

Biofertilization-And micro-elements spraying efficiency on growth and yield of lupine plants

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Lupine (*Lupinus termis* L.) is one of the oldest plants in Egypt. It was known to the Egyptian Pharaohs. Lupine seeds are widely used as food. Also, for some medicinal purposes such as hypoglycemia, diabetes and eczema treatment. The lupine plants, like other grain legumes (beans, peas and lentils), fix atmospheric nitrogen and produce seeds with high protein content. This study included the following points.

1. Interaction effect of biofertilization and micronutrients application on nodulation and N₂-ase activity of white lupine.
 - a. Data showed that the nodulation and N-ase activity gave higher records in all treatments combined with micronutrients application.
 - b. Dual inoculation of lupine with *Br. lupini* + *Bacillus megaterium* var. *phosphaticum* gave higher records of lupine root nodulation and N-ase activity than inoculation with *Br. lupini* individually.
 - c. Higher records of lupine root nodulation and N-ase activity in case of mixture inoculation could be attributed to the synergistic effect between either *Br. lupini* and *B. megaterium* or *Br. lupini* and *B. circulans* or among three of microorganisms.
2. Interaction effect of biofertilization and micronutrients application on macro-elements in soil.
 - a. Data revealed that the macro-elements showed highest records in rhizosphere in the treatments supplemented with micronutrients rather than the treatments which non-supplemented with micronutrients.
 - b. Dual inoculation of lupine by *Br. lupini* in combination with *B. megaterium* gave higher records of N, P and K rather than the inoculation of lupine by *Br. lupini* in combination with *B. circulans*. Also, the highest records of N, P and K were observed in the treatment of mixture inoculation of lupine.
 - c. Data showed that the lowest records of N, P and K content in soil were observed in control treatments.
3. Interaction effect of biofertilization and micronutrients application on plant height and shoot dry weight of white lupine.
 - a. Obtained results showed that the dual inoculation of lupine with *Br. lupini* combined with *B. megaterium* significantly increased the plant height as compared to the dual inoculation of lupine with *Br. lupini* combined with *B. circulans* at 45 days. While no significant difference was observed at 75 days.
 - b. In general, inoculation of lupine with biofertilizing agents and micronutrients supplementation showed higher records of growth characters compared to without micronutrients application.
4. Interaction effect of biofertilization and micronutrients application on macro-nutrients content in shoots of lupine.
 - a. Obtained results showed that the dual inoculation of lupine with *Br. lupini* combined with either *B. megaterium* or *B.*