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Vegetative characters and chemical constituents of cultivated *Portulaca oleracea* L. treated with organic fertilizer.

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The aim of this study was evaluated the response of *Portulaca oleracea L.* growth, production and chemical contents to the influence of organic fertilizer. *Portulaca oleracea* L. plants were cultivated during two successive seasons (2007-2008). The experiment was conducted at experimental farm of the Faculty of Agriculture, Zagazig University, Alsharkia Governorate, Egypt. Three farmyard manure (FYM) levels were added as 10, 20 and 30 m^3/Fed. before two weeks from cultivation compared to control (100 kg/Fed. ammonium sulphate + 100 kg/Fed super calcium phosphate + 50 kg/Fed. potassium sulphate). The vegetative growth characters were recorded included, plant height (cm), number of branches/plant, fresh and dry weights of leaves, stems, aerial parts and roots as g/plant and ton/fed. Chemical constituent measurements such as total carbohydrates, total soluble sugars, crude lipids, crude protein, macro and micro- elements content and fatty acids analysis were determined. The results revealed that the best vegetative growth characters were obtained with applied the highest FYM level (30 m^3/Fed). Similarly, the same level caused the highest accumulation in the percentage of total carbohydrates, soluble sugars as well as phosphorus content in the leaves and stems. Meanwhile, the medium level (20m^3/Fed.) resulted in the highest content of crude lipid, crude protein, nitrogen as well as potassium percentage of leaves and stems. The maximum content of Magnesium and iron were noticed with applied low FYM level (10 m^3/Fed.).

Keywords: Organic Fertilizer (FYM); *Portulaca oleracea* L.; Growth characters; Chemical Constituents; Correlation coefficient

INTRODUCTION

Portulaca oleracea L. (Family Portulaceae), Purslane, known in Egypt as Regla, is an herbaceous weed. It can be found growing wild and/ or cultivated in much of the world. It is considered high nutritional value because it is unusually high in omega-3 fatty acids and contains significant amount of vitamins A and C, calcium, iron, magnesium, potassium and antioxidant compounds. The plant has various medicinal uses. Purslane is a common medication for dysentery, acute gastroenteritis diarrhoea, etc. Its fresh leaves and stems are wildly used in the healing of psoriasis [Shi et al., 1995] chronic atrophic gastritis with intestinal metaplasia and atypical hyperplasia [Rashed et al., 2004], biliary ascariasis [Zhang et al., 2002] urinary tract infection, acne, diabetes, etc.

Organic manure plays an important role in plant growth as a source of all necessary macro and micronutrients in available form during mineralization, improving the physical and crude lipid structure (Tolba, 2005 and Babik and Elkne, 2002). It also improves the aeration; slow release nutrient which supported root development caused higher yield and quality of plants (Abuo El-Magd et al., 2006). Application of farmyard manure (FYM) and nitrogen fertilizer as well as their interaction had considerable influence on most growth parameters of *Allium cepa* L. (Kokobe et al., 2013). Most growth parameters of pepper plant showed an increasing response to different rates of poultry manure as the rates increased. Growth and yield of pepper fruit could significantly be improved by the application of poultry manure (PM) at 3.0 tons/ ha-1 [Adesina et al., 2014]. Organic carbon as FYM combined with algae fertilizer stimulated the growth and yield of *Vetiveria zizanioides* L. plants (Kumar and Nikhil, 2016).

However, there is lake of available information or reports on optimizing level of organic fertilizer application to obtain highest clean production of cultivated *Portulaca oleracea* plant and its active constituents. Thus, the current experiment targeted to estimate the optimum level of organic fertilizer (FYM) for maximizing plants production and its chemical contents.

MATERIALS AND METHODS

Experimental sites and treatments:

Two experiments were carried out at the experimental farm of the Faculty of Agriculture, Zagazig University, Alsharkia Governorate, Egypt during two successive seasons (2007 and 2008) aiming to study the effect of farmyard manure (FYM) on growth characters and chemical composition of *P. oleracea*. Seeds were obtained and identified at the herbarium of Flora and Phytotaxonomy Research Department, Horticulture Research Institute, Giza, Egypt. Soil was cleared, ploughed, harrowed and divided into plats. Three FYM levels viz., 10, 20 and 30 m^3/Fed. were added before two weeks from cultivation compared to control (100 kg/Fed. ammonium sulphate + 100 kg/Fed super calcium phosphate + 50 kg/Fed. potassium sulphate). Seeds were sown at the first week of June during both successive seasons 2007 and 2008. It planted in hills in row with 50 cm distance between each row and 25 cm between each hill.

Properties of the soil and fertilizers:

The physical and chemical analysis of the soil characters were conducted using the methods of Jackson, 1967, and Cottenie et al., 1982 and presented in Table (1). Farmyard manure (FYM) as the organic fertilizer was obtained from Animal Production Department, Faculty of Agriculture, Zagazig University and analyzed according to method of Jackson, 1967 and Cottenie et al., 1982. Chemical compositions of the manure are presented in the Table (2).

Harvesting and vegetative growth measurements:

The plants were harvested on 6th August for the two seasons. The vegetative growth characters i.e. plant height (cm), number of branches/plant, fresh and dry weight of leaves, stems, aerial parts and roots (g/plant and ton/fed) were recorded.

Chemical constituent measurements:

The plant organs i.e. leave and stems were dried under room temperature and grind. The following chemical constituents were determined:

a-Total carbohydrates and total soluble sugars:

Total carbohydrates and soluble sugars determined according to the method of phenol–sulfuric acid [Dubois et al., 1956]. Total carbohydrates and total soluble sugars were determined as glucose.

b- Crude lipids and Crude proteins:

Methods of the Association of Official Analytical Chemists [A.O.A.C. 2000] were used for the determination of total lipid, and crude protein content.

c- Macro element percentage:

Macro element percentage i.e. nitrogen, phosphorus, and potassium, were determined according to methods of Association of Official Analytical Chemists A.O.A.C. 2000. Total nitrogen content was determined using the Kjeldhal method. Potassium and phosphorus content were determined by the flame photometer and by spectrophotometer, respectively

d- Microelement content:

Microelement content including Magnesium (Mg) and Iron (Fe) were measured using an atomic absorption spectrophotometer according to Chapman and Prett, 1961.

Table .1 The physical and chemical properties of experimental soil during both seasons.

Characters	First season	Second season
Particle size distribution (%)		
Clay	52.82	53.30
Silt	12.97	14.25
Fine sand	27.10	25.46
Coarse sand	7.11	6.99
Texture class (According to USDA	Clay	Clay
Field capacity	45.10	44.80
Density (g/cm^3)		
Bulk density	1.43	1.50
Particle density (g/cm^2)	2.54	2.53
organic matter %	0.51	0.48
Soluble ions, EC* and pH**		
C(dS/m) (crude lipids extract 1:10)	2.67	2.33
pH(Crude lipids suspension 1:2.5)	7.82	7.62
Soluble ions (meq /100 g soil)		
Na^+	1.49	1.44
K^+	0.07	0.11
Ca^{++}	0.54	0.51
Mg^{++}	0.66	0.61
CL^-	0.79	0.82
CO_3^{--}	0	00
HCO_3^-	0.30	0.26
SO_4^{--}	1.69	1.71
Available N, P and K (mg/kg)		
N	522	514
P	18.10	17.40
K	134	131

**Suspension of 1:2.5 crude lipids: water; *Water extract of 1:10 crude lipids: water.

Table. 2 The physico-chemical analysis of FYM fertilizer during both seasons.

Characters		First season (2007)	Second season (2008)
E.C* (ds/M)		3.90	4.30
pH**		7.25	7.19
Organic matter %		20.34	20.21
Organic Carbon		11.80	11.72
C/N Ratio		10.17	9.61
Macro nutrients (%)	**N%**	1.16	1.22
	P%	0.22	0.27
	K%	1.21	1.80
Total micro nutrients (mg/kg)	**Fe**	1720	1625
	Mn	551	445
	Cu	117	152
	Zn	187	181

* Water extract of 1:10 organic fertilizer: water.
**Suspension of 1:10 organic fertilizer: water

e- Fatty acids analysis:

Fatty acids were determined according to the procedure reported by Arens et al., 1994**.** Fatty acids were trans esterified into methyl ester (FAME), using N-trimethyl sulfonium hydroxide (Macherey-Nagel, Duern, Germany). FAME was identified on a Shimadzu Gas chromatography (GC)-14A equipped with flame ionization detector (FID) and C-R4AX chromatopac integrator (Kyoto, Japan). The flow rate of the carrier gas helium was 0.6 ml/min and the split value with a ratio of 1:40. A sample of 1µl was injected onto a 30m*0.25 mm*0.2 µm film thickness, Supelco SP™ -2380 (Bellefonte, PA, USA) capillary column. The injector and FID temperatures were set at 250 ºC/min the initial column temperature was 100 º C, programmed by 5 º C/min to 175 º C and kept for 10 min at 175 º C, then by 8 º C/min to 220 º C and kept for 10 min at 220 º C. A comparison of the retention times of the samples with those of authentic standard mixture (Sigma, St. Louis, MO, USA; 99% purity specific for GLC), run on the same column under the same conditions, was made to facilitate identification.

Statistical analysis:

The experiment design was complete randomized with three replicates and each replicate represented 32 plants. Data were statistically analyzed using Co-Stat 6.303 software Computer Program (2004) hypothesis testing method including one-way analysis of variance (ANOVA) using Duncan test. Values of less than 0.05 were considered. The Regression Analysis is a statistical tool used to determine the probable change in one variable for the given amount of change in another. This means, the value of the unknown variable can be estimated from the known value of another variable. Pearson correlation (r) and regression coefficients were estimated among these variables as suggested by Steel and Tome, 1980.

Simple Linear Regression Equation (Prediction):

$Y = b_1 x + b_0$

Where:

Y = Estimated (or predicted) Y value for observation

b_1= Estimate the regression slop

x = value of x for observation

b_0= Estimate of the regression (Intercept)

RESULTS AND DISCUSSION

Vegetative growth characters:

Data in Table (3) and Figure (1) showed that the high rate of FYM fertilizer (30 m^3//Fed.) caused highest significant increase for different growth parameters of *P. oleracea* plant including; plant height, number of branches, fresh and dry weight of leaves, stems and aerial parts (g/plant). Different trend was noticed with another two levels of treatments (10 and 20 m^3/Fed.) during both seasons. At the maintained the high rate of FYM (30 m^3/Fed.) showed increasing to all growth parameters with one exception for roots weight in both seasons, which recorded significant inhibition reached to 20.5% and 29.4% for first and second seasons, respectively. In this respect, it can be noticed that, there are positive correlation between FYM treatments and growth parameters except, fresh weights of roots in both seasons and roots dry weight during 2nd season (Table, 4). During the 1st season, very highest positive significant correlation value was noticed with roots fresh weights (+0.97) followed by dry weight of total aerial parts (+0.96). In the 2nd one, the very highest positive significant correlation was noticed with dry weight of total aerial parts (+0.99) followed by fresh weight of leaves (+ 0.97). Generally, it can be observed that the values of positive correlation between FYM during the 2nd season were largest compared with the values of 1st season, this may be due to the climatic changes between both seasons.

The significant improvement of FYM to growth characters of *P. oleracea* plants could be attributed to its effect on improving soil texture by increasing soil organic matter and promote beneficial organisms. These results were conceded with those reported by Many scientists [Abuo El-Magd et al., 2006, Kokobe et al., 2013, and Adesina et al., 2014].

Chemical constituents:

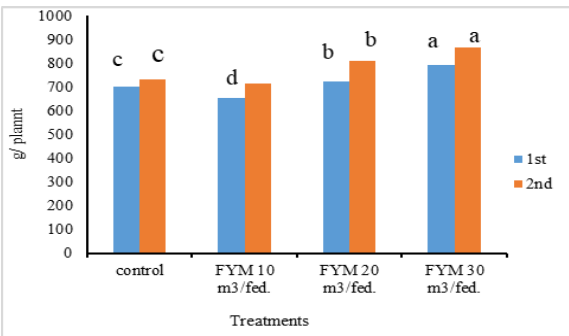
Total carbohydrates and soluble sugars contents

Total carbohydrates in leaves and stems of *P. oleracea* (Table, 5) showed a significant decrease in lower FYM level (10 m3/Fed.) for two seasons. Meanwhile applied the high level of FYM caused significant and the highest accumulation of total carbohydrates for leaves which recorded 44.11 % and 45.00 % at first and second seasons, respectively.

Table 3. Effect of FYM on vegetative characters of *P. oleracea* in two successive seasons 2007-2008.

Treatments	Plant height	Branches No	Fresh weight (g/plant)			Dry weight (g/plant)		
			Leaves	Stem	Root	Leaves	Stem	Root
Control	78.0^b	20.0^{ab}	179.6^c	521.8^c	8.52^a	17.96^c	41.74^c	2.64^a
FYM 10	66.3^d	18.3^b	170.3^d	482.7^d	8.27^a	18.42^{bc}	48.27^b	2.44^b
FYM 20	72.0^c	19.7^{ab}	186.7^b	536.1^b	6.7^b	18.67^b	49.32^b	2.10^c
FYM 30	80.0^a	21.0^a	218.4^a	574.9^a	5.65^c	20.51^a	51.74^a	1.76^d
	The second season							
Treatments	**Plant height**	**Branches No**	**Fresh weight (g/plant)**			**Dry weight (g/plant)**		
			Leaves	**Stem**	**Root**	**Leaves**	**Stem**	**Root**
Control	79.0^b	19.7^b	191.3^d	539.0^c	8.18^a	19.13^c	43.12^d	2.62^a
FYM 10	78.3^b	19.3^b	202.1^c	510.9^d	8.42^a	20.25^b	47.82^c	2.53^a
FYM 20	81.1^{ab}	21.7^a	229.5^b	579.2^b	6.27^b	20.20^b	53.39^b	1.85^b
FYM 30	84.3^a	23.0^a	270.0^a	604.4^a	5.07^c	24.3^a	54.02^a	1.53^c

FYM 10 = 10 m^3/fed.; FYM 20 = 20 m^3/fed.; FYM 30 = 30 m^3/fed.



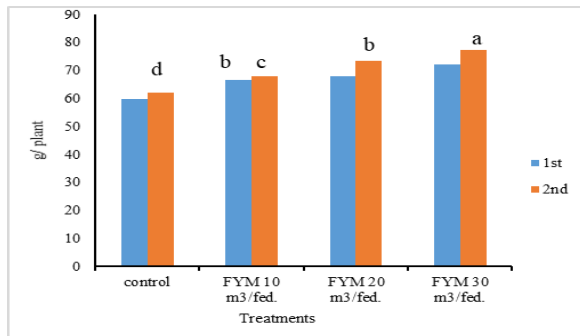


Figure. 1 Effect of FYM levels on aerial parts fresh weight (g/plant) during two successive seasons; part A, and dry weight (g/plant) during two successive seasons; part B.

Table 4. Simple correlation coefficients and regression equation between FYM treatments on some growth parameters of *P. oleracea* plant.

Parameters	Correlation Coefficient (r)		Regression Equations	
	1st season	2nd season	1st season	2nd season
Plant height	+0.24	+0.90***	Y=1.167x+71.16 R^2= 0.059	Y=1.855x+76.03 R^2= 0.804
Branches No	+0.77*	+0.92***	Y=18.13x-71.16 R^2= 0.595	Y=1.233x+17.83 R^2= 0.846
Leaves FW	+0.82**	+0.97***	Y=13.28x+15.5 R^2= 0.674	Y=26.34x+157.30 R^2= 0.97
Stem FW	-0.72*	+0.82**	Y=-21.27x+475.6 R^2=0.519	Y=26.45x+492.2 R^2= 0.675
Roots FW	+0.97***	-0.93***	Y=1.018x+9.81 R^2=0.94	Y=-1.148x+9.855 R^2= 0.859
Arial part FW	+0.77*	+0.91***	Y=34.70x+630.9 R^2=0.586	Y=52.92x+649.1 R^2= 0.837
Leaves DW	+0.91***	+0.88**	Y=0.79x+16.91 R^2=0.830	Y=1.546x+17.10 R^2= 0.766
Stem DW	+0.94***	+0.96	Y=3.105x+40.00 R^2=0.88	Y=3.827x+40.02 R^2= 0.926
Roots DW	-0.99***	-0.96***	Y=-0.298x+2.98 R^2=0.986	Y=-0.395x+3.12 R^2= 0.93
Arial part DW	+0.96***	+0.99***	Y=3.895x+56.92 R^2=0.931	Y=5.373x+57.12 R^2= 0.997

FW= Fresh weight DW=Dry weight *= significant R^2= coefficient determination, Y=Estimated (or predicted) y value for observation, x= value of x for observation **= moderate significant ***= the highest significant

Table 5. The effect of FYM rates on the major components of *P. oleracea* plant in two successive seasons 2007-2008.

The first season								
Treatments	**T. C%**		**T.S%**		**C. L%**		**C. P%**	
	L	**S**	**L**	**S**	**L**	**S**	**L**	**S**
***Control**	39.0[c]	40.82[a]	10.27[b]	7.89[b]	4.86[d]	2.27[b]	19.61[d]	12.63[d]
FYM 10 m^3/fed.	37.05[d]	37.91[c]	9.70[c]	6.96[c]	5.10[c]	1.61[d]	24.69[b]	24.15[a]
FYM 20 m^3/fed.	41.99[b]	39.61[b]	10.02[b]	7.87[b]	6.17[a]	2.51[a]	28.67[a]	18.01[b]
FYM 30 m^3/fed.	44.11[a]	41.11[a]	11.14[a]	8.24[a]	5.75[b]	1.86[c]	21.36[c]	16.80[c]
The second season								
Treatments	**T. C**		**T. S**		**C. L**		**C. P**	
	L	S	L		L	S	L	
Control	40.44[c]	40.98[a]	9.49[b]	7.13[c]	4.57[d]	2.02[b]	18.99[d]	14.00[c]
FYM 10 m^3/fed.	36.69[d]	34.94[d]	7.59[d]	5.88[d]	5.99[c]	1.57[d]	24.40[b]	21.86[a]
FYM 20 m^3/fed.	42.11[b]	37.52[c]	9.12[c]	7.31[b]	6.75[a]	2.40[a]	25.40[a]	17.06[b]
FYM 30 m^3/fed.	45.00[a]	39.12[b]	9.98[a]	8.10[a]	6.17[b]	1.62[c]	21.27[c]	14.61[c]

T. C: Total carbohydrates; T. S: Total Soluble sugars; C. L: Crude lipids, C. P: Crude protein; L: leaves; S: stems,

However, the highest mean values of carbohydrate content in stem were recorded with highest FYM level (30 m3/Fed.) in the 1st season and control during the second one which recorded 41.11 and 40.98%, respectively. The promotion effect of FYM on total carbohydrates content agreed with Badawy et al., 2009 who found that the lowest FYM (10 m3/Fed.) produced the highest significant increase in leaves and stems of dragonhead plants.

Data in Table (6) show that, there are positive moderate significant correlation (+0.84) and significant only (+0.71) between treatments and total carbohydrate content of leaves during 1st and 2nd seasons, respectively. On the other hand, there is no significant correlation between FMY treatments and total carbohydrate content of stems during both seasons.

The low FYM level applied to *P. oleracea* plants caused significant reduction in the content of total soluble sugars of leaves and stems for the two seasons. Similarly, the medium level (20 m3/Fed.) resulted to insignificant decrease total soluble sugar content in the leaves and stems in the first season, while in the second one, the reduction was significant. On the other hand, the highest significant accumulation of soluble sugars was noticed with applied highest FYM level (30 m^3/Fed.) for leaves (11.14 and 9.98%) and stems (8.24 and 8.10%) during the first and second seasons, respectively.

Data tabulated in Table (6), clear that there is a medium significant correlation (0.84) and low significant positive correlation (0.71) between treatments and total carbohydrate (%) for leaves during 1st and 2nd season respectively. On the other hand, there is no significant correlation between FMY treatments and total carbohydrate (%) of stems during both seasons. Concerning the correlation between FMY treatments and soluble sugars, it can be noticed from Table (6) that there is no significant correlation except for leaves during the first season. The decrease in soluble sugars content of stems may attribute to the redistribution of sugar from the vegetative part to the reproductive part of plant. This can be explained by the fact that the soluble sugar transported from flowering part to use by the developing seeds (Chandrasekar et al., 2005). In the same line, the lowest FYM level (10 m3/Fed.) Produced the maximum accumulation of total soluble sugars (%) in different dragonhead plant organs (Badawy et al., 2009) which reached to 61.30, 27.30 and 42.60% over control for leaves, stems and roots respectively. The promotion effect of Farmyard fertilizer on the accumulation of total carbohydrates and sugars might be related to the positive effect of farmyard in increasing the root surface area per unit of crude lipids volume, water-use efficiency, and photosynthetic activity, which directly affects the physiological processes and utilization of carbohydrates. Similar results of carbohydrates were recorded by Mohsen, 2002, on *Ocimum basilicum* plants and Aly, 2003, on *Foeniculum vulgare* L. While it conflicts with those reported by Salama et al., 2003 on *Verbascum thapsus* plants.

Table 6. Simple correlation coefficients and regression equation between FYM treatments and some chemical constituents of *Portulaca oleracea* plant.

Chemical Constituents	Organ	Correlation Coefficient		Regression Equations	
		1st season	2nd season	1st season	2nd season
Total Carbohydrate	Leaves	+0.84**	+0.71*	Y=2.027x + 35.47, R^2= 0.698	Y=1.91x + 36.28,R^2= 0.505
	Stems	+0.23	-0.15	Y=0.257x + 39.22, R^2= 0.052	Y=-0.3x + 38.89 ,R^2= 0.022
Total Soluble Sugars	Leaves	+0.61*	+0.37	Y=0.293x + 9.55,R^2= 0.375	Y=0.3x + 8.295,R^2= 0.140
	Stems	+0.46	+0.61	Y=0.196x + 7.25,R^2= 0.213	Y=0.434x + 6.02, R^2= 0.371
Crude Lipids	Leaves	+0.81**	+0.78*	Y=0.374x + 4.535, R^2= 0.649	Y=0.556x + 4.48, R^2= 0.601
	Stems	-0.10	-0.12	Y=-0.033x + 2.145, R^2= 0.011	Y=-0.037x + 1.995, R^2= 0.015
Crude Protein	Leaves	+0.30	+ 0.34	Y=0.923x + 21.27, R^2= 0.089	Y=0.784x + 20.55, R^2= 0.118
	Stems	+0.17	-0.10	Y=0.637x + 16.30, R^2= 0.029	Y=-0.297x + 17.62,R^2= 0.011

*= significant- **= moderate significant - ***= the highest significant, R^2= coefficient determination
Y= Estimated (or predicted) Y value for observation, x= value of x for observation

These obtained results of soluble sugars are generally parallel with those reported by Priya and Kasera 2001, Alabi 2006 and Eid et al., 2006 on *Evolvulus alsinoides*, pepper and *Celosia argentea* respectively.

Crude lipids contents (%):

Data in Table (5) showed that crude lipids percentage of *P. oleracea* leaves increased significantly with all FYM levels used during both seasons. The highest accumulation was recorded with moderate level (20 m3/Fed.) which gave 6.17 and 6.75%, while the control treatment gave 4.78 and 4.57%, at the two seasons respectively. For stem, different trend was noticed, that the low and high FYM levels caused significant reduction in crude lipids content at the two seasons. Meanwhile, the moderate level of FYM (20 m3/Fed.) caused a significant increase in crude lipids percentage that reached 2.52 and 2.40% compared to control, that recorded 2.27 and 2.02% for the two seasons respectively. In this connection, FYM levels had a positive significant correlation coefficient with crude lipids of leaves which calculated +0.81 and +0.78 in the 1st and 2nd seasons, respectively (Table 6) while there are no significant correlations with crude lipids of stems. Alabi, 2006 on pepper plants showed that increasing organic fertilizers increased crude oil parallel.

Crude protein contents:

Crude protein percentage in leaves and stems of *P. oleracea* plants was increased significantly with various FYM levels during the two successive seasons with one exception of stem treated with high FYM level. However, the maximum accumulation in leaves was noticed with the medium fertilizer levels (20 m^3/Fed.) which produced 28.67 and 25.40% in respect of control treatment that gave 19.61 and 18.99% for the first and second seasons respectively. Meanwhile the maximum increase for stems was showed with low FYM level (10 m3/Fed.) which produced 24.15 and 21.86% in corresponding to control treatment, which recorded 12.63 and 14.00% for two seasons respectively. In this regard FYM treatments had insignificant correlation coefficient with crude protein during both seasons as shown in Table (6). These results agreed with those obtained by Bishr et al., 2006 on *Borago officinalis* L. and Azzaz et al., 2009 on fennel plants.

Mineral contents:

Nitrogen content:

As shown in Table (7), Application of various levels of FYM significant improved the accumulation of nitrogen and phosphorus in leaves and stems of *P. oleracea* plants during successive seasons, except nitrogen of stems of plants fertilized by the highest FYM level at the second season. The maximum nitrogen content was recorded with medium level for leaves (4.50 and 4.06%) and lowest level for stems (3.86 and 3.35%) at the two seasons respectively. The values of correlation coefficient between FYM treatments and nitrogen content (%) did not reach to significant degree for leaves and stems during both seasons. (Table 8).

Table 7. The effect of FYM rates on the mineral of *P. oleracea oleracea* plant in two successive seasons 2007-2008.

The first season										
Treatments	**N%**		**P%**		**K%**		**Mg%**		**Fe%**	
	Leaves	**Stem**	**Leaves**	**Stem**	**Leaves**	**Stem**	**Leaves**	**Stem**	**Leaves**	**Stem**
***Control**	3.14d	2.02[d]	0.26[d]	0.14[c]	2.40[b]	4.93[b]	0.170[ab]	0.078[b]	0.135[a]	0.109[a]
FYM 10 m^3/fed.	3.95[b]	3.86[a]	0.31[c]	0.19[b]	2.52[b]	5.01[b]	0.188[a]	0.096[a]	0.147[a]	0.088[b]
FYM 20 m^3/fed.	4.50[a]	2.88[b]	0.34[b]	0.21[a]	2.71[a]	5.46[a]	0.156[bc]	0.053[c]	0.114[b]	0.087[c]
FYM 30 m^3/fed.	3.42[c]	2.69[c]	0.37[a]	0.21[a]	2.40[b]	4.42[c]	0.148[c]	0.056[c]	0.108[b]	0.066[d]
The second season										
Treatments	**Nitrogen**		**Phosphorus**		**Potassium**		**Magnesium**		**Iron**	
	L	**S**	**L**	**S**	**L**	**S**	**L**	**S**	**L**	**S**
***Control**	3.04[d]	2.24[c]	0.24[d]	0.11[d]	2.31[b]	4.45[b]	0.225[b]	0.089[b]	0.147[a]	0.099[c]
FYM 10 m^3/fed.	3.90[b]	3.35[a]	0.28[c]	0.15[c]	2.38[b]	4.93[ab]	0.266[a]	0.109[a]	0.152[a]	0.134[a]
FYM 20 m^3/fed.	4.06[a]	2.73[b]	0.30[b]	0.17[b]	2.63[a]	5.33[a]	0.224[b]	0.069[c]	0.144[a]	0.111[b]
FYM 30 m^3/fed.	3.40[c]	2.34[c]	0.34[a]	0.18[a]	2.58[a]	4.80[ab]	0.168[c]	0.057[d]	0.128[b]	0.102[bc]

N: Nitrogen, P: Phosphorus, K: Potassium, Mg: Magnesium, Fe: Iron, L: leaves, S: stems,

Table 8. Simple correlation coefficients and regression equation between FYM treatments and some nutrients content (%) of *Portulaca oleracea* plant

Chemical Constituents		**Correlation Coefficient**		**Regression Equations**	
		1st season	**2nd season**	**1st season**	**2nd season**
Nitrogen %	**Leaves**	+0.30	+0.34	Y=0.139x +3.41, R^2= 0.089	Y=0.124x +3.29, R^2= 0.117
	Stems	+0.17	-0.08	Y=0.103x +2.61, R^2= 0.030	Y=-0.032x +2.745, R^2= 0.006
Phosphorus(%):	**Leaves**	+0.99***	+0.99***	Y=0.036x +0.23, R^2= 0.081	Y=0.032x +0.21, R^2= 0.984
	Stems	+0.90***	+0.96***	Y=0.023x +0.13, R^2= 0.807	Y=0.023x +0.095, R^2= 0.92
Potassium (%):	**Leaves**	+0.17	+0.89**	Y=0.019x +2.46, R^2= 0.028	Y=0.106x + 2.21, R^2= 0.787
	Stems	-0.33	+0.51	Y=-0.108x +5.225, R^2= 0.107	Y=0.145x + 4.515, R^2= 0.265
Magnesium	**Leaves**	-0.72**	- 0.68*	Y=-0.009x +0.19, R^2= 0.52	Y=-0.021x + 0.274, R^2= 0.466
	Stems	-0.70*	-0.77**	Y=-0.010x +0.098, R^2= 0.485	Y=-0.013x + 0.115, R^2= 0. 589
Iron (%):	**Leaves**	+ 0.66*	- 0.81**	Y= 0.011x +0.154, R^2=+ 0.66*	Y=- 0.0006x+ 0.159, R^2= 0.654
	Stems	-0.96***	-0.11	Y= -0.013+0.12, R^2=0.913	Y= - 0.001 + 0.115, R^2= 0.013

*= significant- **= moderate significant - ***= the highest significant R^2= coefficient determination
Y = Estimated (or predicted) Y value for observation

These results are in accordance with those published by Sakr, 2001, (Ipinmorati et al., 2008 and Mazher et al., 2010.)

This increase on N% of *P. oleracea* plant as affected with FYM fertilization may be due to organic manure contain many species of living microorganisms as *Azotobacter, Azospirillum*ect., which play an active role in N-fixation and releasing phytohormones (Reynders and Vlassak, 1982). The low rate of FYM caused the highest increase in the case of stem may be due to the redistribution of N from the stems to the leaves of the plant. According to fact that is N is a mobile element.

Phosphorus content:

For phosphorus content, data revealed that applied highest rate of FYM caused the highest accumulation in leaves (0.37 and 0.34%) and stems (0.21 and 0.18%) during the first and second seasons respectively. It can be noticed that the second level of FYM gave the same effect of the highest level on P% during the second season. During the 1st season the mean values of phosphorus content had a positive significant correlation coefficient (+0.99 for both leaves and stems) with FYM rates which can be expressed by the regression equation: Y = 0.004X + 0.038 and Y = 0.032x + 0.21 for leaves and stems, respectively (Table 8). In this connection, there is a regression equation with a slope close to zero, which means that there is no correlation even if there is good correlation coefficient. The same result is noticed between FYM fertilization and phosphorus content during the 2nd season.

Potassium content :

At the maintained, the medium level of FYM produced the highest potassium content in leaves (2.71 and 2.63%) and stems (5.46 and 5.33%) at the first and second seasons, respectively. Data tabulated in Table (8) show that there is insignificant correlation coefficient between FYM treatments and potassium content (%) except the leaves of the 2nd season. The decrease which happened in the potassium by high rate may be due to imply that the nutrient requirement of the plant has been fulfilled at 20 m^3/fed. Amendment and further increase in the rate of applied manure was not necessary [Tanu and Alholeya, 2004]. The increase on K% by FYM treatments may be due to decreasing crude lipids pH which leads to solubilization of nutrient and increases nutrient availability and supply [Salem, 1986], so FYM increased availability of K. FYM fertilizer as a complexion agent, thus minimizes the loss of nutrients by leaching agents [Balba, 1973]. The major problem of K-fertilization was leaching it by water irrigation. However, FYM-fertilization protected it on crude lipids. These results are in harmony with those found by Khater, 2001 on *Carum carvi* L. plant and on the other hand, data disagreed with those of El-Gadban, 1998 on *Origanum majorana* plants.

Magnesium content:

Magnesium content during the two successive seasons were reduced in leaves and stems by applied medium and highest levels of FYM fertilizer, while contrast trend was recorded with low level. The magnesium content in leaves, increased insignificantly with the application of FYM at low level, while the two other levels of FYM caused significant reduction in its content during the two successive seasons. For stems, data recorded contrast trend for the effect of applied various FYM level in the first and second seasons. Significant negative correlation coefficient was noticed between FYM treatments and Mg content (%) for leaves and stem during both seasons. In this regard, there is a regression equation with a slope close to zero, which means there is no correlation even if there is good correlation coefficient.

In this connection El-Sherbeny et al., 2007 on *Ruta graveoleus* and Hussine et al., 2012 on *Plantago ovato* recorded that the nutrients content of N, P, Fe, Zn and Mn in general increased significantly as a result of supplying plants with various sources and levels of organic fertilizers (compost, compost tea and humic acid). Also, Khalid et al., 2006 found that *Calandua officinalis* plants treated with cattle manure with or without soil solorization improvement the accumulation of N, P, K, Fe, Zn and Mn.

Iron content:

Concerning the effect of FYM levels on Fe content (%), data presented in Table (7) reveal that Fe (%) decreased gradually as FYM level increase. In this connection, the correlation coefficient between FYM treatments and Fe (%) gave the same trend which mentioned with Mg (Table, 8). This decline in Fe by increasing FYM rates may be due to the enhancing CO_2 production by organic matter decomposition which CO_2 is readily converted into HCO_3^- and CO_3^{-2} that may affect Fe absorption by roots [38]. Moreover, organic matter increases the solubility of crude lipids $CaCO_3$ and stimulates the formation of Fe and Cu carbonate precipitates, thus renders them unavailable to grown plants.

These finding were in accordance of Khalid et al., 2006 on *Calendula officinalis* L. plants and disagreed with those of Kandeel and Abou-Teleb, 2002 on *Ocimum basilicum* L. plant.

This means that the nutrients in FYM were in available form and there in 10 (m^3/fed.) was sufficient to good plant uptake of Fe and Mg, while increasing application rate from 10 to 20 or 30 m3/fed. FYM decreased the amount of nutrients uptake due to presence of the antagonistic effect to each other. These results were in the same line with Aly, 2001 on fennel plants and Alabi, 2006 on pepper plants.

Fatty acids composition:

The relative percentage of fatty acids extracted from leaves of *P. oleracea* plants treated with different FYM levels are showed in Table (9) five saturated fatty acids (SFA) and four unsaturated fatty acids (USFA) were markedly identified.

Table 9. The effect of FYM rates on the fatty acids composition of *P. oleracea* plant (Mean values of two successive seasons 2007-2008).

Fatty acids %		*Control (N100:P100:K50)	FYM $10m_3$/fed.	FYM $20m_3$/fed.	FYM $30m_3$/fed.
16:0	**Palmitic acid**	16.52	16.90	19.28	21.93
18:0	**Stearic acid**	7.83	13.36	8.11	5.07
18:1	**Oleic acid**	13.02	17.12	12.96	7.83
18:2	**Linoleic acid**	18.04	15.86	17.02	17.79
18:3	**Linolenic acid**	24.86	32.35	33.87	41.07
20:0	**Archidic acid**	1.23	-	-	-
20:1	**Ecosenoic acid**	5.48	-	-	-
22:0	**Decosanoic acid**	8.74	4.41	8.76	6.31
24:0	**Tetraecosanois acid**	4.28	-	-	-
Unsaturated		61.40	65.33	63.85	66.73
Saturates		38.60	34.67	36.15	33.31

Table 10. Simple correlation coefficients and regression equation between FYM treatments and saturated or unsaturated of fatty acids content (%) for *Portulaca oleracea* plant.

Fatty acids	Correlation Coefficient	Regression Equations
Saturated Fatty Acids	-0.82^{**}	$Y = -1.439x + 39.28$, $R^2 = 0.673$
Unsaturated Fatty Acids	$+ 0.82^{**}$	$Y = 1.451x + 60.7$, $R^2 = 0.675$

R^2= coefficient determination, Y= Estimated (or predicted) Y value for observation, x= value of x for observation.

The two SFA; arachidonic and tetracosanoic acids were disappeared in plants treated by FYM levels compared with control plants (1.23 and 4.28%). One USFA, eicosanoic acid was completely disappeared in plants treated with different FYM levels, while appeared in control plants and show 5.48%. In all treatments plants, the major SFA were palmitic acid (ranged 16.90% to 21.93%) followed by stearic acid (ranged 5.07% to 13.33%). There USFA, oleic, linoleic and linolenic acids were found as major components in different treatments plants with one exception for oleic acid in high level of FYM. Fertilization *P. oleracea* plants by various FYM levels increased total USFA percentage and decreased total SFA percentage of leaves compared with control plants. The high FYM level produced the highest USFA (66.73%) and the lowest SFA (33.31%). So, the lowest FYM level produced the highest oleic acid percentage and the lowest linolenic acid percentage, and the contrast was true for the highest FYM levels. Data tabulated in Table (10) indicated that there are medium negative significant and medium positive significant correlation coefficients with SFA and USFA, respectively. Obtained results are in accordance with those obtained by previous investigator (Azzaz et al., 2009).

CONCLUSION

FYM fertilizers in highest level (30 m3/Fed.) was the treatment choice to increase the most vegetative parameters and chemical content of total soluble sugars and total carbohydrates in leaves and stems of *Portulaca oleracea* plants. Meanwhile, the medium level of FYM (20 m3/Fed.) was the most fervour to the highest content of crude protein and crude lipids.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

SEE, AAY and SAE designed and performed the experiment and also wrote the manuscript. MAH made the statistical analysis and wrote it. SSE and RAE wrote and reviewed the manuscript. All authors read and approved the final version.

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