

## The impact of bio-fertilization, plant extracts and potassium silicate on some fruiting aspects and fruit quality of "Le-Conte" pear trees

<sup>1</sup>Abd-El-Latif, F.M., <sup>1</sup>El-Gioushy, S.F., <sup>2</sup>Ismail, A.F. and <sup>2</sup>Mohamed, M.S.

<sup>1</sup>Hort. Dept., Faculty of Agric., Benha Univ., Egypt.

<sup>2</sup>Horticulture Research Institute, Agricultural Research Center, Egypt.

Received: 08 March 2017/ Accepted: 15 May 2017/ Publication date: 15 June 2017

### ABSTRACT

This investigation was carried out during 2015 and 2016 growing seasons on 12- year- old Le-Conte pear trees (*Pyrus communis* L.X *Pyrus pyrifolia* N.) budded on *Pyrus betulaefolia* rootstock, planted at 5 × 5 meters apart (168 trees / feddan) in sandy soil under drip irrigation system and grown at El-Kassasien Horticultural Research Station, Ismailia Governorate. These study included effected of soil bio-fertilizers such as Phosphorene, Rhizobacterin and Potassein at 40 g /tree, foliar spray with Super Amino Bacter at 1.5ml/ litter/tree, foliar spray with Potassium silicate at 8ml/ litter/tree and foliar sprays of some plant extracts (Roselle, Cinnamon, Ginger) at 5L/tree on fruit set, fruit yield, physical and chemical fruit quality .The results showed that foliar spray with the three plant extracts each at 5L/tree (Roselle, Cinnamon and Ginger) associated with soil bio-fertilization was the best one in this respect. Meanwhile, foliar spray with each individual plant extract at 5L/tree lonely extract combined with soil bio-fertilization came in the second rank in this respect. Besides, foliar spray with each individual plant extract as lonely extract at 5L/tree without soil bio-fertilization, as well as foliar spray with K-silicate at8ml/L and soil bio-fertilization alone were less effective in increasing these properties and subsequently arranged in the third rank in this respect. On the other hand, the untreated trees with any of the investigated treatments was the inferior one in this respect as it recorded the least value of these parameters, followed in ascending order by spraying with super amino bacter at 1.5 ml/L during both seasons of study.

**Key words:** pear, Le-Conte, bio-fertilizer, amino bacter plant extract, potassium silicate and fruit quality.

### Introduction

Pear (*Pyrus spp.*) is native to family Rosaceae. It is one of the most celebrated of deciduous fruits. "Le-Conte" pear cultivar budded on *Pyrus betulaefolia* rootstock is grown and widely spread in new reclaimed lands in Egypt. Pear fruits are greatly required for their high nutritive value and high net return.

Le- Conte is the main pear cultivar grown in Egypt resulted as a hybrid between *Pyrus communis* X *Pyrus serotina*. The total harvested area of pears fluctuated sharply during the last decades due to fire blight infection as it dropped from 10990 feddans at 1999 to 6960 feddans at 2005. The cultivated area with pear in Egypt has enormously increased through the last decades reaching about 12182 fed. The fruiting area reached 9515 fed. Producing about 58344 tons with average of 6.13 tons / fed. (Statistics of Ministry of Agriculture, 2014). Most of this area is concentrated in lower Egypt especially in Behera, Alexandria, Monofia, and Kalubia Governorates.

Bio-fertilization is considered an important tool to enhance the yield and fruit quality of fruits trees and it becomes, as positive alternative to chemical fertilizers. It is safe for human and environmental and using them was accompanied with reducing the great pollution occurred on our environment as well as for producing organic foods for export. Application of bio fertilizers in fruit trees orchard is a production system avoids or largely excludes (Abdelaal *et al.*, 2010).

Ascorbic acid is a regulator of plant growth and development owing to its effects on cell division and differentiation and it involves in wide range of important functions such as antioxidants defense, photo protection and regulation of photosynthesis and growth regulation. (El- Sayed *et al.*, 2000)

**Corresponding Author:** EL-Gioushy, S. F., Hort. Dept., Fac. of Agric., Benha Univ., Egypt.  
E-mail: sherif.elgioushy@fagr.bu.edu.eg

reported that ascorbic acid gave the best yield and bunch quality on Flame seedless grapevine.

Citric acid plays an essential role in signal transduction system, membrane stability and functions, activating transporter enzymes, metabolism and translocation of carbohydrates (Smirnoff, 1996). Also, citric acid as antioxidant is suggested mainly for improving yield and fruit in terms of increasing fruit weight, total soluble solids%, and total reducing sugar Introduction and in decreasing pear fruit firmness and total acidity as compared with unsprayed one (Mansour *et al.*, 2008).

Potassium silicate is a source of highly soluble potassium and silicon. It is used in agricultural production systems primarily as a silica amendment, and has the added benefit of supplying small amounts of potassium. Silicon is one of the abundant elements in the lithosphere and it is the most abundant element in soil next to oxygen and comprises 28 per cent of its weight and 3-17 percent in soil solution (Epstein, 1999).

Water extracts of some plant organs such as Roselle, Cinnamon and Ginger, has long been recognized and applied turmeric, onion, seaweed moringa, licorice, garlic as a sources of antioxidants.

This investigation aimed to improve yield and fruit quality of Le-Conte pear trees through manipulation and utilization of some plant extracts as antioxidants and two nutrient compounds as well as some soil bio-fertilizers.

## Materials and Methods

This investigation was carried out during 2015 and 2016 growing seasons on 12- year- old Le-Conte pear trees (*Pyrus communis* L.X *Pyrus pyrifolia* N. ) budded on *Pyrus betulaefolia* rootstock, planted at 5 × 5 meters apart ( 168 trees / feddan) in sandy soil under drip irrigation system and grown at El-Kassasien Horticultural Research Station, Ismailia Governorate. Thirty-three fruitful "Le-Conte" pear trees were carefully selected and devoted for this work.

Those trees were similar in their growth vigor, size shape and diseases - free as well as they received the same Horticulture managements adopted in such Station, included the organic fertilization with compost at the rate of 25kg/tree on December and NPK mineral fertilizers which were added at the recommended rate by the Ministry of Agriculture (450, 100 and 500 g N, P and K per tree/ year, respectively) in the two seasons of study through drip irrigation system. The chemical fertilizers doses were added as soil applications into three equal doses at first week of March, second week of May and first week of July. in the forms of ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>, 33.5 % N) was used as a source of nitrogen at1321g, mono ammonium phosphate (62.5 % P<sub>2</sub>O<sub>5</sub> and 14 % N) was used as a source of phosphorus at160g and potassium sulphate (high dissolve, 50% K<sub>2</sub>O) was used as a source of potassium at1000g of both seasons. Mechanical and chemical analysis of orchard soil have been carried out prior to the first season according to the methods described by Piper (1947) and Jackson (1967) as shown as shown in table (1).

**Table 1:** Physical and chemical analysis of the experimental orchard soil.

Physical characteristics %		Chemical characteristics	
Field capacity	11.77	CaCO <sub>3</sub> %	12.25
Available water	7.54	Organic matter %	0.08
Wilting point	4.23	pH	7.5
Coarse sand	67.01	EC (ds/m)	2.14
Fine sand	9.5	Ca(mg/100g)	0.14
Silt	0.7	Na (mg/100g)	0.34
Clay	5.2	K (mg/100g)	0.16
Texture class	Sandy	Cl (mg/100g)	0.30

### Rate, date and application method of Bio-fertilizers:

Three types of bio-fertilizers were investigated throughout this study, those types namely:

A. *Rhizobacterin*: is a commercial nitrogenous bio- fertilizer which contains special bacteria (*Azotobacter chorococum*) having the ability for free nitrogen fixation.

B. *Phosphorene*: is a commercial phosphorus bio- fertilizer which contains some active bacterial strains (*Arbuscular mycorrhiza* and *Silicate bacteria*) that play an important nutritional role in P uptake through changing the unavailable phosphate form (insoluble tri-Calcium phosphate) into available soluble one (mono- Calcium phosphate).

C. *Potassein*: is a commercial potassium bio- fertilizer contains special bacteria (*Bacillus pasteurii*) which releasing the potassium in available form.

Each of the three abovementioned bio- fertilizers was soil added (15cm depth) to the wetted compost in three equal doses in (January, March and June) at the rate of 40g/tree/dose.

*Rate and application date of Super Amino Bacter:*

Super Amino Bacter was added as foliar spray in three equal doses each at 1.5ml/ liter/tree/dose in (January, March and June). Super Amino bacter contents: total amino acids 20.1%, freeaminoacids 7.19%, N 18.1%, P 0.08%, K 2.51%, Ca 1.1%, Mg 0.001%, NO<sub>3</sub> 1.85%, NH<sub>4</sub> 0.86%, Fe 24.1ppm, Zn 3.5ppm, Mn 0.5 ppm and Cu 0.23ppm.

*Rate, date and application Method of Potassium silicate:*

Potassium silicate was added as foliar spray in three equal doses each at 8ml/ liter/tree/dose in (January, March and June). Potassium silicate contents: K<sub>2</sub>O 10% and Si<sub>2</sub>O<sub>3</sub> 25%.

*Preparation, date and application method of the investigated Antioxidants (plant extracts):*

Foliar sprays of some plant extracts on fruit trees have recently received apparent interest. The various positive effects of applying active plant extracts were attributed to their contents of different nutrients, vitamins, natural plant growth regulators, etc.

*The sprayed plant extract properties were as follows:*

*Roselle (Hibiscus sabdariffa L.):*

*Phytochemicals composition:* The plants are rich in Phytochemicals: anthocyanins, protocatechuic acid; flavonoids, gossypetin, hibiscetin and sabdaretin the major pigment. In dried calyces formerly reported as hibiscin, has been identified as daphniphylline. In addition small amounts of myrtillin, delphinidin, Chrysanthenin (cyanidin 3-monoglucoside) and delphinidin are also present. Sepals contain anthocyanin, a mixture of organic acids namely: malic, citric, tartaric and hibiscus acid. It has antibacterial and fungal effects (Phyllis and James, 1985).

*Preparation of plant extract solution:* 250g of matured dried and grounded calyces were boiled for 15min. in 2L of water then filtered to obtain stock extract solution. (Dina-Abdallah, 2013). Dose of application: The stock extract solution which has already been prepared was diluted with tap water up to 20L, to obtain the final foliar spray solution which distributed on 4 trees (5L/tree).

*Ginger (Zingiber officinale):*

*Phytochemicals composition:* included alpha-pinene, beta- carotene, beta-ionone, beta-sitosterol, caffeic acid, camphor, capsaicin, caryophyllene, chlorogenic, citral, curcumin, farnesol, ferulic acid, geraniol, gingerols, lecithin, 1,8-cineole, zingerone. Nutrients; Amino acids, calcium, essential fatty acids, magnesium, manganese, phosphorus, potassium, selenium, zinc, vitamins B1, B2, B3, B6, C and A. (Phyllis & James, 1985).

*Preparation of stock extract solution:* 250g of grounded roots and rhizomes were depped in 2L of water for 48h then filtered to obtain stock extract solution (Nahla, 2009). Dose of application: the

resulted stock extract solution was diluted with 20L of water and used for spraying at the rate of 5L/tree.

*Cinnamon: (Cinnamo mumverum):*

*Phytochemicals composition:* contained alpha-pinene, benzaldehyde, beta-carotene, beta-pinen, borneol, camphor, caryophyllene, cinnamaldehyde, coumarin, cuminaldehyde, eugenol, farnesol, geraniol, limonene, linalool, mannitol, mucilage, 1,8-cineole, phellandrene, tannin, terpinolene, vanillin. Nutrients; Calcium, Chromium, Copper, iodine, iron, manganese, phosphorus, potassium, zinc, vitamins A, B1, B2, B3 and C. (Phyllis and James, 1985).

*Preparation of stock extract solution:* 250g of grounded dry bark of cinnamon plants were soaked in 2L of water for 48h then filtered to obtain stock extract solution. Dose of application: the resulted stock extract solution was diluted with water to 20L and used for spraying at the rate of 5L/tree.

*Time of application:* The three abovementioned plant extract solutions of Roselle, Ginger and Cinnamon have been sprayed on January, March and June at the rate of 5L/tree.

*The investigated materials including:*

Bio-fertilizers (Rhizobactrin, Phosphorene and Potassien), Super amino bacter, Potassium silicate and some antioxidants (plant extracts) were arranged and designed in different combinations in order to build up the skeleton of the following investigated treatments:

- T1. Water spray (untreated control)
- T2. Bio-fertilizers (Rhizobactren, Phosphorene and Potassien) 40g / tree / dose
- T3. Super Amino Bacter 1.5 cm / L / tree / dose
- T4. Potassium silicate 8cm / L / tree / dose
- T5. Roselle extract 5L / tree
- T6. Cinnamon extract 5L / tree
- T7. Ginger extract 5L / tree
- T8. Bio-fertilizers (Rhizobactren, Phosphorene and Potassien) + Roselle extract
- T9. Bio-fertilizers (Rhizobactren, Phosphorene and Potassien) + Cinnamon extract
- T10. Bio-fertilizers (Rhizobactren, Phosphorene and Potassien) + Ginger extract
- T11. Bio-fertilizers (Rhizobactren, Phosphorene and Potassien) + Roselle extract+ Cinnamon extract+ Ginger extract.

The responses of the tested Le-Conte pear trees to the applied fertilization treatments were evaluated the following parameters:

*Fruiting aspects:*

*Initial fruit set percentage:* Four branches with the same age (more than two years) were selected on each tree (replicate). The total number of flowers on each limb was counted at full bloom and the number of set fruits was counted on the same limbs. Fruit set percentage was calculated as follows:

$$\text{Initial Fruit set percentage} = (\text{number of developing fruitlets} / \text{total number of flowers}) \times 100$$

*Yield per tree:* Fruits were harvested at maturity stage (the last week of August) from each tree of various replicates and yield was recorded either as number of fruits/tree or as Kg/tree.

*Fruit characteristics:* Fruit samples were taken from the tested trees at a rate of 15 fruits per tree (15 fruits / replicate) for the following determinations:

*Fruit Physical properties:*

*Average fruit weight (g):*

*Average fruit size (volume) (cm<sup>3</sup>):*

*Average fruit length (L) and diameter (D) in (cm):*

*Fruit shape index (L/D):*

*Fruit firmness (L/inch<sup>2</sup>):* was determined by using penetrometer (pressure tester) (advance force gorge RH 13 UK).

*Fruit Chemical properties:*

*Fruit pulp juice total soluble solids (T.S.S):* were measured by using a carl zeiss hand refractometer.

*Fruit flesh total titratable acidity (%):* was determined as malic acid (g/ 100g flesh weight) according to Association of Official Agricultural Chemists (1995).

*TSS/acid ratio:*

TSS/acid ratio was estimated by dividing the total soluble solids percentage on total acidity percentage

*Fruit flesh total sugars content:* Total sugars of the fruit pulp were determined colorematically according to the method described by (Dubois *et al.*, 1956).

*Vitamin C:* fruit vitamin c was estimated as (mg/ 100 g) fresh pulp according to Association of Official Agricultural Chemists (1995).

*Statistical Analysis:*

The Complete randomized block design was used for arranging the above mentioned eleven treatments, whereas each treatment was replicated three times and each replicate was represented by an individual fruitful pear tree. All the obtained data in the two seasons of study were statistically analyzed using the analysis of variance method according to Snedecor and Cochran (1980). However, means were distinguished by the Duncan's multiple range test (Duncan, 1955).

## **Results and Dissection**

### **Some fruiting aspects:**

*Initial fruit set percentage (%):*

Referring to the response of fruit set % of Le-Conte pear trees as affected by the different investigated treatments, data presented in Table (2) exhibited that there were significant differences among the investigated treatments when fruit set % was concerned. Furthermore, soil-bio-fertilization with the three investigated bio-fertilizers combined with either the three plant extracts foliar spray each at 5L/tree (Roselle, Cinnamon and Ginger-T11) or with Ginger extract foliar spray(T10) were the superior two treatments as both maximized the investigated parameter as compared with the other investigated treatments during both seasons of study, followed by soil bio-fertilization combined with plant extract spray of Roselle (T8) or Cinnamon (T9) or spray only without soil bio-fertilization with Cinnamon at 5L/tree (T6) or Ginger (T7) at 5L/tree, as those four treatments (T6, T7, T8 and T9) came in the second rank in this respect. On the other hand, the least values of fruit set% was detected with those sprayed trees with super amino bacter at 1.5 cm/L (T3) and untreated trees (control-T1) during 2015 and 2016 seasons of study. These results agreed with those found by El-Badawy (2013) on "Canino" Apricot trees.

*Number of fruits / tree:*

With respect to the response of number of fruits/tree of Le-Conte pear trees as impacted by soil bio-fertilization, spraying with some plant extracts, k-silicate and super amino bacter, data presented

in Table (2) clear that there were significant differences among the investigated treatments in relation to number of fruits /tree. Furthermore, the trees which were soil fertilized with the three investigated bio fertilizers combined with addition of the three sprayed plant extracts as foliar spray each at 5L/tree (Roselle, cinnamon and Ginger) T11 gave the highest number of fruits /tree as compared with the other investigate treatments. Meanwhile, sprayed trees with either Cinnamon or Ginger extract at 5L/tree combined with bio-fertilization with the three investigated bio-fertilizers (T9and T10) reflected an acceptable increment in number of fruits /tree and in turn both treatments ranked the second in this respect. In addition, sprayed trees with Roselle extract at 5L/tree combined with soil bio-fertilization (T8) came after the abovementioned two treatments (T9 and T10) and subsequently occupied the third rank in this respect. Such trend was true during both seasons of study. On the other way around, the reverse was true with untreated trees (control-T1) which exhibited the lowest number of fruits/tree as it was the inferior one in this respect followed in ascending order by soil bio-fertilization with the three investigated bio-fertilizers (T2) and spraying with super amino bacter at 1.5ml/L (T3).

**Table 2:** Initial fruit set percentage (%),Number of fruits /tree and Yield (kg/tree) of "Le-Conte" pear trees as impacted by NPK bio-fertilizers, super amino bacter, potassium silicate and some antioxidants plant extracts during 2015 and 2016 seasons.

Parameters Seasons	Initial fruit set percentage (%)		Number of fruits /tree		Yield (kg/tree)	
	2015	2016	2015	2016	2015	2016
T1-Water spray (control)	5.33 d	6.01 d	335.66 g	341.33 g	49.52 f	53.77 f
T2- Bio-fertilizers (Rhizo+Phos+Pota)	6.21 c	6.32 c	348.33 e	355.00 e	54.32 e	58.25 e
T3-Supre amino bacter	5.81 d	6.01 d	343.00 f	353.00 e	52.89 e	58.03 e
T4-Potassium silicate	6.90 c	7.05 b	357.00 d	364.66 d	58.77 d	62.88 d
T5-Roselle Extract	6.60 c	6.77 c	358.00 d	364.33 d	58.10 d	62.93 d
T6-Cinnamon Extract	7.24 b	7.33 b	354.33 d	359.66 de	59.13 d	62.62 d
T7-Ginger Extract	7.07 b	7.20 b	355.00 d	364.33 d	58.71 d	63.44 d
T8-Bio-fer. (Rhizo+Phos+Pota) +R.E	7.49 b	7.54 b	364.00 c	373.33 c	63.17 c	68.99 c
T9-Bio-fer. (Rhizo+Phos+Pota) +C.E	7.40 b	7.45 b	367.66 b	378.66 b	64.51 c	70.76 c
T10-Bio-fer. (Rhizo+Phos+Pota) +G.E	8.12 a	8.27 a	371.33 b	381.66 b	66.14 b	73.41 b
T11-Bio-fer.Rhizo+Phos+Pota) R.E+C.E+G.E	8.43 a	8.46 a	384.33 a	392.66 a	77.40 a	82.02 a

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

Rhizo= Rhizobactren

R.E= Roselle Extract

Phos= Phosphorene

C.E= Cinnamon Extract

Pota= Potassien

G.E=Ginger Extract

Yield (kg/tree):

Regarding the impact of the different investigated treatments on yield (kg/tree) of Le-Conte pear trees, data tabulated in Table (2), indicate that the investigated parameter (yield) was highly significant affected by the different tested treatments. Herein, sprayed pear trees with the three investigated plant extracts each at 5L/tree (Roselle, Cinnamon and Ginger) conjoint with soil bio-fertilization (T11) proved to be the superior one in this respect as it maximized the investigated parameter (yield-kg/tree) as compared with the other investigated treatments. Such trend was true during both seasons of study. Meanwhile, spraying with Ginger extract at 5L /tree combined with soil bio-fertilization (T5) was better than spraying with either Roselle extract at 5L/tree (T8) or Cinnamon extract at 5L/tree (T9).It was quite clear that spraying with either any of the three investigated plant extracts alone or 3 NPK bio-fertilizers solely (T5, T6, T7 and T2) was less effective in enhancing the yield as compare with the combination between both. On the other hand, the worsen yield value was obtained when the trees were not received any of the investigated treatments (untreated trees-control-T1). These results coincided with those found by Wally *et al.* (2012) on "Canino" apricot. Foliar application of compost tea at 5 liters/tree plus ascorbic acid at 1000 ppm on " Le -Conte " pear trees gave the highest increment of yield/ tree (kg) compared with the untreated trees. (Fayek *et al.*, 2014).

### **Fruit characteristics:**

#### *Fruit physical properties:*

##### *Fruit weight (g)*

Concerning fruit weight of Le-Conte pear trees as affected by the different investigated treatments, data presented in Table (3) reveal that there was a variable response to the different investigated treatments. Hence, the highly positive response of fruit weight was detected with those trees which were soil bio-fertilized with the three investigated bio-fertilizers conjoined with the application of the three plant extracts as foliar spray each at 5L/tree (Roselle, Cinnamon and Ginger-T11), as such treatment was in the top of the treatments evaluation. Such treatment produced the heaviest fruit weight as compared with the other investigated treatments during both seasons of study, followed by spraying with Ginger extract at 5L/tree combined with soil bio-fertilization (T10) which ranked second in the frame of treatments evaluation, meanwhile spraying with the other two plant extracts (Roselle and Cinnamon) combined with bio-fertilization (T8 and T9) came third, Data also referred that it was preferable to spray with the three plant extracts +soil bio-fertilization together to get better response than using each factor solely. On the other hand, the least fruit weight was gotten with untreated trees (T1) followed in ascending order by soil bio-fertilization only (T2) and spraying with super amino bacter at 1.5 ml/L(T3) during both seasons of study. These results are in harmony with those reported by Shaaban *et al.*, (2011) they found that spraying salicylic acid once, twice, thrice and four times at 50 to 400 ppm were very effective in stimulating fruit weight of "Anna" apple trees. Also, El-Gioushy (2016) on Washington navel orange trees.

##### *Fruit volume (cm<sup>3</sup>):*

Data dealing with fruit size (volume) of Le-Conte pear trees as impacted by the different investigated treatments, are presented in Table (3). It was quite clear that there were remarkable significant variations among the investigated treatments, when fruit size parameter was concerned. Furthermore, foliar spray with the three plant extracts each at 5L/tree (Roselle, Cinnamon and Ginger) associated with soil bio-fertilization (T11) was the best one in this respect, as it maximized the investigated parameter, as compared with the other investigated treatments. Meanwhile, foliar spray with each individual investigated plant extract at 5L/tree lonely combined with soil bio-fertilization. i.e., (T8, T9, and T10) came after (T11) and in turn stood the second rank in this respect. Besides, foliar spray with each individual plant extract as lonely extract at 5L/tree without (in the absence of) soil bio-fertilization, as well as foliar spray with K-silicate at 8ml/L and soil bio-fertilization alone (T4, T5, T6, T7 and T2) were less effective in increasing fruit size and subsequently arranged in the third rank in this respect. On the other hand, the untreated trees with any of the investigated treatments (control-T1) was the inferior one in this respect as it recorded the least value of fruit size, followed in ascending order by spraying with super amino bacter at 1.5 ml/L(T3) during both seasons of study. These results are in accordance with those found by Abdou (2013) on "Canino" apricot trees who found that application of some soil bio-stimulants (EM, bio-fertilizer, humic acid and compost tea) increased fruit weight, fruit volume, fruit dimensions (length & diameter), fruit shape index.

##### *Fruit firmness L/inch<sup>2</sup>:*

Referring to the relation between fruit firmness of le-conte pear trees and the different investigated treatments, data presented in Table (3) displayed obviously that fruit flesh firmness of le-conte pear fruits was significantly responded to the different investigated treatments. Herein, the addition of the three plant extracts as foliar spray coupled with soil bio-fertilization (T11) led to produce fruit with highly firmness flesh texture as compared with the other investigated treatments, followed by spraying with each individual plant extract (Roselle, T8), (Cinnamon, T9) and (Ginger, T10) which caused a little bit decrement in fruit flesh firmness. However, soil bio fertilization only (T2), spraying with either super amino bacter at 1.5ml/L (T3) or K-silicate at 8ml/L (T4) or each

individual plant extract (Roselle-T5), (Cinnamon-T6) and (Ginger-T7) came third in this respect. On the other hand, the reverse was true with those untreated trees (T1-control), as such treatment resulted in producing more flesh softened fruits during both seasons of study. It was noticed that there was a positive relationship between fruit size and its firmness, the larger the fruit, the more texture. These results are in accordance with those found by Kabeel *et al.*, (2005) who reported that, physical fruit properties of "Canino" apricot fruits such as fruit weight, volume and firmness were significantly improved by different bio- fertilizers treatments.

**Table 3:** Fruit weight (g), Fruit volume (cm<sup>3</sup>) and Fruit firmness L/inch<sup>2</sup>of "Le-Conte" pear trees as impacted by NPK bio-fertilizers, super amino bacter, potassium silicate and some antioxidants plant extracts during 2015 and 2016 seasons.

Parameters Seasons	Fruit weight (g)		Fruit volume (cm <sup>3</sup> )		Fruit firmness L/inch <sup>2</sup>	
	2015	2016	2015	2016	2015	2016
T1-Water spray (control)	147.54 f	155.42 f	153.56 e	161.34 e	17.57 d	17.60 d
T2- Bio-fertilizers Rhizo+Phos+Pota)	155.93 e	164.09 e	172.69 c	182.73 c	18.53 c	18.60 c
T3-Supre amino bacter	154.22 e	164.37 e	164.41 d	174.28 d	18.42 c	18.53 c
T4-Potassium silicate	164.64 d	172.44 d	175.54 c	185.25 c	18.64 c	18.63 c
T5-Roselle Extract	162.29 d	172.72 d	179.39 c	184.22 c	18.72 c	18.77 c
T6-Cinnamon Extract	166.86 d	174.09 d	176.55 c	184.79 c	18.74 c	18.79 c
T7-Ginger Extract	165.37 d	174.11 d	179.11 c	185.58 c	18.72 c	18.80 c
T8-Bio-fer. (Rhizo+Phos+Pota) +R.E	173.56 c	184.80 c	183.80 b	194.41 b	19.15 b	19.27 b
T9-Bio-fer. (Rhizo+Phos+Pota) +C.E	175.45 b	186.87 c	186.88 b	194.02 b	19.37 b	19.54 b
T10-Bio-fer. (Rhizo+Phos+Pota) +G.E	178.11 b	192.32 b	190.95 b	199.42 b	19.44 b	19.64 b
T11-Bio-fer. (Rhizo+Phos+Pota) +R.E+C.E+G.E	201.39 a	208.89 a	206.83 a	212.06 a	20.15 a	20.29 a

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

Rhizo= Rhizobactren

R.E= Roselle Extract

Phos= Phosphorene

C.E= Cinnamon Extract

Pota= Potassien

G.E=Ginger Extract

#### Fruit length (cm):

Regarding fruit length of Le-Conte pear fruit as affected by the different investigated treatments, data presented in Table (4) display clearly that such parameter was significantly responded to the different investigated treatments. Herein, the trees which were soil bio-fertilized coupled with application of the three investigated plant extracts (Roselle, Cinnamon and Ginger) at the rate of 5L/tree for each plant extract (T11) was the best one as it maximized le-Conte pear fruit length. Meanwhile, soil bio-fertilization with the three investigated bio-fertilizers combined with foliar spray with any of the three investigated plant extracts only i.e. (Roselle-T8) or (Cinnamon-T9) or (Ginger-T10) as well as spraying with either Ginger extract alone (T7) or K-silicate at 8ml/L (T4) came in the second rank in this respect. On the other hand, the least significant value of fruit length was recorded with untreated trees (T1) and in turn it was the inferior in this respect.

#### Fruit diameter (cm):

Concerning the impact of different investigated treatments on le-Conte pear fruit diameter, data presented in Table (4) indicate that fruit diameter was significantly responded to the different studied treatments. Furthermore, the longest fruit diameter (largest fruit width) of Le-Conte fruit was detected when the trees were soil bio-fertilized as well as sprayed with the three studied plant extracts, each at the rate of 5L/tree (Roselle, Cinnamon and Ginger-T11), followed by soil bio-fertilization conjoin with applying each of the three investigated plant extracts individually, (Roselle T8), (Cinnamon T9) and (Ginger T10) as those three treatments occupied the second rank in this respect. On the other hand, the minimum value of fruit diameter was observed with either untreated trees (T1) or with the trees which were sprayed with super amino bacter at 1.5 ml/L (T3) during both seasons of study. These results are in accordance with those found by Abdou (2013) on "Canino" apricot trees who found that application of some soil bio-stimulants (EM, bio-fertilizer, humic acid and compost tea)



increased fruit weight, fruit volume, fruit dimensions (length & diameter), fruit shape index. Sheren Abd-El-Hamid (2014) on Sukkary mango trees and El-Gioushy (2016) on Washington navel orange trees.

*Fruit shape index:*

Data dealing with fruit shape index are presented in Table (4). Such data reflect that soil bio-fertilization with the three studied bio-fertilizers (T2) and foliar spray with either super amino bacter at 1.5ml/L (T3) or K-silicate at 8.0ml/L (T4) or Roselle extract at 5L/tree (T5) or Cinnamon extract at 5L/tree (T6) or Ginger extract at 5L/tree (T7) significantly increased the value of fruit shape index as compared with the other studied treatments. On the other hand, the other investigated treatments including the untreated trees i.e., (T1, T8, T9 and T10) came in the second rank in this respect. It was noticed that bio-fertilization or spraying with super amino bacter or K-silicate, or Roselle or Cinnamon or Ginger extracts (T2 to T7) produced elongated fruits, while the rest treatments produced less elongated fruits. Apricot fruit shape index was significantly affected when the trees were soil bio-fertilized (Abdou, 2013).

**Table 4:** Fruit length (cm), fruit diameter (cm) and Fruit shape index of "Le-Conte" pear trees as impacted by NPK bio-fertilizers, super amino bacter, potassium silicate and some antioxidants plant extracts during 2015 and 2016 seasons.

Parameters Seasons	Fruit length (cm)		fruit diameter (cm)		Fruit shape index	
	2015	2016	2015	2016	2015	2016
Treatments						
T1-Water spray (control)	7.19 e	7.28 e	6.13 d	6.22 d	1.17 b	1.17 b
T2- Bio-fertilizers (Rhizo+Phos+Pota)	7.68 d	7.81 c	6.18 d	6.27 c	1.24 a	1.24 a
T3-Supre amino bacter	7.62 d	7.76 d	6.15 d	6.24 d	1.23 a	1.24 a
T4-Potassium silicate	7.94 b	8.03 b	6.34 c	6.34 c	1.25 a	1.26 a
T5-Roselle Extract	7.78 c	7.92 c	6.22 c	6.32 c	1.25 a	1.25 a
T6-Cinnamon Extract	7.76 c	7.94 c	6.26 c	6.37 c	1.24 a	1.25 a
T7-Ginger Extract	7.81 c	7.95 b	6.31 c	6.33 c	1.23 a	1.26 a
T8-Bio-fer. (Rhizo+Phos+Pota) +R.E	7.93 b	8.11 b	6.86 b	6.94 b	1.15 b	1.16 b
T9-Bio-fer. (Rhizo+Phos+Pota) +C.E	7.91 b	7.99 b	6.85 b	6.93 b	1.15 b	1.15 b
T10-Bio-fer. (Rhizo+Phos+Pota) +G.E	7.99 b	8.07 b	6.93 b	6.99 a	1.15 b	1.15 b
T11-Bio-fer. Rhizo+Phos+Pota) +R.E+C.E+G.E	8.45 a	8.82 a	7.02 a	7.07 a	1.20 a	1.24 a

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

Rhizo= Rhizobactren

R.E= Roselle Extract

Phos= Phosphorene

C.E= Cinnamon Extract

Pota= Potassien

G.E=Ginger Extract

**Fruit chemical properties:**

*Fruit flesh total soluble solids (TSS %):*

Regarding total soluble solids (TSS) of Le-Conte pear fruits as impacted by the different investigated treatments, data tabulated in Table (5) refer that the investigated parameter was significantly responded to the studied treatments. Herein, the trees which were soil bio-fertilized coupled with the three plant extracts foliar spray each at the rate of 5L/tree /extract (Roselle, Cinnamon and Ginger T11) was the superior one, as it recorded the highest significant value of TSS, followed by spraying with each individual plant extract associated with soil bio-fertilization (T8, T9 and T10) which represented the second rank in this respect. Such trend was true during 2015 and 2016 seasons of study. Meanwhile, soil bio-fertilization (T2) and sprayed trees with K-silicate at 8.0ml/L (T4) or Roselle extract (T5), or Cinnamon extract (T6) or Ginger extract (T7) at the rate of 5L/tree /extract, caused a little bit increment in TSS parameter as compared with the other investigated treatments and in turn, arranged in the third rank in this respect, during both seasons of study. On the other hand, the untreated trees with any of the investigated treatments reflected the least

value of TSS parameter and subsequently it was the inferior treatment when TSS parameter was concerned.

These results are in accordance with those found by Sahain *et al.*, (2007) on "Anna" apple and Ahmed *et al.*, (2007) on "Sewy" dates, they found that application of antioxidants namely ascorbic acid and citric acid each at 500 ppm, and vitamin B complex at 25 ppm either alone or at possible combinations increased fruit TSS content. These results also found by Fawzi *et al.*, (2010) who found that single or combined application of FYM, COM and Bio-fertilizers were significantly effective in improving fruit quality such as TSS and TSS/acid ratio in both seasons of study of "Le – Conte" pear tree.

*Fruit flesh total titratable acidity percentage:*

Regarding the relationship between the investigated treatments and total acidity percentage, data tabulated in Table (5) display that the studied parameter was significantly responded to the studied treatments. Meanwhile, the least value of fruit total acidity % was associated with those sprayed trees with the three investigated plant extracts (Roselle, Cinnamon and Ginger) at the rate of 5L/tree/extract coupled with soil bio-fertilization (T11), such treatment minimized the investigated parameter as compared to the other investigated treatments during both seasons of study. Furthermore, soil bio-fertilization combined with each individual plant extract foliar spray (Roselle – T8), (Cinnamon –T9) and (Ginger T10) resulted in acceptable significant lower values of fruit acidity % and in turn, arranged in the second rank in this respect. On the other hand, the highest value of fruit acidity % was connected with untreated trees with any of the investigated treatments (control-T1), during the 1<sup>st</sup> and 2<sup>nd</sup> seasons of study. In this concern, our results are confirmed by Aml- Yousef, *et al.*, (2009) who found that the three antioxidants ( $\alpha$ -tocopherol, nicotinamide and ascorbic acid) at 90 mg/l decreased fruit acidity of "Picaul" olive trees. In addition, Ahmed *et al.*, (2013) found that four sprays of extracts of roselle at 0.2 %, seaweed at 0.2 % and turmeric at 0.1 % gave the least acidity fruit juice of Valencia orange trees.

**Table 5:** (TSS) %, total acidity % and TSS/acid ratio of "Le-Conte" pear trees as impacted by NPK bio-fertilizers, super amino bacter, potassium silicate and some antioxidants plant extracts during 2015 and 2016 seasons.

Parameters Seasons	(TSS) %		Total acidity %		TSS/acid ratio	
	2015	2016	2015	2016	2015	2016
T1-Water spray (control)	12.22 e	12.26 e	0.276 a	0.276 a	44.28 f	44.42 e
T2- Bio-fertilizers (Rhizo+Phos+Pota)	13.60 c	13.66 c	0.264 b	0.263 b	51.52 e	51.94 d
T3-Supre amino bacter	13.36 d	13.46 d	0.264 b	0.262 b	50.61 e	51.37 d
T4-Potassium silicate	13.60 c	13.70 c	0.264 b	0.262 b	51.51 e	52.29 d
T5-Roselle Extract	13.61 c	13.65 c	0.257 c	0.254 c	52.96 d	53.74 c
T6-Cinnamon Extract	13.80 c	13.84 c	0.252 d	0.251 d	54.76 c	55.14 c
T7-Ginger Extract	13.60 c	13.65 c	0.253 d	0.249 d	53.75 c	54.82 c
T8-Bio-fer. (Rhizo+Phos+Pota) +R.E	14.00 b	14.08 b	0.249 e	0.245 e	56.22 b	57.47 b
T9-Bio-fer. (Rhizo+Phos+Pota) +C.E	14.14 b	14.14 b	0.248 e	0.244 e	57.02 b	57.95 b
T10-Bio-fer. (Rhizo+Phos+Pota) +G.E	14.24 b	14.27 b	0.249 e	0.242 e	57.19 b	58.97 b
T11-Bio-fer. (Rhizo+Phos+Pota) +R.E+C.E+G.E	15.44 a	15.49 a	0.239 f	0.233 f	64.60 a	66.48 a

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

Rhizo= Rhizobactren

R.E= Roselle Extract

Phos= Phosphorene

C.E= Cinnamon Extract

Pota= Potassien

G.E= Ginger Extract

*TSS/acid ratio:*

Data of TSS/acid ratio parameter of Le-Conte pear fruits as influenced by the differential investigated treatments are presented in Table (5). It was quite clear that there were significant differences among the investigated treatments in relation to the studied parameter. Hence, soil-bio fertilization coupled with the three plant extracts foliar spray at the rate of 5L/tree/extract (Roselle,

cinnamon and Ginger) T11 proved to be the most effective one in this respect, as it reflected the highest significant value of TSS/ acid ratio as compared with the other investigated treatments during both seasons of study. In addition, spraying with each individual plant extract at the rate of 5L/tree/ combined with soil bio fertilization (T8, T9 and T10) improved TSS/acid ratio as compared with the other studied treatments. Meanwhile, sprayed trees with each individual plant extract each of the rate of 5L/tree in the absence of soil fertilization (T5, T6 and T7) reflected less response to TSS/acid ratio than those treated with (T8, T9 and T10) and in turn stranded the third rank in this respect. On the other hand, the untreated trees (control. T1) produced fruits having the least value of TSS/acid ratio during both seasons of study. These results are in agreement with those stated by EL-Gioushy( 2016) who found that foliar spraying with salicylic acid (0.0, 100 and 200 ppm) in combination with potassium silicate (0.05, 0.1, 0.15 and 0.2 %) solutions improved fruit TSS/Acid ratio) of Washington navel orange trees.

#### *Fruit pulp sugar content:*

Concerning the impact of different investigated treatments on le-conte pear fruit sugar content, data presented in Table (6) indicates that fruit total sugars content was significantly responded to the studied treatments. Furthermore, the trees which were sprayed with the three plant extracts together each at 5l/tree combined with soil bio-fertilization (T11) produced fruits having the highest sugar content as compared with the other investigated treatments followed by spraying with each individual plant extract + soil fertilization (T8, T9 and T10) which came in the second rank. Such trend was true during both seasons of study. However, spraying with any of the three plant extracts (Roselle or Cinnamon or Ginger) alone (T5, T6, and T7) or K. silicate at 8.0ml/L (T4) or soil-bio fertilization alone (T2) came in the third rank in this respect. On the other way around, the reverse was true with those untreated trees with any of the investigated treatments (control. T1) which gave the lowest sweetened fruits, followed in ascending order by spraying with super amino bacter at 1.5ml/L(T3) during both seasons of study.

These results are in harmony with those reported by El-Sharony *et al.*, (2015) who reported that foliar spray with some plant extracts (algae at 2%, roselle at 10% and garlic at 5%) applied four times along each season (at full bloom, fruit set, one and two months later from fruit set) either each extract was sprayed solely or in different combinations enhanced fruit sugar content of Fagri Kalan mango fruits. In this concern, Fawzi *et al.*, (2010) mentioned that bio-organism fertilization improved le-Conte pear fruit sugar content. Mansour *et al.*, (2008) found that the combined application between some nutrients and citric acid was very effective in stimulating TSS and total sugar content of le-Conte pear fruit.

#### *Vitamin C content (V.C.):*

Data concerning the relationship between fruit ascorbic acid content of Le-Conte pear fruit and the different investigated treatments are presented in Table (6). It is quite clear from the data that there were two distinguished trends of treatments in the 1<sup>st</sup>season. The first one was associated with those trees which were soil bio-fertilized combined with either one of the three plant extracts foliar spray (T11) or spray with Ginger extract alone (T10) or Cinnamon extract alone (T9) at the rate of 5L/tree /each extract, as such three treatments (T11, T10 and T9) recorded the highest value of the investigated parameter during both seasons of study. The second trend was connected with the addition of either soil bio fertilizers, (T2) or spraying with super amino bacter at the rate of 1.5ml/L (T3) or K-silicate at 8.0ml/L (T4) or each individual plant extract (Roselle T5) or (Cinnamon T6) or (Ginger T7) as the abovementioned six treatments came in the second rank. Besides, the untreated trees (control-T1) reflected the least value of fruit ascorbic acid content. Such trend was true during both seasons of study. Meanwhile in the 2<sup>nd</sup>season, treatment (T11) was the superior one followed by spraying with either Ginger extract (T10) or Cinnamon extract (T9). These results are in harmony with those reported by Fouad (2014) who found that foliar sprays with plant extracts (Roselle, Cinnamon and Ginger), increased fruit ascorbic acid content of Valencia orange trees. Also, EL-Gioushy, and Baiea, (2015) on canino apricot.

**Table 6:** Total fruit sugar and vitamin C content of "Le-Conte" pear trees as impacted by NPK bio-fertilizers, super amino bacter, potassium silicate and some antioxidants plant extracts during 2015 and 2016 seasons.

Parameters	Seasons	Total fruit sugar		Vitamin (c) mg/100g.	
		2015	2016	2015	2016
T1-Water spray (control)		10.55 e	10.57 e	2.42 c	2.46 e
T2- Bio-fertilizers (Rhizo+Phos+Pota)		11.52 c	11.54 c	2.68 b	2.69 d
T3-Supre amino bacter		11.27 d	11.29 d	2.64 b	2.65 d
T4-Potassium silicate		11.62 c	11.63 c	2.56 b	2.57 d
T5-Roselle Extract		11.61 c	11.63 c	2.64 b	2.64 d
T6-Cinnamon Extract		11.55 c	11.57 c	2.69 b	2.70 d
T7-Ginger Extract		11.70 c	11.71 c	2.80 b	2.83 c
T8-Bio-fer. (Rhizo+Phos+Pota) +R.E		11.92 b	11.96 b	2.56 b	2.87 c
T9-Bio-fer. (Rhizo+Phos+Pota) +C.E		11.90 b	11.94 b	3.01 a	3.07 b
T10-Bio-fer. (Rhizo+Phos+Pota) +G.E		11.93 b	11.94 b	2.94 a	3.03 b
T11-Bio-fer. (Rhizo+Phos+Pota) +R.E+C.E+G.E		12.18 a	12.28 a	3.13 a	3.23 a

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

Rhizo= Rhizobactren

R.E= Roselle Extract

Phos= Phosphorene

C.E= Cinnamon Extract

Pota= Potassien

G.E=Ginger Extract

## References

- Abdelaal, S.H., E. Mohamed and S.S. Kabeil, 2010. Microbial bio-fertilization approaches to improve yield and quality of Washington navel orange and reducing the survival of nematode in the soil; J. of American Sci., 6(12): 264-272.
- Abdou, N.A., 2013. Physiological studies on apricot trees fertilization grown in Ismailia governorate. Ph. D. Dissertation Faculty of Agriculture Benha University.
- Ahmed, F.F., A.E.M. Mansour, M.A.A. Montasser, M.A. Merwad and E.A.M. Mostafa, 2013. Response of Valencia orange trees to foliar application of roselle, turmeric and seaweed extracts. Journal of Applied Sciences Research, 9(1): 960-964.
- Ahmed, F.F., Y. Mohamed and B.M. Abdalla, 2007. The relation between using some antioxidants and productivity of "Sewy" date palm. Minia Journal of Agriculture Research and Development. 27(4): 753-770.
- Aml -Yousef, R.M., S. Hasnaa- Ayad and M.M. Saleh, 2009. The beneficial effect of spraying some antioxidant vitamins on fruit quality, oil composition and improving oil characteristics of "Picaul" olive. World J. Agric. Sci., 5(S): 871-880.
- Annual Reports of Statistical Institute and Agricultural Economic Research in Egypt, 2014.
- Association of Official Analytical Chemists (A.O.A.C). 1995. "Official methods of analysis, the A.O.A.C 14<sup>th</sup> Ed., Benjamin Franklin Station, Washington, D.C.U.A. pp: 490-510.
- Dina-Abdallah, H.K., 2013. The use of phosphate solubilizing bacteria and antioxidants for improving fruit quality of Earligrande Peach. Ph.D. Dissertation Faculty of Environmental Agricultural Sciences, El-Arish, Suez Canal University.
- Dubois, M., K.A. Gilles, J.K. Hamilton, P.A. Rebres and F. Smith, 1956. Colorimetric methods for determination of sugars on related to substances. Analytical Chemistry, 28(3): 350-356.
- Duncan, D.B., 1955. Multiple ranges and multiple F. test. Biometrics, 11: 1-42.
- El- Gioushy, S.F., 2016. Productivity, fruit quality and nutritional status of washington navel orange trees as influenced by foliar application with salicylic acid and potassium silicate combinations. Journal of Horticultural Science & Ornamental Plants, 8(2): 98-107.
- El-Badawy, H.E.M., 2013. Effect of Some antioxidants and micronutrients on growth, leaf mineral content, yield and fruit quality of canino apricot trees. Journal of Applied Sciences Research, 9(2): 1228-1237.
- EL-Gioushy, S.F. and M.H.M. Baiea, 2015. Partial substitution of chemical fertilization of canino apricot by bio and organic fertilization. Middle East Journal of applied sciences, 5(4): 823-832.
- El-Sayed, M.A., M.A. Ahmed and A.H. Ali, 2000. Response of Flam seedless grapevine to application of ascorbic acid. The 2<sup>nd</sup> Conf. Sci. Assuit, Egypt, pp: 317-340.

- El-Sharony, T.F., S.F. El-Gioushy and O.A. Amin, 2015. Effect of Foliar application with algae and plant extracts on growth, yield and fruit quality of fruitful mango trees Cv. Fagri Kalan., *J Horticulture*, 2: 162. doi:10.4172/2376-0354.1000162.
- Epstein, E., 1999. Silicon. *Annual Rev. of Plant physiology and plant molecular biology*, 50: 641-664.
- Fawzi, F.M., A.D. Elham and E.A. Kandil, 2010. Effect of organic and bio-fertilizers and magnesium sulphate on growth yield, chemical composition and fruit quality of "Le-Conte" Pear trees. *Nature and Science*. 8(12): 273-280.
- Fayek, M.A., T.A. Fayed, E.M. El-Fakhrani and N. Shayma-Salam, 2014. Yield and fruit quality of "Le- cont" pear trees as affected by compost tea and some antioxidants applications. *Journal of Horticultural Science & Ornamental Plants*, 6(1): 01-08.
- Fouad, M.H., 2014. Response of Valencia orange trees to antioxidants and bio fertilization. Ph.D. Dissertation Faculty of Environmental Agricultural El-Arish, Suez Canal University.
- Jackson, M.L., 1967. *Soil chemical analysis*. Prentice – Hall. Inc. Englewood Clif., N, I. Library Congress, U. S. A.
- Kabeel, H., G.S. Abd El-Latif and A.A. Khalil, 2005. Effect of soil application of different mineral and bio-fertilizer treatments on growth, fruiting parameters, fruit properties and leaf nutrient content of "Canino" apricot trees. *J. Agric. Sci. Mansoura Univ.*, 30(3): 1583-1594.
- Mansour, A.E.M., F.F. Ahmed, E.A. Shaaban and A. Amera- Fouad, 2008. The beneficial of using citric acid with some nutrients for improving productivity of le-Conte pear trees. *J. Agric .and bio. Sci.*, 4(3): 245-250.
- Nahla, A.I., 2009. Studies on preharvest or postharvest treatments of some flowers and/or foliage plants and/or green. Ph.D. Dissertation, Department of Horticulture, Faculty of Agriculture, Suez Canal University.
- Phyllis, A.B. and F.B. James, 1985. *Prescription for Nutritional Healing* .Every member of Penguin Putnam Inc, New York.
- Piper, C.S., 1947. *Soil and plant Analysis*. Inter. Sci. Publishers. New York, pp: 213-217.
- Sahain, M.F.M., E.Z. El- Motty, M.H. El- Shiekh and L.F. Hagagg, 2007. Effect of some bio-stimulant on growth and fruiting of Anna apple trees in newly reclaimed areas. *Research Journal of Agriculture and Biological Sciences*, 3(5): 422-429.
- Shaaban, M.M., A.M.K. Abd El-Aal and F.F. Ahmed, 2011. Insight into the effect of salicylic acid on apple trees growing under sandy saline soil. *Research Journal of Agriculture and Biological Sciences*, 7(2): 150-156.
- Sheren- Abd El- Hamied, A., 2014. Improving growth and productivity of “Sukkary” Mango trees grown in north sinai using extracts of some brown marine algae, yeast and effective microorganisms 1-mineral content of leaves and fruit growth aspects. *Middle East Journal of Agriculture Research*, 3(2): 318-329.
- Smirnoff, N., 1996. The function and metabolism of ascorbic acid. *Plant. Ann. Bot.* 87: 661-669.
- Snedecor, G.W. and W.G. Cochran, 1980. *Statistical Methods*. Oxford and J.B.H. publishing com. 7<sup>th</sup> edition, p: 593.
- Wally, A.S., N.A. Abd El-Megeed and I.I. Fatma-Abou-Grah, 2012. Effect of gibberellic acid and two antioxidants on yield and fruit quality of ‘Canino’ apricot trees. *Minia International Conference for Agriculture and Irrigation in the Nile Basin countries*, 26<sup>th</sup> March. El-Minia, Egypt.