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SCREENING DALBERGIA SISSOO ROXB. POPULATIONS FOR DROUGHT STRESS TOLERANCE THROUGH SEED GERMINATION UNDER INDUCED OSMOTIC STRESS REGIMES

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ABSTRACT: Four populations viz. P_1- Uttaranchal, P_2- Odisha; P_3 and P_4 -Madhya Pradesh of *Dalbergia sissoo* Roxb., an important multipurpose tree species of the Indian subcontinent, were screened for their drought tolerance on the basis of seed germination under different regimes of polyethylene glycol-6000 (PEG-6000) - induced osmotic stress. The study aimed at identification of appropriate PEG treatment for water stress evaluation in *D. sissoo* and selection of drought tolerant population/s for plantation under such conditions. Seeds of were germinated in petri dishes on germination paper soaked with 5 ml day^{-1} of either distilled water (T_1) or 200g Kg^{-1} H_2O (T_2) or 300g Kg^{-1} H_2O (T_3) solution of PEG-6000 producing osmotic potential of approximately 0 Mpa, 0.5 Mpa and 0.1 MPa, respectively at 25°C. Observations were recorded after 24 h, 3 day and 1 week. Seed germination in all populations was seriously affected at water stress of 0.1 MPa (T_2). Overall, three patterns were discerned- (1) significant increase in germination at moderate water stress (0.5 Mpa) compared to control in P_2, (2) drastic reduction in germination in the same treatment (T_2) over control in P_4; and better adjustment with moderate water stress in other two populations viz., P_1 and P_3. The findings indicate towards differential capacity of the populations for osmotic adjustment with germination under water stress conditions. Screening drought tolerance through seed germination under PEG-induced osmotic stress of 0.5 Mpa has been recommended for tree species like *D. sissoo* where field testing becomes extremely difficult due to perennial growth habit.

Keywords: Drought; germination; PEG; populations; stress

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INTRODUCTION

Water stress is one of the main environmental stresses responsible for reducing crop productivity as it affects growth through various physiological and metabolic processes in plants (Bray 1993). Germination is considered to be the most critical and sensitive stage in the plant life cycle (Pessarakli 1999; Ahmad et al. 2009). Seedling establishment through the seeds exposed to unfavourable environmental conditions such as drought is also affected (Albuquerque and Carvalho 2003; Soleymani et al. 2012). The effect of water deficit on seed germination has been studied extensively in several species (Taylor et al., 1973; Bewley and Black 1978; De and Kar 1995; Van den berg and Zeng 2006). Water stress not only reduced germination percentage but also delayed radical emergence with decrease in osmotic potential of external media (Fady 1992; De and Kar 1995). Richards (1978) suggested germination as a useful criterion in screening for water stress tolerance. However, it is difficult to achieve controlled and uniformly repeated simulation of drought in the field (Shaheen and Hood-Nowotny 2005).

Germination is the stage of the life cycle of higher plants at which they are probably the most vulnerable to various abiotic stresses (Debez et al. 2004). Plant responses to drought stress with regard to seed germination and seedling growth have been recently reported including agricultural crops, *Oryza sativa, Avena sativa, Spinacia oleracea, Amaranthus mangostanus, Helianthus annuus* and *Coffea Arabica* (Gao et al. 2008; Ahmad et al. 2009; Mut et al. 2010; Chen and Arora 2011; Sun et al. 2011, Almida et al. 2018), and grasses, *Anthephora pubescens, Heteropogon contortus, Themeda triandra* and