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**Small-Sized Nanophosphorus Has a Positive Impact on the Performance of Fenugreek Plants under Soil-Water Deficit Stress: A Case Study under Field Conditions**

Biology, 11(1), 115; (2022) <https://doi.org/10.3390/biology11010115>.

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Article  
status

Shared with others inside and outside the specialization  
– Published in International Journal

Impact Factor: **5.168**

**Abstract**

Phosphorus (P) is an essential macronutrient necessary for plant growth, development, and reproduction. Two field experiments were carried out in 2018/2019 and 2019/2020 on P-deficient soil to evaluate the impact of foliar fertilization with nanophosphorus (nP) on growth, yield, and physiobiochemical indices, as well as trigonelline content of fenugreek plants under deficient irrigation (dI) stress (a deficit of 20 and 40% of crop evapotranspiration; dI-20 and dI-40). The growth and yield traits, leaf integrity (relative water content and membrane stability index), photosynthetic pigment contents, leaf and seed P contents, and stem and leaf anatomical features significantly decreased under dI-20, with greater reductions recorded under dI-40. In contrast, water-use efficiency, osmoprotective compounds, including free amino acids, soluble sugars, proline, and trigonelline, along with antioxidant contents (ascorbate, glutathione, phenolics, and flavonoids) and their activity increased significantly under both dI-20 and dI-40. However, foliar feeding with nano-P considerably increased plant growth and yield traits, leaf integrity, photosynthetic pigments contents, leaf and seed P contents, and anatomical features. Besides, water use efficiency, osmoprotectant contents, and antioxidant content and activity were further increased under both dI-20 and dI-40. The positive effects were more pronounced with the smaller nP (25 nm) than the larger nP (50 nm). The results of this study backed up the idea of using foliar nourishment with nP, which can be effective in modulating fenugreek plant growth and seed production.