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Short communication

Effect of Cow Manure Rate on Essential Oil Content of *Rosa damascena* Mill.

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Abstract

The essential oil of *Rosa damascena* Mill. is one of the most valuable and important base material in the flavor and fragrance industry. The aim of this study was to determine the effects of different rates of cow manure on the essential oil of the rose petals. For this a field experiment was conducted on a clay loam soil at the research farm of Alborz research station, Karaj, Iran. Experimental design was randomized complete block design with three replications. Treatments included 15, 30, 40 ton/ha Cow manure and control without any manure. Flower oil content was determined by distilling a representative petal sample per replication in Clevenger's apparatus. Analysis of variance indicated the significant effect of treatment on percent of essential oil and yield oil in third years. The highest oil content was found on 30 t/ha (0.067%) as compared to other treatments. The essential oil yield (1102.44 g/ha) were the highest in 15 t/ha manure. . The essential oil in the third year of flowering has increased 71 percent in treatment of 15 t/ha, compared with the control. Increase of more than 30 tons of manure had a negative effect on the oil yield and essential oil of rose and not advisable.

Key words: *Rosa damascena* Mill., Fertilizers, Essential oils, Organic manure.

Introduction

Damask rose (*Rosa damascena* Mill.) is one of the most important medicinal, aromatic and ornamental plants which is cultivated for its essential oil and medicinal aspects in many areas of the world, e.g. Bulgaria, Turkey, India, and Iran [1]. Because of the low oil content in Rosa genus and the lack of natural and synthetic substitutes, rose oil is one of the most expensive essential oils in the world markets [2]. The rose petals generally contain very little essential oil in comparison with the other essential oil crops. One kg of rose oil can be obtained from about 3000 kg of rose petals [3], and so oil content is only about 0.03%. Because of the low oil content and the lack of natural and synthetic substitutes, rose oil is one of the most expensive essential oil in the world markets. Iran was the main producer of rose oil until the 16th century and exported it to all around the world ([4]; [5]. Soil fertility can influence the quantity and quality of petals rose and essential oil. Organic farming is an important agricultural activity that is practiced in almost all countries of the world, and its share of agricultural land and number of farms is growing. The influence of organic matter on soil biological and physical fertility is well known. Organic matter affects crop growth and yield either directly by supplying nutrients or indirectly by modifying soil physical properties such as stability of aggregates and porosity that can improve the root environment and stimulate plant growth [6]. Incorporation of organic matter either in the form of crop residues or farmyard manures has been shown to improve soil structure and water retention capacity [7], increase infiltration rates [8], and decrease bulk density [9]. Therefore, any nutrient management practice that can improve organic matter status of soil is important. The rate of manure for achievement of the highest essential oil in plantation time was the objective of our research.

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Material and Methods

This experiment was conducted to study the response of percent and yield essential oil of damask rose (*Rosa damascena* Mill.) to different amounts of cow manure. For this, a field experiment was conducted for four consecutive seasons (2005–2009) on a clay loam soil at the research farm of Alborz Research Station, Research Institute of Forests and Rangelands, Karaj, Iran. The soil of the experimental site was low in organic carbon (1/1%), available N (0/08%) and available P (4 ppm) but relatively high in available K (194 ppm). Experimental design was randomized complete block design with three replications. Treatments included 15, 30, 40 ton/ha cow manure and control without any manure. The measured traits included flower yield and essential oil percentage and essential oil yield. The petals were handpicked from 8:00 to 10:00 a.m. oil content was determined by distilling a representative petal sample per replication in Clevenger's apparatus. 600 g of rose petals were placed in a distillation apparatus and hydro-distilled for 2 h. The oil content was measured as percentage (v/w). Data were subjected to analysis of variance (ANOVA). Mean comparison were carried out by Duncan's multiple range tests ($P \leq 0.05$). Statistical analysis was performed using SPSS 18.0 for Windows.

Results and Discussion

Analysis of variance indicated that during the first two years of plant establishment the effect of different doses of fertilizers on oil content and oil yield was not significant and the significant effect ($P \leq 0.01$) of treatment was observed in the third year (Table 1). A juvenile phase was observed for the first two years in rose plants when the environmental parameters and nutrients largely contributed towards broadening of structural base of the rose plants [10].

Table 1 Analysis of variance (ANOVA) of the effect of treatment on the measured traits.

Oil%						Oil yield(g/ha)			
SOV	df	1st year	2nd year	3rd year	Mean	1st year	2nd year	3rd year	mean
Manure rate	3	1.68^{ns}	1.43^{ns}	4.00^{**}	3.42^{**}	1.74^{ns}	2.32^{ns}	9.11^{**}	6.17^{**}

ns= not Significant, ** =significant at 1%

Table 2 Mean (± SE) comparison of oil% and oil yield as affected by different rates of cow manure

Treatments	Oil% 1st year	Oil% 2nd year	Oil% 3rd year	Oil% mean	Oil yield (g/ha) 1st year	Oil yield (g/ha) 2nd year	Oil yield (g/ha) 3rd year	Oil yield (g/ha) mean
Control	0.045 (0.0009)	0.048 (0.0056)	0.050 b (0.0052)	0.047 b (0.0007)	556.84 (111.72)	731.28 (167.94)	1143.46 b (140.83)	810.53 bc (129.29)
15 t/ha	0.055 (0.0090)	0.054 (0.0048)	0.060 ab (0.0028)	0.056a (0.0024)	684.45 (106.88)	661.91 (77.24)	1960.98 a (142.87)	1102.44 a (55.17)
30 t/ha	0.044 (0.0064)	0.054 (0.0040)	0.067 a (0.0058)	0.055 a (0.0051)	614.78 (118.82)	643.88 (98.84)	1818.45 a (265.17)	1025.70 ab (150.56)
40 t/ha	0.052 (.0013)	0.048 (0.0046)	0.047 b (0.0048)	0.049 ab (0.0007)	520.65 (50.83)	421.62 (81.08)	966.43 b (130.39)	636.23 c (50.16)

Means in each column followed by the same letter are not significantly different at $P \leq 0.05$.

The means of essential oil percent and yield in different treatments are presented in Table 2. The highest oil content (0.067%) was obtained by use of 30 t/ha as compared to other treatments. The lowest oil content (0.050%) was observed for 40t/ha application of cow manure that showed no significant difference with control. The essential oil yield (1102.44 g/ha) were the highest in 15 t/ha manure. Sprayings of Fe increased the oil yield of damask Rose to 1170.5 g/ha [11]. Rose oil is one of the most expensive essential oils in the world markets [2], Thus, treatments that can increase the amount of oil is important. Composted manure can be an alternative fertilizing source in organic farming, where the use of manufactured chemicals is prohibited.

A general improvement was observed in physical properties (increase of porosity and hydraulic conductivity and decrease of bulk density), with an optimum application rate of 25–50 t/ ha_of manure compost for *Brassica chinensis* and *Zea mays* L. in organic farming conditions [12]. The essential oil in

the third year of flowering increased 71 percent in treatment of 15 t/ha, compared with the control.

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