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HE USE OF SOME ORGANIC AND BIO-FERTILIZERS FOR EARLIGRANDE PEACH TREES FERTILIZATION UNDER NORTH SINAI CONDITIONS b: Fruiting and fruit quality

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ABSTRACT

This study aimed to examine the effect of organic sources such as fish scrap, goat manure and olive pomace, type of application (surface and trench) and bio-fertilizer applications (Nitrobein or Rhizobacterein) on flowering, fruit yield and fruit quality 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. Results indicated that organic fertilization treatments increased number of flowers per shoot, fruit set percentage, total yield, fruit volume and firmness, Vitamin C and total soluble solids (TSS) in both seasons. The fish scrap treatment produced the highest value of each yield measurement, followed by goat manure treatment, then olive pomace treatment compared with non-fertilized trees (control). On the other hand, trench application achieved very significant effect on tree yield (Kg/tree), fruit weight, fruit volume and firmness compared with surface application in both seasons, But surface application recorded the highest value for each of Vitamin C and total soluble solids (TSS). Also, results showed that Rhizobacterein fertilizer recorded the heights value for each of fruit weight, fruit volume and firmness, Vitamin C and total soluble solids (TSS). Finally, additive the fish scrap (about 2.77 Kg. tree^{-1}. Year^{-1}) with Rhizobacterein fertilizer (50 g/tree) in trench application gave the highest fruit properties, fruit yield and improve "Earligrande" peach fruit quality properties in the same experiment conditions.

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

INTRODUCTION

North Sinai Governorate considered one of the focus points of peach cultivation in a semi-arid region 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 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).** Most of the Sinai soils are sandy or calcareous soil which are poor in organic matter and low action exchange and low water holding capacity. Under this conditions fruit trees cultivation needs special treatments to improve the productivity and fruit quality.

Organic fertilization is an important tool in this respect due to its multiple effects as a foundation for clean agriculture, sustainable agriculture, soil condition and a

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source of slow release fertilizers **(Vogtman and Fricke, 1989, Bahaa, 2007)**. The application of organic compost increased the yield components and the yield per tree and hectare, especially when 72 L of compost was applied per tree, without affecting the nutrient contents in the leaves. The addition of organic compost had few effects on the composition of the peach fruit after harvest and after 30 days of storage **(Melo *et al.*, 2016)**. Organic manure alone or in combination was helpful in improving the fruiting and yield of peach cv. Florida Prince (**Narayan *et al.,* 2016)**.

On the same line, 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 produts **(Hoda, 2012)**. They also biodegrade substances, recycle nutrients, promote mycorrhiza symbiosis and develop bioremediation processes in soils, contaminated with toxic, xenobiotic and recalcitrant substances **(Rivera-Cruz, *et al.,* 2008).** Bio-fertilizers are the most importance for plant production and soil as they play an important role in increasing yield and fruit quality **(El-Shenawy and Fayed, 2005)** on grapevine. Therefore, the main target of this study is to examine the effect of organic sources, type of application and bio-fertilizer applications on flowering, physical and chemical fruit characteristics as well as maximize productivity with high fruit quality of Earligrande 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 private Farm at El-Kharafen village in Rafah district, North Sinai Governorate, Egypt. One hundred and twenty eight "Earligrande" peach trees (*Prunus persica* L.) about twelve-year-old 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 150kg per feddan, respectively and depended only on the rainfall which amounted to about 204.71 mm.year^{-1} during the rainfall season from October up to late April.

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} (Table 1).

There upon 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 as follows:

- 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}.
- Olive pomace (2.5% N) about 10.0 Kg. tree^{-1}. Year^{-1}.

Methods of Organic Fertilizer Application

Two methods of organic fertilizers were selected as follows:

Surface Application

On December of each season, the three organic fertilizers were applied superficially and digged in the soil during deep hand hoeing practice (about 5cm depth) according to **El-Deeb (2003)**.

Table 1. Chemical analysis of tested organic fertilizer materials.

Material	Total N (%)	Total P_2O_5 (%)	Total K_2O (%)	Total CaO (%)	Total MgO (%)
		Animal byproducts			
Fish scrap	9.0	7.1	-	8.5	0.5
		Excreta			
Goat manure	1.25	1.4	3	2	0.1
		Planet residues			
Olive pomace	2.5	1.5	1.5	0.5	0.5

Trench Application (Subsurface) Application

Two trenches (100 cm length x 30 cm width x 25 cm depth) were digged in December of each season 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 **(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) at 1 m apart from the tree trunk.

Measurements

The specific effect of organic fertilizers, method of organic fertilizer application and Biofertilizers as well as their interaction on flowering, fruiting and fruit quality were evaluated through the following measurements:

Number of flowers per shoots and fruit set

Thirty (one – year – old) shoots were chosen at random and labeled on each tree for each season during full bloom (late February) to count the total initial number of flowers per shoot, number of fruitlets and fruits were recorded at monthly intervals up to harvest the percentage of X, fruits set was calculated according to **Ferguson *et al.*, (1994)** as follows:

$$Fruit\ set = \frac{No.of\ developing\ fruitlets}{Total\ initial\ no\ .of\ flowers\ at\ full\ bloom} \times 100\ (\%)$$

Fruit retention was calculated on the basis of initial number of fruit set and total number of fruitlets drop of each season.

Fruit yield (kg.tree^{-1})

At harvest time, (mid-may) the yield was estimated on the basis of number and weight of fruits per peach tree (Kg. tree^{-1}) as outlined in **AOAC (1990).** The average yield per feddan was also calculated according to **Westwood and Roberts (1970).** Fruits per tree were harvested and kept at a normal temperature while transported to the laboratory of the Faculty of Agricultural & Environmental Sciences at El-Arish, Egypt.

As for the fruit quality, a representative sample was taken from each treated tree about (50 fruits) and subjected to some physical and chemical analyses (**AOAC, 1990).**

Fruit quality

Fruit Weight, Fruit Dimensions and Fruit Firmness

The selected twenty fruits from each tree under study were weighted and the average weight of fruit (g) was determined. The average fruit length (L) and width (W) were measured by using vernier caliper and the average was calculated. The fruit shape indexes (L/W) was calculated. Fruit firmness was measured using 10-15 fruit samples per tree. A hand help pressure tester was used to measure fruit firmness.

Total Soluble Solids And Juice Acidity

Total soluble solids was measured using 10-15 fruit samples per tree. A hand refractometer was used to determine the total soluble solid percentages. The acidity of fruit juice determined as malic acid by simple direct titration with 0.1M sodium hydroxide, using phenolphthalein (ph.th) as an indicator according to the methods of **AOAC (1990)**.

- Weight 10g of sample in conical flask and add 50ml distilled water.
- Titrate using 0.1M NaOH and phenolphthalein (ph.th) as indicator.
- Calculate the total acidity of fruit juice.

$$Malic\ acid = 0.1 \times vol.of\ NaOH\ (ml) \times 10^{-3} \times 192.43/3$$

- L-ascorbic acid content (V.C) was determined as mg.100 ml-1 juice according to **Bekele and Geleta (2015)**.

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

Number of Flowers Per Shoot

Results in Table 2 reveale that the organic fertilization treatments increased number of flowers per shoot in both seasons. The non-organic fertilized trees (control) recorded the least number of flowers per shoot. While the fish scrap treatment caused a highest significant value in this respect, followed by fertilized trees by goat manure in first season, but olive pomace recorded the highest significant value in the second season. At the end of flowering, all of organic fertilization increased total number of flowers per shoot in both seasons. These results are in the same line of **Narayan *et al.* (2016)** who found that organic manure alone or in combination was helpful in improving the flowering of peach cv. Florida Prince. Also, results of Table 2 show that differences between surface and trench application treatments were insignificant number of flowers per shoot at different times during both seasons.

Concerning the specific effect of biofertilizers N-fixing bacteria practices. Table 2 indicates that the insignificant differences between Rhizobacterein and Nitrobein bacteria in both seasons. These results are in the same line with **El-Gioushy and Baiea (2015)** on “Canino” apricot trees (*Prunus armeniaca*, L). Respecting the interaction effect between organic fertilizer sources, organic fertilizer application methods and biofertilizers N-fixing bacteria under different methods of application treatments. The results in Table 3 show that the highest number of flowers per shoot were noticed fish scrap or goat manure with Rhizobacterein bacteria under surface application method in first season. But, olive pomace under surface application methods with Rhizobacterein or Nitrobein bacteria achieved high values in this concern in second season. In the meantime the least values were given by non-organic fertilized trees (control) in both seasons.

Fruit Set Percentage

Results in Table 2 indicate that the organic fertilization treatments increased fruit set percentage in both seasons. The fish

Table 2. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on number of flowers per shoot at different times, fruit set and fruit yield per tree of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment	Number of flowers/shoot (beginning of blooming)		Number of flowers/shoot (End of blooming)		Fruit set (%)		Fruit yield (kg.tree^{-1})	
	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	7.58 a	8.16 ab	17.25 a	15.00 ab	28.00 a	32.00 a	55.08 a	62.08 a
Goat manure	7.58 a	8.91 ab	16.91 a	15.83 a	27.16 a	32.08 a	47.50 b	51.00 b
Olive pomace	5.50 b	9.50 a	15.91 a	15.33 ab	24.41 b	29.08 b	35.83 c	39.08 c
Control	4.50 c	4.60 b	13.00 b	13.00 b	23.00 b	22.00 c	33.00 d	29.33 d
Specific effect of methods of organic fertilizer application (MA)								
Surface application	4.75 a	6.83 a	15.95 a	14.83 a	25.37 b	28.62 a	42.04 b	44.25 b
Trench application	4.58 a	7.45 a	15.58 a	14.75 a	26.91 a	28.95 a	43.66 a	46.50 a
Specific effect of Biofertilizers N-fixing bacteria (BF)								
Rhizobacterein	5.58 a	7.50 a	15.70 a	14.62 a	26.50 a	29.33 a	44.45 a	47.12 a
Nitrobein	4.75 b	6.79 b	15.83 a	14.95 a	25.79 a	28.25 a	41.25 b	43.62 b

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

Table 3. The interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on number of flowers per shoot at different times, fruit set and fruit yield per tree of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment			Number of flowers/shoot (beginning of blooming)		Number of flowers/shoot (End of blooming)		Fruit set (%)		Fruit yield (kg.tree^{-1})	
OF	MA	BF	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15	2013/14	2014/15
Fish scrap	Surface	Rhizobacterein	8.00 a	3.33 c	17.66 a	15.33 ab	26.00 c-f	33.33 ab	57.00 a	63.33 a
		Nitrobein	6.33 ab	4.33 bc	17.33 a	15.00 ab	28.33 abc	31.66 bc	55.00 b	59.00 c
	Trench	Rhizobacterein	8.33 a	12.66 a	16.33 ab	14.33 ab	27.66 a-d	31.0 bcd	55.00 b	64.00 a
		Nitrobein	7.66 a	4.33 bc	17.66 a	15.33 ab	30.00 ab	32.00 bc	53.33 c	62.00 b
Goat manure	Surface	Rhizobacterein	8.33 a	8.00 abc	16.00 ab	15.00 ab	26.33 b-f	31.0 bcd	49.33 d	52.00 e
		Nitrobein	8.33 a	8.66 abc	18.66 a	16.33 a	24.33 def	31.66 bc	40.66 f	45.00 g
	Trench	Rhizobacterein	8.33 a	8.33 abc	17.00 a	15.66 ab	31.00 a	34.66 a	53.33 c	57.00 d
		Nitrobein	6.33 ab	10.66abc	16.00 ab	16.33 a	27.00 b-e	31.0 bcd	47.00 e	50.00 f
Olive pomace	Surface	Rhizobacterein	5.00 b	15.33 a	16.33 ab	15.66 ab	25.00 c-f	30.33 cd	35.33 g	40.00 i
		Nitrobein	5.00 b	15.00 a	15.66 ab	15.33 ab	23.00 f	27.00 e	33.00 h	36.00 k
	Trench	Rhizobacterein	5.66 b	12.33 ab	16.33 ab	15.00 ab	26.00 c-f	30.33 cd	40.00 f	42.00 h
		Nitrobein	4.33 c	7.33 abc	15.33 ab	15.33 ab	23.66 ef	28.66 de	35.00 g	38.33 j
Control			4.50 c	4.00 c	13.00 b	13.00 b	23.00 f	22.00 f	33.00 h	29.33 l

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

scrap and goat manure treatments caused the highest significant value in this respect, followed by fertilized trees by olive pomace in both seasons. On the contrary, the non-organic fertilized trees (control) recorded the least number of fruit set percentage in both seasons. These results are in the same line of **Narayan *et al*., (2016)** on peach cv. Florida Prince.

Concerning the specific effect of methods of organic fertilizer application results of Table 2 show that trench application method achieved high value on fruit set percentage during first season. But, no significant differences between Surface and trench application treatments during second season. As for the specific effect of biofertilizers N-fixing bacteria practices on fruit set percentage. Table 2 revealed no significant differences between Rhizobacterein and Nitrobein bacteria in fruit set percentage during both seasons. This result are in the same line with **El-Gioushy and Baiea (2015)** on "Canino" apricot trees (*Prunus armeniaca*).

Respecting the interaction effect between organic fertilizer sources, organic fertilizer application methods and biofertilizers N-fixing bacteria under different methods of application treatments, results in Table 3 show that the highest number of fruit set percentage were noticed with goat manure by due to Rhizobacterein bacteria under trench application method in both seasons. While, least values were given by Non-organic fertilized trees (control) in both seasons. The other interactions revealed in-between effect.

Fruit Yield (Kg. tree^{-1})

Results given of Table 2 show that the fruit yield was increased linearly by adding the organic fertilization. The fertilized trees with fish scrap was the best treatment and recorded the highest values (55.08 & 62.08 kg.tree^{-1}), followed by goat manure treatment (47.50 & 51.00 kg.tree^{-1}) in both seasons. On the contrary, non-organic fertilized trees (control) had the least values (33.00 & 29.33 kg.tree^{-1}) respectively in both seasons. Thus, the increment percentage of yield/ tree due to use fish scrap over non-organic fertilizer attained 66.90 & 111.66 % during both seasons, respectively. These results go in line with those reported by **Kassem and El-Seginy (2002)**, and **Narayan *et al*., (2016)** they reported that organic manure had a significant response on fruit yield.

As for the specific effect of methods of organic fertilizer application on fruit yield data of Table 2 clear that trench application treatment achieved a highest significant increase in fruit yield compared to surface application method in both seasons. Concerning the specific effect of biofertilizers N-fixing bacteria practices, data of Table (2) reveal the Rhizobacterein caused high significant effect in fruit yield (Kg) in both seasons. While, Nitrobein treatment resulted in a remarkable decrease in this respect. These results are in agreement with those reported by **El-Shenawy and Fayed (2005)** they found that bio-fertilizers significantly increased yield.

Regarding the response of fruit yield to the interaction effect between organic fertilizer source, organic fertilizer application methods and biofertilizers N-fixing bacteria practices, data of Table 3 reveal that the fish scrap with Rhizobacterein and adding surface of fertilization caused the highest significant increase in fruit yield in first season. While, fish scrap with Rhizobacterein using both methods of adding fertilization treatments recorded the highest value of total yield in second season. Non-organic fertilized trees (control) treatment had the least values in this concern. On the other hand, other interactions induced intermediate values of fruit yield between the previously mentioned categories. These results are in agreement with those reported by **El-Deeb (2003),** who concluded that the application of fish scrap in trenches and enriching with Rhizobacterein gave the highest values of yield per tree.

Fruit weight (g)

Table 4 reveals that in both study seasons, fruit weight was increased linearly with adding organic manure fertilization. The fish scrap, goat manure and olive pomace fertilizers were similar and gave the highest values in this concern. On the other hand, the non-organic fertilized trees (control) were the most depressive effect in first season but, there were no significant differences between all treatments in second season. This pattern is similar to that reported by **El-sayed *et al.* (2010)** who showed that, fruit quality fruit weight, diameter were, generally, improved under all organic treatments as compared with control on pomegranate trees.

Respecting the specific effect of methods of organic fertilizer application on fruit yield, data of Table 4 illustrate that no significant differences were observed between surface and trench applications in first season. While, the trench application treatment achieved high significant increase in fruit weight compared to surface application method in second season. As for the specific effect of biofertilizers N-fixing bacteria practices, data in the same Table show that Rhizobacterein caused a high significant increase in fruit weight (g). While, Nitrobein gave the least values in this respect during both seasons. Similar results were obtained by **Mansour (1998)** who found that bio-fertilization had a positive effect on fruit weight of Apple trees. Regarding the interaction effect between organic fertilizer source, organic fertilizer application methods and biofertilizers N-fixing bacteria treatments, data of Table (5) show that fertilization treatments by fish scrap using trench method × Nitrobein treatment was significantly interactive for fruit weight and gave the highest values in this respect in the both seasons. While, Non-organic fertilized trees (control) treatment had the least values in this regared.The other interactions reveal in between effect.

Pulp/ Stone Ratio

Table 4 indicates that, pulp/ stone ratio was increased with different source of organic manure fertilization in both seasons. The fish scrap fertilizer achieved the highest values of pulp / stone ratio, followed by olive pomace treatment in both study seasons. On the other hand, the non-organic fertilized trees (control) was the most depressive effect in both seasons.

As for the specific effect of methods of organic fertilizer application on fruit yield, data of Table 4 notice that no significant differences between surface and trench applications were found in first season. While, the surface application treatment achieved a highest significant increase in pulp/stone ratio compared to trench application method in second season. Regarding the specific effect of biofertilizers N-fixing bacteria practices, data in the same Table 4 show that the three were no significant differences between Rhizobacterein and Nitrobein on pulp/ stone ratio during both seasons. Concerning the interaction effect between organic fertilizer source, organic fertilizer application methods and biofertilizers N-fixing bacteria treatments on pulp/stone ratio of peaches, data of Table 4 illustrate that fertilization treatments by fish scrap using trench method × Nitrobein treatment was significantly interactive for pulp/stone of Table 4 illustrate that fertilization treatments by fish scrap using trench method × Nitrobein treatment was significantly interactive for pulp/stone ratio and gave the highest value in this respect in the both seasons. While, goat manure using trench method × Rhizobacterein and olive pomace using surface method × Rhizobacterein treatments

Table 4. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on fruit and pulp / stone ratio of " Earligrande" peach trees during 2014 and 2015 seasons.

Treatment	Fruit weight (g)		Pulp / stone ratio	
	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)				
Fish scrap	154.33 a	136.20 a	17.64 a	16.99 a
Goat manure	154.76 a	130.25 a	17.03 b	16.49 b
Olive pomace	165.45 a	133.80 a	17.15 ab	16.71 ab
Control	127.46 b	140.96 a	15.99 c	15.37 c
Specific effect of methods of organic fertilizer application(MA)				
Surface application	153.15 a	130.15 b	17.36 a	15.91 a
Trench application	147.85 a	140.45 a	17.18 a	17.55 b
Specific effect of Biofertilizers N-fixing bacteria (BF)				
Rhizobacterein	152.00 a	136.54 a	17.02 a	16.90 a
Nitrobein	149.00 b	134.06 b	17.52 a	16.56 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 fruit and pulp/stone ratio of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment			Fruit weight (g)		Pulp / stone ratio	
OF	MA	BF	2013/2014	2014/2015	2013/2014	2014/2015
Fish scrap	Surface	Rhizobacterein	154.0 bc	130.2ab	16.42f	16.34d
		Nitrobein	152.4 c	122.9ab	17.45c	15.93def
	Trench	Rhizobacterein	155.3abc	139.7ab	17.18cde	17.17c
		Nitrobein	176.7 a	151.9a	19.49a	18.51a
Goat manure	Surface	Rhizobacterein	168.0abc	127.1ab	18.09b	16.18de
		Nitrobein	161.5abc	117.6b	17.02de	15.29g
	Trench	Rhizobacterein	131.6 de	148.3ab	15.74h	18.04b
		Nitrobein	157.9abc	127.9ab	17.26cd	15.48ef
Olive pomace	Surface	Rhizobacterein	175.5 ab	121.9ab	18.18b	14.61h
		Nitrobein	158.8abc	139.5ab	17.01de	17.09cd
	Trench	Rhizobacterein	155.6abc	143.0ab	16.51ef	18.06b
		Nitrobein	150.8 cd	130.6ab	16.91def	17.07cd
Control			127.46 e	140.9ab	15.99 g	15.37 f

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

had the least values in this regared in both seasons, respectively. Similar results were obtained by **Moharam and Zaen El-deen (2011)** they revealed that some physical properties of peach fruits (fruit flesh thickness, fruit volume and pulp/stone ratio) were significantly affected by organic fertilizers (olive solid water OSW) types (fresh – compost).

Fruit Size (cm^3)

Table 6 reveals that in both study seasons, fruit size increased linearly with different organic fertilization. The fish scrap fertilized trees gave the highest values of fruit size in both seasons, followed by goat manure fertilized trees in this concern. On the other hand, the non-organic fertilized trees (control) were the most depressive effect in both seasons. Also data of Table (6) clear that trench application treatment achieved a highest significant increase in fruit size compared to surface application method in both seasons.

Concerning the specific effect of biofertilizers N-fixing bacteria practices, data in the same Table (6) show that the highest fruit size was given by Rhizobacterein. In the meantime, Nitrobein treatment had the least values in this concern in both seasons. Similar results were reported by **Fayed (2005a)** and **Moharam and Zaen El-deen (2011)** on peach. Regarding the interaction effect between organic fertilizer source, organic fertilizer application methods and biofertilizers N-fixing bacteria treatments, data of Table (7) show that fertilization treatments by fish scrap ×trench application Rhizobacterein × treatment were significantly interactive for fruit size during both seasons. While the non-organic fertilized trees gave the least values in this respect in the both seasons.

Fruit firmness ($kg.cm^{-2}$)

Results presented in Table 6 declare that fruit firmness ($kg.cm^{-2}$) was increased significantly by different organic fertilization sources. The fish scrap treatment produced the highest values of fruit firmness, followed by goat manure treatment. Meanwhile, the least values of fruit firmness were obtained by control treatment in both seasons. These results are in agreement with those reported by **EL-Gioushy and Baiea (2015)** who reported that fruit firmness was greatly affected by the studied organic fertilization. As for specific effect of methods of adding organic fertilizer application on fruit firmness ($kg.cm^{-2}$) of "Earlygrand" peaches during 2014 and 2015 seasons, Table (6) shows that surface application achieved the highest fruit firmness compared to trench application during both seasons.

Concerning the specific effect of biofertilizers N-fixing bacteria practices on fruit firmness ($kg.cm^{-2}$), data presented in Table 6 show that biofertilizers succeeded in increasing fruit firmness. Rhizobacterein caused a high significant increase in fruit firmness ($kg.cm^{-2}$). While, Nitrobein gave the least values in this respect during both seasons. Regarding, the interaction effect between organic fertilizer source and biofertilizers N-fixing bacteria under application methods of adding organic treatments on fruit firmness of "Earligrande" peaches during 2014 and 2015 seasons, data of Table (7) show that surface application of fish scrap fertilization with Rhizobacterein biofertilizer was significantly interactive for fruit firmness and gave the highest values in this respect in the both seasons. On the contrary, control treatment had the least values in fruit firmness during both seasons. The other interactions reveal in between effect.

Total Soluble Solids (TSS %)

Results in Table 8 notice that the fish scrap treatment recorded the highest values of total soluble solids (TSS), followed by goat manure treatment in both seasons respectively. While, the least values of total soluble solids was obtained by non-organic fertilized trees (control) in both seasons.

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

Treatment	Fruit size (cm^3)		Fruit firmness ($kg.cm^{-2}$)	
	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)				
Fish scrap	63.11 a	71.89 a	0.41 a	0.42 a
Goat manure	60.13 ab	64.53 b	0.35 b	0.33 b
Olive pomace	55.50 b	60.86 c	0.26 c	0.27 c
Control	56.40 b	50.47 d	0.22 d	0.21 d
Specific effect of methods of organic fertilizer application(MA)				
Surface application	57.77 b	61.29 b	0.32 a	0.31 a
Trench application	59.79 a	62.59 a	0.30 b	0.30 b
Specific effect of Biofertilizers N-fixing bacteria (BF)				
Rhizobacterein	59.95 a	62.95 a	0.32 a	0.32 a
Nitrobein	57.61 b	60.92 b	0.29 b	0.29 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 fruit size and fruit firmness of Earligrande peach trees during 2014 and 2015 seasons.

Treatment			Fruit size (cm^3)		Fruit firmness ($kg.cm^{-2}$)	
OF	MA	BF	2013/2014	2014/2015	2013/2014	2014/2015
Fish scrap	Surface	Rhizobacterein	63.18 b	72.72 ab	0.43 a	0.45 a
		Nitrobein	60.26 bc	68.14 c	0.41 c	0.41 c
	Trench	Rhizobacterein	66.10 a	74.82 a	0.42 b	0.43 b
		Nitrobein	62.90 b	71.89 b	0.39 d	0.38 d
Goat manure	Surface	Rhizobacterein	59.78 cd	64.03 de	0.38 e	0.36 e
		Nitrobein	57.31 de	63.91 de	0.33 g	0.32 g
	Trench	Rhizobacterein	61.53 bc	66.57 cd	0.35 f	0.34 f
		Nitrobein	61.89 bc	63.62 e	0.32 h	0.31 h
Olive pomace	Surface	Rhizobacterein	56.32 e	62.05 ef	0.30 i	0.29 i
		Nitrobein	52.54 f	58.54 g	0.24 k	0.27 k
	Trench	Rhizobacterein	59.91 cd	62.50 ef	0.27 j	0.27 j
		Nitrobein	53.22 f	60.36 fg	0.23 l	0.24 l
Control			56.40 e	50.47 h	0.22 m	0.21 m

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

Table 8. Specific effect of organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on total soluble solids (TSS), total acidity, TSS/Acid and vitamin C of "Earligrande" peaches during 2014 and 2015 seasons.

Treatment	Total soluble solids (%)		Total acidity (%)		Vitamin C (mg /100ml juice)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Specific effect of organic fertilizer source (OF)						
Fish scrap	10.39 a	10.58 a	0.40 c	0.40 b	7.61 a	7.79 a
Goat manure	9.72 b	9.93 b	0.52 b	0.54 a	7.41 b	7.57 ab
Olive pomace	9.08 c	9.27 c	0.65 a	0.59 a	7.23 d	7.38 b
Control	9.00 c	9.03 d	0.58 ab	0.65 a	7.35 c	6.80 c
Specific effect of methods of organic fertilizer application(MA)						
Surface application	9.62 a	10.23 a	0.56 a	0.55 a	7.42 a	7.52 a
Trench application	9.47 b	9.48 b	0.52 b	0.54 a	7.38 b	7.24 b
Specific effect of Biofertilizers N-fixing bacteria(BF)						
Rhizobacterein	9.67 a	9.85 a	0.56 a	0.57 a	7.44 a	7.43 a
Nitrobein	9.42 b	9.55 b	0.53 a	0.52 a	7.36 b	7.34 b

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

These results go in line with those reported by **El-sayed *et al.* (2010) and Fawzi *et al.*, (2010)** on pomegranate and **Moharam and Zaen El-deen (2011)** who reported that application of OSW compost gave the highest significant TSS compared to control treatment on peach. From the same Table (8), data showed that the surface application achieved the highest total soluble solids compared to trench application during both seasons. Concerning biofertilizer treatments, it succeeded in increasing total soluble solids in both seasons.

Rhizobacterein caused a high significant increase in total soluble solids. On the contrary, Nitrobein biofertilizer treatment gave the least value in this respect in 2014 and 2015 seasons. Similar results were obtained by **Sahain, *et al.* (2007)** who found that TSS (%) at harvest was improved by two forms EM (a commercial Biostimulant) of effective microorganisms as compared to the control on Anna apple trees.

Regarding, the interaction effect between organic fertilizer source and biofertilizers N-fixing bacteria under application methods of adding organic treatments, data of Table (9) show that surface application of fish scrap fertilization with Rhizobacterein were significantly interactive for total soluble solids and gave the highest values in this respect in both seasons. While, trench application of olive pomace fertilization with Nitrobein treatment had the least values in this result during both seasons.

Total Acidity "malic acid" (%)

Table 8 reveals that in both study seasons, acidity values as malic acid were decreased linearly with adding organic fertilization. The fertilized trees with olive pomace gave the highest values of acidity in both seasons. On the other hand, fertilized trees with fish scrap had the most depressive effect in this respect. These results are in agreement with those reported by **EL-Gioushy and Baiea (2015)** who reported that acidity was greatly affected by the studied organic fertilization. On the other hand, surface application achieved the highest acidity percentage compared to trench application during first season.

Table 9. The interaction effect between organic fertilizer source, fertilizer application method and biofertilizers N-fixing bacteria on total soluble solids (TSS), total acidity, TSS/ Acid and vitamin C of "Earligrande" peach trees during 2014 and 2015 seasons.

Treatment			Total soluble solids (%)		Total acidity (%)		Vitamin C (mg /100ml juice)	
OF	MA	BF	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Fish scrap	Surface	Rhizobacterein	10.64 a	10.95 a	0.44 def	0.41 de	7.66 a	8.08 a
		Nitrobein	10.30 bc	10.78 ab	0.42 ef	0.42 de	7.61 b	7.90 b
	Trench	Rhizobacterein	10.47 ab	10.47 bc	0.41 ef	0.43 de	7.63 b	7.63 e
		Nitrobein	10.13 cd	10.13 cd	0.35 f	0.37 e	7.56 c	7.56 f
Goat manure	Surface	Rhizobacterein	9.97 de	10.52 b	0.58 bc	0.46 cde	7.50 d	7.81 c
		Nitrobein	9.61 fg	9.93 d	0.49 cde	0.65 a	7.38 f	7.72 d
	Trench	Rhizobacterein	9.81 ef	9.81 de	0.54 bcd	0.45 cde	7.43 e	7.43 h
		Nitrobein	9.47 gh	9.47 ef	0.49 cde	0.62 ab	7.33 gh	7.33 i
Olive pomace	Surface	Rhizobacterein	9.32 hi	9.85 d	0.70 a	0.64 a	7.32 h	7.61 e
		Nitrobein	9.11 ij	9.32 fg	0.71 a	0.64 a	7.19 j	7.50 g
	Trench	Rhizobacterein	9.18 ij	9.18 fg	0.62 ab	0.52 bcd	7.28 i	7.28 j
		Nitrobein	8.73 k	8.73 h	0.58 bc	0.56 abc	7.35 fg	7.12 k
Control			9.00 jk	9.03 gh	0.58 bc	0.65 a	7.12 k	6.80 l

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

While, the acidity percentage was not significantly affect by the method of adding organic fertilization in both seasons. But, the acidity values were not significantly affecting by the biofertilizers treatments in both seasons.

Regarding the interaction effect between organic fertilizer source and biofertilizers N-fixing bacteria under application methods of adding organic treatments on acidity value of "Earligrande" peaches during 2014 and 2015 seasons, data of Table (9) indicate that surface application of olive pomace with Rhizobacterein or Nitrobein was significantly interactive for acidity percentage and gave the highest value in this respect in the first season. While, surface application of goat manure or olive pomace fertilization with Rhizobacterein or Nitrobein as well as control treatment recorded the highest value during second season. On the contrary, trench application of fish scrap with Nitrobein treatment had the least value in acidity percentage during both seasons.

Vitamin C Content

Results presented in Table 8 clear that Vitamin C was increased significantly by different organic fertilization sources. The fish scrap treatment produced the highest value of vitamin C content, followed by goat manure treatment in both seasons respectively. Meanwhile, the least values of vitamin C content were obtained by non-organic fertilized trees (control) in both seasons. Similar results were obtained by **El-Desouky and Abd El-Hamied (2014)** they found that using compost as organic fertilization gave the high vitamin C on pomegranate fruit trees. Also, data showed that the surface application achieved the highest vitamin C compared to trench application during both seasons. Concerning the biofertilizer treatments it succeeded in increasing Vitamin C in both seasons. Rhizobacterein caused a high significant increase in vitamin C content while, Nitrobein gave the least values in this respect in 2014 and 2015 seasons. The obtained data are confirmed with those reported by **Shrestha *et al.,* (1996)** on “Anna” apple trees.

Regarding the interaction effect between organic fertilizer source and biofertilizers N-fixing bacteria under application methods of adding organic treatments, data of Table (9) show that surface application of fish scrap fertilization with Rhizobacterein were significantly interactive for vitamin C and gave the highest value in this respect in both seasons while, control treatment had the least values in this result during both seasons.

DISCUSSION

Several studies indicated that the improvement in flowering, resulted by organic fertilization, may be attributed to the stimulation effect of the absorbed nutrients on photosynthesis process which certainly reflected positively on the flowering characteristics **(Bhangoo *et al.,* 1988)**. Also, the slow release nutrients resulted from the biodegradation of manure by soil microorganisms could explain the present results **(Cole *et al.,* 1987 and Al-Kahtani and Ahmed, 2012)**.

The increase in yield/tree could be due to organic manure effects in increasing the fruit weight during two the studied seasons. In addition, the improving effect of organic manure on fruit yield could be attributed to their vital role in improving tree growth and nutritional status can encourage the cell division and the development of meristematic tissues (**Miller *et al.,* 1990**) consequently improving the number of inflorescences borne (**Al-Wasfy and El-Khawaga, 2008**). Nitrobein or Rhizobacterein emphasized the positive action of them, on yield and fruit weight. Besides, the yield as affected by organic and bio- fertilizer could be explained by the ability of N2-fixation, P- solubilising, Indole acetic acid (IAA) and antimicrobial substance production (**Cakmakci *et al.*, 2007; Elkoca *et al.,* 2008**).

Generally, organic fertilizer increased fruit TSS % content and total acidity comparing to control treatment of peach trees **(Fayed, 2005a, Fayed, 2005b Bahaa, (2007) and Stino *et al.* 2010**). The role of organic fertilizer in improving TSS % was reported previously by **Stino *et al*., (2010)** in peach tree. Also, citrate content of mature peach fruit is correlated negatively with total sugar content. Whereas, increasing in sugar content induce a related reduction in estimated "mitochondrial equipment" which diminishes the potential for citrate synthesis. Furthermore, decreasing percentages of inorganic N and, at the same time, increasing levels of humic acid resulted in decreasing total acidity of Florida Prince Peach comparing with using the suitable N completely via inorganic form alone **El-Khawaga (2011)**. In addition to that, increases in total sugars of fruits may result from the increase of chlorophyll content which is combined by an increase in apple leaves photosynthetic capacity and there was a liner relationship between total sugars and total chlorophyll content (**El-Motaium, 2007, Stino *et al*., 2010 El-Khawaga, 2011**).

Conclusions

Finally, from the present study we can recommend that the combination between surface application of organic manure (in form of fish scrap) with biofertilizer in the form (Rhizobacterein) improving "Earligrande" peach productivity and fruit quality under the same condition of our study.

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الملخص العربى

استخدام بعض الأسمدة العضوية والحيوية لتسميد أشجار الخوخ إيرلى جراند تحت ظروف شمال سيناء
ب. محصول الثمار وجودة الثمار

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هدفت هذه الدراسة لإختبار تأثير المصادر العضوية مثل فتات الأسماك، زبل الماعز، وتفل الزيتون، وطريقة الاضافة (سطحي، وخندقي)، والتسميد الحيوي (الريزوباكتيرين، والنيتروبين) على التزهير والعقد والمحصول وصفات الجودة 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 جميع معاملات التسميد العضوي المضافة أدت لزيادة في عدد الأزهار للفرخ والنسبة المئوية للعقد والمحصول الكلي وكذا حجم وصلابة الثمار ومحتوى الثمار من فيتامينC ومجموع المواد الصلبة الذائبة في كلا الموسمين، وكانت معاملة فتات الأسماك الأفضل في القيم في هذا الخصوص، تليها الأشجار المخصبة بسماد الماعز ثم معاملة تفل الزيتون مقارنة بمعاملة الكنترول (المقارنة). وحققت المعاملة الخندقية أعلى زيادة معنوية في محصول الثمار (كجم/للشجرة) ووزن الثمار واللب وحجم وصلابة الثمار مقارنة مع طريقة المعاملة السطحية في كلا الموسمين، وحققت الإضافة السطحية للأسمدة العضوية أعلى قيم لصفتي محتوى الثمار من فيتامين C والمواد الصلبة الذائبة الكلية، أبرزت النتائج أن المعاملة الريزوباكتيرين حققت أفضل النتائج لصفات وزن الثمرة وحجم وصلابة الثمار ولمحتوى الثمار من فيتامين C والمواد الصلبة الذائبة الكلية، وبناءاً على ما سبق فأنه تحت ظروف مماثلة لظروف التجربة فأنه تعتبر إضافة أسمدة فتات الأسماك بمعدل ٢,٧٧ كيلوجرام للشجرة مع التسميد الحيوي بالريزوباكتيرين بمعدل ٥٠ جرام للشجرة الواحدة في خنادق تعطي أفضل معاملة لمعظم الصفات المؤثرة على زيادة نسبة العقد والمحصول وتحسين خصائص ثمار الخوخ الإيرلي جراند.

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

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