



**Management of supplementary education
Faculty of Water and Soil
Department of Geology
Dissertation for obtaining a master's degree in soil science**

Title:

**The effect of humic substances and plant growth
stimulating bacteria on the germination indices of
two types of medicinal plant seeds**

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Abstract

A factorial experiment in the form of a completely randomized design was carried out in-vitro conditions with four replications and, in total, 72 experimental units (36 experimental units for each type of seed) to investigate the effect of humic acid, fulvic acid and plant-growth-promoting-rhizobacteria treatments on the germination indices of medicinal plant seeds. The first factor was humic substances in three levels include distilled water (control), application of fulvic acid and humic acid and the second factor was plant-growth-promoting-rhizobacteria in three levels include physiological serum (control), the use of *Pseudomonas* sp. R27N7 and *Staphylococcus* sp. R38N2 plant-growth-promoting-rhizobacteria. The results showed a significant mutual effect of humic materials x bacteria on all measured traits for *Sesbania* plant. For this plant, fulvic acid treatment was the best treatment compared to the control in terms of improving all the measured traits (including 4 growth traits and 8 germination indices of *Sesbania* seeds). In addition, compared to the control, the combination treatment of fulvic acid and *Pseudomonas* bacteria, the treatment of *staphylococcus* bacteria alone, the combination treatment of humic acid and *staphylococcus* bacteria, and the combination treatment of fulvic acid and *Staphylococcus* bacteria were ranked respectively. For artichoke plants, the main effect of bacteria was significant only on the mean germination time trait. The main effect of humic substances was also significant on seedling weight, germination percentage, germination rate, mean daily germination and vigor index I and II. For this plant, humic acid treatment was the best treatment compared to the control in terms of improving seedling weight, germination percentage, germination rate, mean daily germination, vigor index I and II. Of course, in addition to humic acid, fulvic acid also significantly increased the rate of seed germination compared to the control. Also, each of the treatments of *Pseudomonas* and *Staphylococcus* bacteria significantly reduced the mean germination time compared to the control. Overall, it can be said that the use of fulvic acid treatment in *Sesbania* plant and humic acid treatment in artichoke plant improves most of the seed germination indices and their growth indices.

Keywords: *Staphylococcus*, fulvic acid, humic acid, *Sesbania*, *Pseudomonas*, artichoke