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EFFECT OF ORGANIC AND BIO-FERTILIZER SOURCES ON SUMMER SQUASH UNDER EL-ARISH CONDITIONS

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ABSTRACT

A field study was carried out during summer seasons of 2013 and 2014 at the Experimental Farm, Faculty of Environmental Agricultural Sciences, Arish University, Egypt. It aims to study the effect of organic fertilizer sources (cow manure "CM"; chicken manure (ChM); pressed olive cake (POC); compost "Comp"} and two bio-fertilizer sources (Bio-1 and Bio-2) plus without biofertilizer on summer squash (*Cucurbita pepo* L.) *cv* "Askandrany" under EL-Arish conditions. The experiment included 12 treatments and the experimental design was split plot design with three replications. Organic fertilizers were randomly distributed in the main plots (four sources), while, sub plots contained three bio treatments (without bio, Bio-1 and Bio-2). The obtained results indicated that cow manure treatment gave the highest values of number of fruits/plant, mean fruit weight, yield/plant and yield/fed., also, cow manure x Bio-1 treatment gave the highest value in case of average fruit weight/plant, while, cow manure x Bio-2 treatment gave the superior values in cases of number of fruits/plant, yield/ plant and yield/fed., in both seasons. Results of the interaction between organic and bio fertilizers, chicken manure and Bio-1 produced the highest value of TSS%.

Kew words: Organic, bio-fertilizer, cow manure "CM", chicken manure (ChM), pressed olive cake (POC), compost "Comp", summer squash.

INTRODUCTION

Squash *(Cucurbita pepo* L.) is one of the most popular vegetable crops in Egypt. It has a high vital nature due to its high content of vitamins A, B3 (niacin) and moderate content of vitamin C and riboflavin. The total cultivated area of squash in Egypt reached about 33213 feddans in 2013 season, which produced about 262102 tons with an average yield of 7.892 ton/fed. To reduce and eliminate the adverse effects of synthetic fertilizers and pesticides on human health and environment, new agricultural practices have been developed in the so-called organic agriculture, ecological agriculture or sustainable agriculture **(Aksoy, 2001).**

Marketing organic crops in Egypt is mainly produced for exports. Local consumption of organic vegetables and fruits followed in latter stage, but of a lower significance and requires large efforts to be organized **(Abo-Hadid, 2001).** Excessive use of chemical fertilizers adversely affects the soil environment leading to declining crop productivity and production of potentially harmful food, unsafe for human consumption, these unintended harmful effects and the energy intensive processes have resulted in several research initiatives for developing organic fertilizer alternatives **(Chaturvedi *et al.*, 2012)** because use organic matter such as animal manures, human wastes, food wastes, yard wastes, sewage sludge and compost has long been recognized in agriculture as beneficial for

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plant growth and yield and improving soil structure, enhancing soil fertility and increasing crop yield.

Biofertilizer is a natural product carrying living microorganisms derived from the root or cultivated soil, so they don't have any effect on soil health and environment, besides their role in atmospheric nitrogen fixation and phosphorous solubolization, these also help in stimulating the plant growth hormones providing better nutrient uptake, a small dose of biofertilizer is sufficient to produce desirable results because each gram of carrier of bio fertilizers contains at least 10 million viable cells of a specific strain; *i.e.,* Azotobacter, Azospirillum and biogein **(Ramakrishnan and Selvakumar, 2012).**

Therefore, it is essential to adopt a system of organic farming in vegetables due to increasing the objectives against the chemical farming as a main source of soil and water pollution as well as food products. Organic farming is a system that excludes the use of synthetic fertilizers, pesticides and growth regulators. Insects, weeds and other pests are managed by mechanical cultivation, cultural and biological control.

Cow manure, chicken manure, pressed olive cake and compost are good sources of organic fertilizers. These sources play an important role in increasing growth, yield and yield components of many crops. The objective of this study was to study the effect of organic fertilizers; *viz.*, cow manure "CM", chicken manure (ChM), pressed olive cake (POC) and compost "Comp" on the productivity of summer squash in order to produce high yield and fruit quality with less contamination.

MATERIALS AND METHODS

A field study was carried out during summer seasons of 2013 and 2014 at the Experimental Farm, Faculty of Environmental Agricultural Sciences, Arish University. It aims to study the effect of organic fertilizer sources [cow manure (CM); chicken manure (ChM); pressed olive cake (POC); compost (Comp) and two bio-fertilizer sources (Bio-1 and Bio-2)] on summer squash (*Cucurbita pepo*L.) cv. "Askandrany" under El-Arish conditions. Bio-1, is one of the beneficial bacteria (*Frateuria aurentia*, family Psudomonaceae) in potassium edit facilitator of absorbed share by the plant in all soil types, while, Bio-2, is a biological enriched vital (powder) containing a combination of types of fungi mikroheeza and another set of micro-organisms living in the soil, such as bacteria (*Bacillus megaterium*) which plays a vital important role in facilitating the phosphorus in the soil. The physical and chemical analyses of the soil and irrigation water as well as analyses of organic fertilizers is presented in Tables 1, 2, 3 and 4, respectively.

The experiment included 12 treatments as follows: Control + without Bio (cow manure), Control + Bio-1, Control + Bio-2, Chicken manure + without Bio, Chicken manure + Bio-1, Chicken manure + Bio-2, Pressed olive cake + without Bio, Pressed olive cake + Bio-1, Pressed olive cake + Bio-2, Compost + without Bio, Compost + Bio-1, and Compost+Bio-2. The experimental design was split plot design with three replications. Organic fertilizers were randomly distributed in the main plots (four sources), while, sub plots contained three bio treatments (without bio, Bio-1 and Bio-2).The sub - plot area was 10 m^2 (1m width x 10m in length, and 50 cm spacing between plants in the raw). The amounts of organic fertilizers were calculated based on percent in the cow manure. Organic manures were added at the time of soil preparation, trenched in the bottom of the row and covered by 20 cm height of soil. Summer squash seeds were sown on April 8^{th} 2013 and 2014, agricultural practices were applied according the organic farming recommendations.

Table (1): The physical and chemical analyses of the experimental soil site.

Soil properties	First season(2013)	Second season (2014)
	Soil depth (cm.)	
	0-30	
Mechanical analysis		
Coarse sand (%)	68.00	67.99
Fine sand (%)	20.60	20.55
Silt (%)	3.50	3.52
Clay (%)	7.90	7.94
Soil texture class	Sandy	Sandy
Bulk density ($g.cm^{-3}$)	1.53	1.53
Particle density ($g.cm^{-3}$)	2.49	2.49
Chemical analysis (soluble ions in (1:5) extract)		
Ca^{++} ($meq.1^{-1}$)	3.03	2.10
Mg^{++} ($meq.1^{-1}$)	2.11	2.20
Na^{+} ($meq.1^{-1}$)	1.18	4.49
K^{+} ($meq.1^{-1}$)	0.48	0.31
CO_3^{--} ($meq.1^{-1}$)	-	-
HCO_3^{-} ($meq.1^{-1}$)	2.00	2.40
Cl^{-} ($meq.1^{-1}$)	1.02	2.30
$SO4^{--}$ ($meq.1^{-1}$)	3.78	4.40
EC ($dS\ m^{-1}$) (soil paste)	0.68	0.91
pH in (1:2.5 extract)	8.10	8.20
Organic matter (%) in air dried soil	0.16	0.21
$CaCO_3$ (%) in air dried soil	3.95	3.95

Table (2): The physical and chemical analyses of irrigation water.

EC	Soluble ions($meq.I^{-1}$)							
	Cations				Anions			
$dS\ m^{-1}$	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl^{-}	HCO_3^{-}	CO_3^{-}	SO_4^{--}
7.03	16.56	17.60	35.87	0.27	42.26	6.13	-	21.91

Table (3): Analyses of organic fertilizer compost.

Organic fertilizer Contents	First season (2013)	Second season (2014)
Total N (%)	0.71	0.69
Total P (%)	0.39	0.49
Total K (%)	0.42	0.29
Total Fe (ppm)	1110	1188
Total Cu (ppm)	123	110
Total Zn (ppm)	219	214
Total Mn (ppm)	170	166
Organic matter (%)	30.20	24.05
Organic carbon (%)	12.88	13.95
C/N (%)	18.14	20.20

Source: Center laboratory of Organic Agriculture, Agri. Res. Center, Ministry of Agriculture.

Table (4): Chemical analyses of organic fertilizers.

Organic fertilizer contents	Organic Fertilizers		
	Cow manure	Chicken manure	Pressed Olive Cake
	First season (2013)		
Total N (%)	2.8	2.1	2.1
Total P (%)	0.3	0.1	0.3
Total K (%)	2.0	1.0	2.0
	Second season (2014)		
Total N (%)	6.0	1.1	1.2
Total P (%)	0.3	0.3	0.3
Total K (%)	1.7	1.5	2.0

Data Recorded

Vegetative growth characters

Random samples of Three summer squash plants of every replicate were taken at 20 and 40 days after sowing (DAS) in both seasons for conducting the following growth parameters: stem length (cm), number of leaves per plant, leaf area/plant (cm), and total dry weight /plant.

Flowering characters

A random sample of five plants were taken from every treatment during both studying seasons to calculate the percent of female flowers, then sexratio was determined by dividing number of staminate flowers by number of pistillate flowers.

Yield and its components

Fruits were harvested day after day up to the end of plant production; productivity was determined as number of fruits/plant, yield/plant (g) and total fruit yield (ton/fed.)

Fruit quality

Total soluble solids percentage (TSS %) was determined in the extract of fresh fruits

by using a hand refractometer. Fruit diameter and fruit length (cm) at commercial stage were determined using a Caliper. Firmness (Kg/cm^2) was determined by using hand firmness tester Model ST-207, made in Italy.

Plant chemical composition

Total nitrogen, phosphorus and potassium were determined in dry matter of leaves from the third sample (at 60 days) methods described by **Bremner and Mulvaney (1982), Piper 1950, and Brown and Lilliand (1946),** respectively.

Data subjected to statistical analysis as randomized complete block design in a split plot after planting) and from the second harvest (at 80 days after transplanting) using the with three replicates in both seasons. MstatC program was used for statistical analysis, and data were tested by analysis of variance. Duncan's multiple range test was used for comparison among the treatment means **(Duncan, 1958).**

RESULTS AND DISCUSSION

Vegetative Growth Characters

Effect of organic fertilizers

Results in Tables 5 and 6 clear that organic fertilizer sources affected significantly stem length, number of leaves, leaf area and total dry weight per pant after twenty and forty days after sowing in both seasons, except, number of leaves at 20 days after sowing in the first season. Compost treatment resulted in the highest value for each of stem length, number of leaves and leaf area at 20 days after sowing, while cow manure gave the highest values at 40 days after sowing. However, application of cow manure or chicken manure gave the highest values for total dry weight at 20 and 40 days after sowing in both seasons.

The superiority of compost at 20 days after sowing may be due to the enough time allowed for compost analysis before soil application as compared with other organic sources obtained from organic forms in incomplete analysis to confine mineralization after soil application. The increment in dry weight of summer squash plant may be due to the simulative effect of organic fertilizer treatments on the meristematic activity of tissues, where these treatments contained adequate nutrients required for plant growth as reported by **Safia *et al*. (2001).**

Also, results may be due to the effect of organic fertilizers on soil physiochemical and biological properties as reported by **Darwesh, Faysa (2002)**. In addition, our results are in agreement with those reported by **El-Ghanam *et al.* (2005)** who found that organic fertilizer application caused a reduction in soil pH in the rhizosphere zone which may be due to the formation of CO_2 and other organic acids during decomposition of the organic fertilizer.

Effect of bio fertilizers

Results in Tables 5 and 6 clear that bio-fertilizers had no significant effect on most of vegetative growth characters, except for stem length at 20 days after sowing and leaf area 40 days after sowing in the second season, which increased significantly with application of Bio-2 and Bio-1, respectively.

Effect of interaction between organic fertilizers and Bio fertilizers

Results in Tables 5 and 6 show that the interaction between organic fertilizers and bio-fertilizers affected significantly most vegetative characters, except, number of leaves/plant at 20 days in the second season.

The increases in most vegetative growth traits may be refer to the ability of bio-fertilizers to release some chemical compounds that may affect the improvement of plant growth characters, it is interest to note that Organic fertilizer contributes through: (a) release of nutrients through the decomposition of organic matter

Table (5): Effect of organic fertilizers, bio-fertilizers and their interactions on vegetative growth characters of summer squash during 2013 season.

Character / Treatment	Stem length (cm)		No. leaves/ plant		leaf area/plant (cm^2)		Plant dry weight (g)	
	Days after sowing							
	20	40	20	40	20	40	20	40
Organic fertilizers First season (2013)								
Cow manure	2.68b	10.22a	5.61a	12.56a	205.7b	2636.0a	4.34a	25.99ab
Chicken manure	2.86b	9.39a	6.06a	12.61a	204.4b	2658.0a	4.26ab	28.72a
Pressed olive cake	3.56a	5.53b	6.0a	8.33c	156.6c	634.20c	1.84c	18.29b
Compost	3.83a	7.08b	6.72a	10.0b	258.4a	1352.0b	3.63b	20.77ab
Bio fertilizers								
Without bio	3.04a	7.73a	6.13a	10.92a	202.1a	1820.0a	3.33a	23.22a
Bio-1	3.15a	8.25a	6.0a	11.17a	202.0a	1959.0a	3.66a	23.33a
Bio- 2	3.50a	8.19a	6.17a	10.54a	214.8a	1682.0a	3.55a	23.78a
Organic fertilizers x bio fertilizers								
Cow manure x without bio	2.42d	9.83ab	5.17c	12.0a	192.8cd	2363.0cd	3.98bc	24.03a-c
Cow manure x bio-1	2.53cd	11.0a	5.67bc	13.33a	211.2cd	2995.0 a	4.77a	26.73ab
Cow manure x bio-2	3.08bc	9.83ab	6.0bc	12.33a	213.1cd	2549.0bc	4.27a-c	27.22ab
Chicken manure x without bio	2.75cd	8.83a-c	5.83bc	13.17a	202.6cd	3009.0a	4.63ab	29.90a
Chicken manure x bio-1	2.75cd	10.33ab	6.0bc	12.83a	186.3de	2843.0ab	3.85c	27.17ab
Chicken manure x bio-2	3.08bc	9.0a-c	6.33a-c	11.83ab	224.3bc	2123.0d	4.30a-c	29.08a
Pressed olive cake x without bio	3.08bc	6.17de	6.33a-c	8.17d	151.8f	632.5f	1.73e	19.07c
Pressed Olive Cake x Bio-1	3.75a	4.5e	5.83bc	8.67cd	157.7ef	652.7f	1.95e	18.12c
Pressed Olive Cake x Bio-2	3.83a	5.92de	5.83bc	8.17d	160.3ef	617.3f	1.83e	17.70c
Compost x Without Bio	3.92a	6.08de	7.17a	10.33bc	261.1a	1274.0e	2.98d	19.88bc
Compost x Bio-1	3.58ab	7.17cd	6.5ab	9.83cd	252.9ab	1343.0e	4.07a-c	21.32bc
Compost x Bio-2	4.0a	8.0b-d	6.5ab	9.83cd	261.3a	1437.0e	3.82c	21.12bc

* Means followed by the same alphabetical latter (s) within each column are not significantly different at the 5% level, according to Duncan multiple range Test.

Table (6): Effect of organic fertilizers, bio-fertilizers and their interactions on vegetative growth characters of summer squash during 2014 season.

Character / Treatment	Stem length(cm)		No. leaves/Plant		leaf area/plant (cm^2)		Plant dry weight (gm)	
	Days after sowing							
	20	40	20	40	20	40	20	40
Organic fertilizers Second season (2014)								
Cow manure	2.65 b	10.08 a	5.64 b	12.33 a	202.9 b	2642.0 a	4.39 a	24.67 ab
Chicken manure	2.89 b	9.19 b	6.11 ab	12.61 a	207.9 b	2601. 0 a	4.23 a	28.47 a
Pressed Olive Cake	3.61 a	5.46 d	6.03 a	8.36 c	155.1 c	631.9 c	1.84 c	18.40 c
Compost	3.75 a	7.03 c	6.64 a	9.89 b	257.5 a	1353.0 b	3.66 b	21.06 bc
Bio fertilizers								
Without Bio	3.02 b	7.58 a	6.04 a	10.85 a	199.9 a	1827.0 ab	3.37 a	23.08 a
Bio-1	3.12 b	8.10 a	6.02 a	11.02 a	200.0 a	1956. 0 a	3.69 a	22.48 a
Bio- 2	3.53 a	8.14 a	6.25 a	10.52 a	217.6 a	1638.0 b	3.54 a	23.90 a
Organic fertilizers x Bio fertilizers								
Cow manure x Without Bio	2.38 e	9.42 bc	5.250 e	11.67 c	190.6 de	2377. 0 b	4.10 b	21.78 cd
Cow manure x Bio-1	2.49 de	11.08 a	5.583 c-e	13.08 ab	203.5 de	3007.0 a	4.72 a	25.30 bc
Cow manure x Bio-2	3.09 c	9.75 ab	6.083 b-e	12.25 a-c	214.7 cd	2542.0 b	4.35 ab	26.94 ab
Chicken manure x Without Bio	2.79 cd	9.17 bc	5.500 de	13.33 a	203.0 de	3035.0 a	4.68 a	30.74 a
Chicken manure x Bio-1	2.75 c-e	9.58 a-c	6.250 a-d	12.42 a-c	186.2 e	2825.0 a	3.95 b	25.29 bc
Chicken manure x Bio-2	3.13 c	8.83 bc	6.583 ab	12.08 bc	234.6 bc	1943. 0 c	4.05 b	29.39 ab
Pressed Olive Cake x Without Bio	3.13 c	5.75 ef	6.333 a-d	8.25 f	149.3 f	648.9 e	1.68 d	19.34 d
Pressed Olive Cake x Bio-1	3.71 ab	4.67 f	5.833 b-e	8.83 ef	157.1 f	629.2 e	1.96 d	18.38 d
Pressed Olive Cake x Bio-2	4.0 a	5.96 ef	5.917 b-e	8.0 f	159.0 f	617.5 e	1.89 d	17.49 d
Compost x Without Bio	3.79 ab	6.0 ef	7.083 a	10.17 d	256.9 ab	1246.0 d	3.02 c	20.45 cd
Compost x Bio-1	3.54 b	7.08 de	6.417 a-c	9.75 de	253.2 ab	1364. 0 d	4.12 b	20.97 cd
Compost x Bio-2	3.92 ab	8.0 cd	6.417 a-c	9.75 de	262.3 a	1449.0 d	3.85 b	21.76 cd

* Means followed by the same alphabetical latter(s) within each column are not significantly different at 5% level, according to Duncan multiple range Test.

(b) lowering of nutrients fixation through several mechanisms such as chelating and formation of complex relatively available for plant (c) production of humates which could exchange for absorbed anions such as P which should be available. In addition many researchers came to similar explanation, where they indicated that organic fertilizers may increase soil fertility which reflected on the crop production potential possibly affected by changes in soil physical and chemical properties including nutrient bio availability, soil structure, water holding capacity, cation exchange capacity, soil pH and microbial community and activity **(Marchner, 1995; Clement and Bernal, 2006; Agbede *et al*., 2008; Malak *et al*., 2008; Ayeni *et al*., 2010**). On the other hand, Bio fertilizers plays a vital role in plant metabolism such as their effects on constituent of proteins, enzymes, hormones, vitamins, chlorophyll and photosynthesis pigments **(Reddy and Reddi, 2002).**

Refai *et al*. (2009) found that the bacterial bio-fertilizer application promoted the crop growth by increasing root number and root length, subsequently, a significant increment in stem length, number of leaves, root system can absorb more water and nutrients from soil including the applied N. Thus, N lose hazards to the environment is reduce especially, in reclaimed sandy soil. In this concern**, Sarhan *et al*. (2011)** found that the biological (Azotobacter) fertilizers significantly affected the vegetative (shoot) characteristics of summer squash as compared with the control treatments.

However, **Shaban, Sally (2009)** found that organic nitrogen fertilizer sources affected all vegetative growth parameters of summer squash; *i.e.*, plant length, number of leaves/plant, leaf area/plant, fresh and dry weight/plant. She found, also that the highest values were recorded with compost manure.

Flowering Characters

Effect of organic fertilizers

Results presented in Table 7 clear significant differences among organic fertilizer treatments on pistillate, staminate and sex ratio, the treatment of cow manure gave the highest pistillate number and sex ratio during the two seasons.

Effect of bio fertilizers

Results in Table 7 show that there were no significant effects for bio treatments on flowering traits in both seasons**.**

Effect of interaction between organic fertilizers and Bio fertilizers

Results in Table 7 show that the interaction among organic fertilizers and bio-sources affected significantly number of staminate, pistillate flowers and sex ratio. The interaction between cow manure treatment and Bio-2 treatment gave the highest number of pistillate flowers and the best sex ratio at both seasons, while pressed olive cake + bio-fertilizer treatments gave the lowest values.

Results are in harmony with **Refai *et al*. (2009)** who found that application with bio-fertilizer (Azotobacter wild type strain) for squash plants that received no mineral N fertilizer resulted in a significant increment in number of female and male flowers.

Also, **Galal *et al*. (2012)** reported that the use of Bio-fertilization resulted in a significant increment in number of female and male flowers. In addition, **Abd El-Fattah and Sorial (2000),** on summer squash, indicated that bio-fertilizer treatment (Halex 2) significantly enhanced the induction of female flowers, which was reflected afterward on the increase of fruit yield.

Yield and its Components

Effect of organic fertilizers

Results in Table 8 clear significant differences in yield and its components among organic fertilizer sources. Cow manure treatment gave the highest value for each of number of fruits /plant, mean fruit weight, yield /plant and yield / fed. It could

Table (7): Effect of organic fertilizers, bio-fertilizers and their interactions on flowering characters of summer squash during 2013and 2014 seasons.

Treatment / Character	No. Pistillate flowers	No. Staminate flowers	Sex ratio	No. Pistillate flours	No. Staminate flowers	Sex ratio
	First season (2013)			Second season (2014)		
Organic fertilizers						
Cow manure	**36.67 a**	56.78 a	1.570 a	36.33 a	56.22 ab	1.566 b
Chicken manure	**32.11 ab**	58.22 a	1.828 a	31.56 b	58.44 a	1.864 a
Pressed Olive Cake	**24.78 c**	48.0 b	1.953 a	24.89 c	47.39 c	1.909 a
Compost	**25.89 bc**	50.67 ab	1.963 a	26.44 c	50.78 bc	1.924 a
Bio fertilizers						
Without Bio	29.17 a	53.25 a	1.841 a	29.13 a	52.75 a	1.826 a
Bio-1	29.33 a	54.25 a	1.885 a	29.13 a	54.21 a	1.877 a
Bio- 2	31.08 a	52.75 a	1.760 a	31.17 a	52.67 a	1.745 a
Organic fertilizers x Bio fertilizers						
Cow manure x Without Bio	33.0 b	56.67 a-c	1.723 a-c	33.17 bc	54.33 a-e	1.643 c
Cow manure x Bio-1	35.67 b	58.33 ab	1.647 bc	34.67 b	59.17 a-c	1.710 bc
Cow manure x Bio-2	41.33 a	55.33 a-c	1.340 c	41.17 a	55.17 a-d	1.343 d
Chicken manure x Without Bio	31.0 b-d	54.0 a-c	1.747 a-c	30.50 cd	54.17 a-e	1.777 a-c
Chicken manure x Bio-1	31.33 bc	62.33 a	2.017 ab	30.0 c-e	61.67 a	2.077 a
Chicken manure x Bio-2	34.0 b	58.33 ab	1.720 a-c	34.17 b	59.50 ab	1.740 bc
Pressed Olive Cake x Without Bio	27.0 c-e	51.0 bc	1.893 ab	27.0 ef	51.33 b-f	1.903 a- c
Pressed Olive Cake x Bio-1	25.0 e	46.0 c	1.867 ab	25.50 f	46.17 ef	1.813 a-c
Pressed Olive Cake x Bio-2	22.33 e	47.0 c	2.100 a	22.17 g	44.67 F	2.010 ab
Compost x Without Bio	25.67 e	51.33 bc	2.000 ab	25.83 f	51.17 c-f	1.980 ab
Compost x Bio-1	25.33 e	50.33 bc	2.010 ab	26.33 f	49.83 d-f	1.907 a-c
Compost x Bio-2	26.67 de	50.33 bc	1.880 ab	27.17 d-f	51.33 b-f	1.887 a-c

* Means followed by the same alphabetical latter(s) within each column are not significantly different at 5% level, according to Duncan multiple range Test.

Table (8): Effect of organic fertilizers, bio-fertilizers and their interactions on yield and its components of summer squash during 2013 and 2014 seasons.

Character / Treatment	No. Fruits/ plant	Mean fruit weight (gm)	Yield/ plant (g)	Yield/ fed. (ton)	No. Fruits/ plant	Mean fruit weight (g)	Yield/ plant (g)	Yield/ fed. (ton)
	first Season (2013)				Second Season (2014)			
Organic fertilizers								
Cow manure	8.192 a	111.2 a	908.4 a	7.63 a	8.18 a	111.5 a	910.0 a	7.64 a
Chicken manure	7.448 ab	106.7 ab	794.9 ab	6.68 ab	7.38 b	106.3 b	784.8 b	6.59 b
Pressed Olive Cake	6.249 c	102.1 b	636.9 c	5.35 c	6.23 c	102.5 c	638.3 c	5.36 c
Compost	6.754 bc	107.1 ab	723.6 bc	6.08 bc	6.80 bc	107.0 b	728.5 b	6.12 b
Bio fertilizers								
Without Bio	7.045 a	107.9 a	760.7 a	6.39 a	7.03 a	107.5 a	756.8 a	6.36 a
Bio-1	6.978 a	108.6 a	760.6 a	6.39 a	7.01 a	108.9 a	765.4 a	6.43 a
Bio- 2	7.459 a	103.8 a	776.7 a	6.52 a	7.41 a	104.1 a	773.9 a	6.50 a
Organic fertilizers x Bio fertilizers								
Cow manure x Without Bio	7.62 bc	111.4 ab	850.3 bc	7.140 bc	7.56 bc	110.3 b	833.9 b	7.0 b
Cow manure x Bio-1	7.90 b	115.8 a	910.9 ab	7.65 ab	7.81 b	116.8 a	910.2 a	7.65 a
Cow manure x Bio-2	9.06 a	106.3 ab	964.1 a	8.10 a	9.16 a	107.5 bc	986.0 a	8.28 a
Chicken manure x Without Bio	7.09 cd	106.1 ab	752.0 c-e	6.32 c-e	7.04 c	106.2 b-d	747.9 cd	6.28 cd
Chicken manure x Bio-1	7.48 bc	108.9 ab	814.1 bc	6.837 bc	7.41 bc	107.3 bc	794.6 b-d	6.67 b-d
Chicken manure x Bio-2	7.78 bc	105.1 ab	818.4 bc	6.873 bc	7.70 b	105.3 b-d	811.8 bc	6.82 bc
Pressed Olive Cake x Without Bio	5.94 e	106.8 ab	633.6 f	5.320 f	5.96 e	106.3 b-d	632.8 f	5.32 f
Pressed Olive Cake x Bio-1	6.17 e	100.2 b	617.4 f	5.183 f	6.30 de	101.4 de	638.7 ef	5.36 ef
Pressed Olive Cake x Bio-2	6.64 de	99.42 b	659.8 ef	5.543 ef	6.44 de	99.93 e	643.4 ef	5.41 ef
Compost x Without Bio	7.53 bc	107.1 ab	806.7 b-d	6.777 b-d	7.56 bc	107.3 bc	812.6 bc	6.83 bc
Compost x Bio-1	6.37 e	109.7 ab	699.8 d-f	5.880 d-f	6.52 d	110.1 b	718.2 de	6.03 de
Compost x Bio-2	6.36 e	104.4 ab	664.4 ef	5.580 ef	6.32 de	103.6 c-e	654.5 ef	5.50 ef

* Means followed by the same alphabetical latter(s) within each column are not significantly different at 5% level, according to Duncan multiple range Test.

concluded that the vigor growth plants were resulted due to application cow manure treatment, which is known that, its organic fertilizer addition to the soil resulted in slow release of nutrients along the plant life and improves soil chemical properties as well as maintaining soil fertility, consequently their absorption increase. Also, it is worth to mention that, good effect of organic nitrogen treatment would be to increasing plant growth parameters **(Saleh *et al*., 2007;** on tomato, **El-Kafrawy and Radwan, 2008** on cucumber**)**.

Effect of bio fertilizers

Results in Table 8 clear no significant differences on yield and its components by bio-fertilizer.

Effect of interaction between organic fertilizers and Bio fertilizers

Results in Table 8 show significant differences among organic fertilizers for early yield/fed. The interaction between organic and bio-fertilizers resulted in significant differences in case of early yield/fed., and the percentage of early yield to total yield.

Also, results in the same Table show significant effects for the interaction among organic fertilizer sources and bio-fertilizers. Cow manure x Bio-1 treatment gave the highest value in case of average fruit weight / plant, while, Cow manure x Bio-2 treatment gave the superior values in cases of number of fruits/plant, yield /plant and yield/fed., in both seasons.

The increases in total fruits yield and its components might be attributed to the increase in vegetative growth characteristics (Tables 5 and 6) and reproductive phases of plant which have impact on total fruits yield and its components **(Hamed, 1997; Turemis *et al*., 1998; Awad, 2005; Awad *et al*., 2006; Rathore *et al*., 2008).**

However, this increase in yield and its components may be due to the increasing in vegetative growth parameters; *i.e.*; plant length, dry weight/plant, number of leaves as well as leaf area/plant as shown in Tables 5 and 6. It may be also stated that the sufficient addition and the efficient absorption of nutrients (NPK) were coupled together to promote the production for good yield and its components **(Floresen *et al*., 1991; Ali, 2002).**

Fruit quality

Effect of organic fertilizers

Results in Table 9 show significant differences among most of organic fertilizer sources. Fruit TSS (%) had higher significant values in fruits of plants fertilized with chicken manure, cow manure and compost, while pressed olive cake produced the lowest fruit TSS(%) in both seasons. Organic fertilizers are claimed to produce higher nutritional quality of vegetable fruits in forms of TSS (%) in tomatoes **(El-Kassas and Abd El-Mowly, 1999; Youssef *et al*., 2001; Bayoumi, 2005).** Cow manure without bio addition resulted in the highest values of fruit firmness in both seasons, while compost without bio addition produced the lowest firmness values. These results are on agreement with **Pelaez *et al*. (1984)** on squash and **Ali (2002)** on cucumber Cow and chicken manures produced the highest fruit length values.

Effect of bio fertilizers

Results in Table 9 show no significant effects for biofertilizers on all determined parameters in both seasons.

Effect of interaction between organic fertilizers and bio fertilizers

Results in Table 9 show that the interaction between organic and bio fertilizers resulted in significant differences for all determined parameters in both seasons. Significant differences in TSS(%) were appeared as a result of the interaction between organic and bio fertilizers, chicken

Table (9): Effect of organic fertilizers, bio-fertilizers and their interactions on fruit quality of summer squash during 2013 and 2014 seasons.

Character / Treatment	Fruit TSS (%)	Fruit Diameter (cm)	Fruit Length (cm)	Fruit Firmness (kg/cm^2)	Fruit TSS (%)	Fruit Diameter (cm)	Fruit Length (cm)	Fruit Firmness (kg/cm^2)
	first Season (2013)				Second Season(2014)			
Organic fertilizers								
Cow manure	5.04 ab	3.70 a	14.26 a	3.73 a	5.04 a	3.72 a	14.42 a	3.69 ab
Chicken manure	5.06 a	3.73 a	14.31 a	3.76 a	5.07 a	3.72 a	14.22 a	3.75 a
Pressed Olive Cake	4.96 b	3.63 a	12.68 b	3.53 ab	4.95 b	3.54 a	12.57 b	3.54 bc
Compost	5.01 ab	3.46 a	12.88 ab	3.46 b	5.0 ab	3.46 a	12.96 b	3.45 c
Bio fertilizers								
Without Bio	5.03 a	3.65 a	13.61 a	3.68 a	5.03 a	3.60 a	13.61 a	3.68 a
Bio-1	5.01 a	3.54 a	13.57 a	3.59 a	5.02 a	3.53 a	13.56 a	3.56 a
Bio- 2	5.0 a	3.71 a	13.42 a	3.58 a	5.00 b	3.71 a	13.46 a	3.58 a
Organic fertilizers x Bio fertilizers								
Cow manure x Without Bio	5.07 ab	3.70 ab	14.39 ab	3.86 a	5.07 b	3.71 bc	14.48 a	3.85 a
Cow manure x Bio-1	5.02 a-e	3.68 ab	14.04 ab	3.68 a-d	5.03 c	3.71 bc	14.18 a	3.61 bc
Cow manure x Bio-2	5.01 b-f	3.71 ab	14.36 ab	3.65 a-e	5.01 d	3.75 b	14.59 a	3.60 bc
Chicken manure x Without Bio	5.06 a-c	3.78 ab	14.56 a	3.75 ab	5.07 b	3.76 b	14.49 a	3.77 ab
Chicken manure x Bio-1	5.08 a	3.80 ab	14.62 a	3.72 a-c	5.09 a	3.77 b	14.49 a	3.71 ab
Chicken manure x Bio-2	5.04 a-d	3.62 b	13.74 bc	3.81 ab	5.04 c	3.63 b-d	13.69 b	3.78 ab
Pressed Olive Cake x Without Bio	4.98 e-g	3.69 ab	12.86 de	3.73 ab	4.96 e	3.50 cd	12.75 c	3.72 ab
Pressed Olive Cake x Bio-1	4.95 fg	3.11 c	12.32 e	3.40 e	4.95 ef	3.09 e	12.27 d	3.43 cd
Pressed Olive Cake x Bio-2	4,94 g	4.08 a	12.86 de	3.45 c-e	4.94 f	4.02 a	12.70 c	3.46 cd
Compost x Without Bio	5.01 c-f	3.41 bc	12.62 de	3.39 e	5.01 d	3.41 d	12.73 c	3.36 d
Compost x Bio-1	5.0 d-g	3.56 b	13.29 cd	3.57 b-e	5.0 d	3.54 b-d	13.31 b	3.50 cd
Compost x Bio-2	5.01 b-f	3.40 bc	12.74 de	3.41 de	5.0 d	3.42 d	12.85 c	3.48 cd

* Means followed by the same alphabetical latter(s) within each column are not significantly different at 5% level, according to Duncan multiple range Test.

manure and Bio-1 produced the highest value of TSS (%). The lowest TSS (%) value resulted from the interaction between pressed olive cake and Bio-2 in both seasons. Many Researchers found that squash plants treated with pressed olive cake and Bio-2 produced the highest value in fruit diameter, except for chicken manure + Bio-2.

On the other hand, Such increase in TSS, fruit dimensions and firmness could be attributed to cow manure which contained a lot of macro and micro elements, carbohydrates and growth hormones, vitamins and amino acids and their involvement in one or more of important biological functions which referred to the simulate plant growth and consequently increased fruit quality contents **(Eris *et al*., 1995)**.

The highest fruit diameter was recorded with application of pressed olive cake x Bio-2 in both seasons. The highest fruit length was recorded with application of cow manure x without Bio in both seasons.

Chemical Contents

Effect of organic fertilizers

Results in Tables 10 and 11 clear that there were significant effects for organic fertilizers on leaves content of P and K in the first season and N and P in the second season. On the other hand, there were significant effects for fruits content of P in the first and second seasons.

Effect of bio fertilizers

Results in Tables 10 and 11 clear that there were no significant differences among bio-fertilizer treatments on NPK contents of squash leaves and fruits.

Effect of interaction between organic fertilizers and Bio fertilizers

Tables 10 and 11 clear that there were significant effects among the interaction treatments in both seasons, except N and K contents of fruits in the first season and P and K contents of leaves in the second season. The highest contents in leaves were recorded for N when cow manure was mixed with Bio-1 (2.323%) in the first season and with Bio-2 (2.13) in the second one; for P with chicken manure and Bio-2 (0.137); for K with compost without bio (1.10) in the first season.

The highest contents in fruits were recorded for N (2.45%) with application of pressed olive cake and bio- 2 in the first season; for P (0.333% and 0.280% in the first and second seasons, respectively) with application of cow manure with Bio-1 and compost without bio, respectively; for K (0.287) with application of pressed olive cake and bio- 1 in the second season. The increments of N, P and K contents in the leaves and fruits might be attributed to organic elements constituents as reported by **Hamed (1997) and El-Aidy *et al.* (2002). Shaban, Sally (2009)** found that percent N,P and K in the leaves and fruits of summer squash were significantly influenced by different types of organic nitrogen fertilizer sources.Also, **Shehata (2001)** on squash and **El-Sherif (2006)** on cucumber found that application of organic fertilizers increased the concentration of N,P and K in both shoots and fruits.

On the other hand, many researchers reported that the steady release of nitrogen from organic manures in form of ammonium at relatively slow release probably caused low nitrate contents in the fruits of squash plants **(Clark *et al*., 1999; Abd El-Kawy, 2003; Awad,2005; Ibrahim and Selim, 2007).**

In addition, **El-Sherif (2006)** indicated that increment uptake of N, P and K in the leaves and fruits may be due to higher availability of the nutrients which resulted in better root growth and increased physiological activity of root to absorb the nutrients through decomposition of organic matter that led to increase their concentration in plant leaves and fruits.

Table (10): Effect of organic fertilizers, bio-fertilizers and their interactions on chemical contents in leaves and fruits of summer squash plants during 2013 season.

Character / Treatment	Leaves			Fruits		
	N(%)	P(%)	K(%)	N(%)	P(%)	K(%)
Organic fertilizers						
Cow manure	2.804 a	0.100 b	0.626 b	2.11 a	0.312 a	0.137 a
Chicken manure	2.713 a	0.103 ab	0.653 ab	1.99 a	0.282 ab	0.111 a
Pressed Olive Cake	2.534 a	0.117 ab	0.912 a	1.92 a	0.222 b	0.140 a
Compost	2.356 a	0.121 a	0.916 a	1.77 a	0.240 b	0.154 a
Bio fertilizers						
Without Bio	2.664 a	0.106 a	0.774 a	2.01 a	0.277 a	0.139 a
Bio-1	2.638 a	0.112 a	0.800 a	1.87 a	0.248 a	0.133 a
Bio- 2	2.504 a	0.113 a	0.756 a	1.97 a	0.268 a	0.134 a
Organic fertilizers x bio fertilizers						
Cow manure x Without Bio	2.953 ab	0.120 ab	0.527 e	2.21 a	0.337 a	0.150 a
Cow manure x Bio-1	3.137 a	0.100 ab	0.650 de	2.11 a	0.267 b-d	0.133 a
Cow manure x Bio-2	2.323 b	0.080 ab	0.700 c-e	2.00 a	0.333 a	0.127 a
Chicken manure x Without Bio	2.947 ab	0.073 b	0.650 de	1.86 a	0.297 ab	0.117 a
Chicken manure x Bio-1	2.477 ab	0.100 ab	0.650 de	1.84 a	0.263 b-d	0.110 a
Chicken manure x Bio-2	2.717 ab	0.137 a	0.660 de	2.28 a	0.287 a-c	0.107 a
Pressed Olive Cake x Without Bio	2.397 ab	0.110 ab	0.820 b-d	2.19 a	0.223 d	0.147 a
Pressed Olive Cake x Bio-1	2.597 ab	0.123 ab	0.917 a-c	1.77 a	0.213 d	0.130 a
Pressed Olive Cake x Bio-2	2.610 ab	0.117 ab	1.000 ab	1.79 a	0.230 cd	0.143 a
Compost x Without Bio	2.360 b	0.120 ab	1.10 0 a	1.78 a	0.250 b-d	0.143 a
Compost x Bio-1	2.340 b	0.123 ab	0.983 ab	1.75 a	0.247 b-d	0.160 a
Compost x Bio-2	2.367 b	0.120 ab	0.663 de	1.81 a	0.223 d	0.160 a

* Means followed by the same alphabetical latter (s) within each column are not significantly different at 5% level, according to Duncan multiple range Test.

Table (11): Effect of organic fertilizers, bio-fertilizers and their interactions on chemical contents in leaves and fruits of summer squashplants during 2014season

Character / Treatment	Leaves			Fruits		
	N (%)	P(%)	K(%)	N (%)	P (%)	K(%)
Organic fertilizers						
Cow manure	1.87 a	0.083 a	0.512 a	1.68 a	0.202 c	0.182 a
Chicken manure	1.30 b	0.074 ab	0.500 a	1.65 a	0.226 b	0.199 a
Pressed Olive Cake	1.68 ab	0.060 b	0.553 a	2.02 a	0.251 a	0.248 a
Compost	1.64 ab	0.070 ab	0.527 a	1.79 a	0.249 a	0.196 a
Bio fertilizers						
Without Bio	1.63 a	0.076 a	0.548 a	1.65 a	0.235 a	0.188 a
Bio-1	1.59 a	0.071 a	0.503 a	1.87 a	0.232 a	0.219 a
Bio- 2	1.65 a	0.069 a	0.518 a	1.84 a	0.229 a	0.211 a
Organic fertilizers x bio fertilizers						
Cow manure x Without Bio	1.78 ab	0.090 a	0.537 a	1.89 a-e	0.227 a-c	0.160 c
Cow manure x Bio-1	1.71 ab	0.080 a	0.467 a	1.64 b-e	0.197 c	0.173 c
Cow manure x Bio-2	2.13 a	0.080 a	0.533 a	1.52 c-e	0.183 c	0.213 bc
Chicken manure x Without Bio	1.43 ab	0.077 a	0.517 a	1.42 de	0.210 bc	0.183 c
Chicken manure x Bio-1	1.13 b	0.077 a	0.487 a	1.52 c-e	0.227 a-c	0.213 bc
Chicken manure x Bio-2	1.33 b	0.070 a	0.497 a	2.02 a-d	0.240 a-c	0.200 bc
Pressed Olive Cake x Without Bio	1.51 ab	0.060 a	0.570 a	1.52 c-e	0.223 a-c	0.200 bc
Pressed Olive Cake x Bio-1	1.82 ab	0.063 a	0.583 a	2.10 a-c	0.270 ab	0.287 a
Pressed Olive Cake x Bio-2	1.70 ab	0.057 a	0.507 a	2.45 a	0.260 ab	0.257 ab
Compost x Without Bio	1.79 ab	0.077 a	0.567 a	1.79 b-e	0.280 a	0.210 bc
Compost x Bio-1	1.69 ab	0.063 a	0.477 a	2.22 ab	0.233 a-c	0.203 bc
Compost x Bio-2	1.45 ab	0.070 a	0.537 a	1.36 e	0.233 a-c	0.173 c

* Means followed by the same alphabetical latter(s) within each column are not significantly different at 5% level, according to Duncan multiple range Test.

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الملخص العربي

تأثير مصـــادر التســـميد العضـــوي والحيـــوي علـــى الكوســـة تحـت ظـــروف العـــريـش

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١- مركز البحوث الزراعية بالعريش، وزارة الزراعة واستصلاح الأراضي، مصر.
٢- قسم الإنتاج النباتي، كلية العلوم الزراعية البيئية، جامعة العريش، مصر.

أجريت دراسة حقلية خلال الموسم الصيفي لعامي ٢٠١٣ و٢٠١٤م في المزرعة التجريبية بكلية العلوم الزراعية البيئية بالعريش جامعة العريش، محافظة شمال سيناء، مصر، وذلك بهدف دراسة تأثير أنواع مختلفة من التسميد العضوي (السماد البقري، وسماد الدواجن، وتفلة الزيتون، وسماد الكمبوست) بالإضافة إلي استخدام نوعين من التسميد الحيوي ("بيو"١، و"بيو٢") على محصول الكوسة صنف "اسكندراني" في الحقل المكشوف تحت ظروف منطقة العريش، تم توزيع المعاملات عشوائياً في نظام القطع المنشقة مرة واحدة في ثلاث مكررات، حيث تم توزيع معاملات التسميد العضوي عشوائياً في القطع الرئيسية، ووزعت معاملات التسميد الحيوي في القطع المنشقة مرة واحدة، وتم زراعة نبات الكوسة صنف "اسكندراني" في تربة رملية مع استخدام نظام الري بالتنقيط، وأوضحت النتائج أن استخدام السماد البقري أدى إلى الحصول على أعلى القيم لصفات النمو الخضري، وعدد الثمار للنبات الواحد، ومتوسط وزن الثمرة، ومحصول النبات الواحد، والمحصول للفدان، كما نتج عن استخدام سماد الأبقار مع السماد الحيوي" بيو ١" أعلى القيم لمتوسط وزن الثمار للنبات، بينما أدى استخدام السماد البقري مع السماد الحيوي" بيو٢" إلى الحصول على أفضل القيم لعدد الثمار للنبات الواحد، ومحصول النبات الواحد، والمحصول للفدان في كلا موسمي الزراعة، ونتج عن استخدام سماد الدواجن مع السماد الحيوي " بيو١" أعلى محتوى للثمار من المواد الصلبة الذائبة الكلية.

الكلمات الاسترشادية: التسميد العضوي، الحيوي، السماد البقري، وسماد الدواجن، وتفله الزيتون، وسماد الكمبوست، الكوسة.