

## البحث الأول

Safi-naz S. Zazi, **Eman E. Belal**, Mostafa M. Rady (19 March 2019). Cyanobacteria and Glutathione Applications Improve Productivity, Nutrient Contents, and Antioxidant Systems of Salt-Stressed Soybean Plant. International Letters of Natural Sciences. Vol. 76, pp.72-85.

تطبيق السيانو بكتيريا والجلوتاثيون يحسن الإنتاجية، المحتوي الغذائي، والأنظمة المضادة للأكسدة لنبات فول لصويا المجهد ملحيًا .

### ملخص البحث باللغة الإنجليزية:

Salt stress restricts plant performance by disrupting various physio-biochemical processes like photosynthesis. Plants growing in saline substrates show deficiencies in absorption of some essential elements due to the presence of excessive sodium ( $\text{Na}^+$ ) in the rhizosphere, which antagonizes beneficial cations and causing toxicity in metabolism. Cyanobacteria (CB; a natural biofertilizer) play a fundamental role in building-up soil fertility, thus increasing plant performance. Glutathione (GSH) is a well-known antioxidant, which contributes to increase salt tolerance in the plant. This work was conducted as a pot experiment (sand culture) in 2017 to study the combined effect of CB, applied as seed inoculation, and GSH, applied as foliar spray, on growth, pods and seed yields, the contents of antioxidants, osmoprotectants, and nutrients, and the antioxidative enzymes activities of soybean (*Glycine max L., cv. Giza 111*) plants grown under saline conditions. At fourth leaf stage (21 days after sowing; DAS), CB-pretreated seedlings were supplemented with NaCl (150 mM) along with Hoagland's nutrient solution, and at the same time seedlings were sprayed with 1 mM GSH. Samples were taken at 60 DAS to assess morphological, physio-biochemical and antioxidant defense systems attributes. Results showed that the integrative application of CB and GSH under saline conditions was effective in improving significantly the growth characteristics, yield components, photosynthetic efficiency (pigments contents and chlorophyll fluorescence), membrane stability index, relative water content, contents of soluble sugars, free proline, ascorbic acid, glutathione,  $\alpha$ -tocopherol, and protein, and activities of superoxide dismutase, catalase, and guaiacol peroxidase. The contents of macronutrients (N, P,  $\text{K}^+$ , and  $\text{Ca}^{2+}$ ) were also increased significantly in *Glycine max* plants compared to the stressed control. In contrast,  $\text{Na}^+$  content and electrolyte leakage were significantly reduced. Our results recommend using the combined CB (as seed inoculation) and GSH (as foliar spray) application for soybean plants to grow well under saline conditions.