



## Effect of selenium on the content and composition of *Hyssopus officinalis* essential oil under drought stress

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### Abstract

Hyssop (*Hyssopus officinalis* L.) as a perennial subshrub of the family Lamiaceae is distributed in the eastern Mediterranean to central Asia. The purpose of this study was to investigate the functions of Se on the phytochemical characteristics in *Hyssopus officinalis* L. subjected to PEG-induced drought stress. The experimental treatments included three concentrations of Polyethylene glycol (PEG-6000) 0 %, 2 % PEG and 4 % PEG as the first factor, sodium selenate at three concentrations (0, 20 and 40 mg L<sup>-1</sup>) as the second factor and their combined effects. The pots filled with perlite and placed in the greenhouse. According to our results, applying Se enhanced the EO content and improved EO quality by increasing hyssop's main EO constituents. The obtained results proposed that Se promoted the morpho-physio-biochemical features of hyssop plants and supported them for cope on drought stress. Therefore, its use may be recommended under arid and semiarid regions.

**Key words:** Essential oil, Medicinal plant, PEG

### Introduction

Drought stress causes abnormality in photosynthesis and transpiration that may affect the yield and composition of essential oil (EO). It should be noted, the effect of drought stress on the amount and essential oil components is different in plant species (Khalid, 2006; Baher *et al.*, 2002). It was demonstrated that selenium fertilization improved essential oil content of Iranian borage (Hosseinzadeh Rostam Kalaei *et al.*, 2022) and *Hypericum perforatum* (Nazari *et al.*, 2022). As far as we know, no information about the effect of selenium application on the growth parameters, phytochemical and physiological effects in *Hyssopus officinalis* under PEG-induced drought stress was found in the literature. Therefore, this study was carried out to investigate the effectiveness of Se spraying in enhancing the drought tolerance potential of *Hyssopus officinalis* by improving its phytochemical attributes.

### Materials and methods

This pot cultivation experiment was conducted at the experimental station of Urmia University (41° N latitude and 44.97° E longitude) in West Azerbaijan Province, Urmia, from October 2023 to May 2024. Completely randomized design with three replications was used. Each treatment consisted of 3 biological replicates (n = 3), and plants were harvested at the vegetative and flowering stages for EO analysis, respectively.

### Results and discussion

The exposure to drought stress significantly enhanced essential oil content by 29 % and 41 % at 2 % and 4 % PEG treatments, respectively. Foliar Se spray significantly increased essential oil content (1.02- and 1.12-fold at 20 and 40 mg<sup>-1</sup> L, respectively). The effect of drought stress on essential oil content is different in plant species. In some studies, drought stress enhanced the essential oil percentage (Khalid, 2006) and in others, it decreased (Zehtab-Salmasi *et al.*, 2001; Singh, 2002; Mirsa and Strivastava, 2000). It has been suggested that the induction of EO yield under drought stress may be because when plants grow under stress conditions, they only allocate low amounts of carbohydrates from photosynthesis to plant development, and instead use these for the synthesis of secondary and reserve metabolites, thus generating a balance between growth and defense (Krause *et al.*, 2021). Based on our results, applying Se enhanced the EO content and improved EO quality by increasing hyssop's main EO constituents.

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