammer 1.5g/L soil drench (6th treatment) was the most effective and ranked statistically the superior, whereas it resulted in the greatest number of shoots per one meter limb, average shoot (length & thickness), number of leaves per shoot and average leaf area during both experimental seasons. On the other hand Biomagic 7.5g/L spray solely and Peptone 0.5g/L spray + Hammer 1.5g/L soil drench i.e., (2nd & 7th treatments) were statistically similar and ranked 2nd except with average shoot length and number of leaves per shoot, whereas later treatment was significantly more effective than former one during both seasons. On the contrary, the least values of all investigated growth parameters were significantly exhibited by water sprayed trees (control). In addition, other investigated treatments were in between the aforesaid two extremes.

This result goes in line with the findings **Izquierdo et al., (1993)** and **Chokha et al., (2000)** on growth measurements of biofertilized Volkamer lemon and Mosambi sweet orange, respectively give support to the obtained result regarding the benefit effect of Biomagic application. On the other hand, obtained result regarding the positive response of vegetative growth to organic nutritive amendment goes in line with those previously mentioned by **El-Kobbia (1999)** on Washington navel orange, **Grassi et al., (1999)** on Rangpur lime and **Obreza and Hampton (2000)** on some *Citrus spp.* Moreover, **Moustafa (2002)** on Washington navel pointed out the beneficial effect of bio and organic amendments on Washington navel orange which gave support to our results in this concern.

On the other hand, the noticeable positive effect of three investigated nutritive amendments may be attributed to the additional N source like as Biomagic and/or Peptone foliar spray, beside such improvement on soil physical and chemical properties which reflected positively on various nutrient absorption .

B- Some fruiting (cropping/productivity) measurements:

In this respect fruit set %, periodical changes in fruits retention % and yield expressed as weight (kg) or number of harvested fruits per tree were investigated regarding their response to the differential evaluated treatments with bio & organic nutritive substances. Data obtained during both 2009 & 2010 experimental seasons are presented in **Table (2)**.

It is quite evident that all investigated treatments with different nutritive bio & organic substances increased significantly fruit set %, fruits retention % and yield of Washington navel orange cv. (estimated either number or weight of harvested fruits/tree) as compared to the water sprayed trees (control) during both 2009 & 2010 experimental seasons. However, the rate of response exhibited by the differential bio & organic compounds substances in the aforesaid three fruiting measurements (fruit set %, fruits retention % and yield as number or weight of harvested fruits/tree) varied greatly from one treatment to another from one hand, but all fruiting parameters followed approximately the same trend found during both 2009 & 2010 experimental seasons from the other. Hence, Biomagic 7.5g/L foliar spray + Hammer 1.5g/L soil drench (6th treatment) was statistically the superior which resulted in the highest increase than control and overall other investigated treatments for all fruiting measurements (fruit set %, fruits retention and yield/tree) during both experimental seasons. On the other hand, four other investigated treatments with bio & organic nutritive fertilizers could be significantly arranged, into the following descending order regarding their efficiency for increasing values of these fruiting measurements over control as follows: a-Peptone 0.5g/L foliar spray + Hammer 1.5g/L soil drench (7th treat.), b-Biomagic 7.5g/L foliar spray solely (2nd treat.), Peptone 0.5g/L spray solely (3rd treat.) and Hammer 1.5g/L solely either foliar spray or soil drench (4th & 5th treatments), which ranked 2nd , 3rd and 4th after the superior one, respectively during both seasons.

Obtained results regarding the positive effect of bio nutritive fertilizers go partially with the findings of **Paschoal *et al.*, (1999)** on sweet orange , **Moustafa (2002)** on Washington navel orange , **Salama (2002)** on Balady mandarin and **Osman *et al.*, (2010)** on two olive cultivars (Coronaki and Manzanillo)

C- Fruit quality:

In this regard some fruit physical (fruit weight, dimensions, shape index, juice volume and peel thickness) and chemical properties (fruit juice TSS %, acidity %, TSS/Acid ratio, total sugars % and vitamin C content) were the investigated.

Fruit quality in response to the differential treatments of bio & organic nutritive compounds. Data obtained during both 2009 & 2010 experimental seasons are presented in **Table (3)** and **Table (4)**.

Fruit physical properties:

In this regard average fruit weight, dimensions (polar & equatorial dimensions) , shape index (polar : equatorial ratio) , juice volume and peel thickness were the five investigated fruit physical characteristics of Washington navel orange Cv. as influenced by the various bio & organic fertilizers treatments . Data obtained during both 2009 & 2010 experimental seasons are presented in **Table (3)**

It was so clear that, all investigated fruit physical properties except peel thickness and fruit shape index were increased by the differential studied bio & organic nutritive treatments as compared to control. The rate of response varied from one treatment to another, whereas the heaviest fruit of the tallest polar diameter, widest equatorial diameter and greatest juice volume was significantly coupled with those fruits of Washington navel orange trees subjected to Biomagic 7.5g/L foliar spray + Hammer 1.5g/L soil drench (6th treatment) and the great extent those treated with Peptone 0.5g/L spray + Hammer 1.5g/L soil drench i.e., (7th treatments) especially weight, juice volume and polar diameter. Moreover, Biomagic 7.5g/L foliar spray solely (2nd treat.) followed statistically the aforesaid two effective treatments, however three other investigated treatments (Peptone 0.5g/L spray solely and Hammer 1.5g/L solely either foliar spray or soil drench application) ranked third in spite of two latter treatments were less effective. On the other hand, the rate of response exhibited in both fruit shape index and fruit peel thickness was less pronounced and differences in most cases didn't reach level of significance as compared to control with few exception i.e., Biomagic 7.5g/L foliar spray + Hammer 1.5g/L soil drench (6th treatment) and Hammer 1.5g/L soil drench (5th treat.) resulted significantly in the thickest and most oblonged fruits, respectively.

Moreover, obtained results regarding the positive effect of bio fertilizers application on some fruit physical characteristics goes generally in the line of several investigators findings i.e., **Paschoal *et al.*, (1999)** on fruit juice volume and peel of orange fruit and **Abd El-Migeed *et al.*, (2007)** on Washington Navel orange fruits.

In addition, earlier findings of several investigators gave support to the present results regarding the beneficial effect of some organic fertilizers on some physical properties. In this regard, **Ebrahiem and Mohamed (2000)** on fruit juice volume of Balady mandarin, besides **Abd El-Migeed *et al.*, (2007)** and **El-Mohamedy and Ahmed (2009)** on average fruit weight , size , dimensions , juice volume and peel thickness of Washington Navel orange and

Balady mandarin , respectively. Pertaining the enhancement exhibited in such fruit physical properties of some organic fertilizers application.

Fruit juice chemical characteristics:

In this concern fruit juice TSS %, total acidity %, TSS/Acid ratio, total sugars % and ascorbic acid (vitamin C.) content were the investigated fruit juice chemical properties in response to different bio & organic nutritive treatments. Data obtained during both 2009 & 2010 experimental seasons are presented in **Table (4)**.

It is quite clear that, all investigated bio & organic nutritive treatments increased obviously the five fruit juice chemical properties under study. Such trend was true during both 2009 & 2010 experimental seasons and differences were significant either treatment compared each other or to control except for the TSS/Acid ratio, whereas differences in most cases didn't reach level of significance . Anyhow, it could be safely concluded that, the highest values of fruit juice TSS %, TSS/Acid ratio, total sugars % and ascorbic acid (V.C.) content were significantly in concomitant to fruits of Washington Navel orange trees subjected to Biomagic 7.5g/L foliar spray + Hammer 1.5g/L soil drench (6th treatment) and Peptone 0.5g/L spray + Hammer 1.5g/L soil drench (7th treat.) which ranked 1st , 2nd , respectively during both experimental seasons . On the other hand, Hammer 1.5g/L applied solely either foliar or soil drench showed two conflicted trends regarding the influence on the five investigated fruit juice chemical characteristics , whereas both treatments resulted significantly in the highest total acidity % but the least values of four other juice components particularly Hammer foliar spray .

Findings of several investigators i.e., **Tachibana and Yahata (1998)** on Satsuma mandarin , **El-Kobbia, (1999)** on Washington navel orange Cv., **Ebrahiem and Mohamed, (2000)** on Balady mandarin and **El-Mohamedy and Ahmed, (2009)** on Balady mandarin, all demonstrated that, various organic fertilizers application increased fruit juice acidity. However, **Abd El-Migeed, (2007)** on Washington navel orange cv. found that fruit juice acidity didn't respond to bio and organic fertilizers.

B- Nutritional status (leaf mineral composition):

Leaf N, P, K, Ca, Mg % were determined as an indicator of nutritional status of Washington navel trees in response to different bio and organic nutritive treatments. Data obtained during both 2009 & 2010 experimental seasons are presented in **Table (5)**.

It was so worthy as shown from **Table (5)** that all leaf macro elements content (N, P, K, Ca, Mg %) were increased significantly by any of the investigated bio & organic nutritive treatments as compared to control

(Washington navel orange trees water sprayed). such trend was true during both seasons except with Hammer 1.5g/L foliar spray or soil drench (4th & 5th treatments) which showed no appreciable effect than control on studied macro nutrient elements except leaf k% . the rate of increase varied not only from one treatment to another, but also macro nutrient elements showed its own rate of response . Anyhow, the Biomagic 7.5g/L foliar spray + Hammer 1.5g/L soil drench (6th treat.) was the most effective and exhibited statistically the highest leaf macro nutrient elements content except as compared to the Peptone 0.5g/L foliar spray + Hammer 1.5g/L soil drench (7th treat.) where differences were too slight to reach level of significance particularly with leaf N, P and Mg % during both seasons. On the hand, Biomagic 7.5g/L foliar spray solely (treat.) ranked statistically 2nd treatment except with leaf Mg% which didn't statistically differ than the aforesaid superior treatments (6th & 7th treatments).

This result goes in line with **Moustafa, (2002)** on Washington navel orange trees, **Abd El-Migeed *et al.*, (2007)** on Washington navel orange and **El-Mohamedy and Ahmed, (2009)** on Balady mandarin. as well as **Osman *et al.*, (2010)** on two olive cultivars were in partial agreement with the present result in this respect regarding the stimulative effect of some bio fertilizers.

LITERATURE CITED

- Abd El-Migeed, M. M.; M. M. Saleh; E. A. Mostafa, (2007):** The beneficial effect of minimizing mineral nitrogen fertilization on Washington navel orange trees by using organic and biofertilizers. World J. of Agric. SCI. IDOSI Publications, Faisalabad, Pakistan:3:1, 80-85. 22 ref.
- Anonymous (2008):** Year book of statistics of Ministry of Agriculture. (Agricultural Economical and Statistical Department, Arab Republic of Egypt: Cairo) [In Arabic].
- Brown, J. D. and O. Lilliand (1946).** Rapid determination of potassium and sodium in plant material and soil extract by flam photometer. Proc. Amer. Soc. Hort. Sci., 48: 341-346.
- Chapman, H. D. and P. F. Pratt (1961):** Methods of Analysis for Soil, Plant and Waters. Univ. of Calif. Division of Agric. Sc. 6th Ed. P: 56-64.
- Chokha, S.; S. K. Saxena; A. M. Gaswami; R. R. Sharma and C. Singh (2000):** Effect of fertilizers on growth, yield and quality on sweet orange (*Citrus sinensis*) Cv. Mosambi. Indian Journal of Horticulture, 57 (2): 114-117.
- Duncan, D. B. (1955):** Multiple range and multiple F. tests. Biometrics, 11: 1-42.
- Ebrahiem, T. A. and G. A. Mohamed (2000):** Response of Balady mandarin trees growing on sandy soil to application of filter mud and farmyard manure. Assiut Jour. Of Agric. Sci. 31 (5): 55-69.

- El-Kobbia, A. M. (1999):** Response of Washington navel orange to organic fertilizer “biohumus” and cattle manure application. Alexandria Journal of Agricultural Research, 44(2): 199-207.
- El- Mohamedy, R. S. R. and M. A. Ahmed (2009):** Effect of bio fertilizers and humic acid on control of dry root - rot disease and improvement yield and quality of mandarin. Research J. Agric. Biol. Sci., 5 (2): 127-139.
- Grassi, F. H.; M. A. Pereira; A. A. Savino and V. T. Rodrigues (1999):** Growth of Rangpur lime seedlings (*Citrus limonia*, Osbeck) on different substrates. Revista Brasileira de Fruticultura, 21 (2): 186-190.
- Ishac, Y. Z. (1989):** Inoculation with associative N₂-fixers Egypt. Nitrogen fixation with non-legumes, Kluwer Academic Publishers. Pp. 241-246.
- Izquierdo, I.; M. Lescaille; B. Sandrino; M. J. Garcia; E. Canizares; J. Azcuy; M. E. Rodriguez and J. F. Gallardo (1993):** Effects of biofertilizer combinations on the availability of soil NPK to citrus Volkameriana seedlings. Actas del 12 Congreso latinoamericano de la Ciencia del Suelo, Salamanca, Sevilla (Espana) la 26 de Septiembre de, 711-719.
- Moustafa, M. H. (2002):** Studies on fertilization of Washington navel orange trees. Ph.D. Dissertation Fac. of Agric., Moshtohor, Zagazig University, Benha Branch, Egypt.
- Obreza, T. A. and M. O. Hampton (2000):** Management of organic amendments in Florida citrus production systems. Fifty Ninth Annual Meeting of the soil and crop Science Society of Florida Sarasota, Florida, USA, 22-24 Sept. 1999. Soil and Crop. Sci. Soci. of Florida, 59: 22-27.
- Osman, S. M.; M. A. Khamis and A. M. Thorya (2010):** Effect of mineral and Bio-NPK Soil application on vegetative growth, flowering, fruiting and leaf chemical composition of young olive trees. Research Journal of Agriculture and Biological Sciences, 6 (1): 54-63.
- Paschoal, A. D.; Y. D. Senanayake and U. R. Sangakkara (1999):** Improved soil chemical and physical conditions and their relations to yield and fruit quality of orange in a field under Kyusei Nature Farming and EM. Technology in Brazil. Fifth International Conference on Kyusei Nature Farming, Bangkok, Thailand, 23-26 October, 175-181.
- Piper, C. S. (1958):** Soil and Plant Analysis. Inter. Sci. Publishers. New York, 213-217.
- Pregl, E. (1945).** Quantitative Organic Micro Analysis. 4th Ed. Chundril, London.
- Saber, S. M. (1993):** The use of multi-strain bio-fertilizer in agriculture. Theory and pratice. Proc. Sixth International Symposium on Nitrogen Fixation with Non-legumes, Ismailia, Egypt, p.61.

Salama, A. S. M. (2002): Response of some fruit species transplants and trees to organic fertilization. Ph.D. Dissertation, Fac. Agric., Moshtohor, Zagazig Univ. Benha Branch, Egypt.

Snedecor, G. W. and W. G. Cochran (1977): Statistical Methods, Eight Edition, Iowa State University Press.

Tachibana, S. and S. Yahata (1998): Effects of organic matter and nitrogen fertilizer application on fruit quality of Satsuma mandarin in a high density planting. J. of the Japanese Society for Horticultural Science, 67 (5): 671-676.

الملخص العربي

تأثير بعض المركبات الحيوية والعضوية كمغذيات إضافية علي النمو والانتاجية وجودة الثمار والحالة الغذائية لأشجار البرتقال ابوسرة (واشنجن)

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قسم البساتين - كلية الزراعة - جامعة بنها

أجريت هذه الدراسة على أشجار برتقال بسره مثمره نامية بمزرعة كلية الزراعة بمشتهر (طوخ- قليوبية) خلال موسمي ٢٠٠٩، ٢٠١٠ بهدف تحسين نمو وإنتاجية وجودة الثمار والحالة الغذائية لأشجار هذا الصنف باستعمال ثلاثة مركبات حيوية وعضوية هي البيوماجيك (بيوستيموليت) و الهامر (مصدر للهيوميك) والبيتون سواء استخدم كل مركب بمفرده أو مع غيره والإضافة إما رشا ورقيا أو ارضيا وعليه كانت المعاملات المختبرة هي:

- ١- الرش بالماء (كنترول) ،٢- بيوماجيك ٧,٥ جم/لتر رش ورقي ، ٣- بيتون ٠,٥ جم/لتر رش ورقي ، ٤- هامر ١,٥ جم/لتر رش ورقي ، ٥- هامر ١,٥ جم/لتر أرضي ، ٦- بيوماجيك ٧,٥ جم/لتر رش ورقي +هامر ١,٥ جم/لتر أرضي ، ٧- بيتون ٠,٥ جم/لتر رش ورقي +هامر ١,٥ جم/لتر أرضي.

وقد استخدم التصميم التجريبي (القطاعات التامة العشوائية) بحيث كررت كل معاملة أربع مرات ومثلت كل مكرره بشجرة واحدة.وقد عوملت الأشجار ٦ مرات شهريا (أول فبراير - أول يوليو) بمعدل ٣ لتر/شجرة كل مرة (سواء رش ورقي أو أرضي). هذا وقد تم تقييم المعاملات من حيث تأثيرها ومعدل التغير الموسمي في القياسات المختلفة الآتية:

أولا قياسات النمو الخضري

عدد الأفرخ النامية على المتر الطولي للفرع الرئيسي، طول وسمك وعدد الأوراق /فرخ و مساحة الورقة.

ثانيا القياسات المرتبطة بالإنتاجية:

نسبة العقد، التغير الموسمي في نسبة بقاء الثمار ومحصول الشجرة (وزنا و عددا).

ثالثا صفات جودة الثمار:

الصفات الطبيعية (وزن الثمرة- أبعادها - شكل الثمرة- حجم العصير - سمك القشرة) والصفات الكيميائية (نسبة المواد الصلبة الذائبة الكلية - الحموضة الكلية والنسبة بينهما والسكريات الكلية وفيتامين ج)

رابعا الحالة الغذائية (محتوي الأوراق من العناصر الكبرى (N,P,K, Ca, Mg)

واهم النتائج كانت كالتالي:

أظهرت جميع المعاملات للمركبات الحيوية والعضوية الثلاث تأثيرها الايجابي علي جميع القياسات الخضرية وكذلك الإنتاجية وصفات جودة الثمار وحالة الأشجار الغذائية (محتوي أوراقها من العناصر الكبرى) وان تباينت الاستجابة من معاملة إلي أخرى وعموما فان المعاملة السادسة (بيوماجيك ٧,٥ جم/لتر رش ورقي + هامر ١,٥ جم/لتر أرضي) كانت هي الأكثر تقدما في هذا الصدد يليها كل من المعاملتين الثانية والسابعة (بيوماجيك ٧,٥ جم/لتر رش ورقي) & (بيتون ١٠,٥ جم/لتر رش ورقي + هامر ١,٥ جم /لتر أرضي) أما اقل المعاملات فعالية فكان استخدام الهامر منفردا سواء رشا ورقياً أم إضافة أرضية. كما أن القياسات المختلفة تباينت نسبيا من حيث الاستجابة لمختلف المعاملات . وعلية يمكن أن نوصي باستخدام بيوماجيك ٧,٥ جم/لتر رش علي الأشجار مع الهامر ١,٥ جم/لتر أرضيا كمعاملات إضافية مغذية الشجار البرتقال أبوسره تحت الظروف المماثلة للتجربة.

Table (1): Effect of some bio& organic nutritive compounds treatments on vegetative growth measurements (No. of shoots/one meter limb, average shoot length & thickness, No. of leaves per shoot and leaf area) of fruitful Washington navel orange trees during both 2009 & 2010 experimental seasons.

Treatments	No. of shoots/one meter limb		Shoot length (cm)		Shoot thickness (mm)		No. of leaves /shoot		Leaf area (cm ²)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
1-Control (water spray)	13.50 D	14.50 D	26.25 E	28.65 F	2.25 F	2.75 D	20.75 F	18.75 E	14.70 F	14.83 G
2-Biomagic (foliar spray) at 7.5 g/L	19.00 B	18.50 B	29.80 C	32.15 C	3.75 B	4.00 B	25.00C	24.00 C	18.20 B	18.00 B
3-Peptone (foliar spray) at 0.5 g/L	17.00 C	16.25 C	28.75 D	30.33 D	2.75 E	3.00 CD	20.75 F	23.75 C	15.90 E	16.13 E
4-Hammer (foliar spray) at 1.5 g/L	17.00 C	16.25 C	28.33 D	29.65 E	3.23 CD	3.75 B	22.75 E	23.75 C	15.73 E	15.40 F
5-Hammer (soil drench) at 1.5 g/L	17.00 C	16.75 C	28.73 D	28.83 F	3.00 DE	3.50 BC	23.75 D	22.25 D	16.38 D	16.58 D
6-Biomagic (foliar spray)+ Hammer (soil drench)	20.00 A	20.75 A	34.93 A	35.50 A	4.75 A	5.00 A	30.50 A	31.25 A	18.83 A	18.80 A
7-Peptone (foliar spray) + Hammer (soil drench)	18.50 B	19.25 B	32.83 B	33.40 B	3.50 BC	4.00 B	28.50 B	29.25 B	16.90 C	16.83 C

Values within each column followed by the same letter/s are not significantly different at 5 % level.

Table (2): Effect of some bio& organic nutritive compounds treatments on fruit set %, changes in fruit retention % and yield (weight & number of harvested fruits/ tree) for Washington navel orange trees during both 2009 & 2010 seasons.

Treatments	Fruit set (%)		Seasonal changes in fruit retention %						Yield/ tree			
			June 20 th		August 1 st		October 3 rd		No. of fruits		Fruit weight (kg)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
1-Control (water spray)	14.01 E	15.76 F	18.85 G	19.38 E	15.13 F	15.30 E	12.23 F	12.54 F	46.00 D	51.25 E	9.36 E	10.36 F
2-Biomagic (foliar spray) at 7.5 g/L	20.11 C	20.33 C	21.13 C	21.58 C	17.73 C	18.03 C	14.55 C	15.58 C	76.25 B	85.00 C	20.73 B	22.60 C
3-Peptone (foliar spray) at 0.5 g/L	19.80 C	20.30 C	20.00 D	20.43 D	15.49 E	15.99 D	13.40 D	14.00 D	76.25 B	83.25 C	17.03 C	18.50 D
4-Hammer (foliar spray) at 1.5 g/L	16.04 D	17.10 E	19.08 F	19.43 E	15.37 EF	15.55 E	12.84 E	13.13 E	50.00 CD	56.25 D	10.63 DE	12.24 EF
5-Hammer (soil drench) at 1.5 g/L	16.57 D	18.36 D	19.33 E	20.28 D	16.08 D	16.10 D	13.52 D	14.11 D	52.75 C	59.00 D	11.09 D	12.55 E
6-Biomagic (foliar spray)+ Hammer (soil drench)	23.70 A	24.59 A	23.60 A	24.08 A	19.46 A	19.91 A	16.37 A	17.42 A	92.25 A	105.50 A	28.35 A	32.04 A
7-Peptone (foliar spray) + Hammer (soil drench)	21.58 B	22.80 B	21.70 B	21.98 B	18.90 B	19.11 B	15.09 B	15.85 B	72.00 B	91.00 B	21.61 B	26.97 B

Values within each column followed by the same letter/s are not significantly different at 5 % level.

Table (3): Effect of some bio & organic nutritive compounds treatments on some fruit physical properties of Washington navel orange trees during both 2009 & 2010 experimental seasons.

Treatments	Fruit weight (g)		Fruit dimensions (cm.)				Fruit shape index Polar/ Equatorial		Fruit juice volume (ml)		Peel thickness (mm)	
			Polar diameter(cm)		Equatorial diameter(cm)		2009	2010	2009	2010	2009	2010
	2009	2010	2009	2010	2009	2010						
1-Control (water spray)	203.25 D	201.25 D	7.400 D	7.475 E	7.400 E	7.425 F	1.000 D	1.007 B	68.25 E	72.75 F	2.75 B	2.50 B
2-Biomagic (foliar spray) at 7.5 g/L	253.75 B	265.00 B	8.025 B	8.075 C	7.825 C	8.000 C	1.022 BC	1.009 B	94.00 BC	91.25 D	2.50 BC	2.75 B
3-Peptone (foliar spray) at 0.5 g/L	223.75 C	223.75 C	8.100 B	7.875 D	7.775 C	7.775 D	1.042 B	1.007 B	95.75 B	96.75 C	2.75 B	2.25 B
4-Hammer (foliar spray) at 1.5 g/L	210.00 CD	215.00 CD	7.775 C	7.900 D	7.625 D	7.575 E	1.016 CD	1.043 A	92.75 C	90.75 D	2.00 C	1.75 C
5-Hammer (soil drench) at 1.5 g/L	211.50 CD	216.50 CD	7.775 C	7.875 D	7.300 E	7.525 EF	1.064 A	1.048 A	80.25 D	84.25 E	2.25 BC	2.25 B
6-Biomagic (foliar spray)+ Hammer (soil drench)	306.25 A	305.00 A	8.400 A	8.475 A	8.375 A	8.425 A	1.003 D	1.006 B	102.25 A	105.25 A	3.50 A	3.25 A
7-Peptone (foliar spray) + Hammer (soil drench)	300.00 A	296.75 A	8.325 A	8.325 B	8.000 B	8.225 B	1.040 B	1.009 B	101.25 A	102.25 B	2.25 BC	2.50 B

Values within each column followed by the same letter/s are not significantly different at 5 % level.

Table (4): Effect of some bio & organic nutritive compounds treatments on some fruit juice chemical properties of Washington navel orange trees during both 2009 & 2010 experimental seasons.

Treatments	TSS %		Total acidity %		TSS / Acid ratio		Total sugars %		V.C (mg /100ml)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
1-Control (water spray)	9.325 G	9.325 F	0.887 C	0.805 G	10.518 C	11.655 B	6.100 E	6.000 F	50.25 E	53.00 E
2-Biomagic (foliar spray) at 7.5 g/L	10.175 D	10.025 D	1.025 A	1.020 C	9.995 C	9.870 C	7.425 B	7.400 C	51.25 ED	56.00 D
3-Peptone (foliar spray) at 0.5 g/L	9.575 F	9.675 E	0.907 BC	0.989 D	10.902 C	9.850 C	6.300 D	6.225 E	61.25 B	62.75 B
4-Hammer (foliar spray) at 1.5 g/L	9.875 E	10.025 D	1.021 A	1.037 A	9.893 C	9.718 C	6.150 E	6.125 E	56.00 C	59.00 C
5-Hammer (soil drench) at 1.5 g/L	10.500 C	10.325 C	0.992 AB	1.031 B	10.698 C	10.227 C	6.800 C	7.000 D	52.25 D	62.00 B
6-Biomagic (foliar spray)+ Hammer (soil drench)	11.200 A	11.400 A	0.815 C	0.824 F	13.770 A	13.630 A	7.975 A	8.100 A	64.00 A	66.75 A
7-Peptone (foliar spray) + Hammer (soil drench)	10.775 B	11.075 B	0.853 C	0.853 E	12.650 B	13.030 A	7.475 B	7.525 B	63.00 A	64.00 B

Values within each column followed by the same letter/s are not significantly different at 5 % level.

Table (5): Effect of some bio& organic nutritive compounds treatments on leaf macro nutrient elements contents of fruitful Washington navel orange trees during both 2009 & 2010 experimental seasons.

Treatments	N %		P %		K %		Ca %		Mg %	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
1-Control (water spray)	2.20 C	2.13 D	0.122 C	0.125 C	1.34 C	1.30 C	4.42 C	4.47 C	0.39 C	0.40 C
2-Biomagic (foliar spray) at 7.5 g/L	2.43 B	2.50 B	0.130 B	0.144 B	1.50 B	1.51 B	4.80 B	5.00 B	0.51 AB	0.52 AB
3-Peptone (foliar spray) at 0.5 g/L	2.42 B	2.45 BC	0.125 BC	0.131 BC	1.49 B	1.49 B	4.00 D	4.03 D	0.48 BC	0.49 BC
4-Hammer (foliar spray) at 1.5 g/L	2.23 C	2.20 D	0.122 C	0.127 C	1.46 B	1.47 B	4.10 D	4.38 C	0.42 C	0.42 C
5-Hammer (soil drench) at 1.5 g/L	2.27 C	2.30 CD	0.125 BC	0.132 BC	1.49 B	1.48 B	3.73 D	3.87 D	0.43 C	0.45 C
6-Biomagic (foliar spray)+ Hammer (soil drench)	2.64 A	2.73 A	0.159 A	0.166 A	1.62 A	1.66 A	5.33 A	5.47 A	0.57 A	0.60 A
7-Peptone (foliar spray) + Hammer (soil drench)	2.58 A	2.64 AB	0.157 A	0.161 A	1.49 B	1.52 B	4.93 B	4.97 B	0.52 A	0.54 A

Values within each column followed by the same letter/s are not significantly different at 5 % level.