

## Abstract

The study was conducted to investigate the effects of humic acid, iron nano-chelated and methanol on quantitative and qualitative characteristics of medicinal plants psyllium (*Plantago ovata* L.), chicory (*Cichorium intybus* L.) and European borage (*Borago officinalis* L.) in greenhouse condition (University of Zabol, Research Farm, Chahnimeh). The experimental design was factorial in a completely randomized design with three replications. The treatments were methanol (0, 10% and 20%), humic acid (without humic acid, humic acid with half level ( $17.4 \text{ g Li}^{-1}$ ) and total ( $34.8 \text{ g Li}^{-1}$ ) and, iron nano-chelated (without nano-iron and use of nano-iron). The treatments were applied combined and alone on the plants. The examined characteristics were height, root volume, number of nodes, seed weight, number of flowers per plant, biological yield, economic performance, harvest index, chlorophyll fluorescence, photosynthesis pigments, anthocyanins, flavonoids, mucilage and carbohydrates. The results showed that there were significant differences among levels of humic acid, iron nano-chelated and methanol on the plants. Results revealed that humic acid had significant impact on all characters of *P. ovata* L. except for the total phenol and the mucilage. Methanol spraying showed significant impacts on all characters except for seed weight, harvest index, phenol, carbohydrate. Application of iron nano-chelated had significant impacts on the most of characteristics of *P. ovata* L. except for the number of leaves, chlorophyll, phenols and carbohydrates. Results showed that humic acid increased the quantity characteristics of *C. intybus* L. significantly except for the chlorophylla and phenolic compounds (anthocyanins and phenol). In this experiment, methanol spraying had not significant effects on biological yield, harvest index, photosynthesis pigments and anthocyanin content. Effect of iron nano-chelated was not significant on carotenoids, anthocyanins, phenols and carbohydrates in *C. intybus* L. Different levels of humic acid increased significantly all characteristics of *B. officinalis* L. except height, the anthocyanin and carbohydrates. Methanol spraying and iron nano-chelated was also the same trend on the characteristics of the plant. Generally, the effective level of humic acid, methanol and iron nano-chelated on the growth of plants were  $0.5 \text{ g Li}^{-1}$ , 10% and use of iron nano-chelated respectively. The use of these fertilizers on the growth of medicinal plants could be helpful.

**Keywords:** Humic Acid, Methanol, Iron Nano-Chelated, *Plantago ovata*, *Cichorium intybus*, *Borago officinalis*.



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