Phosphorus level affecting lavender and spearmint grown in soilless cultivation

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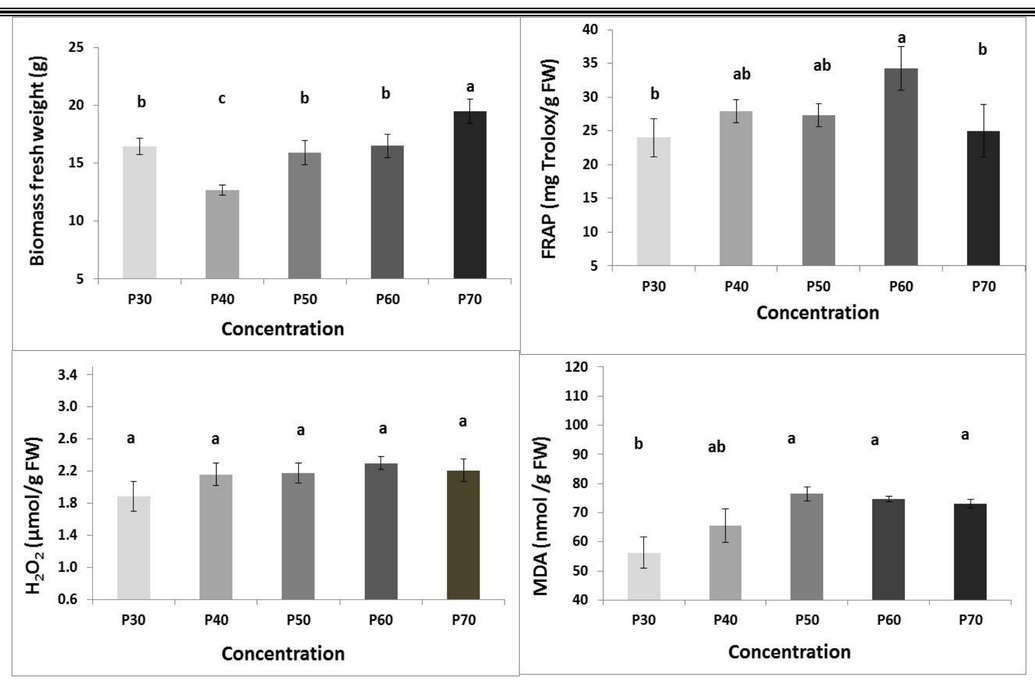
Introduction

Medicinal and aromatic plants are of great importance in fragrance and pharmaceutical industries and/or landscaping. Chemical and biological diversity of medicinal plants are depending on several variables such as cultivation area, microclimate, vegetation stage as well as genetic modifications (Miliauskas et al., 2004). Phosphorus plays an important role in various metabolic processes, being a constitute of nucleic acid, phospholipids, coenzymes activating the amino acid production used in protein synthesis, DNA, RNA and ATP (Rouached et al., 2010). The P deficiency is related with the reduction of chloroplast carbon fixation as a consequence to the photosynthetic potential. Furthermore, high P application rates have been shown to decrease *Matricaria chamomilla* L. essential oil yield (Emongor et al., 1990), whereas they are associated with increased oil yield of *Salvia officinalis* L. (Nell et al., 2009).

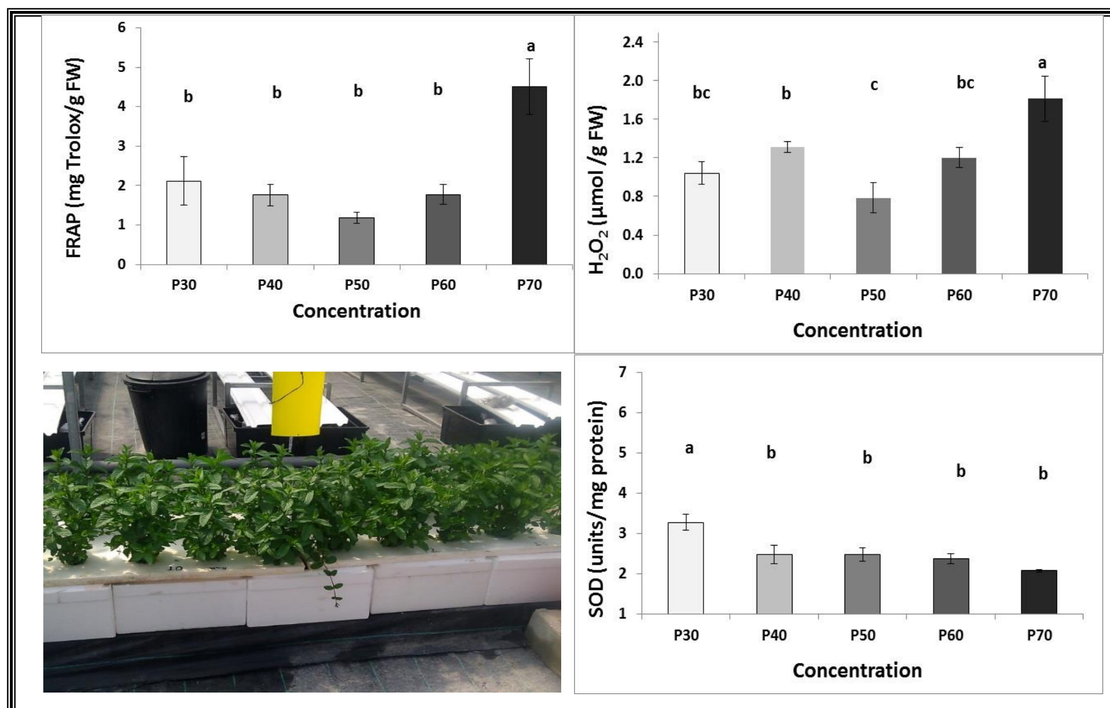
Material and Methods

The present study evaluated the impact of phosphorus (P) application rate increments (P: 30-40-50-60-70 mg/L) on plant growth and physiological parameters, antioxidant activity, mineral accumulation and essential oil composition of lavender and spearmint hydroponically grown plants. Lavender (*Lavandula angustifolia* Mill.) and spearmint (*Mentha spicata* L.) were grown in perlite and in deep flow technique (DFT), respectively.



Lavender

	RI	P concentrations				
EO compound (%)		P30	P40	P50	P60	P70
α-Pinene	933	2.21 a	1.96 a	2.10 a	2.02 a	2.10 a
β-Pinene	977	3.58 a	3.25 a	3.55 a	3.35 a	3.67 a
Limonene	1028	1.66 a	1.64 a	1.69 a	1.61 a	1.91 a
1.8-Cineole	1031	60.70 ab	62.28 a	58.55 ab	55.12 b	55.08 b
Camphor	1145	7.71 a	8.15 a	8.02 a	7.73 a	7.43 a
Borneol	1166	9.36 a	8.45 a	9.10 a	12.34 a	12.23 a
α-Terpineol	1191	2.17 b	2.28 b	2.16 b	3.01 a	2.81 a
Myrtenal	1197	2.04 a	2.07 a	2.38 a	2.44 a	2.42 a



Spearmint

	Oxalic acid (g/100 g dw)	Malic acid (g/100 g dw)	Ascorbic acid (g/100 g dw)	Citric acid (g/100 g dw)	Total organic acids (g/100 g dw)
P 30	4.85 b	1.06 c	0.030 d	4.20 c	10.10 c
P 40	4.71 d	1.17 b	0.030 d	4.37 b	10.29 b
P 50	5.01 a	1.08 c	0.300 a	4.90 a	11.29 a
P 60	4.78 c	1.29 a	0.200 b	4.90 a	11.17 a
P 70	4.32 e	0.84 d	0.150 c	3.35 d	8.70 1d

		P concentrations				
EO compound (%)	RI	P30	P40	P50	P60	P70
α-Pinene	933	0.93 a	0.91 a	0.81 a	0.88 a	0.78 a
β-Pinene	977	1.30 a	1.25 a	1.17 a	1.25 a	1.14 a
Limonene	1028	10.60 a	10.96 a	10.42 a	10.82 a	10.07 a
1.8-Cineole	1031	5.27 a	5.52 a	5.54 a	5.58 a	4.78 a
Carvone	1244	72.19 ab	71.28 b	74.25 a	70.29 b	74.27 a
β-Caryophyllene	1425	1.05 a	1.13 a	0.80 b	1.16 a	1.01 a
Germacrene D	1497	2.28 a	2.50 a	2.09 a	2.55 a	2.09 a

Results:

- Increased P levels resulted in high biomass and dry matter content of the aerial part for lavender and spearmint.
- Chlorophylls content, leaf stomatal conductance and plant height did not differ among the examined P levels.
- Total phenolics and antioxidant activity of lavender and spearmint leaves were significantly increased at high P levels indicating a higher bioactivity.
- Higher mineral accumulation in both leaves and roots was found in medium (40-50-60 mg/L) P levels.
- Although essential oil yield was not affected, essential oil composition varied among the studied P levels, especially 1.8-cineole and α-terpineol content for lavender and carvone content for spearmint**.**
- P application rate may affect lavender and spearmint growth and development, as well as their chemical composition and essential oil components.

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