Ecophysiology and Phytochemistry of Medicinal and Aromatic Plants
EPPMAPs

Effect of UV-B stress and spray of nano-titanium dioxide (TiO_2) on the physiological aspects of (*Salvia officinalis* L.)

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ABSTRACT

Introduction: *Salvia officinalis* L. is a plant of family Lamiaceae native of Asia and Latin America. The major phytochemical constituents of *Salvia officinalis* include phenolic compounds (e.g., coumarins, flavonoids, tannins), polyacetylenes, steroids and terpenes/terpenoids (e.g., monoterpenoids, diterpenoids, triterpenoids, sesquiterpenoids. *Salvia* is an important genus consisting of about 900 species in the family Lamiaceae. Nowadays, many Mediterranean countries where sage grows have substantial gains from its production and its export. UV radiation causes the generation of oxygen free radicals such as singular oxygen, superoxide anion, hydrogen peroxide and hydroxyl radicals which disturb the metabolic balance of cells. TiO_2 nanoparticles possess all of the characteristics of TiO_2 and due to smaller sizes, their contact surface with other materials and consequently their efficiencies are increased such that these unusual characteristics have created concerns regarding their potential environmental effects. In order to investigate the applicability of titanium oxide nanoparticles in decreasing the effects of stresses due to UV radiation in the sage plant, an experiment was conducted in biology department of Technical and Vocational University.

Experimental: In the current survey, based on the pot culture method using (Titanium dioxide nanoparticles) TiO_2 NPs pretreatment in three levels of (0 ppm, 30 ppm, 60 ppm) then applying UV-B in three levels of (0, 20, 40 min),totally in 9 treatments and three repetitions for every treatment, the growth and some biochemical detectors of the sage plant (*Salvia officinalis*) were studied. During 3 weeks and irrigated with Hoagland solution every day.

Results and Disscussion: The analysis of variance revealed that that UV-B stress increased cell death, carotenoids, anthocyanin, flavonoid, root protein. The results also showed that TiO_2 NPs decreased dry weight, soluble protein compared to control plants. The results obtained from investigating the application of UV-B combined with TiO_2 NPs showed that applying 30 ppm TiO_2 NPs concomitant with UV-B improved the effects of UV-B stress in sage plant compared to other

concentrations of TiO_2 NPs. The results obtained from investigating the application of UV-B combined with titanium oxide nanoparticles showed that applying 30 ppm titanium oxide nanoparticles concomitant with UV-B improved the effects of UV-B stress in sage plant compared to other concentrations of titanium oxide nanoparticles. TiO_2 NPs are able to activate an adaptive survival mechanism the plant even under oxidative stressful conditions.

Extension: Based on the results, growers can apply TiO_2 NPs at low concentrations of 30 ppm to complete the life cycle of sage plant to improve the antioxidant capacity of *S. officinalis*.

***Keywords*:** Biochemical parameters, Cell death, Sage, TiO_2 NPs, UV-B radiation.