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Seed Priming Methods to Break Seed Dormancy and Enhance Seed Germination in Selected Underutilized Crop and Fruit Species in Sri Lanka

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Abstract

Many cultivated crops and fruit species worldwide remain underutilized, despite their potential to enhance food security, nutrition, health, and income generation. Poor germination rates, coupled with prolonged dormancy, may contribute to their infrequent cultivation. Therefore, studying treatments to break seed dormancy and enhance germination is essential. In this study, we examined the seed viability [using 1% Tetrazolium chloride (TTC)], water imbibition, seed germination (in distilled water and in 5% saline solution) and priming of *Antidesma bunius, Averrhoa bilimbi, Canavalia ensiformis, Coccinia grandis, Cordia dichotoma, Ipomoea alba, Momordica denudata, Sauropus androgynus* and *Solanum violaceum*. For each species in each treatment, we used 100 seeds in total, with 20 seeds per replicate (n=5), and observed 36 days under optimum light and dark conditions. Water imbibition was measured for batches of 10 seeds in 5 replicates. We employed several seed priming methods: manual scarification (MS), acid scarification (AS) (dipping in 98% H_2SO_4 for 2 minutes), and treatment with a 500 ppm gibberellic acid (GA_3) solution, following standard protocols. The results of the TTC test showed that all species exhibited over 80% viability. The highest imbibition was observed in *C. ensiformis* when immersed in both distilled water and in saline solution (4.21 g and 2.45 g respectively), while *C. dichotoma* (0%) did not imbibe water in either distilled water or saline solution. *Averrhoa bilimbi* produces recalcitrant seeds but the rest of the species possess dormant seeds. Manual scarification of *A. bunius* and *C. dichotoma (p=0.001)* and AS of *S. violaceum (p=0.001)* enhanced their seed germination, but only up to 50%. In contrast, MS significantly enhanced the germination of *M. denudate (p<0.001)* and *I. alba (p=0.004)* while significantly reducing the time taken for their germination (*p=0.001* and *p=0.007*). Application of GA_3 solution significantly decreased the time taken for the germination in *C. ensiformis, C. grandis, S. androgynus, S. violaceum,* and *I. alba (p=0.001)*. Further, the GA_3 treatment resulted in 100% germination of *C. ensiformis, S. androgynus,* and *I. alba* seeds, while 80% seed germination in *C. grandis.* In contrast, *A. bilimbi* did not respond to any of the tested seed priming methods. Enhancing seed germination of *A. bunius, C. dichotoma, C. grandis, M. denudate* and *S. violaceum* can encourage farmers to cultivate these species, thereby positively contributing to the country's food and nutritional security, in line with the United Nation's Sustainable Development Goals. The study also suggests the necessity of exploring seed priming methods for other underutilized crop and fruit species of the country.

Keywords: *Gibberellic acid, Acid scarification, Manual scarification, Viability test, Imbibition*