

Effect of Seed Priming Agents on the Germination of Rice (*Oryza sativa* L.): A Laboratory Investigation on Germination Performance

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Seed priming has emerged as a promising strategy to enhance germination and early seedling vigor under abiotic stress, particularly salinity stress, which adversely affects rice production. This study was conducted under laboratory conditions at the Department of Crop Science, University of Peradeniya, Sri Lanka, following a completely randomized design. The experiment evaluated the effects of six seed priming agents: mannitol, calcium chloride (CaCl_2), magnesium chloride (MgCl_2), sodium nitroprusside (SNP), zinc sulfate (ZnSO_4), and gibberellic acid (GA_3) on the seed germination of a salinity-susceptible rice variety, Bg 300. Seeds were primed in different concentrations of each agent: Mannitol (10, 20, 30, 40, 50 g/L), CaCl_2 (10, 15, 20, 25, 30 g/L), MgCl_2 (0.25, 0.5, 0.75, 1, 1.25 g/L), SNP (0.01, 0.016, 0.021, 0.026, 0.031 g/L), ZnSO_4 (2.5, 5, 7.5, 10, 12.5 g/L), and GA_3 (0.025, 0.05, 0.075, 0.1, 0.125 g/L). Germination parameters including, germination percentage, mean germination time, time for 50% germination, germination value, vigor index, radicle and plumule length, and radicle: plumule ratio, were assessed over a five days. Data were subjected to analysis of variance using statistical analysis software, and differences between treatment means were analyzed using Duncan's multiple range test at $p \leq 0.05$. GA_3 at 0.125 g/L, SNP at 0.031 g/L, MgCl_2 at 1 g/L, CaCl_2 at 10 g/L, mannitol at 30 g/L, and ZnSO_4 at 2.5 g/L were identified as optimal concentrations enhancing seed germination without reducing the quality of the seedling. GA_3 and SNP significantly accelerated the germination, while MgCl_2 and ZnSO_4 maintained stable germination indices across concentrations. CaCl_2 and mannitol at higher concentrations exhibited inhibitory effects due to osmotic stress. The selected priming agents were previously reported to be effective in mitigating salinity stress. Therefore, these findings highlight the potential use of these seed priming agents for improving crop establishment of rice in stress-prone environments. Future research should focus on evaluating the long-term field performance and stress adaptation of primed seeds.

Keywords: Paddy, Priming treatments, Stress, Tolerance