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# Nutrient Seed Priming Improves Germination Rate and Seedling growth under Submergence Stress at Low Temperature

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**Abstract**

Seed quality plays an important role in crop production. Seed mineral nutrients are one of the key factors determining seed quality. Micronutrients take part in a number of biochemical and physiological processes during germination and early seedling establishment. Due to important functions in membrane stabilisation, free radical detoxification and secondary plant metabolism sufficient availability of micro-nutrients such as Zn, Mn or B in the seed is essential for seed germination and seedling growth, particularly when germinating seeds or seedlings are facing abiotic and biotic stress.

'Nutrient seed priming' is a technique in which seeds are soaked in a mineral nutrient solution with subsequent re-drying to the initial moisture content. The final goal is an improvement of germination rate, early seedling growth and stress resistance, acting via an improved micronutrient status and a pre-activation of metabolic pathways important for germination during the pre-imbibition treatment (priming effect).

In the present study, soybean (*Glycine max* L.) cv. 'Conquista' seeds were primed with nutrient solution of Mn, Zn and B (Mn and Zn at the rate 5 and 15 mM using $MnSO_4$ and $ZnSO_4$ solutions respectively, and B at 0.5 and 10 mM as Boric acid solution) for 12 hours at 20°C between 5 layers of moist filter paper. After seed nutrient priming seeds were dried to initial seed moisture content and stored at 4°C. After one week of storage, seeds were submerged into chilled water at 4°C for 24 hours as a stress treatment and subsequently tested for germination and early seedling development. Nutrient seed priming significantly increased content of micro-nutrients in the seeds up to 20 times for Mn, 5 times for Zn and 2 times for B. Boron seed priming increased germination rate significantly by 80 % compared to unprimed control, which was not able to produce any seedling under these stress conditions.

**Keywords:** Micronutrients, nutrient seed priming, seed germination, soybean, submergence stress

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