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## Essential Oils and Heavy Metal Accumulation in *Salvia officinalis* Cultivated at Different Inter-row Spaces in Ash-Shoubak, Jordan

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### Abstract

Essential oil yields and heavy metal contents were determined in the sage medicinal plant, *Salvia officinalis* L., cultivated at 15, 30 and 45 cm inter-row spacing in Ash-Shoubak in the South of Jordan. Samples were harvested during vegetation (VEG), beginning of blooming (BB), full-blooming (FB) and fruit maturation (FM) stages. Essential oil yield and the content of heavy metals in the plant were determined by using hydrodistillation and atomic absorption spectrometry methods, respectively. The yields of essential oil and heavy metal contents were affected by inter-row spacing and phenological stage. The maximum oil yield  $2.00 \pm 0.115\%$  was obtained in plants cultivated with 15 cm inter-row spacing and harvested at VEG stage, while the minimum (0.87%) was obtained in plants cultivated with the same inter-row spacing but harvested at FM stage. Heavy metal contents were variable depending upon both inter-row spacing and phenological stage. Co, Cd, and Pb were not detectable. The content of Ni, Zn, Fe, and Cu were increased during the vegetative life cycle of the plant but still below their toxic level. *Salvia officinalis*, cultivated in Ash-Shoubak region is found to be rich in oil extract and free from hazard heavy metals.

**Keywords:** Essential oil, heavy metals, Jordan, sage, Salvia