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Germination response of alder and birch seeds to applied gibberellic acid and priming treatments in combination with chilling

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Abstract – The effects of seed moisture content (MC), gibberellic acid (GA₃) concentration, chilling and priming pretreatments on the germination of common alder (*Alnus glutinosa*) and downy birch (*Betula pubescens*) seeds were examined. After treatment, the seeds were allowed to germinate for 42 days at 15 °C or 20 °C (dark)/30 °C (light). Treatment responses were similar at both temperatures and in both species. GA₃ treatment of seeds in fully imbibed (FI) state for 30 days, or at the lower, target moisture content (TMC) for 30–90 days, significantly improved germination, but longer treatment periods reduced it (FI seeds) or had no effect (TMC seeds). Priming for two days improved germination in the FI seeds, but more than 4 days reduced it. Priming for up to 14 days had little effect on the germination of the TMC seeds.

alder / birch / seed / GA₃ / priming

Résumé – Réponse germinative des graines de l'aulne glutineux et du bouleau pubescent à l'application d'acide gibbérellique et de traitements d'amorçage en combinaison avec du froid. Les effets de l'humidité des graines (MC), de la concentration en acide gibbérellique (GA₃), du froid et des prétraitements d'amorçage sur la germination des graines d'*Alnus glutinosa* et de *Betula pubescens* ont été examinés. Après traitement, les graines ont été mises à germer pour 42 jours à 15 °C ou 20 °C (à l'obscurité)/30 °C (à la lumière). Les réponses au traitement ont été similaires aux deux températures et pour les deux espèces. Le traitement, par GA₃, des graines totalement imbibées (FI) pour 30 jours, ou de façon moindre, l'objectif d'humidité (TMC) pour 30–90 jours, ont amélioré significativement la germination, mais des périodes de traitements plus longues l'ont diminuée (graines FI) ou n'ont pas eu d'effet (graines TMC). Un amorçage de deux jours améliore la germination pour les graines FI, mais un amorçage de plus de 4 jours la diminue. Un amorçage jusqu'à 14 jours a eu peu d'effet sur la germination des graines TMC.

Alnus glutinosa / *Betula pubescens* / graine / GA₃ / amorçage

1. INTRODUCTION

There has been a large increase in the planting of broadleaf species, such as common alder (*Alnus glutinosa*) and downy birch (*Betula pubescens*), in Ireland and other European countries in recent years. For this reason, there has been a renewed interest in examining all phases of nursery culture and seed¹ factors with a view to improving yields in the nursery. Seeds of alder and birch often germinate poorly in the nursery, perhaps in part because of dormancy problems [40, 41]. Moist chilling (ca 0–5 °C) for 4–8 weeks usually releases dormancy in seeds of both species [19, 39], but there is little information on the effect of applied growth regulators on dormancy release and the germination response in these species. Seeds can also be primed to stimulate germination, but the exact mechanism of this response is not understood [13]. Priming usually involves incubating seeds in a warm environment for a short period before sowing.

Endogenous factors, especially plant growth regulators, such as gibberellins (GAs) (usually GA₃) and abscissic acid (ABA) play a key role in the dormancy response mechanism in most tree seeds [3, 28, 35]. Dormant seeds of many tree species contain ABA in the embryonic axis, which prevents embryo growth [5]. However, embryo dormancy can be broken in hazelnuts (*Corylus avellana*) by exogenous GA₃ or indirectly by applying treatments that result in the synthesis of endogenous GA, such as chilling [6]. Chilling appears to change the inhibitor – promoter balance in the seeds, suggesting that the requirement for moist chilling cannot be replaced entirely by exogenous GA application. However, additional GA₃ might reduce the chilling requirement to release dormancy [35, 44]. For this reason, a combination of chilling and GA₃ treatments have been used to improve germination in a range of tree species [27].

Seeds of alder and birch are normally chilled in their fully imbibed (FI) state (ca 50%–60% moisture content; MC) to release dormancy, but lower seed MC levels may be preferable. Seeds of these species can be adjusted to about 30–35% MC and then chilled for 12–18 weeks to release dormancy and maximise germination speed [9]. Seeds adjusted to these 'target' MC (TMC) levels can be held at chilling or freezing

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¹ The 'seeds' of alder and birch are actually winged fruits (achenes) that contain a single seed without endosperm that is surrounded by a pericarp.