

**ENRICHMENT OF HUMIC ACID AND AZOLLA WITH IRON OR ZINC AND  
 THEIR IMPACTS ON FABA BEAN PLANTS GROWN ON A CALCAREOUS SOIL  
 BY**

**El-Ghozoli, M. A. and Abd El-Warh, M**  
 Soils, Water and Environment Res. Institute, Agric. Res. Center, Giza, Egypt

**ABSTRACT**

A pot experiment using surface calcareous composite soil (0-20cm) as growth medium for faba bean plants (*Vicia faba*, C.V. Giza 2) was carried out to study the effect of both humic acid and Azolla enriched with Fe and/or Zn individually or impregnated in comparison with those of Fe-EDTA (5% Fe), FeSO<sub>4</sub> (56% Fe), Zn-EDTA (14.2% Zn) and ZnSO<sub>4</sub> · 7H<sub>2</sub>O (22.6%Zn) on the growth of faba bean plants. Status of N, P, K, Fe and Zn, number, dry weight of root nodules, nitrogenase (N<sub>2</sub>-ase) activity, CO<sub>2</sub> evolved and total counts of bacteria, fungi and actinomycetes were observed. Results obtained could be summarized as follows:

- All treatments caused increases in dry weight of faba bean plants compared with the control treatment.
- The dry matter yield and concentrations of N, P, Fe and Zn of faba bean. Plants were positively affected by humic acid and Azolla enriched with Fe and/or Zn. The increases were higher in case of humic acid or Azolla impregnated with Fe or Zn as compared with humic acid or Azolla combined with Fe or Zn.
- The combinations between any of the humic acid or Azolla and Fe or Zn were more effective for increasing the number and dry weight of nodules, N<sub>2</sub>-ase and CO<sub>2</sub> evolution. However, the increases seemed to be dependent not only on the applied but also on type of the manure.
- Humic acid or Azolla enriched with iron and/or zinc could be considered as equivalent and effective source of iron or zinc to those of the chelated forms. Iron and zinc enriched humic or Azolla was equivalent to the highly expensive iron or zinc chelate like Fe-EDTA and Zn-EDTA.
- Results indicated that the soil supplemented with humic acid or Azolla impregnated or combined with Fe or Zn showed higher counts of bacteria, fungi and actinomycetes than that recorded with the control treatment.

**Key words:** Humic acid – Azolla – Fe – Zn – bean plants – Enrichment – Calcareous

**INTRODUCTION**

The availability of trace elements to plants is governed by a variety of reactions that include complication with organic and inorganic ligands, ion exchange and adsorption, precipitation and dissolution of solids and acid-base equilibria. (Mattigod *et al.*, 1981).

Chen *et al.* (1982) found that peat enriched with iron (3.7% Fe) reduced symptoms of chlorosis and increased yield of

peanuts. El-Hedek (2007) found that addition of poultry manure, compost and sulfur to a high calcareous soil caused relative increase in DTPA-extractable Fe of about 8.3%, 22.8% and 11.0% compared to control.

Shams El-Den (1993) noticed that Fe concentration in shoot and seeds of wheat plants significantly increased with increasing Fe application rate in a mineral or chelated form.