

Abstract

Viola odorata from the family of *Violaceae* is found in the temperate regions of the world. Essential oils and pigments are the most important compounds of the violet plant. An experiment was done in a completely randomized block design with 3 replications in a greenhouse in Eleshtar town of Lorestan province on July 2014 in order to investigate the use of nano-iron, copper sulphate and salicylic acid on the physiology and morphology characteristics of medicinal plant violet. The factors of test include: salicylic acid (0, 0.75 and 1.5 mM), copper sulfate (0, 8 and 16 μ M) and nano-chelated iron fertilizer (0 and 1 per thousand). Treatments were applied as a foliar application in seedling stage and flowering.

The results of this experiment showed that the application of salicylic acid 1.5 mM had caused increasing the Shoot's fresh weight, chlorophyll a, chlorophyll b, total chlorophyll and carotenoid's content in both of the seedling and flowering stages significantly ($P \leq 0.05$). Also this treatment increase the catalase in seedling stage and polyphenols oxidase in flowering stage and it increased the percentage of mucilage and flavonoids and anthocyanins in flowering stage, too. The interaction of salicylic acid (1.5 mM) and nano-iron (1 per 1000) had caused increasing the length of plant in flowering stage. The application of nano- iron increased the percentage of mucilage and iron in both seedling and flowering stages. Also this treatment had increased the amount of catalase enzyme, chlorophyll (a, b and ab), mucilage, protein and flavonoid, the fresh weight of shoot and the number of flowers in flowering stage. Chlorophyll a, b and ab, carotenoids, proteins and plant's length had increased in treatment containing copper sulfate (4 μ M) in the seedling stage. Copper sulfate (8 μ M) had the most fresh weight of shoots in seedling stage, Also it caused the most plant's height and the least amount of anthocyanin in flowering stage. The interaction of nano-iron and copper sulfate (4 μ M) showed that the highest levels of catalase were observed in the flowering stage. The interaction of nano-iron and copper sulfate (8 μ M) showed the highest percentage of copper element was in shoots in the flowering stage.

Key words: anthocyanins, chlorophyll, nano- iron, protein, *Viola odorata*



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The effects of salicylic acid, Nano-iron chelated and cu on morphology and physiology characteristics of (*Viola odorata*)

Title

The effects of foliar feeding of nano and bio-fertilizer on physiological and morphological characteristics of hibiscus under drought stress conditions

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