Evaluation the effect of increasing atmospheric carbon dioxide and cadmium on the qualitative and quantitative characteristics of the lavender (*Lavandula officinalis*)

Abstract

In order to evaluation the effect of increasing atmospheric carbon dioxide and cadmium on the qualitative and quantitative characteristics of the lavender (*Lavandula officinalis*), an experiment was conducted as split plat based on randomized complete block design (RCBD) with three replications. Treatments consisted of 4 levels of cadmium (0, 10, 20 and 40 mg kg^{-1} soil) from the source of nitrate salt as the main factor and 2 levels of carbon dioxide (400 and 900 μL L^{-1}) as a sub-factor. The results of the analysis of variance of the data obtained from the experiment showed that the effect of cadmium and carbon dioxide and their interactions on fresh and dry weight of root, fresh and dry weight of shoot, length of the stem, essential oil percentage, cadmium concentration of shoot, soil cadmium concentration, cadmium transfer factor, iron, zinc and Cupper in the root and shoot was significant, but root cadmium concentrations were only affected by cadmium in the soil. Interactions of means comparison showed that the highest root dry weight (9.103 gr per plot) and shoot dry weight (88.88 gr per plot), the highest root fresh weight (32 gr per plot) and the highest shoot fresh weight (57.72gr per plot), the highest length of the stem (123.40 cm), the highest soil cadmium (0.109 mg kg^{-1} dry weight), the highest root iron concentration (16.26 mg lit^{-1}) and the highest shoot iron concentration (14.76 mg lit^{-1}), highest root zinc concentration (0.703 mg lit^{-1}) and the highest shoot zinc concentration (0.733 mg lit^{-1}), the highest root copper concentration (0.088 mg lit^{-1}) and the highest shoot copper concentration (0.083 mg lit^{-1}) was obtained by application of 10 mg cadmium per kg soil under 900 μL L^{-1} carbon dioxide condition. The highest essential oil percentage (1.24 %), the highest cadmium transfer factor (1.36), the highest refining ratio (0.238 %), was obtained by application of 40 mg cadmium per kg soil under 900 μL L^{-1} carbon dioxide condition. The highest root cadmium concentration (6.83 mg kg^{-1} dry weight) was obtained by application of 40 mg cadmium per kg soil. The highest bio concentration factor (1.87) was obtained by non-used cadmium (control) under 900 μL L^{-1} carbon dioxide condition. The highest bio accumulation coefficient (1.99), the highest tolerance index (1.059) by non-used cadmium (control) under 400 μL L^{-1} carbon dioxide condition. Given that absorption is obtained by multiplying dry weight in elemental concentration, so cadmium adsorption from soil increased significantly. Since absorption indicates the ability of the plant to remove cadmium from the soil, it can be concluded that by increasing the concentration of carbon dioxide, cadmium has accumulated more in the roots and shoots of lavender. In other words, it can be said that more cadmium is transferred from the soil to the plant's shoots.

Keywords: Medicinal plant, Dry weight, Essential oil percentage, Cadmium transfer factor, Iron, Zinc, Copper

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