From Forest Nursery Notes Winter 2013

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Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

RESEARCH ARTICLE

Seed Treatment Optimizes Benefits of Seed Bank Storage for Restoration-Ready Seeds: The Feasibility of Prestorage Dormancy Alleviation for Mine-Site Revegetation

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Abstract

Dormant seeds of 18 species from 9 families covering a diverse range of seed dormancy syndromes and life histories from the southwest Australian biodiversity hotspot were assessed for germinability following storage at 15–25°C for 36 months. A total of 10 species with physical dormancy (PY) and 8 with either physiological dormancy (PD) or morphophysiological dormancy (MPD) were assessed as part of the study. Prior to storage, germination from dormant seeds was 1–27%, rising to 41–100% following specific dormancy-breaking treatments. When seed dormancy was removed prior to storage for 36 months seeds from all species were found to maintain a nondormant state and germinate to a similar level to that observed at the beginning of the experiment (44–100%). Likewise, seeds that did not receive a prestorage dormancy-breaking treatment maintained a dormant state (0–50% germination) and subsequently responded well to a dormancy-breaking treatment immediately prior to germination assessment (49–99%). There were minimal differences in response to dormancy-breaking treatments before and after 36 months storage (average 4–6% difference) and in the germination responses observed between both storage environments assessed (15°C/15% eRH or 15–25°C air dried). Based on these findings, storing seeds in a nondormant state does not alter germinability and this approach provides significant benefits to current seed-based restoration programs through reduction of double handling and improved seed use efficiency.

Key words: land restoration, mining, seed broadcasting, seed dormancy, seed germination.

Introduction

Germination is an integral step in the lifecycle of seed plants with germination efficiency often tied to effective dormancy loss—indeed if dormancy is present, seeds need to be exposed to a dormancy-breaking treatment(s) to allow germination to proceed. Dormancy is a seed characteristic that defines the environmental conditions that must be met before germination is possible (Finch-Savage & Leubner-Metzger 2006) and seeds have evolved many dormancy mechanisms to sense the external environment, germinating only during periods conducive for plant growth and establishment (Merritt et al. 2007). Given that the majority of angiosperm species possess some type of seed dormancy most wild species require a specific set of conditions for dormancy-break and germination (Baskin & Baskin 1998; Baker et al. 2005*a*; Turner & Merritt 2009). Coupled with the high cost associated with the collection of native seeds and limits on wild collection, it is essential that restoration practitioners make the best use of finite seed resources and collect, store, and utilize seeds to science-driven, leading practice standards (Merritt et al. 2007; Rowe 2010; Merritt & Dixon 2011).

To date, much of the research on restoration of mine-sites has focused on utilizing soil seed banks to "inoculate" rehabilitation sites with seeds, microbes, and other propagules, an approach that is generally highly productive and cost effective (Koch & Ward 1994; Grant et al. 1996; Koch 2007*a*). Nevertheless, while the use of harvested topsoil is an effective, reliable and economical means for the rapid reestablishment of native plant communities it has some limitations, particularly for species whose seeds are canopy stored (bradysporous) and only released following fire or whose seeds have highly specific dormancy alleviating requirements which cannot be met

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doi: 10.1111/j.1526-100X.2012.00879.x