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Effect of seed priming with polyamines on seed germination under stress conditions

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Abstract

Seed germination is one of the critical and sensitive stages of plant development and is affected by stresses. Polyamines (PAs) are aliphatic amine growth regulators playing key roles in plant development and defense. Diamine putrescine (Put), triamine spermidine (Spd), and tetramine spermine (Spm) are the most common free PAs in plants. The study was conducted to explore the benefits of seed priming with PAs on seed germination under stress conditions; for tomato (*Solanum lycopersicum* L.) under water stress and for rice (*Oryza sativa* L.) under Aluminium (Al^{3+}) stress. Tomato and rice seeds were surface sterilized and primed with 50 μ M and 1mM PAs solutions respectively or with sterile distilled water (controls). Pre-soaked 10-15 seeds were placed on filter papers and water stress for tomato seeds was enforced with 0.5% and 1% polyethylene glycol-6000 (PEG) and control (PEG free) solution while Al^{3+} stress for rice was induced by 250 μ M and 750 μ M of $AlCl_3$ solutions (pH 4.2) and control (Al free). Germination percentage, mean germination time and α -amylase activity of germinating seeds was assessed. After 04 days of sowing, percentage of tomato seed germination was reduced in 0.5% and 1% PEG in comparison to control. Percentages of germination of control, Put, Spd and Spm-primed tomato seeds were 43%, 53%, 62% and 63%, respectively in 0.5% PEG and in 1% PEG the percentages of germination were 37%, 52%, 60% and 62%, respectively. PA-untreated control rice seeds showed significantly reduced germination ($p < 0.05$) at 250 μ M Al^{3+} (14%) and 750 μ M Al^{3+} (4%) compared to germination at Al -free growth conditions (26%) after 03 days of sowing. Put, Spd and Spm-primed seeds showed enhanced germination both under Al -stressed and control conditions. Under 750 μ M of Al^{3+} , Put (28%), Spd (38%) and Spm (32%) primed seeds showed significantly higher percent germination in comparison to control (4%). Relatively higher α -amylase activities in Spd and Spm-primed tomato seeds were observed than that of control at 04 days of tomato seed germination in 1% PEG. Germinating PA-primed rice seeds indicated increased α -amylase activity compared to the PA-untreated controls under Al stress. These results exhibited that PA priming enhances germination of tomato seeds under water stress and rice seeds under Al stress suggesting positive effects of exogenous PA treatment in seed germination under these stress situations.

Keywords: Aluminium, Amylase, Germination, Polyamines, Water stress

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