World Journal of Pharmaceutical Sciences
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Published by Atom and Cell Publishers
Available online at: http://www.wjpsonline.org/
Original Article

Response of *Portulaca Oleracea* L. plants to various fertilizers ratios on growth, yield and chemical composition under Egyption conditions

El-Sherbeny, S.E.[1] El-Saadany, S. S.[2]; Youssef, A. A.[1, 3] El-Massry, R. A.[2] and El-Newary, S. A.[1]

[1]Department of Medicinal and Aromatic plants research, National Research Center, Dokki, Giza, Egypt.
[2]Biochemistry Dept., Fac. of Agric., Zagazige Univ., Egypt.
[3]Jazan University, Chemistry Dept., Fac. of Sci., Jazan, KSA

Received: 25-10-2015 / Revised: 21-11-2015 / Accepted: 28-11-2015

ABSTRACT

Tow field experiments were carried out during two successive seasons (2007 and 2008) to investigate the effect of seven NPK fertilizers ratios on growth and chemical constituents of *Portulaca oleracea* L. plants. The results revealed that, in general, all NPK ratios caused significant stimulation to various growth parameters. Applied the ratio of 200:100:50 kg/fed. of NPK fertilizer resulted to produce the highest mean values of plant characters. Similarly, the chemical constituents of the total carbohydrates, soluble sugars of leaves, crude lipid of stem and crude protein of leaves and stems as well as nitrogen and potassium of leaves and stems, phosphorus of stems were improved significantly in general by applied the same ratio of (200:100:50 kg/fed NPK).

Key words*: Portulaca oleracea*, Purslane, NPK fertilizer, plant characters, chemical constituents

INTRODUCTION

Purslane (*Portulaca oleracea L.*) is an annual green herb with edible succulent stems and leaves slightly acidic and spinach-like taste [1]. Several biological properties have been attributed to *P. oleracea* as antiseptic, antispasmodic, diuretic and vermifuge [2,3]. It has also been used on the treatment of dysentery, skin lesions and insect and snake bite, cancer and heart disease [4]. Purslane is a good source of compounds with a positive impact in human health. Those compounds include omega-3 fatty acids and β-carotene[5], vitamins and essential amino acids, α-tocopherols, ascorbic acid, and glutathione[6], as well as phenolics[4,7] and coumarins[8]. Organic acids are also present [9, 10]. Alkaloids have been reported to be important chemical constituents of this species [3].

The need for increasing medicinal plants production in many parts of the world became an ultimate goal to meet the dramatic side effects induced by chemical therapy on human health and also to increase the economic return from exporting their products. Therefore, considerable attentions are being given from cultural practices as an effective tool for controlling growth, yield and accumulation of active ingredients in medicinal plants. In addition to traditional practices, a range of modern approaches are now receiving more attention to enhance the growth and productivity of medicinal plants [11].

Plant nutrition is one of the most important factors that increase plant production. Nitrogen is most recognized in plants for its presence in the structure of the protein molecule. In addition, nitrogen is found in such important molecules as purines, pyrimidines, porphyrines, and coenzymes. Purines and pyrimidines are found in the nucleic acids RNA and DNA, which are essential for protein synthesis. Phosphorus is a component of many cell constituents and plays a major role in several key processes, including photosynthesis, respiration, energy storage and transfer, cell division and cell enlargement. Adequate phosphorus is needed for the promotion of early root formation and growth. Potassium, is often referred to as "the regulator" since it is involved with over 60 different enzyme systems in plants. Potassium helps plants to resist drought and effects from excessive temperatures. It also increases crop resistance to disease [10, 11].

As we mentioned above, many of the recent studies proved that *P. oleracea* plants are important in medicinal uses. But in the same time it consider as wild plant under Egyptian condition. To improving the yield production quality and quantity, it must be

***Corresponding Author Address:** Youssef, A. A, Department of Medicinal and Aromatic plants research, National Research Center, Dokki, Giza, Egypt; E-mail: youssef115@hotmail.com*

cultivated the plants under the suitable fertilization condition. Present research was conducted to find the adequate amount of N, P and K fertilizer for better production of *P. oleracea* under soil and climate condition of Egypt and also the satisfactory balance amongst the amounts of the three fertilizer elements.

MATERIALS AND METHODS

The experiment was carried out at the farm of Agriculture Faculty- Zagazig University at El-Sharkia Governorate, during the two successive seasons, of 2007 and 2008 aiming to study the effect of some NPK fertilizers ratios on growth, production and chemical composition on *Portulaca oleracea* L plants. Seeds of *Portulaca oleracea* were obtained and identified at the herbarium of Flora and Phytotaxonomy Research, Horticulture Research Institute, Agriculture Research Centre to be used as plant material. The experimental farm was cleared, ploughed, harrowed and divided into plots. The physical and chemical properties of the soil (Table 1) were conducted using the methods described by (Jackson[12]) and Cottenie et al., [13].

NPK fertilizers were applied using ammonium sulphate (20.5% N), calcium super phosphate (15.5% P2O5) and potassium sulphate (48% K2O) as a source of nitrogen, phosphorus and potassium, respectively. NPK ratios were applied at different levels including seventh treatments, (three levels for each mineral, N and P; 100, 150 and 200 kg/fed and K; 50, 75 and 100 kg/fed.) which the treatment represented as 100:100:50, 150:100:50, 200:100:50, 100:150:50, 100:200:50, 100:100:75 and 100:100:100).

Each treatment contained 3 replicates and each replicate represented by 32 plants. After the soil was prepared, it divided into plots 2 X 2 m with 4 rows.

Seeds were sowing on 6th June during two successive seasons of 2007 and 2008. Seeds were planted in hills in row with 50 cm distance between each row. The distance between each hill was 25cm. The layout experiment was complete randomized design.

Plants were harvest on 6th Augusts for two successive seasons 2007 and 2008. The following parameters were recorded; plant height (cm), number of branches/plant, fresh weight of herbage (leaves, stems and roots) (g/plant), dry weight of herbage (leaves, stems and roots) (g/plant), fresh yield of herbage (leaves, stems and root ton/fed.) and dry yield of herbage (leaves+ stems+ root ton/fed.).

Representative samples of plant were dried under natural shading for 15 day and then at 70C^{o} until constant weight were recorded. The dried plant organs were powdered and kept in desiccator for chemical analysis.

Total carbohydrates content and soluble sugars of dried leaves and stems were determined according to Dubois *et al.*, [14]. N% was determined adopting the method of A.O.A.C. (15). P% and K% were determined according to the method described *by* (Cottenie *et al*.,[13]. Calculation of the protein was done according to method of A.O.A.C.[15]. Micro elements (Mg and Fe) were determined in the digested samples by atomic absorption described by Chapman and Prett [16].

Crude lipids were determined as A.O.A.C., [15] methods. Fatty acids determined according to the procedure reported by Arens *et al*., [17]. Fatty acids were trans esterified into methyl ester (FAME), using N-trimthylsulfonium 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 ^{o} C/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.

All studied data were statistically analyzed using Co-Stat 6.303 Software Computer Program (2004) hypothesis testing methods included one way analysis of variance (ANOVA) using Duncan Test. value of less than 0.05 were considered through COSTAT-C program [18].

RESULTS AND DISCUSSION

Vegetative Characters:

Plant height: Plant height of *P. oleracea* L. was significantly increased in most cases by various NPK fertilizers ratios, except plants fertilized by ratio of 100:100:100 at the first season compared with control plants (Table 2). The highest plants were obtained by NPK fertilizer ratio of 200:100:50 followed by 100:150:50 at the first and

second seasons respectively. These increments reached to 13.47% and 10.16% respectively in comparison to control. These results are ascertained by those of Hossain *et al.,* [19] on *Aloe indica* plant and Azz El-Din *et al*., [20] on *Carum carvi* L. plants**,** while these results were disagreed with El-Mahrouk and Kandeel[21] on *Calendula officinalis* L.

Number of branches: Data in Table (2) illustrated that branches number of *P. oleracea* didn't affect by different NPK fertilizers ratios in the first season. While at the second season, significant improvements were recorded with applied the ratios of 150:100:50, 200:100:50 and 100:100:100 NPK fertilizers which recorded an increased over control plants reached to 11.51%, 8.21% and 9.84% respectively. Moreover the ratio of 150:100:50 showed the highest significant value of branches number. These results were agreed with Badawy *et al.,* [22] on *Artimisia annua* L. plant, while an opposite direction were obtained by Alabi,[23] on *Casicum annuum* L. and Olaniyi and Ajibola,[24] on *Corchorus olitorius* plants**.**

Fresh and Dry Weight:

Leaves fresh weights of *P. oleracea* were increased significantly in the first season by applied various fertilizer ratios as compared with control plants. The maximum mean value was recorded with applied 200:100:50 NPK, followed by 100:100:75 NPK which produced an increase over control reached to 13.86 and 10.76, respectively. In the second season, various NPK fertilizers ratios caused significant accumulation in fresh weight of leaves as compared with control plants. The heaviest weight produced by plants fertilized by NPK ratio of 200:100:50 which caused an increased percent reached to 59.53%. Meanwhile, the lowest increment was recorded by ratio of 100:200:50 which produce accumulation in leave weight reached to 21.37% more than control.

P. oleracea fresh weight of stems Table (2) show during the two seasons that, applied various fertilizer ratios recorded significant stimulation with one exception (100:200:50 at the first season). The heaviest weights of stem were recorded with plants fertilized by 100:100:75 NPK ratios at the first season (694.77 g) and 200:100:50 at the second one (796.73 g). The increment in stem weight reached to 30.42 and 48.93% over control treatments for 1st and 2nd seasons respectively.

For roots fresh weight, it is clear to notice that, at the first season, all NPK fertilizers ratios significantly increased it, with one exception (100:200:50, which did not affect). The heaviest weight of root was produced by NPK ratio of 100:100:75 which giving an increase of (29.33%), more than control plants. In the second season, two NPK fertilizers ratio of 200:100:50 and 100:100:75 increased fresh weight of root significantly which reached 23.39 and 22.74% over the control plant. On the other hand, data in Table (2) showed that, the dry weight of leaves, in the first season was increased significantly by the two ratios of 200:100:50 and 100:100:75 reached to 15.80% and 14.33% over control plants respectively). In the second season all NPK fertilizers ratios caused significant increase in dry weight of leaves. The heaviest dry weight showed by plants treated with ratio of 100:100:75 and 200:100:50 which caused increases about 57.68% and 55.19% respectively above control plants.

As shown in Table (2), application of different NPK fertilizers ratios recorded significant increase in dry weight of stems at two seasons, in comparison to control plants. The highest increment recorded with plants fertilized with the two ratios of 100:100:75 and 200:100:50 that given an increment about 29.61 and 28.41 % more than control plant, respectively at the first season, while at the second season the ratio of 200:100:50 recorded 64.44%, above control treatment. For the dry weight of root, no significant differences were showed in dry weight with applied various NPK fertilizers ratios, except treatments of 100:100:75 at the first season and two ratios 100:100:75 and 200:100:50 at the second one.

As shown in Fig. (1), the fresh weight of aerial parts of *P. oleracea* plants were increased significantly, with different NPK ratios at the two seasons, with one exception of 100:200:50 in the first season. Applied higher nitrogen ratio of N200:P100:K50 caused the heaviest increase in aerial parts weight. Thus it caused an increase reached to 25.46% and 51.60% at the first and second seasons respectively.

Dry weight of aerial parts of *P. oleracea* Fig (2) was elevated significantly by NPK fertilizers ratios at the first and second seasons. Ratios of N200:P100:K50 and N100:P100:K75 showed the highest increment reached to 24.90 and 23.90% at the first season and 62.51% and 57.32% at the second season respectively over control plants. Obtained results agreed with those of Hammad,[25] on *Spinacia oleracea***,** Hammam**,**[26] on *Cassia acutifolia***,** Abd El-Azim[27] on *Salvia officinalis* L. plant and Kandeel,[28] on *Calendula officinalis*, L.

Commonly, it is clear from the previous results that, the fertilization with high nitrogen ratio (N200) combined with middle ratio of P and K (150 and 75) resulted in most cases, to produce

highest promotion for the growth. The fertilizer ratio of 200:100:50 showed the highest; plant height, fresh and dry weight of leaves, stems and aerial parts (g/plant), followed by NPK ratio of N100:P100:K75 at the first and second seasons respectively. Ratio of N100:P100:K75 produced the highest fresh and dry weight of roots at two seasons of 2007 and 2008. These increases are quite expected since it is well established that decreasing the C/N ratio within the plant usually favors vegetative growth. N is a key constituent of proteins, which in turn provide a basic foundation for the plant infrastructure [29]. Moreover, the effect of nitrogen fertilization on plant might be through its effect on either the biosynthesis or destruction of some plant hormones **[30].** Moreover, nitrogen plays an important role for increasing meristematic activities consequently the vegetative growth of plants **[31].** In this connection Gharib ***et al.,*****[32]** reported that stimulating effect of nitrogen on morphological characters of marjoram plants may be due to that nitrogen increases the meristematic activity of plant tissues also play an important role in building protein molecules.

Chemical Composition:

Total carbohydrates: Total carbohydrates % of the leaves was increased significantly at the two seasons, with some exception for 150:100:50 the first season and 100:100:75 for the two seasons Table (3). However, the highest total carbohydrates% production was recorded by applied 100:100:100 ratios followed with 200:100:50 ratios at the first and second seasons. For stems, the total carbohydrates % was insignificant decreased as a result of employed various NPK ratios at the two seasons. So the highest carbohydrates accumulation was showed with the control plants. The stimulation effect of carbohydrates content in leaves by applied NPK ratios may be due to the effect of nitrogen fertilization on chlorophyll synthesis stimulation, hence the photosynthesis increased and lead to increase carbohydrate synthesis. Similar results were reported by Hussein and Darwish[33] on *Populus alba* L. and Abdelaziz *et al*.,[34] on *Rasmarinus offiecinalis* L.

Total Soluble Sugars: Application various levels of NPK ratios significantly improved the accumulation of T.S.S. % of *P. oleracea* during the two seasons (Table 3). The maximum value of soluble sugars% were obtained as a result of applying NPK ratios of 100:100:75 and 200:100:50 at the first season (21.60% and 19.08% respectively) and the ratio of 200:100:50 at the second one (23.80%) as compared with control plants. For stems, opposite trends were noticed that significant decrease during the two seasons with applied all NPK fertilizers ratios, with one exception of 100:100:100, which showed significant increase at two seasons. The stimulated effect of NPK ratio on TSS agreed with the results of Hassan *et al.,* [35] on *Calendula officinalis* L plant. Meanwhile, Hanafy *et al*.,[36] on *Eruea vescaria* reported that soluble sugars concentration (reducing, non-reducing and total) in the leaves of rocket were decreased when fertilized with high nitrogen level (200 kg/fed.). In this connection, a negative relationship between nitrogen level application and sugar concentration were reported by Hanafy [30] on spinach plants.

Crude lipids: Data illustrated in Table (3) showed that crude lipids % on leaves were significantly increased by the application of different NPK ratios, at the two seasons. The maximum crude lipids were produced with applied 100:200:50 ratios, during the two seasons. In stems, crude lipid was significant improved at the two seasons, with one exception obtained as a result of fertilizer treatment by 150:100:50 and 100:100:75 at the first season and ratio of 100:100:75 at the second one. However the highest accumulation of stem crude lipid was showed with applied NPK ratio of 200:100:50 at the first and the second seasons. These results were in harmony with those obtained by Salman *et al.,* [37] on *Eruca sativa* and Alabi, [23] on *Capiscum annuum* L plants.

Crude Protein: data presented in Table (3) showed that the different NPK ratios added to *P. oleracea* plants caused significantly accumulation to crude protein% in leaves. Plants fertilized with 200:100:50 ratios produced the highest crude protein% (27.56 and 27.08% respectively) at the first and second seasons respectively. Similarly crude protein showed the same trend of leaves at the two seasons. These results are ascertained by those of Mekki and Hassanein,[38] and Risk,[39] on *Carthamus tinctorius* and *Abelmoschus esculentus* plant respectively.

Mineral Component:

Nitrogen: N% in *P. oleracea* leaves was increased significantly by various NPK ratios at the first and second season with two expectation of N100:P150:K50 and N100:P100:100 at the second season (Table. 4). Application of 200:100:50 ratios caused the maximum of N% at the two seasons. Similarly, N% of stems was stimulated significantly with applied different NPK ratios, compared with control plants. The highest N% of stems (2.94%) was showed with employed the ratio of 200:100:50 NPK at the two seasons. Such finding was obtained by Osman, [40] on *Coriandrum sativum* plant and Abd El—Azim[27] on *Salvia officinalis* plants. El Gohary[41] indicated that

increasing NPK levels restudied a gradually increment in nitrogen percentage of *Grindelia camporum* herb.

Phosphorus: Data show in the Table (4) indicated that P% of *P. oleracea* leaves was elevated significantly in plants fertilized by different NPK ratios at the two seasons, compared with control plants. Ratio of N100:P200:K50 caused the highest improved to P%; which produced 0.377 and 0.353% at the first and the second season respectively. For the stem content, it could show that, in general, the different NPK ratio caused significant difference in P% at the first season. In the second season, the ratio of 100:100:75was the only treatment caused significant increment in P% (0.177%), while the other various ratios did not effect on its accumulation. These results were in agreement with those obtained by Kassem[42] and Elgohary[41] on *Rosmarinus officinalis* and *Grindelia camporum* plant.

Potassium: K% of the leaves (Table 4) was improved significantly by applied various NPK fertilizers ratios at two seasons, compared with control plants, with two exceptions of 100:100:75 and 100:100:100 ratios at the first season. The highest K% in leaves showed in plants fertilized by ratio 200:100:50 at the first and the second seasons. K% of stems showed the same trend of the leaves at the two seasons. The present results were in harmony with those found by Elgohary [41] on *Grindelia camporum* plant who found that the increased in NPK fertilization levels at beginning of flowering stage caused gradually increasing in potassium percentage, while at the end of flowering no significant increased were observed.

Magnesium: different NPK fertilizers ratios caused significant reduction in Mg% in *P. oleracea* leaves, at two seasons, compared with control plants (Table 4). The lowest decreased was showed with treated of 100:100:100 NPK ratios at the two seasons. Mg% of stems was decreased significantly in most cases by NPK ratios at the two seasons, two exceptions were recorded that 100:150:50 at the first season and ratio of 150:100:50 at the second season, which caused significant accumulation. Opposite results recorded by Ughreja and Chundawat,[43] on Coriander (*coriandrum sativum*) plant and Alabi,[23] on pepper plant *(Casicum annuum*L.).

Iron: As illustrated in Table 4, Fe% in *P. oleracea* leaves was decreased significantly by various NPK ratios at the two the seasons, with two exception, which were 100:100:100 and 100:150:50 that caused significant and insignificant increment, respectively. In this respect, Hanafy *et al*.,[36] reported that iron concentration was slightly increased when rocket plants were fertilized with high level of nitrogen (200 kg/fed.) as compared with low nitrogen fertilization (100 kg/fed.). For the stem Fe% at the first season was decreased significantly by various NPK ratios used. So, the control plant contained the highest Fe% (0.120%). In the second season; the same trend was observed with one exception of 100:150:50 ratios that improved Fe% and recorded 0.135% while the control recorded (0.123%). Similar results were found by Hanafy *et al*., [36] on (*Eruca vesicaria* subsp. Sativa). On other hand these results disagreed with Risk, [39] on okra (*Abelmoschus esculentus*).

Fatty Acids Composition: Five saturated fatty acids and four unsaturated ones were markedly identified and grouped into three classes, i.e., Major fatty acids (more than 10 %), minor fatty acids (less than 10 %) and traces (less than 1 %) were identified Table (5). Accordingly, in all treatments the major saturated fatty acids were palmetic and stearic acids. The three unsaturated fatty acids of oleic, linoleic and α-linolenic acids were found as major components in all treatments. Different NPK fertilizers ratios increased total unsaturated fatty acids and decreased total saturated fatty acids of *P. oleracea* leaves with respect of control plant, with one exception of ratio 100:100:100. The two NPK ratios of 200: 100:50 and 100:200:50, produced the highest total unsaturated fatty acids percentage (69.56 and 69.43%, respectively) with the lowest total saturated fatty acids percentage (30.44 and 30.57% respectively). Meanwhile, the two ratios of N100:P200:K50 and N100:P100:K75 produced the highest percentage of linolenic acids (32.60 and 31.19% respectively). On the other hand, linoleic acid decreased with different NPK ratios compared with control, except, plant treated with 100:150:50 ratios. Similar results were found by Palaniswamy *et al*., [9] and Fontana *et al*., [10] on *Portulaca oleracea* L. plant.

CONCLUSION

It is therefore concluded that the application of NPK at the rate of 200:100:50 kg/fed enable maximum exploitation of soil resources, hence resulting in enhanced most of vegetative growth Characteristics, chemical constituents and overall yield of *P. oleracea* plants. Fertilization of NPK at the rate of (200:100:50) is adequate for optimum growth, dry matter production and stable yield of Purslane (*P. oleracea* L.). The ratio of NPK 200:100:50 fertilizer increased plant N, P, K, Mg and Fe in *P. oleracea* plant. The ratios of N100:P200:K50 and N100:P100:K75 produced the highest percentage of the unsaturated fatty acids.

Table (1) physical and chemical properties of experimental soil during two seasons of 2007 and 2008.

Characters	1st Season	2nd season	Characters	1st season	2nd season
Particle size distribution (%)			Soluble ions (meq /100 siol)		
Clay	52.82	53.30	Na	1.49	1.44
Silt	12.97	14.25	K	0.07	0.11
Fine sand	27.10	25.46	Ca	0.54	0.51
Coarse sand	7.11	6.99	Mg	0.66	0.61
Field capacity	45.10	44.80	CL	0.79	0.82
Texture class (According to USDA triangle)			CO3	0	00
	Clay	Clay			
Density (gm/cm^3)			HCO3	0.30	0.26
Bulk density	1.43	1.50	SO4	1.69	1.71
Particledenist (g/cm^2)	2.54	2.53	Available N, P and K (mg/kg)		
organic matter %	0.51	0.48	N	522	514
Soluble ions, EC* and pH**			P	18.10	17.40
C(dS/m) (soil extract 1:2.5)	2.67	2.33	K	134	131
pH (Soil suspension 1:2.5)	7.82	7.62			

* Water extract of 1:10 soil: water. **Suspension of 1:10 soil: water.

Table (2): Effect of NPK fertilizers ratios on some growth parameters of *P. oleracea* plant during two successive seasons of 2007 and 2008.

First season								
Treatments	Plant height	No. branches	Fresh weight (g/plant)			Dry weight (g/plant)		
N:P:K			Leaves	stems	roots	Roots	Stems	Leaves
100:100:50	76.67^{d}	21.67^{a}	193.82^{b}	532.70^{d}	6.99^{d}	1.73^{b}	48.37^{e}	18.49^{b}
150:100:50	80.33^{b}	21.00^{a}	196.28^{b}	639.75^{b}	7.68^{c}	1.92^{ab}	57.77^{b}	19.10^{b}
200:100:50	87.00^{a}	20.67^{a}	220.68^{a}	690.83^{a}	8.07^{bc}	2.00^{ab}	62.11^{a}	21.41^{a}
100:150:50	80.67^{b}	22.00^{a}	176.52^{c}	575.67^{c}	7.67^{c}	1.89^{ab}	52.17^{c}	17.29^{c}
100:200:50	77.67^{cd}	20.00^{a}	174.92^{c}	529.58^{d}	6.98^{d}	1.79^{b}	50.63^{d}	17.21^{c}
100:100:75	80.00^{bc}	22.67^{a}	214.67^{a}	694.77^{a}	9.04^{a}	2.24^{a}	62.69^{a}	21.14^{a}
100:100:100	74.00^{e}	22.00^{a}	189.87^{b}	574.63^{c}	8.52^{ab}	2.14^{ab}	52.20^{c}	18.85^{b}
Second season								
Treatments	Plant height	No. branches	Fresh weight			Dry weight		
N:P:K			Leaves	stems	roots	Leaves	stems	Roots
100:100:50	82.00^{d}	20.33^{c}	181.20^{e}	534.98^{g}	6.20^{b}	17.25^{e}	43.17^{g}	1.44^{bc}
150:100:50	86.00^{c}	22.67^{a}	234.22^{c}	691.50^{d}	6.53^{b}	25.20^{b}	55.52^{d}	1.55^{b}
200:100:50	90.33^{a}	22.00^{ab}	289.07^{a}	796.73^{a}	7.65^{a}	27.20^{a}	70.99^{a}	1.85^{a}
100:150:50	87.67^{b}	20.00^{c}	242.02^{c}	580.63^{e}	6.01^{bc}	24.70^{b}	50.52^{e}	1.48^{b}
100:200:50	81.33^{d}	19.67^{c}	219.92^{d}	555.83^{f}	5.12^{c}	21.18^{d}	47.36^{f}	1.24^{c}
100:100:75	85	20.67^{bc}	275.01^{b}	775.03^{b}	7.61^{a}	26.77^{a}	68.27^{b}	1.84^{a}
100:100:100	84.67^{c}	22.33^{a}	233.90^{c}	755.12^{c}	6.53^{b}	22.79^{c}	62.60^{c}	1.58^{b}

Mean of three replicates. $P \leq 0.05$, Value with the same letter has no significant but value with different letter has significant at 0.05.

Table (3): Effect of NPK fertilizers ratios on the major components of *P. oleracea* plant in two successive seasons 2007-2008.

First season								
Treatments N:P:K	Total carbohydrates (%)		Soluble sugars (%)		Crude lipids (%)		Crude protein (%)	
	Leaves	Stems	Leaves	Stems	Leaves	Stems	Leaves	Stems
100:100:50	38.59^{c}	43.73^{a}	9.12^{d}	7.87^{b}	5.22^{e}	1.73^{d}	19.27^{e}	13.17^{d}
150:100:50	40.38^{bc}	39.25^{bc}	9.86^{bc}	7.43^{c}	5.47^{c}	1.81^{d}	20.46^{d}	14.88^{c}
200:100:50	42.40^{b}	38.54^{bc}	10.86^{a}	7.30^{c}	5.93^{a}	2.18^{a}	24.58^{a}	18.40^{a}
100:150:50	41.07^{b}	35.81^{d}	9.54^{c}	6.80^{d}	5.68^{b}	2.06^{bc}	19.50^{e}	14.48^{c}
100:200:50	42.14^{b}	37.83^{c}	10.09^{b}	7.38^{c}	6.05^{a}	2.11^{ab}	24.04^{b}	17.19^{b}
100:100:75	40.39^{bc}	38.30^{bc}	11.09^{a}	6.28^{e}	5.35^{d}	1.81^{d}	20.90^{c}	17.21^{b}
100:100:100	45.37^{a}	40.06^{b}	10.02^{b}	8.35^{a}	5.78^{b}	1.98^{c}	20.63^{cd}	17.42^{b}
Second season								
Treatments N:P:K	Total carbohydrates (%)		Soluble sugars (%)		Crude lipids (%)		Crude protein (%)	
	Leaves	Stems	Leaves	Stems	Leaves	Stems	Leaves	Stems
100:100:50	40.46^{d}	43.74^{a}	8.70^{f}	7.45^{b}	5.26^{f}	2.03^{e}	20.64^{c}	14.23^{f}
150:100:50	43.15^{bc}	38.2^{6d}	9.91^{d}	7.16^{c}	5.68^{d}	2.43^{b}	23.79^{b}	14.54^{ef}
200:100:50	45.28^{a}	35.38^{e}	10.77^{a}	7.13^{cd}	6.01^{b}	2.72^{a}	26.23^{a}	20.06^{a}
100:150:50	42.20^{cd}	35.78^{e}	9.95^{d}	6.71^{e}	5.86^{c}	2.19^{d}	20.60^{c}	15.04^{de}
100:200:50	43.15^{b}	40.05^{c}	10.09^{c}	7.50^{b}	6.18^{a}	2.42^{b}	24.38^{b}	15.69^{c}
100:100:75	41.40^{d}	40.30^{c}	10.48^{b}	7.02^{d}	5.48^{e}	194^{f}	23.75^{b}	15.40^{cd}
100:100:100	45.49^{a}	41.67^{b}	9.58^{e}	7.91^{a}	5.96^{bc}	2.29^{c}	21.23^{c}	16.73^{b}

Mean of three replicates. $P \leq 0.05$, Value with the same letter has no significant but value with different letter has significant at 0.05.

Table 4: Effect of NPK fertilizers ratios on minerals of *P. Oleracea* plant during two successive seasons 2007-2008.

First season										
Treatments N:P:K	Nitrogen (%)		Phosphorus (%)		Potassium (%)		Magnesium (%)		Iron (%)	
	L.	S.	L.	S.	L.	S.	L.	S.	L.	S.
	3.08^{e}	2.11^{d}	0.253^{d}	0.137^{b}	2.57^{d}	4.67^{f}	0.172^{a}	0.077^{b}	0.132^{b}	0.120^{a}
150:100:50	3.27^{d}	2.38^{c}	0.297^{c}	0.157^{a}	2.96^{b}	5.15^{b}	0.143^{d}	0.061^{c}	0.113^{c}	0.071^{c}
200:100:50	3.93^{a}	2.94^{a}	0.347^{b}	0.163^{a}	3.14^{a}	5.49^{a}	0.137^{e}	0.046^{d}	0.090^{d}	0.075^{c}
100:150:50	3.12^{e}	2.32^{c}	0.307^{c}	0.137^{b}	2.73^{c}	5.04^{c}	0.157^{bc}	0.085^{a}	0.136^{b}	0.082^{c}
100:200:50	3.85^{b}	2.75^{b}	0.377^{a}	0.153^{a}	2.91^{b}	4.91^{d}	0.153^{c}	0.075^{b}	0.114^{c}	0.073^{c}
100:100:75	3.34^{c}	2.75^{b}	0.227^{e}	0.160^{a}	2.52^{d}	4.77^{e}	0.151^{c}	0.073^{b}	0.112^{c}	0.10^{b}
100:100:100	3.3^{cd}	2.80^{b}	0.223^{e}	0.153^{a}	2.61^{d}	4.71^{ef}	0.160^{b}	0.077^{b}	0.157^{a}	0.082^{c}
Second season										
Treatments N:P:K	Nitrogen (%)		Phosphorus (%)		Potassium (%)		Magnesium (%)		Iron (%)	
	L.	S.	L.	S.	L.	S.	L.	S.	L.	S.
100:P100:50	3.30^{c}	2.28^{f}	0.236^{d}	0.143^{b}	2.47^{f}	4.55^{e}	0.213^{a}	0.107^{a}	0.145^{bc}	0.123^{b}
150:100:50	3.81^{b}	2.33^{ef}	0.300^{b}	0.143^{b}	2.85^{bc}	5.32^{b}	0.183^{b}	0.107^{a}	0.139^{cd}	0.078^{d}
200:100:50	4.20^{a}	3.21^{a}	0.350^{a}	0.147^{b}	3.01^{a}	5.63^{a}	0.159^{d}	0.080^{d}	0.101^{e}	0.095^{c}
100:150:50	3.30^{c}	2.41^{de}	0.297^{b}	0.140^{b}	2.73^{d}	5.30^{b}	0.177^{bc}	0.099^{ab}	0.153^{b}	0.135^{a}
100:200:50	3.90^{ab}	2.51^{c}	0.353^{a}	0.147^{b}	2.78^{cd}	4.85^{d}	0.162^{d}	0.091^{bc}	0.136^{cd}	0.121^{b}
100:100:75	3.80^{b}	2.46^{cd}	0.273^{bc}	0.173^{a}	2.63^{e}	5.36^{b}	0.167^{cd}	0.079^{d}	0.134^{d}	0.083^{d}
100:100:100	3.40^{c}	2.68^{b}	0.260^{cd}	0.140^{b}	2.88^{b}	5.09^{c}	0.187^{b}	0.084^{cd}	0.166^{a}	0.076^{d}

L=Leaves, S=Stems Mean of three replicates. $P \leq 0.05$, Value with the same letter has no significant but value with different letter has significant at 0.05.

Table (5): Effect of NPK fertilizers ratios on the fatty acids composition of *P. oleracea* plant in the season of 2008.

Fatty acids	NPK fertilizers ratios						
	control	150:100:50	200:100:50	100:150:50	100:200:50	100:100:75	100:100:100
C16:0	16.52	21.61	15.65	19.21	14.76	14.1	20.66
C18:0	7.83	7.05	14.01	8.32	7.31	11.44	15.86
C18:1	13.02	22.06	18.03	16.45	17.58	21.44	16.7
C18:2	18.04	21.06	16.59	17.54	14.43	14.75	14.65
C18:3	24.86	26.17	28.52	27.04	32.6	31.19	28.83
C20:0	1.23	0.56	2.97	3.12	2.06	0.27	-
C20:1	5.48	0.27	1.03	2.51	4.82	0.27	-
C22:0	8.74	0.69	2.36	4.05	4.73	4.84	3.3
C24:0	4.28	0.53	0.84	1.76	1.71	1.59	-
Unsat.	61.4	69.56	64.17	63.54	69.43	67.65	60.18
Sat.	38.6	30.44	35.83	36.46	30.57	32.35	39.82

Unsat.= Unsaturated fatty acids Sat.= Saturated fatty acids

Fig. 1: Effect of NPK fertilizers ratios on fresh weight of aerial parts of *P. oleracea* plant during two successive seasons of 2007 and 2008

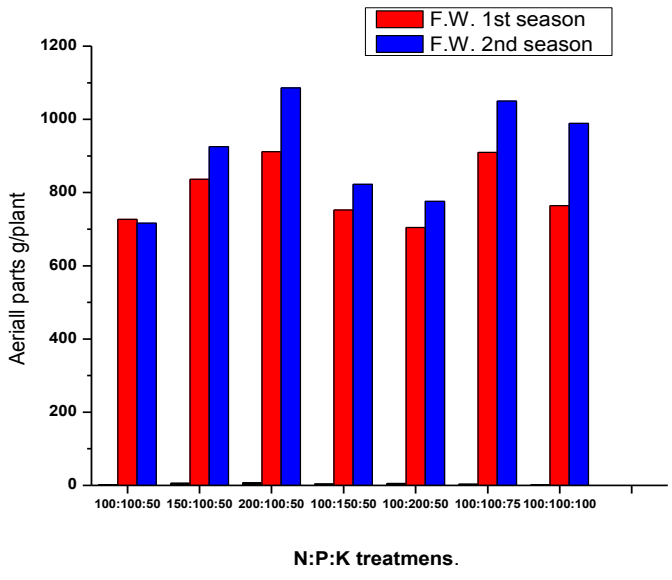
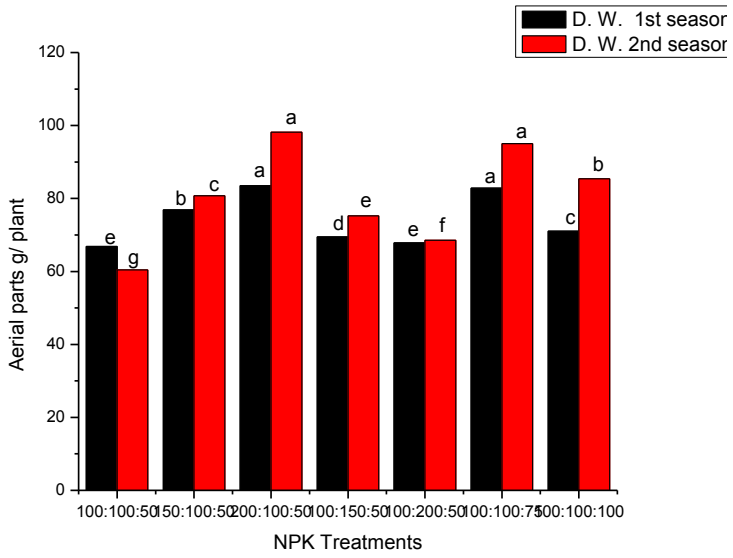


Fig. 2: Effect of NPK fertilizers ratios on dry weight of aerial parts of *P. Oleracea* plant during two successive seasons of 2007 and 2008.



REFRANCES

[1]. Rashed AN et al. Simple evaluation of the wound healing activity of a crude extract of *Portulaca oleracea* L. (growing in Jordan) in Mus masculus JVI. 1. Journal of Ethanopharmacolgy 2003; 88:131-36.
[2]. Radhakrishnan RM et al. Neruropharmacological actions of *Portulaca oleracea* L. v. Sativa (Hawk). J of Ethanopharm 2001; 76: 171-76.
[3]. Xiang L et al. Alkaloids from *Portulaca oleracea* L. photochem 2005; 66: 2595-601.
[4.] Xu CD et al. Dietary cholesterol stimulates in rats, receptor is not activated gastrointestinal and liver. Am. J. Physiol 2006; 286: 730G-735G.
[5]. Lui L et al. Fatty acids and β-carotene in Australian purslane (*Portulaca oleracea*) varieties. J. Chromatogr 2000 ; A 893: 207 –13.
[6]. Simopoulos AP et al. Common Purslane: a source of omega-3 fatty acids and antioxidants. J. Am Coll Nutr 1992 ; 11: 374–82.
[7]. Spina M et al. Comparative evaluation of flavonoids content in assessing quality of wild and cultivated vegetables for human consumption. J Sci Food Agric 2008 ; 88: 294–304.
[8]. Awad N.E. Lipid content and antimicrobial activity of phenolic constituents of cultivated *Portulaca oleracea L*. bullt Fac of pharmacy Cairo Univ 1994 ; 32: (1) 137-42.
[9]. Palaniswamy UR. Oxalic acid concentration in Purslane (*Portulaca oleracea* L.) is altered by the stage of harvest and the nitrate to ammonium ratios in hydroponics. Scientia Hortic 2004 ; 102: (2) 267-75.
[10]. Fontana E. Nitrogen concentration and nitrate/ammonium ratio affect yield and change the oxalic acid concentration and fatty acid profile of purslane (*Portulaca oleracea* L.) grown in a soilless culture system. J Sc Food Agric 2006 ; 86: 2417–424.
[11]. Abdel-Razek TM. Effect of sowing dates and different nitrogen sources on *Sideritis Montana* plants**.** B. Sc Thesis, Fac of Agric, cairo Univ Egypt 2007.
[12]. Jackson ML. Soil Chemical Analysis. Prentice-Hall of India Ptv, Ltd., New Delhi 1973; 200-50.
[13]. Cottenie et al. Chemical Analysis of Plant and Soil. Laboratory of Anal. and Agrochemistry. State Univ Ghent, Belgium, 1982; 100-29.
[14]. Dubois M et al. Colorimetric Method for Determination of Sugars and Related Substances. Anal Chem 1956; 28: (3) 350-56.
[15]. A.O.A.C. Association of Official Analytical Chemists. Official Methods of Analysis. A O A C, Washington D.C. 2000.
[16]. Chapman HD, Pratt PE. Methods of Analysis for Soils, Plant and Water. University California., Davis, Div of Agric Sci 1961.
[17]. Arens M et al. fattsauremethylester, Umesterung mit Trimthylsulfoniumhydroxide (Schnellverfahren). Fat Sci and Techn 1994; 96: (2) 67-8.
[18]. COSTAT-C., statistical software Users guides: a microcomputer program for the design, arrangement and analysis of agronomic research. Michigan University, East Lansing, 1988 ; 138.
[19]. Hossain KL et al. Effect of different nitrogen and potassium level on agronomic characters of *Aloe indica*. Bul. Agron. 2007 ; 35: 58-62.
[20]. Azz El-Din AA. Enhancing growth, yield and essential crude lipids of caraway plants by nitrogen and potassium fertilizers. Intern J. of Acad. Res. 2010 ; 2:192-97.
[21]. El-Mahrouk EM, Kandeel YM. Effect of different nitrogen levels and sources on *Calendula officinalis*, L. J Agric Res Tanta Univ 1997; 23: 18-30.
[22]. Badawy EM, El-Maadawy EI, Heikal AAM. In: Effect of nitrogen, potassium, levels and harvesting date on growth and essential oil productivity of *Artemisia annua* L. plant. 4th Conference on Recent Technologies in Agriculture: Cairo University, Egypt, 2009; pp. 600-15.
[23]. Alabi DA. Effect of fertilizer phosphorus and poultry droppings treatments on growth and nutrient components of pepper (*Casicum annuum*L.). Afric J of Biotechn (2006; 5: 671-77.
[24]. Olaniyi JO, Ajibola AT. Growth and yield performance of *Corchorus olitorius* varieties as affected by nitrogen and phosphorus fertilizers application. Americ Euras J of Sustainable Agric 2008; 2: 235-241.

[25]. Hammad SAR. Comparative study of using different nitrogenous source as substitutions of mineral-N fertilizers on growth, some physiological and chemical aspects and yield and its quality of spinach. Anal Agri Sci Ain Shams Univ Cairo 2009; 54: 291-303.
[26]. Hammam KAM. Effect of irrigation intervals and chemical fertilization of growth, yield and chemical constituent's of *Cassia acutifolia* Delile plnts. Ph.D Thesis, University of Cairo: Egypt, 2002.
[27]. Abd El-Azim WM. Production of *Salvia officinalis* L. plant under Sinai conditions. Ph.D Thesis, University of Cairo: Egypt, 2003.
[28]. Kandeel YMR. Effect of NPK fertilization treatments and GA_3 on growth, flowering and chemical composition of marigold (*Calendula officinalis*, L.). J Agric Res Tanta Univ 2004; 30: 925-43.
[29]. Shah SH, Samiullah. Response of Black Cumin (Nigella sativa L.) to Applied Nitrogen with or without Gibberellic Acid Spray. World J of Agric Sci 2007; 3: (2) 153-58.
[30]. Hanafy AH. Effect of foliar application of some chemicals on sex expression of squash plants. J. Agric. Sci. Mansoura Univ. 1997; 22: 697-717.
[31]. Bidwell, R G S, Plant physiology. Macmillan Publishing Co., Inc. New Yourk; Collier Macmillan Publishers, London, 1974; pp 643.
[32]. Gharib FA et al. Effect of compost and bio-fertilizers on growth, yield and essential oil of sweet marjoram (Majoranahortensis) plant. Inter J Agri Bio 2008; 10 (4): 381-87.
[33]. Hussein MM, Darwish MA. Effect of planting spaces and nitrogen fertilization on growth of *Populus alba* L. in sandy crude lipids. Egypt J of Appl Sci 2001; 16: 271-93.
[34]. Abdelaziz M et al. Influence of compost, microorganisms and NPK fertilizer upon growth, chemical composition and essential oil production of *Rosmarinus officinalis* L. Not. Bot. Hort. Agrobot 2007; 35: 86-90.
[35]. Hassan AH et al. Physiological studies on *Calendula officinalis* L. 1- Effect of nitrogen fertilization and GA3 on the growth, flowering and chemical composition of the plants. J Agric Res Tanta Univ 1991; 17: 734-46.
[36]. Hanafy AH et al. Nit level accumulation, growth, yield and chemical composition of rocket (*Eruca vesicaria* subsp. Sative) plant as affect by NPK fertilization, kinetin and salicylic acid. Bull Fac Agric Cairo Univ 2000; 495-508.
[37]. Salman SR et al. The effect of different nitrogen level sand row spacing on green yield, seed yield and seed crude lipids contents of arugula (*Eruca sativa*). Egypt J Applied Sci 2000; 15: 244-55.
[38]. Mekki BB, Hassanein MS. Effect of nitrogen fertilizer and plant spacing on growth and yield of safflower. Egypt. J. Applied Sci., 1995; 10: 249-61.
[39]. Risk FA. Effect of organic manure with or without inorganic fertilizers on the productivity of okra plant (*Abelmoschus esculentus*, L.). Egypt. J. Applied Sci. 2000; 17: 364-83.
[40]. Osman YAH. Possibility of production of coriander (*Coriandrum sativum*, L.) under Sinai conditions. PhD Thesis, University of Cairo: Egypt, 2000.
[41]. Elgohary, AI. Studies on production of *Grindelia camporum* plant as influenced by biofertilization, PhD Thesis, University of El-Azhar: Egypt, 2011.
[42]. Kassem AHM. Effect of chemical fertilization on *Rosmarinus officinalis*l. Plant, MSc Thesis, University of Cairo: Egypt, 1997.
[43]. Ughreja, PP, Chundawat BS. Gujarat Agric. Univ Res J 1992; 18(1): 70-7.