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Effect of lead and cadmium on germination and seedling growth of soybean (*Glycine max* L.)

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Abstract

This study was conducted to determine the effect of different concentrations of lead and zinc on seed germination and seedling growth of soybean plant (Glycine max L.). Seeds were grown under laboratory conditions at (0, 0.5, 2.5, 4.5 and 6.5 mM) of lead (II) chloride and different concentrations of zinc chloride (5, 10, 15 and 20 mM). Both lead and zinc treatments showed toxic effects on seed germination percentage of soybean. With increasing concentration of lead chloride to 6.5 mM, significantly ($p<0.05$) decreased seed germination as compared to control. However, in comparison with the control treatment, the lowest germination percentage determined at 5 mM zinc in the level ($P <0.05$). The decrease of 58.24 and 73.17 % in germination rate was noticed following the treatment with 4.5 and 6.5 mM lead chloride compared with control treatment, respectively. But, zinc chloride increased germination rate over control at 5 mM, however by increasing zinc concentration, the speed of germination was significantly decreased in comparison with the control. Lead was found to penetrate thick seed coat of this plant and affects its germination and growth rate. Soybean plants is a non-tolerant plant to lead during its germination and initial growth. The toxic effects of lead may be observed in low concentrations (5 mM) since they significantly reduce germination percentage. The decrease in seed germination can be attributed to alterations of selection permeability properties of cell membrane. Also, it seems that soybean plants cannot be tolerated by these elements because of their genetic and inductive ability. The reason for low tolerance against both metals might be due to change in the physiological mechanism in seed germination and seedling growth of plant.

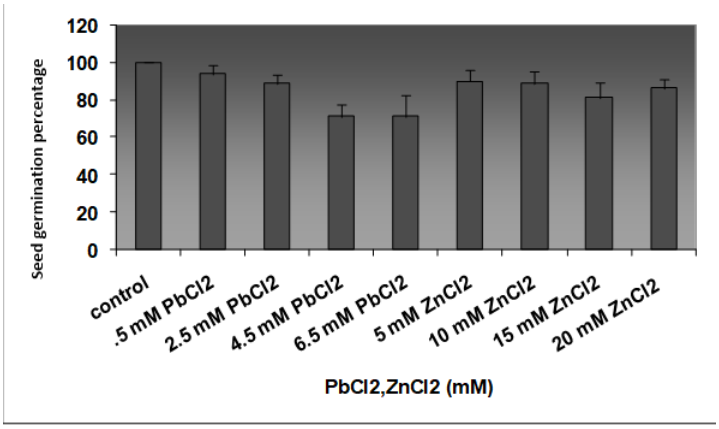


Fig 1. Effect of different concentrations of $PbCl_2$ and $ZnCl_2$ on soybean seed germination percentage

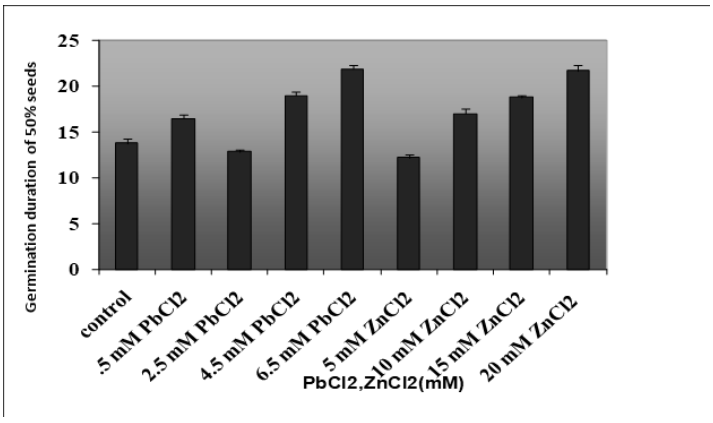


Fig 2. Effect of different concentrations of $PbCl_2$ and $ZnCl_2$ on the germination duration of 50% of soybean seeds

Recent Publications

1. Asghar, H. N., Zafar, M.A., Khan, M.Y., Zahir, Z.A. 2013. Inoculation with ACCdeaminase containing bacteria to improve plant growth in petroleum contaminated soil. Rom. Agric. Res. 30, 34e38.
2. Ahmet, T., K. Hayrettine, Vedat, S. 2011. Effects of Different Salt Concentration (NaCl) on Germination of Some Spinach Cultivars. Journal of Agricultural of Uludag Unversity, 25(1): 65-77.
3. Augusto, A. S.; Bertoli. A. C.; Cannata, M. G.; Carvalho, R.; Bastos, A. R. R. 2014. Bioacumulação de metais pesados em Brassica juncea: relação de toxicidade com elementos essenciais. Revista Virtual Química, v. 6, n. 5, p. 1221-1236
4. Natarajan, A., Vijayarengan, P., Vijayaragavan, M. 2018. Influence of cadmium on growth and biochemical contents of tomato plants. Journal of Plant Stress Physiology:04-6.
5. Sundaramoorthy P, Murugan A, Ganesh K. S. 2018. Effect of chromium on growth and yield of Vigna mungo (L.). Journal of Plant Stress Physiology: 4:17-21.



Biography

Elham Abedi has studied in plant physiology. She received her B.S. and M.S. degrees in plant physiology from the Department of basic science, Isfahan University, and Science and Research Branch, Islamic Azad University, Tehran, Iran, respectively. In 2015, she started her Ph.D. in the same department where her thesis is about the Effect of different concentrations of Nanoparticles and Sodium selenate on germination, some physiological and biochemical parameters of *Dorema ammoniacum* D. Don.

She has worked in evaluation of some physiological parameters in several poaceae family plants under in vitro stresses, such as heavy metal and salt. Now she has focused on selenium supplement on endemic species plants.

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Notes/Comments

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