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Effect of Foliar Application of Biofertiliser and Nanofertilisers on Morpho-Physiological Characteristics of Peppermint (*Mentha piperita* L.)

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Abstract

Peppermint (*Mentha piperita* L.) leave extracts are being used widely in pharmaceutical, food and cosmetic industry. Although this plant originally is not native to Iran, its cultivation significantly increased during the last two decades. As the use of chemical fertilisers and their influence on the environment is viewed critically, bio- and nano-fertilisers may become an alternative fertiliser source. In order to evaluate the effect of foliar application of nano- and bio-fertilisers on the morpho-physiological characteristics of peppermint, a completely randomized experiment was conducted with 7 treatments and 3 replications at the research greenhouse of Malayer University in 2015. Treatments were control, foliar application of 3 different nano-fertilisers (aqueous solution of nitrogen, iron and potassium at the rate of 2 g L⁻¹) and foliar application of 3 different bio-fertilisers (normal vermiwash, enriched vermiwash (normal vermiwash + aqueous extracts of *Urtica dioica*) and tea compost). After transplantation stems were cut at 3 cm above the soil level and plants received first foliar application when the stem reached 5 cm of height. Foliar application was effectuated by evenly spraying of the solution until the whole plant was wet; spraying was done 4 times at weekly intervals. The results showed a significant positive effect of both nano- and bio-fertilisers on plant height, leaf area, leaf dry weight, total dry weight, relative water content, photosynthesis pigments and the concentration of mineral nutrients. The lowest amount of leaf dry weight (1.73 g pot⁻¹) was observed for the control. The application of nitrogen nano-fertiliser increased leaf dry weight by 165%. The lowest plant height (12 cm) was recorded for the control, whereas the highest plant height (28.8 cm) was found for the nitrogen nano-fertiliser treatment followed by the enriched vermiwash (20.4 cm). In all treatments the chlorophyll *a* content was higher than found for the control, but the application of enriched vermiwash resulted in the highest amount of chlorophyll *a* (2.4 mg g⁻¹ FW). The highest amount of soluble protein (1.53 mg g⁻¹ FW) was related to enriched vermiwash but the lowest soluble protein content (1.05 mg g⁻¹ FW) was observed in tea compost treatment. In general, nitrogen nano-fertiliser and enriched vermiwash had the highest positive effects on the studied traits and were the best fertilisers among nano-fertilisers and bio-fertilisers, respectively. It is therefore recommendable to use enriched vermiwash or nitrogen nano-fertiliser for increasing the yield and quality of peppermint.

Keywords: Compost, crop nutrition, medicinal plants, nano-fertiliser, vermiwash