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ORIGINAL PAPER

Seed priming and phosphorus fertilization boost nutrient biofortification of lentil plants*

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Abstract

This experiment investigated effects of seed priming and phosphorus fertilization on the biofortification of lentil plants grown under low-phosphorus field conditions. Four phosphorus doses and six priming treatments were used in the experiment. According to results, 15 and 30 kg P ha^{-1} significantly increased the nitrogen concentration in plants while all phosphorus doses stimulated greater magnesium accumulation over control. Higher phosphorus addition restricted potassium acquisition by 9.5% under high-potassium soils. Moreover, 15 kg P ha^{-1} application of salicylic acid, citric acid, inorganic phosphorus or plant growth-promoting bacteria (PGPB) distinctly promoted the uptake of nitrogen, phosphorus, potassium, manganese, iron and zinc. PGPB mostly promoted nitrogen and phosphorus uptake, while citric acid priming highly stimulated the acquisition of Mg, Mn and Fe. All priming treatments were lower than the control for potassium accumulation, in which the lowest value was observed in PGPB-primed plants, because it can solubilize phosphorus compounds in rhizosphere, thereby causing an antagonistic effect on potassium uptake. Seed priming with 4 mM silicon enhanced copper accumulation in tissues up to 9.4%. Priming with 100 mg kg^{-1} citric acid promoted iron, magnesium and manganese accumulation by 13.8%, 3.8% and 4.7% compared with control, respectively. In conclusion, phosphorus addition boosted macro- and micronutrient acquisition, although the 15 kg P ha^{-1} dose is recommended from an economic perspective. Also, phosphorus application and seed priming treatments exhibited synergistic effects on nutrient acquisition depending on a nutrient element. Finally, seed priming with PGPB, 4 mM salicylic acid and 100 mg kg^{-1} citric acid exhibited superior performance on nutrient uptake in lentil.

Keywords: beneficial microorganism, food security, *Lens culinaris*, phosphorus deficiency, sustainable agriculture

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