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ORIGINAL ARTICLE

Target seed moisture content, chilling and priming pretreatments influence germination temperature response in *Alnus glutinosa* and *Betula pubescens*

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Abstract
The response of common alder [Alnus glutinosa (L.) Gaertn.] and downy birch *(Benda pubescens* Ehrh.) seeds to germination temperature was examined following chilling and priming. Seeds of two seed lots of each species were subjected to combinations of chilling (4 ± 1 °C) and priming (20 °C) treatments in fully imbibed (FI) state or a lower target seed moisture content (TMC) level (30% and 35% in alder and birch, respectively). After treatment, the seeds were allowed to germinate for 56 days at constant temperatures of 7.5, 10, 15, 20, 25 or 30 °C. The response to temperature and pretreatment differed between species, but the effect was consistent in each seed lot within each species. In alder, the TMC seeds germinated well across the full range of temperatures, whereas there was an optimum temperature (-22--23 °C) for seeds given the FI pretreatment. Priming had no significant effect on the germination response of the TMC seeds in alder, but priming greatly improved germination in the FI seeds, especially at the lower germination temperatures (optimum 18-19 °C). In contrast, in birch, the TMC seeds germinated better across the full temperature range, but the optimal germination temperature (15 °C) was the same for all seed pretreatments. Priming improved germination in both the FI and TMC seeds in birch.

Keywords: *Alder, birch, seed lot.*

Introduction

Poor seed [alder and birch "seeds" are actually winged fruits (achenes) that contain a single seed without endosperm that is surrounded by a pericarp, but "seed" is used for convenience] germination reduces plant yields, increases variation in seedling size and reduces stock quality in many tree species in the nursery (Derkx, 2000). In particular, common alder *[Alnus glutinosa (L.)* Gaertn.] and downy birch *(Betula pubescens* Ehrh.) seeds often germinate poorly, especially in bareroot nurseries. Temperature may be the most crucial factor for seed germination under ambient conditions (Roberts, 1988; Allen et al., 2000). Seedbed temperatures are frequently suboptimal for germination, particularly for seeds sown early in the spring. Although low moisture availability may also reduce germination after sowing, the judicious use of irrigation water and seed coverings may help to minimize the risk of damage from desiccation (O'Reilly & Doody, 2006). However, it is more difficult to alleviate the effect of low temperatures. To maximize seed germination, the seeds of species that perform well at cool temperatures could be sown early in the spring, whereas those that germinate best at warm temperature could be sown latest. However, it is not always convenient to follow this recommendation, especially since seedbed space may not be available until a crop of seedlings has been lifted. Furthermore, while seeds sown late in the spring may germinate well (assuming no drought or other problems after sowing), the growing season for the resulting plants will be short; this may reduce the yield of usable plants from the seedbeds.

The depth of dormancy and other seed factors may influence the response of seeds to temperatures.

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