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Influence of Fe, K, N, and P on phytomass amount and *Pelargonium graveolens* essence percentage in Kashan

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ABSTRACT

This plan was performed to study the influence of Fe, K, N, and P elements on phytomass amount and Pelargonium graveolens essence percentage amount and fragrant geranium essence in dry and desert region research station of Kashan iron fertilizer and nitrate, phosphate, potassium fertilizers were used in main and secondary plots, respectively. Analysis of data resulted from the performance of aerial organ wet products showed that the difference between various fertilizer treatments (nitrate, phosphate and potassium) and between the mutual effect of the main (Fe) and secondary (N.P.K) treatments were significant in 1% and 5%, respectively. So that the highest performance of aerial organ wet products was 73.34 ton/hectare in a 200 kg N/hectare treatment. Also, the maximum wet aerial organ was obtained in 200 kg N and Fe (1 per 1000) with an average of 77.67 ton/hectare. Analysis of data from the essence performance also showed that maximum essence obtained in 200 kg N/hectare treatment with an average of 115.79 kg/hectare. In addition, analysis of data from dried anthophorous lop product showed that the difference between elements (N, K, P) was significant in a 1% level and the maximum performance obtained by using 200 kg N/hectare on 17.6 ton/hectare of dried anthophorous lop product which has no significant difference to the application of Pelargonium graveolens wet crop in industry, using at least 100 kg N/hectare and Fe 0.5 per 1000, in from of solution dispersion can lead to the maximum crop production on Kashan.

Keywords: Essence, Biomass, *Pelargonium graveolens*, Fertilizer.

INTRODUCTION

Pelargonium graveolens L. is a plant from Geraniaceae family. These plants are often grassy and are seldom lignified [13]. Different species of *Geranium* are anthophorous plants which are economically significant. Breeding power of this plant has resulted in producing a great number of hybrids and varieties. Mainly the purpose of amelioration program for this plant is the production of *Geranium* with various colors and forms and also more effective material (secondary metabolite) [1]. Useable part of this plant is applied for the extraction of its leaf essence and aerial part [2] .The amount of essence depends on the plant's age and it decreases by the plants ageing [5]. The essence of this plant is similar to that of rose and it contains geranial, citronellal, tripineol and alcohols. The more citronellal, the more valuable the essence will be [9]. Generally, the essence scent improves with elimination of D-metal solaphid from essence through staying and staling or by air emission [8]. In order to increase physicochemical features of essence, they should be kept in covered container and be far from the light. Improper packaging, especially for a long time and in semi full container and at the hot climate causes changes in essence quality [3]. In the early of 19 century, the commercial cultivation of geranium for essence appeared around Greece,

France and the other significant productive regions [11]. Some works showed the amount of required elements of plant includingnitrogen, phosphorus, potassium, calcium and magnesium [6] and it was indicated that to produce 75 kg/ha oil in Reunion region, we need to absorb 100 kg nitrogen, 14 kg phosphorus, 134 kg potassium, 179 kg calcium, 17 kg magnesium, 15 kg sodium and 10 kg sulphur [4, 7]. *Geranium* and *Pelargonium* cultivation doesn't have a long history in Iran and previously it was used as decoration pot at houses and greenhouses, but recently, as a result of the industrial improvement in essenceand using it in different industries, especial attention has been paid to its cultivation [6]. It has features like tranquilizing, promising, anti-depression, anti- giddiness, anti- horror and anti-anxiety. It effects on concentration as well [12]. In our country, there has been no study concerning the nutritious needs of plant to organic fertilizer, the most and less needed elements and also the effect of these nutritious elements on amount of plant's essence. Consequently, present research was carried out to investigate the effect of nutritious elements, nitrogen, phosphorus, potassium and iron on dry/wet products and plant essence of *Pelargonium graveolens* function.

MATERIALS AND METHODS

This research has been conducted at the research center of arid and desert region of Kashan with 950 m altitude from sea level, clay and sandy soil texture, average rain of 139.5 mm, maximum heat of 47.8°C and minimum heat of -12°C and with geographical the length and the width respectively 50° 50′ and 30° 33′ in split plate of statistic scheme frame in totally random blocks repeated 3 times. Iron fertilizer was put in main plots and nitrogen, phosphate and potassium was put in minor plots. In this research, nitrogen fertilizer at 3 levels (0, 100, 200 kg on the basis of nitrogen) phosphorus fertilizer at the levels of 0, 100, 200 kg in hectare on the basis of P_2O_5) potassium fertilizer at the 3 levels (0, 100, 150 kg on the basis of K_2O) and iron fertilizer at the 3 levels (0, 0.5, 1 in thousands) have been assessed. *Geranium* is multiplied more by scion after plant growing growths stopped when the stems aren't wooden or grassy completely, preparation action of scions was done. Scions were 15-20 cm in long with 1-1.5 cm in diameter and they contained 2-3 sprouts. In order to prevent from evaporation and transpiration, the leaves on the scion were eliminated and the bottoms of scions were cut obliquely. To plant scion in nursery, first the appropriate crop bed, being a mixture of ⅔ sand and ⅓ soil of rotten leaf, was prepared and then divided into suitable places so that the irrigation operation and weeding and other keeping material could easily be done. Then scions were put inside nursery with the distance of 2-3 cm. immediately after planting scions, irrigation was done. At the beginning the irrigation was done within short intervals and a limited volume, because too much irrigation can rot scions. This procedure continued until the scion's rotting. Meanwhile moisture and temperature were under controlled to prevent of scions growing growth. The land used for the research purpose was divided into 3 parts with 5.5 m distance relative to the number of repetition and each repetition was divided into three main plots and each main plot was divided into 9 small plots with 2 × 3 dimensions. In spring, when spring frost and risk of frostbite was passed, rooting scions were moved to main land and they were planted with 50 cm distance from each other. In this experiment, irrigation was done by using waterlogged once in every 4-5 days. According to the research methodology, phosphorus and potassium fertilizer, before planting and nitrogen fertilizer were distributed evenly on the land (during planting and after that top dress fertilizer twice) 3 times when the color of the plant changed, iron fertilizer (as solution) was sprayed in 3 levels (0, 0.5, 1 in 1000). In order to measure the essence, in the middle of October when the plant reached its highest growth level and on the basis of research, two margined row sand 1 m from the beginning and the end of each plots were eliminated and from the remaining stands, different treatment were gathered randomly with the amount of 100 g of aerial organ. After coding, they were put in the plastic bags for extraction and determination essence amount and were transferred to Barij Essence Company. To determinate phytomass on the basis of research method, after eliminating two margins draw sand existing stands at 1 m distance from the beginning and ending of each treatment remaindering product was measured to determine the performance of wet product and after drying the dry performance. The data obtained from the amount of essence and dry as well as wet function was analyzed by MSTATC software.

RESULTS

Table 1 presents the results obtained from the data analysis related to essence percentage, wet and dry function of *Pelargonium graveolens* L. The results showed that difference between various treatments was not significant in terms of essence percentage. Function of wet aerial organ of plant between different levels of nitrogen, phosphorus, potassium fertilizer was meaningful at the 1% level and interactive effect between main treatment of iron and minor (N.P.K elements) also at the 5% level was significant. Dry plant function was significant only at the different N.P.K. at 1% level (Table 1).

Table 1. Analysis of variance of essence percent, wet/dry produce in different treatments.

MS			df	S.O.V
Dry production	Wet production	Essence		
9.842^{ns}	230.542**	90.596^{ns}	2	Repetition
1.021^{ns}	36.147^{ns}	8.046^{ns}	2	Iron fertilizer
4.798	8.595	24.211	4	Error
76.016**	1396.504**	14.234^{ns}	8	N.P.K
2.041^{ns}	9.251*	7.850^{ns}	16	N.P.K, Fe
1.332	4.717	12.683	48	Error

** and **: significant in level of 5% and 1% , ns: no significant*

Given the difference between different levels of nitrogen, phosphorus, potassium fertilizers, the data mean were compared by Duncan's test at the probability of 1%. Table 2 shows comparison of data means from nitrogen, phosphorus, potassium fertilizer.

Table 2. Mean comparison of produce of wet anthophorous lop (ton/hectare) under effect of N.P.K.

Production (ton/hectare)	Level	Element
43.578cd	0	
69.567 b	100	N
73.344a	200	
42.267cd	0	
43.333cd	100	P
45.078 c	200	
41.200d	0	
43.367cd	100	K
45.022c	150	

In each column, means with the similar letters are not significantly different at 5% level of probability

As it is clear in the variance analyze table of aerial organ wet function, interact effect of nitrogen, phosphorus, potassium fertilizer with iron fertilizers was significant at 5%. Therefore means were compared using Duncan's Test at 5% level of probability (Table 2). As the table shows the highest amount of aerial organ was produced at the 200 kg treatment of nitrogen manure and iron fertilizers and the lowest level production of aerial organ was producing at the zero treatment of potassium and iron, because of the difference between different levels of nitrogen, phosphorus, potassium fertilizers in dry plant function, data mean with Duncan's test were compared at probability 1% level.

Table 3. Mean comparison of interaction effect of Fe and N.P.K on production.

Degree	Mean of production (ton/hectare)	Treatment		
Def	43.33	N_1		
C	67.67	N_2	N	
Bc	70	N_3		
Fg	41.16	P_1		
Def	43.33	P_2	P	Fe_1
De	45.500	P_3		
G	38	K_1		
Def	42.16	K_2	K	
Def	43.66	K_3		
Def	43.400	N_1		
Be	69.200	N_2	N	
B	72.36	N_3		
Def	43.76	P_1		
Def	44.96	P_2	P	Fe_2
D	46.400	P_3		
Def	42.93	K_1		
Def	44.200	K_2	K	
de	45.83	K_3		
Def	44	N_1		
B	71.3	N_2	N	
A	77.66	N_3		
Ef	41.86	P_1		
Ef	42	P_2	P	Fe_3
Def	43.33	P_3		
Def	42.66	K_1		
Def	43.73	K_2	K	
De	45.56	K_3		

As seen in Table 4, the highest amount of product was produced at 200 kg treatment of nitrogen amounting to 17.46 ton anthophorous lop in hectare, that is not significantly different from 100 kg treatment of nitrogen.

Table 5. Mean comparison of production of dry anthophorous lop (ton/hectare) under effect of N.P.K.

Mean	Element
10.22bc	N1
16.48a	N2
17.46a	N3
10.04c	P1
10.61bc	P2
11.05bc	P3
9.89c	K1
10.17bc	K2
11.68b	K3

In each column, means with the similar letters are not significantly different at 5% level of probability

DISCUSSION

According to the obtained results in this research, nitrogen, phosphorus, potassium, iron elements do not have significant effect on plant essence but nitrogen, phosphorus, potassium fertilizers and also Fe, and N.P.K and have interactive effect on production of aerial organ, in other words, nitrogen element (200 kg in hectare) and interactive effect of this element with iron with theamount of 1 in 1000 hectare have caused maximum production of crop. So it can be concluded that, optimum usage of nitrogen element with iron fertilizer is important for increasing crop. The analysis data variance resulting from dry organ function shows that there is significant difference between N.P.K elements and maximum dry crop was produced by applying 100 and 200 kg nitrogen, but it should be considered that for essence extraction from *P. roseom* plant, the wet anthophorous lop should be used. However, it is the dry function that is estimatedin calculation. Thus, it is important to consider the results of N.P.K and Fe elements effect on the wet anthophorous lop function. The result of analyzing iron fertilizer and nitrogen element effect revealed that iron 5% and 1 in thousand and treatment 200 kg nitrogen in hectare increased the wet and dry aerial organ function and 100 kg treatment of nitrogen increase essence function in hectare which has no significant difference with 200 kg treatment in hectare. So, the rule of iron fertilizer and nitrogen in function's increasing is revealed aerial organ's function can be increased by increasing iron with the amount of 5% in thousand and 200 kg nitrogen in hectare. Essence increasing in hectare with increasing 100kg nitrogen in hectare is an indication of more water absorption in 200 kg treatment in nitrogen's hectare. Thus it can be concluded that iron will help the absorption of nitrogen and this absorption rise causes production increase. Phosphorous element doesn't have effect on production of wet/dry crop and essence and also iron increasing had no rule in more absorption of phosphorous and the highest amount of crop was in treatment. The result of analyzing the potassium elements and iron fertilizer effect showed that 0.5 and 1 in thousand iron increased the essence function in hectare. But potassium did not have any effect in increasing essence and production. The results related to analyzing of increasing iron fertilizer, nitrogen, phosphorous, potassium elements indicated that iron fertilizer with nitrogen and potassium element can increase wet/dry aerial organ function and essence of *P. roseom* plant.

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