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Modification of Yield and Oil Quality of Peppermint by Different Soil Fertility and Water Limitation

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Abstract

Pepper mint (*Mentha piperita* L.) is an important medicinal plant which is a source of aroma chemicals like menthol, menthone, isomenthone and menthofuran. A field experiment was conducted in 2017 to study the effects of vermicompost and urea fertiliser as a source of nitrogen [control (without fertiliser), V1U5 (95 kg N ha^{-1}),V2U4 (71.25 kg N ha^{-1}) + (3.3 ton vermicompost ha^{-1}), V3U3 (47.5 kg N ha^{-1}) + (6.75 ton Vermicompost ha^{-1}),V4U2 (23.75 kg N ha^{-1}) + (10.1 ton vermicompost ha^{-1}) and V5U1 (13.5 ton vermicompost ha^{-1})] and sustained deficit irrigation impacts [irrigated at 85 % of field capacity (no stress, I1), 70 % of field capacity (mild stress, I2) and 55 % of field capacity (severe stress, I3)] on biomass, oil yield and oil components of pepper mint (Black Mitchum) in Iran. For this purpose, we used a randomised complete block design with three replications. Plots were irrigated frequently with drip irrigation system to apply deficit irrigation treatment. The irrigation schedule followed the soil water balance method. The hydro distilled essential oils of pepper mint were analysed by gas chromatography and gas chromatography-mass spectrometry. The results showed that biomass yield, oil percentage and oil yield were remarkably affected by water deficit stress and oil yield reduced with increasing deficit water stress from 16 to 6 kg ha^{-1}. The maximum of biomass yield (2046 kg ha^{-1}), oil percentage (0.9 %) and oil yield (16.9 kg ha^{-1}) were obtained in I1, I2 and I1, respectively. The pepper mint yield was also significantly influenced by fertiliser regimes. The highest biomass yield (1709 kg ha^{-1}), oil percentage (0.78 %) and oil yield (13.5 kg ha^{-1}) were obtained in V2U4, V3U3 and V2U4, respectively. In generally, 16 compounds were found in essential oil of pepper mint by means of GC-mass that all of them exhibited a significant change against water limitation and fertiliser treatment. Menthol, menthone and menthofurane were the dominant essential oil compounds which illustrated an enhancing under water deficit irrigation and vermicompost. The results indicated that oil quality improved under moderate drought stress and vermicompost application.

Keywords: Essential oil, *Mentha piperita*, nitrogen, urea, vermicompost

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