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Original Article

Morphological Variations of *Rosa damascena* Mill. in Response to Nutrition of Some Macro- and Micronutrients

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Abstract

Nutrition as an environmental factor has a special place in the growth, main and sub branches number of *Rosa damascena* Mill. and these morphological traits affected yield and flower number of the plant. So, this experiment was conducted in the Research Institute of Forest and Rangelands, Karaj, Iran, to evaluate the effect of macro- and micronutrients on the plant growth. A split plot design was conducted based on randomized complete block design with three replications. The main factor was combination of fertilizer in 5 levels: 1) N0, P0 & K0 kg/ha+manure 0 ton/ha, 2) N40, P40 & K0kg/ha+manure 15 ton/ha, 3) N40, P40 & K40kg/ha+ manure 15ton/ha, 4) N80, P80 & K40 kg/ha + manure 30ton/ha & 5) N120, P120 & K80kg/ha+manure 40ton/ha. The sub factor was micro nutrients intake of iron chelate in 3 levels (0,8 and 12 g). The analysis of variance showed that the main and sub factor effect were significantly different for all of measured traits ($\alpha \leq 0.01$). Results indicated that the highest main branch (66.35cm) and sub branch (15.96 cm) growth belonged to treatment 2 and micronutrients intake of 0 g, respectively. Treatment 4×8g showed the highest main branches number (49.66 n/plant). The highest sub branch number with average value of 26.66n/plant was obtained in treatment 4×0g. According to positive correlation between bush height with yield and flower number per bush, treatment 2×12g could be used for increasing quality and quantity flower yield in *R. damascena*.

Key words: *Rosa damascena*, Morphological traits, Iron chelate, NPK

Introduction

Rosa damascena known as aromatic gold [1] is one of the oldest and most valuable medicinal plants. The bush height depends on climatic condition and varies 2-2.5m. The bush has a lot of branches [2]. Of course, excessive vegetative growth can be cause tangle branches and creating the favorable environment for the growth of pathogens [3]. The soils is considered to *Rosa* cultivation should be rich in nutrient and organic matter [2].

Nitrogen (N), phosphorus (P) and potassium (K) are some of the most important macronutrients that participate in plant's major activities. N participates in the production of nucleic acids, amino acids, proteins, chlorophyll and cell wall. P is also involved in nucleic acid and mechanisms of energy transfer. K is part of plant cell membrane and regulates stomata [4,5].

In the countries with advanced agriculture, fertilizers containing micronutrients constitute about 4% of total consumption. This amount not only used for increasing production but also enrichment agriculture products [6]. Micronutrients play essential role in plant nutrition, enzymatic reaction, metabolic processes including: carbohydrates metabolism, nitrogen and plants resistance against disease and adverse condition [7,8]. So, these elements increase photosynthesis capacity and improve growth condition [9].

Thripathi reported that potassium and sulfur consumption increased seed yield of *Coriandrum*

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sativum L. [10]. Consumption of iron, zinc, magnesium and boron lead to significant increase in the umbels number of *C. sativum*. And umbels number had the highest correlation with seed yield [11].

Due to the importance of nutrition as an environmental factor, it played an important role in plant's growth. Amount of growth and branches number are correlated with yield and flowers number [12,13]. So, consumption method determination and exact amount of macro- and micronutrients is necessary for increasing yield of *R. damascena*.

Material and Methods

This project was performed in Research Institute of Forest and Rangelands, Karaj, Iran in 2011. A split plot design was conducted based on randomized complete block with three replications. The main and sub factors were combined fertilizers in 5 levels (Table 1) and intake of iron chelate in 3 levels (0,8 and 12 g), respectively.

Combine fertilizer with known amounts (Table 1) were used in the form of deep placement with the seedlings transition to the main field simultaneously.

Table 1 Different levels of combined fertilizers

Fertilizer treatment	1 (control)	2	3	4	5
N (kg/ha)	0	40	40	80	120
P (kg/ha)	0	40	40	80	120
K (kg/ha)	0	0	40	40	80
Manure (ton/ha)	0	15	15	30	40

In the beginning of flowering (1 May 2011), Fertilizer treatment from the source of Khazra Iron Chelate (Fe 8.9, Zn 0.92 & Mn 0.92% by weight) was used in broad caste application with watering (Table 2).

Height and number of main and sub branches was measured two times, before (3 March) and after (25 September) growth season and recorded. Data were analyzed using SAS and means were compared according to the Duncan's multiple range test**.**

Table 2 Time and amount of iron chelate

Treatments	Consumption time	Date
0g/plant (control)	Beginning of flowering	1 May
8g/plant	Beginning of flowering	1 May
12g/plant	Beginning of flowering	1 May

Results and Discussion

Analysis of variance showed (Table 3) that combined fertilizers, microelements and their interaction significantly affected main branch growth, sub branch growth, main and sub branch number ($\alpha \leq 0.01$). According to the significant interaction effect of treatments, appropriate model of macro- and micronutrients for *Rosa damascena* can be offered with the studied treatments.

According to results (Table 4), the highest main branch growth (66.35 cm), number (19.88 n/plant) and also the lowest sub branch growth (4.27 cm) and number (5.77 n/plant) observed in treatment 2 (N40, P40 & K0 kg/ha+manure 15ton/ha). Treatment 4 (N80, P80 & K40kg/ha + manure 30ton/ha) had the highest sub branch growth and number with average values of 19.11cm and 15.66n/plant. Also results indicated that the lowest main branch growth (35.89 cm) and number (11.44 n/plant) belonged to control treatment (N0, P0 & K0kg/ha+manure 0 ton/ha).

Table 3 Analysis of variance of the effect of fertilizer treatments on morphological traits

SOV	Df	Mean Squares (MS)			
		Main branch growth	Sub branch growth	Main branch number	sub branch number
Block	2	30.66^{**}	23.41^{**}	79.35^{**}	8.62^{ns}
Combined fertilizers (A)	4	1248.90^{**}	327.88^{**}	185.57^{**}	148.36^{**}
Error A	8	0.18	1.39	3.99	8.15
Microelements (B)	2	1704.35^{**}	162.04^{**}	562.75^{**}	84.35^{**}
(A) × (B)	8	2053.59^{**}	281.69^{**}	485.56^{**}	195.71^{**}
Error B	20	0.02	0.20	7.03	3.77
CV (%)	-	0.93	3.51	14.99	15.13

ns, non significant; *, significant at P≤0.05; **, significant at P≤0.01

Table 4 Effect of combined fertilizers on measured traits

Combined fertilizers	Main branch growth(cm)	Sub branch growth(cm)	Main branch number(n/plant)	sub branch number(n/plant)
1) N0, P0, K0kg/ha + manure 0ton/ha	35.89 e	14.80 c	11.44 c	14.11 ab
2) N40, P40, K0kg/ha + manure 15ton/ha	66.35 a	4.27 e	19.88 a	5.77 c
3) N40, P40 , K40kg/ha + manure 15ton/ha	41.29 d	16.50 b	33.14 b	13.33 b
4) N80, P80 , K40kg/ha + manure 30ton/ha	47.60 c	19.11 a	21.33 a	15.6 6 a
5) N120, P120 & K80kg/ha + manure 40ton/ha	53.57 b	8.85 d	21.44 a	15.33 ab

Means in a column followed by the same letter are not significantly different at P≤0.01.

Table 5 Effect of microelements consumption on measured traits

Microelements dose	Main branch growth(cm)	Sub branch growth(cm)	Main branch number(n/plant)	sub branch number(n/plant)
0g/plant (control)	36.63b	15.96a	13.20b	14.93a
8g/plant	55.07a	9.39c	24.66a	10.26c
12g/plant	55.11a	12.77b	15.20b	13.33b

Means in a column followed by the same letter are not significantly different at P≤0.01.

Table 6 Effect of interaction of combined fertilizers × microelements consumption on measured traits

Combined fertilizers	Microelements dose	Main branch growth(cm)	Sub branch growth(cm)	Main branch number(n/plant)	sub branch number(n/plant)
1) N0, P0, K0kg/ha+manure 0 ton/ha	0g/plant	23.33 l	9.12 g	10.33f g	6.66 d
1) N0, P0, K0kg/ha+manure 0 ton/ha	8g/plant	27.46 k	16.51 e	12.22 ef	14.66 c
1) N0, P0, K0kg/ha+manure 0 ton/ha	12g/plant	56.88 e	18.75 c	11.66 ef	21 b
2) N40, P40, K0kg/ha+manure 15 ton/ha	0g/plant	44.35 h	2.8 k	13.66 ef	4.66 d
2) N40, P40, K0kg/ha+manure 15 ton/ha	8g/plant	56.49 e	3.29 k	13 ef	6.66 d
2) N40, P40, K0kg/ha+manure 15 ton/ha	12g/plant	98.19 a	6.72 h	33 b	6 d
3) N40, P40, K40kg/ha+manure 15 ton/ha	0g/plant	47.04 g	29.96 b	15.33 ef	24 ab
3) N40, P40, K40kg/ha+manure 15 ton/ha	8g/plant	72.41c	4.09 j	21.66 d	3.66 d
3) N40, P40, K40kg/ha+manure 15 ton/ha	12g/plant	4.41 m	15.5 f	6 gh	12.33 c
4) N80, P80, K40kg/ha+manure 30 ton/ha	0g/plant	40.36 i	33.51 a	10.66f g	26.66 a
4) N80, P80, K40kg/ha+manure 30 ton/ha	8g/plant	67.19 d	6.37 h	49.66 a	5.66 d
4) N80, P80, K40kg/ha+manure 30 ton/ha	12g/plant	35.23 j	17.44 d	3.66 h	14.66 c
5) N120, P120, K80kg/ha+manure 40 ton/ha	0g/plant	28.06 k	4.46 j	16 e	12.66 c
5) N120, P120, K80kg/ha+manure 40 ton/ha	8g/plant	51.82 f	16.67 e	26.66 c	20.66 b
5) N120, P120, K80kg/ha+manure 40 ton/ha	12g/plant	80.84 b	5.42 i	21.66 d	12.66 c

Means in a column followed by the same letter are not significantly different at P≤0.01.

Table 7 Effect of correlation between measured traits

Traits	Main branch growth	Main branch number	Sub branch growth	sub branch number
Main branch growth	1	-	-	-
Main branch number	0.65^{**}	1	-	-
Sub branch growth	-0.31^{*}	-0.31^{*}	1	-
sub branch number	-0.24^{ns}	-0.29^{ns}	0.89^{**}	1

ns, non significant; *, significant at P≤0.05; **, significant at P≤0.01

Comparison results indicated that micronutrients intake of 8 g/plant had the highest main branch growth (55.07 cm), number (24.66 n/plant) and also the lowest sub branch growth (9.39 cm) and number (10.26n/plant). Control treatment showed the highest sub branch growth and number with 15.96 cm and 14.93n/plant, respectively. The lowest main branch growth (36.63cm) and number (13.20n/plant) observed in control treatment (Table 5). Studying the interaction of combined fertilizers by microelements consumption showed that treatment 4 (N80, P80 & K40 kg/ha+manure 30ton/ha) by intake of 0g/plant had the highest sub branch growth (33.51 cm) and number (26.66n/plant). The highest main branch growth was belonged to treatment 2 (N40, P40 & K0 kg/ha + manure 15ton/ha) by micronutrients intake of 12g/plant with 98.19cm. Treatment 4 by consumption of 8g/plant showed the highest number of main branch with 49.66 n/plant. The lowest main branch growth (4.41 cm) was belonged to treatment 3 (N40, P40, K40 kg/ha + manure 15ton/ha) by intake of 12g/plant. The lowest sub branch growth observed in treatment 2 (N40, P40 &

K0kg/ha + manure 15 ton/ha) by intake of 0g/plant and 8g/plant with 2.80 cm and 3.29cm, respectively. Treatment 3 (N40, P40, K40 kg/ha+manure 15 ton/ha) by intake of 12 g/plant showed the lowest sub branch number with 3.66n/plant (Table 6). Results indicated (Table 7) that there was significant positive correlation between main branch number with main branch growth ($r=0.65^{**}$).Sub branch number showed significant positive correlation with sub branch growth ($r=0.89^{**}$). There was significant negative correlation between sub branch growth with main branch growth ($r=-0.31^{*}$) and number ($r=-0.31^{*}$). Medicinal plants such as *Rosa damascene* are rich for the secondary metabolites for many herbal medicines. Although producing secondary metabolites affected by genetic characteristics of the plant, but a significantly higher rate of production is affected by environmental factors [14]. One of these factors is nutrition that has played an important role in plant's growth. Growth of the plant affects bush height, number of main and sub branches. On the other hand, height of bush had positive correlation with main branch number. According to results of other researchers, there is a positive and significant correlation between height and number of branches, yield and flowers number per bush [12,13]. The results also confirmed that treatment 22 ([N40, P40 & K0 kg/ha + manure 15ton/ha] × micronutrients intake of 12 g) with the highest main branch growth showed the highest flowers number and yield per bush and hectare [15]. Negative correlation between main branch growth and number with sub branch growth show that photosynthetic substances are divided between different plant organs. If the main branches number be high, main branch length and growth increase due to competition for light, and therefore sub branch growth will be decreased. Also, number of branches per bush had negative and significant correlation with flowers number per branches [13]. So these traits are correlated with yield and flowers number [12,13] and can be used as yield indicator.

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