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THE USE OF SOME ORGANIC AND BIO-FERTILIZERS FOR EARLIGRANDE PEACH TREES FERTILIZATION UNDER NORTH SINAI CONDITIONS A: VEGETATIVE GROWTH AND LEAF CHEMICAL CONTENT

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ABSTRACT

This study aimed to examine the effect of organic sources such as fish scrap, goat manure and olive pomace and bio-fertilizer applications (Nitrobein or Rhizobacterein) on vegetative growth and leaf chemical content of Earligrande peach trees during the two consecutive seasons of 2013/2014 and 2014/2015 at the private Farm at El-Kharafen village in Rafah district, North Sinai Governorate, Egypt. The type of application was surface and trench. Results indicated that fish scrap treatment recorded the highest effect on vegetative growth and leaf nutrients content compared with other organic fertilizer sources in both seasons. Rhizobacterein increased vegetative growth and had greater leaf nutrients content than Nitrobein during both seasons. Trench application method achieved a high values in these parameters compared to surface application method in both seasons. Finally, the interactions between fish scrap with Rhizobacterein under trench application method had the highest value for each of vegetative growth, leaf nutrient content and pigments in both seasons.

Key words: Peaches (*Prunus persica* L.), fish scrap, goat manure, trench application, Rhizobacterein fertilizer.

INTRODUCTION

Peach (*Prunus persica* L.) are native to family Rosacea. It is one of the most important deciduous fruit grown in Egypt, while the harvested area reached about 80609 feddan and produced 273256 tons **(FAO, 2011)**. The extension of the cultivated area nowadays is due to its highly economic value, exporting potential and introducing new low chilling peach cultivars such as Earligrand and Florida Prince which are an early ripening varieties and its exhibited a high adaptation with the local environmental conditions. **(Shaltout, 1987 and El-Kosary *et al.,* 2013)**. North Sinai Governorate considered one of the focus points of peach cultivation in a semi-arid region which poor in organic matter and low cation exchange and low water holding capacity with a total precipitation of about 200 mm/year, concentrated chiefly in January, February and March (**Ahmed and Morsy 2001).**

In Egypt, the total area of peach trees declined from 44850 feddan in 2010 to 28355 feddan in 2017. Average production in this region declined from 3.14 ton/feddan in 2010 to 1.64 ton/feddan in 2017 according to **Ministry of Agriculture, A.R.E., (2017).** In this respect, organic fertilizations are considered a naturally nitrogen source such as fish scrap, goat manure and olive pomace **(Ganzhara,**

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1998) that increase soil total organic nitrogen content and soil fertility (**Kavdir *et al.,* 2008)**. On the other hand, it is important tool, due to its multiple effects as a foundation for clean agriculture, sustainable agriculture, soil condition and a source of slow release fertilizers **(Vogtman and Fricke, 1989, Bahaa, 2007)**.

On the same way, biofertilizers are known to improve fixation of nutrients in the rhizosphere, produce growth stimulants for plants, improve soil stability and provide biological control.

Applying biofertilizers has been a good strategy in controlling chemical fertilization, reducing environmental pollution and obtaining safe products **(Hoda, 2012)**. Biofertilizers consist mainly of beneficial microorganisms that can release nutrients from raw materials and plant residues in the soil and make them available commercially where specific strains are used as biological fertilizers (**Abd El-Gleel *et al.,* 2014)**.

Therefore, the main target of this study is to examine the effect of organic fertilizers sources, type of application and bio-fertilizer applications on vegetative growth, leaf mineral content and pigments of Earligrand peach trees under North Sinai conditions.

MATERIALS AND METHODS

This study was carried out during the two consecutive seasons of 2013/2014 and 2014/2015 at a private Farm at El-Kharafen village in Rafah, North Sinai Governorate, Egypt. One hundred and twenty eight "Earligrande" peach trees (*Prunus persica* L.) about twelve-years-ol district grown in sandy soil and budded on "Bitter Almond" (*Prunus amygdalus* L.) were chosen according to their similarity in growth, vigor, productivity and uniform as possible and devoted for achieving this experiments, the annual pruning is a critical management practice for trees similarity (200 – 250 units of fruiting shoots per tree). The trees were planted at 5 × 5 m apart and all tested trees received regularly the annual horticultural practices except for mineral fertilization while the untreated trees including the control was fertilized with ammonium sulfate, super phosphate and potassium sulfate at the rate of 200, 75 and 150 kg per feddan, respectively and depended only on the rainfall which amounted to about 204.71 mm.year^{-1}.

On mid-September soil samples were collected from peach orchard for chemical analysis according to **Richard's, (1954)** from the successive depth of three profiles (0-15 cm), (15-30 cm) and (30-45 cm) (Table 1).

Table 1. Soil chemical analysis of the investigated peach orchard at Rafah region in North Sinai Governorate.

Soil Depth(cm)	EC (dS.m^{-1})	pH	Cations (meq.l^{-1})				Anions (meq.l^{-1})				$CaCO_3$
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{-}	
0 – 15	0.31	7.81	2.33	0.09	0.65	0.03	-	0.85	1.05	1.25	1.45
15 – 30	0.56	8.50	1.90	1.42	2.07	0.21	-	2.50	1.70	1.40	4.21
30 – 45	0.46	8.70	2.01	1.38	0.86	0.34	-	2.61	1.61	0.38	4.30

Treatments and Experimental Design

Organic Fertilizer Source

According to the recommendation of Water and Soils Research Institute Ministry of Agriculture, Egypt. The actual nitrogen (g tree^{-1}. Year^{-}) required to peach tree older than 6 years is 500 g. tree^{-1}. Year^{-1}. Thereupon half of the required nitrogen (250 g N. tree^{-1}. Year^{-1}) was suggested to be satisfied through one of the organic fertilizer sources according to its content of nitrogen fish scrap (9.0 % N) about 2.77 Kg. tree^{-1}. Year^{-1}, goat manure (1.25 % N) about 20.0 Kg. tree^{-1}. Year^{-1} and olive pomace (2.50% N) about 10.0 Kg. tree^{-1}. Year^{-1}.

Methods of organic fertilizer applications

Two methods of organic fertilizers were selected. The first method was surface application which applied superficially and digged in the soil during deep hand hoeing practice (about 5 cm depth) on December of each season. The second method was trench application (subsurface) application using two trenches (100 cm length x 30 cm width x 25 cm depth) were digged on both sides of tree at 1 m apart from the tree trunk, then the estimated amount of each organic fertilizer was divided equally and applied in the two trenches and covered with soil in December of each season.**(El-Deeb, 2003)**.

Biofertilizers Applications (N-fixing bacteria)

The remaining N-requirement for each tree was assumed to be partially satisfied through using N-fixing fertilizers. Rhizobacterein fertilizer is a mixture of nitrogen fixing bacteria (*Azotobacter chroococcum* and *Azospirillum brasilense*) while Nitrobein fertilizer containing *Azospirillum* spp and *Azotobacter chroococcum*. Such products are produced by the General Organization for Agric. Equalization Fund, Ministry of Agric., Egypt. on late October of each season, the biofertilizers (50 g from Nitrobein or Rhizobacterein per tree) were applied in trenches (40 cm length x 20 cm width x 5 cm depth) were digged on both sides of tree at 1 m apart from the tree trunk **(El-Deeb, 2003)**.

Measurements

Tree Height, Trunk Thickness and Tree Canopy Circumference

Tree height (m) of each tree was measured from the soil surface to the main branch apex. At the end of the both seasons (late August) trunk thickness (cm) was measured at fixed point (10 cm above the soil surface) and tree canopy circumference was measured (m) **(El-Deeb, 2003)**.

Number of Shoots Per Branch, Shoots Length and Number of Leaves Per Shoot

On early March, for each tree five branches distributed around the tree canopy were labeled in each season. Number of shoots per branch was determined and recorded. Fifty uniform shoots was chosen at random and labeled. Twenty previously tagged shoots per tree were randomly selected on late August to estimate shoot length (cm) and number of leaves per shoot **(El-Deeb, 2003)**.

Leaf Area

Leaf area was measured by counting the squares to the nearest cm^2 by using the fresh weight method. Certain known disks were taken from the leaves with a cork borer and weighted the leaf area was calculated using the following formula:

$$\text{Leaf area (cm}^2) = \frac{\textit{Leaf fresh weight (g)}}{\textit{Disk fresh weight}} \times \textit{Area of disks} \text{ (cm}^2)$$

Leaf Pigments Content

On mid-June of both seasons, leaf samples consisting of 10 mature fresh leaves were selected from the middle of some the previously selected shoot were taken to determine the Chlorophyll a & b and carotenoids contents which were estimated according to the method described by **Arnon (1949)**. Fresh leaves extracted with 85% acetone and absorbance of the supernatant was measured at 662, 644 and 440.5 nm, using Spectrophotometer (Model 6300 Jenway Co.). Concentration of total pigments as mg g^{-1} fresh weight (F.W) was calculated.

Leaf Nutrient Content

Nitrogen, Phosphorus and Potassium Contents

Nitrogen content was determined by micro kjeldahl method as described by **Pregl (1945)**. Phosphorus content was determined colorimetrically using the Spectrophotometer (Model 1600 Jenway Co.) according to **Jackson (1958).** Potassium content was determined using the flame photometer according to **Brown and Lilliland (1946).**

Calcium, Magnesium, Manganese, Zinc and Iron Contents

Calcium (%), magnesium (%), zinc (ppm), iron (ppm) and boron (ppm) concentrations were determined using the Atomic Absorption Spectrophotometer (Perkin-Elmer Model 305B). All determinations were carried out by using air-acetylene gas mixture at rate of 5:1 L. min^{-1} **(El-Deeb, 2003)**.

Statistical Analysis

The results were arranged in a randomized complete block design (three factors split split plots design), while in the third stage results were arranged in a randomized complete block design (for factors strip plots) using MSTATC computer program **(Russell, 1986)** with four replicates and each replicate was represented by two trees. Duncan's multiple range test was used for comparison between means. Different alphabetical letters in the column are significantly differed at (0.05) level of significance **(Duncan', 1955).**

RESULTS AND DISCUSSION

Tree Height, Trunk Thickness and Tree Canopy Circumference

Results given in Table 2 show that, the tree height was significantly increased by adding organic fertilizers. The fish scrap treatment recorded the highest effect on tree height as compared with other organic fertilizer sources (2.46 and 2.50m), followed by goat manure treatment (2.34 and 2.35m) in both seasons, respectively. Tree canopy circumference and trunk thickness were increased by adding organic fertilizer sources. Fish scrap recorded the highest effect in first season and all organic manure treatments in second season. The most depressive effect was always concomitant to the control treatment. These results go in line with those reported by **El-Kosary *et al.* (2013)**, who found that using high dose of organic fertilization (50 kg/tree olive solid waste) had enhanced the performance of Earligrande peaches under Northern Sinai conditions in terms of vegetative growth.

Results from the same table clear that surface application achieved high values of tree height, tree canopy circumference and trunk thickness compared to trench application method in both seasons. As for the specific effect of biofertilizers N-fixing bacteria practices, Results showed that Rhizobacterein significantly increased tree height and trunk thickness (2.34 and 2.37m) and had a greater values than Nitrobein (2.31 and 2.31m) during both seasons, respectively. While Nitrobein bacteria treatment had a greater value of tree canopy circumference than Rhizobacterein in first season, but there was no significant effect between the two sources of bacteria in second season. These results are in agreement with those reported by **El-Gioushy and Baiea (2015)** in “Canino” apricot trees. In the same line, Table (3) shows that the interaction between fish scrap with Rhizobacterein under surface

Table 2. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on Earligrande peach trees parameters during 2014 and 2015 seasons.

Treatment	Tree height (m)		Tree canopy (m)		Trunk thickness (cm)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)						
Fish scrap	2.46 a	2.50 a	13.05 a	12.20 a	83.40 a	85.13 a
Goat manure	2.34 b	2.35 b	11.73 ab	12.59 a	66.81 b	72.61 b
Olive pomace	2.27 c	2.29 b	12.44 ab	11.65 a	56.85 c	62.57 c
Control	2.23 c	2.21 c	10.95 b	10.19 b	52.35 d	51.71 d
Specific effect of methods of organic fertilizer application (MA)						
Surface application	2.34 a	2.34 a	12.25 a	11.95 a	65.90 a	69.18 a
Trench application	2.32 b	2.34 a	11.84 b	11.36 b	63.81 b	66.83 b
Specific effect of Biofertilizers N-fixing bacteria(BA)						
Rhizobacterein	2.34 a	2.37 a	11.84 b	11.55 a	66.78 a	70.47 a
Nitrobein	2.31 b	2.31 b	12.24 a	11.76 a	62.93 b	65.54 b

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

Table 3. Interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on EarliGrande peach trees parameters during 2014 and 2015 seasons.

Treatment			Tree height (m)		Tree canopy (m)		Trunk thickness (cm)	
OF	MA	BF	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Fish scrap	Surface	Rhizobacterein	2.50 a	2.56 a	13.61 a	12.45 abc	88.74 a	91.02 a
		Nitrobein	2.45 ab	2.44 c	12.40 ab	13.25 a	82.14 c	82.34 c
	Trench	Rhizobacterein	2.48 a	2.53 ab	12.81 ab	12.68 ab	85.78 b	87.48 b
		Nitrobein	2.43 b	2.49 b	13.39 a	10.41 cd	76.94 d	79.69 d
Goat manure	Surface	Rhizobacterein	2.35 c	2.42 cd	12.58 ab	12.65 ab	71.00 e	75.47 e
		Nitrobein	2.35 c	2.28 f	12.21ab	13.25 a	65.67 g	73.95 ef
	Trench	Rhizobacterein	2.33 c	2.37 de	9.45 b	12.08 a-d	67.78 f	72.56 f
		Nitrobein	2.36 c	2.35 e	12.69 ab	12.38 abc	62.81 h	68.47 g
Olive pomace	Surface	Rhizobacterein	2.34 c	2.38 de	12.53 ab	11.40 a-d	58.60 i	67.98 g
		Nitrobein	2.27 de	2.25 fg	12.77 ab	12.21 a-d	56.36 j	59.27 i
	Trench	Rhizobacterein	2.28 d	2.29 f	11.88 ab	10.75 bcd	57.65 ij	65.87 h
		Nitrobein	2.21 f	2.27 f	12.60 ab	12.25 a-d	54.81 k	57.18 i
Control			2.23 ef	2.21 g	10.95 ab	10.19 d	52.35 l	51.71 j

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

application method was highly interactive for tree height, tree canopy circumference and trunk thickness. While, control treatment (without organic fertilizers) had the least values in this respect during both seasons.

Shoot length and Number of Shoots Per Branch

Table (4) discloses that shoot length and number of shoots per branch were positively correlated with adding organic fertilization. Fish scrap treatment showed to be the most significantly effected on shoot length and number of shoots per branch as compared to goat manure and olive pomace treatments in both seasons. While, control treatment recorded the least value in this respect during both seasons. Similar observations were reported by **Moharam and Zaen El-deen (2011)** who found that the increase of growth (shoot length) of peach trees due to combination of NPK and OSW compost compared with only NPK and only OSW either fresh or compost may be due to the fact that compost contains high amount of available nutrients which improve tree growth. Also, the same table, shows that trench application achieved a height effect on shoot length of "Earlygrand" peach trees compared to surface application in both seasons. No significant differences between surface and trench application in number of shoots per branch during both seasons.

Meanwhile, results showed that biofertilizers N-fixing bacteria practices significantly increased shoot length and number of shoots per branch. The highest values in the both seasons was recorded by Rhizobacterein bacteria than Nitrobein bacteria in both seasons. These results tend to agree with those reported by **Sahain, *et al.* (2007) and EL-Gioushy and Baiea (2015)** who concluded that Rhizobacterein enhanced shoot length of Anna Apple and “Canino” apricot trees compared with Nitrobein application. **Ibrahim *et al.* (2005)** on “Canino” apricot, who reported that, microbial fertilization led to a great promotion in all trees characters.

Also, data of Table (5) show that the interaction between fish scrap application with Rhizobacterein bacteria under trench application method were highly interactive for shoot length and number of shoots per branch during both seasons. While, olive pomace × Nitrobein under surface application method in first season and control treatment (without organic fertilizers) in second season had the least values in this respect. The other interactions came in between effect.

Leaves Per Shoot and Leaf Area

As for the specific effect of organic fertilizer source treatments on number of leaves per shoot, data of Table (4) show that all the organic fertilizer treatments influenced the number of leaves per shoot and leaf area. Moreover, the trees were fertilized by fish scrap had the highest significant values in both seasons. Meanwhile, non-organic fertilized trees (control) produced the least significant effect in this respect. This pattern is similar to that reported by **Al-Rawi *et al.,* (2016)** on "Peento" peach cultivar and **El-Deeb (2003)** who found that leaf surface area were remarkably increased with fish scrap fertilizer. Regarding the specific effect of methods of organic fertilizer application on number of leaves per shoot, data of Table (4) show that trench application recorded lowest value of No. leaves per shoot and leaf area during both seasons. These results go in line with those reported by **El-Deeb, (2003)**, on Manzanillo olive trees.

Results of Table (4) reveal that both biofertilizers N-fixing bacteria practices caused a high significant increase in number of leaves per shoot in both season. Wherein, the Rhizobacterein treatment gave the highest value of least area in first season.

Table 4. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on shoot length, No. of leaves per shoot, number of shoots per branch and leaf area of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment	Shoot length (cm)		No. of shoots / branch		No. of leaves / shoot		Leaf area (cm^2)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)								
Fish Scrap	2.46 a	2.50 a	13.05 a	12.20 a	83.40 a	85.13 a	8.76 a	8.80 a
Goat manure	2.34 b	2.35 b	11.73 ab	12.59 a	66.81 b	72.61 b	8.61 a	8.63 b
Olive pomace	2.27 c	2.29 b	12.44 ab	11.65 a	56.85 c	62.57 c	7.80 b	8.47 c
Control	2.23 c	2.21 c	10.95 b	10.19 b	52.35 d	51.71 d	8.37 ab	8.33 d
Specific effect of methods of organic fertilizer application(MA)								
Surface application	2.34 a	2.34 a	12.25 a	11.95 a	65.90 a	69.18 a	8.23 b	8.58 a
Trench application	2.32 b	2.34 a	11.84 b	11.36 b	63.81 b	66.83 b	8.54 a	8.53 a
Specific effect of Biofertilizers N-fixing bacteria (BF)								
Rhizobacterein	2.34 a	2.37 a	11.84 b	11.55 a	66.78 a	70.47 a	8.24 b	8.58 a
Nitrobein	2.31 b	2.31 b	12.24 a	11.76 a	62.93 b	65.54 b	8.52 a	8.52 a

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

Table 5. The interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on shoot length, No. of leaves per shoot, number of shoots per branch and leaf area of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment			Shoot length (cm)		No. of shoots / branch		No. of leaves / shoot		Leaf area (cm^2)	
OF	MA	BF	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
Fish scrap	Surface	Rhizobacterein	34.33 a	35.00 a	13.00 a	15.33 a	58.00 ab	63.00 b	8.81 a	8.89 a
		Nitrobein	26.66 c	33.00 b	11.33 bc	13.00 bc	55.33 bcd	60.33 cd	8.74 ab	8.81 b
	Trench	Rhizobacterein	33.66 a	31.33 b	12.00 ab	14.33 ab	58.33 a	65.00 a	8.78 ab	8.78 c
		Nitrobein	29.00 b	33.00 b	11.66 ab	12.00 cd	57.33 abc	62.00 bc	8.71 abc	8.71 d
Goat manure	Surface	Rhizobacterein	24.00 d	32.00 b	9.33 def	12.00 cd	52.00 ef	57.00 ef	8.67 bc	8.72 d
		Nitrobein	23.00 de	29.33 c	10.33 b-e	10.66 def	55.00 b-e	57.33 ef	8.59 c	8.61 f
	Trench	Rhizobacterein	27.00 c	32.00 b	10.66 bcd	11.33 cde	53.00 def	58.66 de	8.63 bc	8.63 e
		Nitrobein	27.00 c	32.00 b	9.66 c-f	12.33 cd	55.66 a-d	55.33 fg	8.56 c	8.56 g
Olive pomace	Surface	Rhizobacterein	20.33 fg	24.33 e	11.00 bcd	9.66 ef	54.33 c-f	56.00 fg	5.85 e	8.52 h
		Nitrobein	18.66 h	22.00 f	8.33 fg	9.00 f	51.66 f	52.00 hi	8.45 cd	8.45 j
	Trench	Rhizobacterein	21.33 f	27.00 d	8.66 efg	10.33 def	57.00 abc	54.66 g	8.49 cd	8.49 i
		Nitrobein	19.00 gh	27.00 d	7.33 g	10.33 def	53.33 def	52.33 h	8.42 cd	8.42 k
Control			21.66 ef	18.00 g	8.66 efg	7.00 g	55.00 b-e	50.00 i	8.37 d	8.33 l

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

While, no significant differences between different types of biofertilization in this respect in second season. These results go in line with those reported by **Ibrahim *et al.* (2005)** on "Canino" apricot, who reported that microbial fertilization led to a great promotion in tree characters. Also, **Mansour (1998)** found that Nitrobein had higher leaf area on Anna apple trees and there was a gradual increase in leaf area with increasing dose of application.

Regarding the interaction between organic fertilizer source, organic fertilizer application methods and biofertilizers N-fixing bacteria. Table (5) reveals that the fish scrap application with Rhizobacterein bacteria under trench method induced a significantly stimulated effect on number of leaves per shoot, while fish scrap × Rhizobacterein × surface application treatment induced more stimulate effect on leaf area. Control treatment had the least values in this respect. The other interactions came in-between effect in both seasons. This pattern is similar to that reported by **Fayed (2005b)** who found that organic manure plus bio- fertilizers improved leaf area of Apple trees compared with the same organic fertilizers alone.

Chlorophyll (a), (b) and Carotenoid Contents

Results in Table (6) indicate that chlorophyll (a) content concentration in leaf tissues were affected significantly by organic fertilizer source. The fish scrap was induced more stimulate effect in leaf chlorophyll (a) and carotenoid contents, followed by goat manure treatment, but the goat manure were induced more stimulate effect in chlorophyll (b) content in 2014 and 2015 seasons, respectively. On the other hand, the Non-organic fertilized trees (control) treatment caused a significant reduction in this respect. These results tend to agree with those reported by **El-Deeb (2003)** who found that chlorophyll (a & b) were remarkably increased with fish scrap fertilizer applied on Manzanillo olive trees.

Results in Table (6) reveal that trench application caused a high significant increase in leaf chlorophyll (a) and (b) contents in both seasons compared to surface treatment. No significant differences between surface and trench application on carotenoid content during both seasons.

Concerning the effect of biofertilizers N-fixing bacteria practices. Data of Table (6) show that the Nitrobein biofertilizer treatment had the highest value of leaf chlorophyll (a) and (b) content. While, Rhizobacterein biofertilizer treatment hade the highest values of carotenoid content compared to Nitrobein treatment during both seasons.

Results of Table (7) indicate that the most obvious increments in leaf chlorophyll (a) content was observed with fertilized trees by fish scrap with Nitrobein bacteria and using trench application method in both seasons, respectively. The most obvious increments in leaf chlorophyll (b) and carotenoid contents were observed with fertilized trees by goat manure with Rhizobacterein using surface application method in both seasons, respectively. While non-organic (mineral) trees (control) treatment gave the least values in both seasons. Other interactions came in-between effects. These results tend to agree with those reported by **El-Deeb (2003)** who reported that chlorophyll (a & b) were remarkably increased with fish scrap fertilizer applied in trenches and supported with Rhizobacterein on Manzanillo olive trees.

Leaf Nitrogen, Phosphorus, Potassium and Calcium Contents

Results in Table (8) show that the highest leaf nitrogen and phosphorus contents were recorded with fish scrap and goat manure treatments.

Table 6. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on leaf pigments content of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment	Chlorophyll (a) (mg.100 g f.w^{-1})		Chlorophyll (b) (mg.100 g f.w^{-1})		Carotenoid (mg.100 g f.w^{-1})	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)						
Fish scrap	11.89 a	11.67 a	6.30 b	6.44 b	1.41 a	1.43 a
Goat manure	10.45 b	10.34 b	6.98 a	7.13 a	1.37 ab	1.39 a
Olive pomace	11.36 ab	11.69 ab	6.84 ab	7.05 ab	1.31 b	1.33 b
Control	8.6 c	8.89 c	5.45 c	5.46 c	1.32 b	1.32 b
Specific effect of methods of organic fertilizer application (MA)						
Surface application	11.17 b	11.14 b	6.57 b	6.73 b	1.36 a	1.38 a
Trench application	11.30 a	11.33 a	6.85 a	7.01 a	1.36 a	1.39 a
Specific effect of Biofertilizers N-fixing bacteria(BF)						
Rhizobacterein	11.19 b	11.13 b	6.66 b	6.81 b	1.40 a	1.41 a
Nitrobein	11.28 a	11.34 a	6.76 a	6.93 a	1.33 b	1.35 b

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

Table 7. Interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on Earligrande peach trees parameters during 2014 and 2015 seasons.

Treatment			Chlorophyll (a) (mg.100 g f.w^{-1})		Chlorophyll (b) (mg.100 g f.w^{-1})		Carotenoid (mg.100 g f.w^{-1})	
OF	MA	BF	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Fish scrap	Surface	Rhizobacterein	12.60 ab	12.39 ab	5.46 e	5.55 e	1.35 c	1.34 c
		Nitrobein	11.64 abc	11.07 c	6.53 cd	6.57 cd	1.34 c	1.40 b
	Trench	Rhizobacterein	10.63 cde	10.31 de	6.48 cde	6.71 c	1.4 b	1.41 b
		Nitrobein	12.70 a	12.89 a	6.73 bcd	6.91 bc	1.38 bc	1.40 b
Goat manure	Surface	Rhizobacterein	9.63 ef	9.90 f	7.45 a	7.46 a	1.62 a	1.57 a
		Nitrobein	11.70 b	10.53 cde	6.88 bc	7.23 abc	1.34 c	1.45 ab
	Trench	Rhizobacterein	10.73 cd	10.11 e	6.48 cde	6.39 d	1.33 c	1.35 c
		Nitrobein	9.73 def	10.83 cd	7.11 ab	7.45 a	1.35 c	1.41 b
Olive pomace	Surface	Rhizobacterein	11.45 bc	11.20 bc	6.97 bc	7.33 ab	1.32 c	1.30 d
		Nitrobein	10 de	11.23 bc	6.11 de	6.23 de	1.20 d	1.27
	Trench	Rhizobacterein	12.64 ab	12.34 ab	7.09 b	7.42 a	1.38 bc	1.40 b
		Nitrobein	11.34 c	12.0 abc	7.18 ab	7.2 abc	1.34 c	1.36 c
	Control		8.6 f	8.89 g	5.45 e	5.46 f	1.32 c	1.32 cd

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

The highest leaf potassium content was recorded with goat manure treatment in first season or fish scrap treatment in second season, respectively. Calcium content was noticed with fish scrap and goat manure treatments than olive pomace treatment in both seasons. On the other hand, the control treatment gave the least values in this respect. Similar results were reported by = **Vogtman and Fricke (1989)** who rstated that organic materials were known to be mineralized and release unavailable nutrient, organic matters added to soil act as a slow release fertilizers and provide plants with necessary nutrients throughout long period of time. **Sharaf *et al.* (2015)** they concluded that organic fertilizer resulted in a significant increase in leaf Ca content. Data of Table (8) show that no significant differences between surface and trench application treatments were found regarding leaf nitrogen, phosphorus and calcium contents during both seasons. While, trench application recorded the highest value of leaf potassium content during both seasons. From the same table, the highest leaf nitrogen and phosphorus contents were found with Rhizobacterein biofertilizers N-fixing bacteria. On the contrary, the least ones were recorded with Nitrobein. No significant differences found between Rhizobacterein and Nitrobein treatments in calcium content during both seasons. Similar results were reported by **Fayed (2005a)** on Dessert red peach trees. **Mahmoud and Mahmoud (1999)** who found that adding biofertilizer every 15 days was much better than 30 or 45 days, which increased leaf macronutrient content.

The results in Table (9) illustrate that the highest leaf nitrogen content was noticed due to the interaction between fish scrap and Rhizobacterein bacteria under trench application method in both seasons. The highest leaf phosphorus content was noticed with intraction effect of goat manure ×Nitrobein×surface application in first season or fish scrap by Rhizobacterein bacteria under trench application method in both seasons. The highest leaf potassium content were noticed with goat manure × Rhizobacterein×trench application in first season or fish scrap×Rhizobacterein× surface application method in second season. The highest leaf calcium content was noticed with fish scrap×Rhizobacterein or Nitrobein × surface application method in first season. While, goat manure × Rhizobacterein × trench application treatment recorded the highest value in second season. While, the least values were given by non-organic fertilized trees (control) in both seasons. The other interactions revealed in between effect. The other interactions revealed in-between effect. These results are in the same line of **El-Deeb (2003)** who found that leaf N, P and K contents were enhanced with fish scrap fertilizer or olive pomace applied in trenches and provided with Rhizobacterein. **Melo, *et al.* (2012)** reported that the application of compost may increase the soil porosity, which would reduce the soil density and increase the availability of nutrients, such as Ca and Mg in soils.

Leaf Magnesium, Zinc, Iron and Boron Contents

Results in Table (10) indicate that the highest values of leaf magnesium, zinc, iron and boron contents were noticed with fertilized trees by fish scrap source, followed by goat manure in both seasons compared to other treatments. This pattern is similar to that reported by **Al-Rawi *et al.* (2016)** on "Peento" peach trees and **El-Deeb (2003)** on Manzanillo olive trees. Also Table (10) show that trench application treatment generally achieved a higher significant increase in concentration of leaf magnesium, zinc, iron and boron contents in both seasons. These results go in line with those reported by **Melo *et al.* (2012)** of peach trees.

Table 8. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on leaf N, P, K and Ca content of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment	N (%)		P (%)		K (%)		Ca (%)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)								
Fish Scrap	2.62 a	2.94 a	0.38 a	0.37 a	1.40 b	1.45 a	0.45 a	0.47 a
Goat manure	2.54 a	2.58 b	0.31ab	0.30 b	1.64 a	1.33 ab	0.43 b	0.47 a
Olive pomace	2.34 b	2.40 c	0.23 bc	0.26 b	1.25 b	1.29 b	0.37 c	0.39 b
Control	2.10 c	1.90 d	0.13 c	0.20 c	1.16 b	1.13 c	0.21 d	0.22 c
Specific effect of methods of organic fertilizer application(MA)								
Surface application	2.38 a	2.42 a	0.27 a	0.26 a	1.25 b	1.30 b	0.38 a	0.38 a
Trench application	2.42 a	2.48 a	0.25 a	0.30 a	1.67 a	1.39 a	0.37 a	0.41 a
Specific effect of Biofertilizers N-fixing bacteria(BF)								
Rhizobacterein	2.43 a	2.51 a	0.35 a	0.32 a	1.66 a	1.31 a	0.38 a	0.41 a
Nitrobein	2.36 b	2.39 b	0.28 b	0.26 b	1.27 b	1.28 a	0.37 a	0.38 a

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

Table (9): The interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on leaf N, P, K and Ca content of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment			N (%)		P (%)		K (%)		Ca (%)	
OF	MA	BF	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
Fish scrap	Surface	Rhizobacterein	2.50 b-e	3.06 a	0.400 ab	0.30 bc	1.40 b	1.53 a	0.51 a	0.48 b
		Nitrobein	2.56 a-d	2.80 b	0.333 a-d	0.40 ab	1.30 b	1.40 bc	0.51 a	0.47 b
	Trench	Rhizobacterein	2.80 a	3.20 a	0.433 a	0.50 a	1.53 b	1.40 bc	0.45 b	0.48 b
		Nitrobein	2.63 abc	2.70 bc	0.366 abc	0.30 bc	1.40 b	1.46 ab	0.44 bc	0.48 b
Goat manure	Surface	Rhizobacterein	2.66 ab	2.60 cd	0.300 b-e	0.30 bc	1.26 b	1.30 cd	0.45 b	0.45 b
		Nitrobein	2.50 b-e	2.50 de	0.433 a	0.20 c	1.26 b	1.30 cd	0.43 c	0.44 b
	Trench	Rhizobacterein	2.60 abc	2.60 cd	0.200 ef	0.40 ab	1.65 a	1.36 bc	0.43 c	0.57 a
		Nitrobein	2.40 cde	2.63 cd	0.300 b-e	0.30 bc	1.26 b	1.36 bc	0.42 de	0.45 b
Olive pomace	Surface	Rhizobacterein	2.30 ef	2.40 ef	0.200 ef	0.23 c	1.20 bc	1.36 bc	0.44 bc	0.42 b
		Nitrobein	2.33 def	2.26 f	0.233 def	0.26 bc	1.30 b	1.30 cd	0.41 e	0.41 b
	Trench	Rhizobacterein	2.43 b-e	2.46 de	0.200 ef	0.33 bc	1.20 bc	1.30 cd	0.42 de	0.43 b
		Nitrobein	2.30 f	2.46 de	0.266 cde	0.23 c	1.30 b	1.20 de	0.43 cd	0.42 b
Control			2.10 f	1.90 g	0.133 f	0.20 c	1.16 c	1.13 e	0.21 f	0.22 c

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

Table (10) shows that Rhizobacterein caused a high significant increase in concentration of leaf magnesium, zinc, iron and boron contents in both seasons. These results go in line with those reported by **El-Deeb (2003)** in olive trees. **Sahain *et al.* (2007)** indicated that the EM biostimulant treatments, has significantly increased the leaf Fe values as compared with the untreated trees of Anna Apple.

The interaction effect between organic fertilizer sources and biofertilizers N-fixing bacteria under different methods of application treatments. The results in Table (11) illustrate that the highest leaf magnesium, zinc, iron and boron contents were noticed with fish scrap × Rhizobacterein × trench application method in both seasons. On the contrary, the least values were given by non-organic fertilized trees (control) in both seasons. The other interactions revealed in-between effect. These results go in line with those reported by **EL-Gioushy and Baiea (2015)** they reported that the highest values of leaf Ca and Mg contents were accompanied with 10 ton compost+ bio-fertilizer and 5 ton compost + bio-fertilizer treatments of “Canino” apricot trees. **Fayed (2005a)** found that organic fertilizer + tetra combined BF. increased leaf contents of Fe element, especially in the second season compared with all other organic treatments with biofertilizers of Dessert red peach trees.

DISCUSSION

Generally, the increase in leaf pigments might be result of balanced nutritional environment in the soil and thus is evident from the other data in this study that yield expressed in weight and number of fruit /tree was positively affected by fertilized "EarliGrande" peach trees with fish scrap either single or combined with Rhizobacterein **(Fawzi *et al.*, 2010)**. This increment in pigment contents was due to increase the uptake of nutrient elements **(Abd El-Razek *et al.*, 2012).**

Table 10. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on leaf Mg, Zn, Fe and B content of "Earligrande" peach trees during 2014 & 2015 seasons.

Treatmen	Mg (%)		Zn (ppm)		Fe (%)		B (ppm)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)								
Fish Scrap	0.266 a	0.29 a	23.75 a	26.75 a	0.46 a	0.47 a	52.50 a	63.75 a
Goat manure	0.239 b	0.27 b	22.50 b	23.66 b	0.42 b	0.45 a	44.16 ab	53.75 b
Olive pomace	0.230 c	0.24 c	22.16 b	22.33 c	0.43 b	0.42 b	44.58 ab	37.91 c
Control	0.220 d	0.21 d	21.00 c	20.00 d	0.42 b	0.38 c	35.00 b	21.66 d
Specific effect of methods of organic fertilizer application(MA)								
Surface application	0.23 b	0.25 b	22.20 b	22.87 b	0.43 a	0.36 b	40.83 b	40.62 b
Trench application	0.24 a	0.26 a	22.50 a	23.50 a	0.43 a	0.44 a	47.29 a	47.91 a
Specific effect of Biofertilizers N-fixing bacteria (BF)								
Rhizobacterein	0.24 a	0.26 a	22.66 a	23.75 a	0.43 a	0.44 a	44.79 a	46.87 a
Nitrobein	0.23 b	0.25 b	22.04 b	22.62 b	0.39 b	0.32 b	43.33 b	41.66 b

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

Table 11. The interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on leaf Mg, Zn, Fe and B content of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment			Mg (%)		Zn (ppm)		Fe (%)		B (ppm)	
OF	MA	BF	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
Fish scrap	Surface	Rhizobacterein	0.26 b	0.29 c	24.00 b	27.00 b	0.44 b	0.47 a	50.0 bc	65.00 b
		Nitrobein	0.25 c	0.28 d	22.00 e	26.00 c	0.43 c	0.46 a	45.0 d	55.00 d
	Trench	Rhizobacterein	0.28 a	0.31 a	25.00 a	28.00 a	0.45 a	0.48 a	60.0 a	70.00 a
		Nitrobein	0.27 b	0.30 b	24.00 b	26.00 c	0.44 b	0.47 a	55.0 ab	65.00 b
Goat manure	Surface	Rhizobacterein	0.24 d	0.27 e	23.00 c	24.00 e	0.42 d	0.45 ab	40.0 de	50.00 e
		Nitrobein	0.23 e	0.26 f	22.00 e	21.66 g	0.41 e	0.44 b	45.0 cd	45.00 f
	Trench	Rhizobacterein	0.24 c	0.28 d	23.00 c	25.00 d	0.42 d	0.46 a	45.0 cd	60.00 c
		Nitrobein	0.24 d	0.28 d	22.00 e	24.00 e	0.41 e	0.45 ab	46.6 cd	60.00 c
Olive pomace	Surface	Rhizobacterein	0.22 f	0.25 g	23.00 c	23.00 f	0.43 b	0.43 b	41.6 de	36.66 g
		Nitrobein	0.23 e	0.24 h	21.66 f	21.33 g	0.41 e	0.28 c	35.0 e	30.00 h
	Trench	Rhizobacterein	0.25 c	0.26 f	21.33 g	23.00 f	0.44 b	0.44 b	51.6 bc	50.00 e
		Nitrobein	0.22 f	0.24 g	22.66 d	22.00 g	0.43 c	0.43 b	50.0 bc	35.00 g
Control			0.22 f	0.21 i	21.00 h	20.00 h	0.42 c	0.38 c	35.00 e	21.66 i

Mean values of treatments were differentiated by using Least Significant Range (Duncan's multiple range test) at 5% probability

It can be concluded that addition of organic fertilizer to soil was efficient in supplying the nutritional requirements of peach trees each of Nitrogen, phosphor and Potassium and that reflected on tree growth and productivity that could be attributed to the role of NPK. Hence N is found in many important compounds including amino acids, proteins, enzymes, nucleic acids and chlorophyll. Also, P is the key factor in compounds that store, transfer and utilize energy in plants. It is also building blocks for DNA. However, K plays an important role in maintaining cell turgid and in the opening **(Johnson and Phene, 2008).** Organic fertilizers improved peach leaf mineral content **(Fayed 2005a, Bahaa 2007 and El-Khawaga, 2011)**. The enhancement of leaf mineral content due to application of organic manure may explained by the fact that it induced positive effect on physical condition of soil; creates favorable conditions for root growth and nutrients absorption, it supplies much nutrients and it facilitates the absorption of fixed nutrients by tree roots **(Cook, 1982)**. Moreover, the organic fertilizer contains high organic matter and high macro and micro nutrients which help to improve soil physical and chemical characteristics **(Vogtman and Fricke, 1989).** Also, these effects could be due to that a set of soil microorganism processing the ability and mobilizing the unavailable forms of nutrient elements to be available for absorption by roots **(Fawzi *et al.,* 2010)**.

The previous results of different vegetative growth parameters due to organic fertilizers in general and fish scrap fertilizer in particular, may be attributed to physical and chemical properties of coarse textured soils and provide essential elements. Besides biofertilizers has capability to fix inorganic form.

Conclusions

Finally, using fertilized trees by fish scrap with Nitrobein bacteria and using trench application method achieved the vegetative growth parameters, mineral content and total pigments.

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الملخص العربى

استخدام بعض الأسمدة العضوية والحيوية لتسميد أشجار الخوخ ايرلى جراند تحت ظروف شمال سيناء

أ. النمو الخضري والمحتوى الكيماوي للأوراق

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هدفت هذه الدراسة لاختبار تأثير المصادر العضوية مثل فتات الأسماك، سماد الماعز، وتفل الزيتون، وطريقة الاضافة (سطحي، وخندقي)، والتسميد الحيوي (الريزوباكتيرين، والنيتروبين) على النمو الخضري لأشجار الخوخ صنف إيرلي جراند خلال موسمي ٢٠١٣/٢٠١٤ ، و٢٠١٤/٢٠١٥ في مزرعة خاصة بمنطقة الخرافين بمركز رفح، محافظة شمال سيناء، مصر، وقد أظهرت النتائج أن معاملة التسميد بفتات الأسماك هى الأكثر المعاملات فاعلية في زيادة النموات الخضرية للشجرة (ارتفاع الشجرة، محيط حجر الشجرة، سمك الجذع) وقياسات الأفرخ (طول الفرخ، عدد الأفرخ للفرع) وقياسات الأوراق (عدد الأوراق للفرخ، المساحة الورقية، محتوى الأوراق من الصبغات) ومحتوى الأوراق من العناصر الغذائية مقارنة بباقي المصادر العضوية الأخرى، كما تعتبر طريقة إضافة الأسمدة العضوية الخندقية أفضل معاملة مقارنة بمعاملة الإضافة السطحية خلال كلا الموسمين، كما أظهرت النتائج أن معاملة التسميد الحيوي الريزوباكتيرين هي أكثر المعاملات فاعلية في الحصول على أفضل النموات الخضرية (الشجرة، الأفرخ، الأوراق) ومحتوى الأوراق من العناصر الغذائية فى كلا الموسمين. طبقاً للنتائج المتحصل عليها فإنه يمكن التوصية باستخدام التسميد العضوي خاصة فتات الأسماك من خلال الإضافة الخندقية إضافة للتسميد الحيوي مستخدماً الريزوباكتيرين حيث تؤدي هذه المعاملة إلى تقليل الاحتياج السمادي إلى النصف فضلاً عن تحسين النمو والحالة الغذائية لأشجار الخوخ بالإضافة للمحافظة على البيئة من مشاكل التلوث الناشئ عن التسميد المعدني وكذلك استخدام المخلفات البيئية.

الكلمات الاسترشادية: الخوخ (إيرلى جراند)، فتات السمك، سماد الماعز، الإضافة الخندقية، التسميد الحيوى.

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