

## The effects of humic substances and mycorrhiza fungus on Fe and Zn uptake and some soybean growth characteristics under greenhouse conditions

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### Abstract

Iron (Fe) and zinc (Zn) deficiency has been known as a key factor in limiting crop production in calcareous soils of arid and semi-arid regions. Since the components of organic matter can change Fe and Zn availability, this study was conducted to investigate the effects of humic treatments including humic acid (HA), fulvic acid (FA), vermicompost (Verm), HA+FA and HA+FA+Verm and mycorrhiza inoculation on some growth characteristics of soybean and Fe and Zn uptake under greenhouse conditions. Results showed that significant differences among humic substances and mycorrhiza were recorded for soybean growth and Fe and Zn uptake. The response of soybean plants to humic substances was different. The largest increases in plant height, shoot fresh weight, shoot dry weight, root fresh weight and root dry weight were found in humic acid amended soil, being 0.9 fold, 2.37 fold, 6.11 fold, 3.54 fold and 5.5 fold, respectively, as compared to the control. Mycorrhiza also improved soybean growth characteristics. Humic treatments (with an exception for humic acid and vermicompost) increased Fe and Zn content of soybean aerial parts. The highest Fe content (657.3 mg/kg) and Zn content (87.4 mg/kg) was measured in plants treated with fulvic acid. Mycorrhizal inoculation resulted in 10% increase in Fe and 64% in Zn content of soybean as compared to control plants. The results of this research revealed that application of humic acid and mycorrhiza can improve soybean growth by increasing the uptake of Fe and Zn.

**Keywords:** Sustainable agriculture, Bio-fertilizers, Nutrients uptake, Chelates.

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