Pre-sowing treatments for the improvement of germination of *Pinus radiata*.

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Introduction

The germination of forest tree seeds is appreciably slower than that of most agricultural crops. This can increase the likelihood of reduced uniformity of establishment and poor seedling growth. In New Zealand there is currently a shortage of high quality seed of preferred genotypes of *Pinus radiata* and as a consequence of this, the proportion of plantable seedlings produced from seed sown in nursery beds is often only 50% (e.g., FRI, 1985). Accordingly there would appear to be good potential for pre-sowing treatments designed to improve germination performance in this species.

Commercially, *Pinus radiata* seed is sorted into four size grades, the smaller grades often having poor emergence and vigour and thus little commercial value. The aim of the project summarised in this poster was thus to evaluate the potential of seed priming to improve the seed quality of this species, with a particular interest in enhancing the planting value of the smaller size grades. Pre-sowing (priming) treatments have been investigated with some success in other *Pinus* species (e.g., Simak, 1976; Huang, 1989), but this appears to be the first time that such a study has been undertaken in *Pinus radiata*.

Materials and Methods

The seed used in this study were from FRI stock No. 88/103, collected in 1988 from 8 year old clones of mixed genotypes grown at the Amberley 850 seed orchard, Canterbury. Seeds were graded by FRI into four different grades and the second largest grade split again to produce the five lots listed in Table 1.

Seeds of each grade were primed by holding them in a mixed -1.0 MPa solution of KNO_3 and KH_2PO_4 for 10 d at 20°C. Seeds were then air-dried to near original moisture contents. Preliminary studies (Kusmintardjo, 1992) had demonstrated that priming with salts was more effective than with PEG and that treatment of seeds by dusting with thiram before priming was essential to prevent subsequent losses due to damping off. Germination performance was evaluated in the laboratory using the top of the paper method as per ISTA (1985), while seedling growth tests were carried out in the glasshouse by planting seeds in a 1:1 mixture of fine sand and commercial potting mix in root trainers.

Interactions between seed priming and storage were evaluated using an adaptation of the controlled deterioration method of Matthews and Powell (1987), by holding seed at a constant 20% seed moisture and 45°C for up to 3 d. Respiratory gas exchange of treated and untreated seeds was measured using a Gilson respirometer.

Results and Discussion

Seed priming has the potential to improve the emergence of all size grades by 4 - 6 d. Seedling growth is a linear function of seed mean seed weight (Fig. 1) and priming is more beneficial to seeds of heavier grades. The underlying mechanisms of germination advancement due to priming remain unknown. Although our studies showed increased respiratory activity in primed seeds, it is unclear whether this is a causal event.

Table 1. Diameter and weights of the different size grades of *Pinus radiata* seeds used in this study.

Seed grade	Number of seeds per Kg	Diameter (mm)	Thousand seed Weight (g)
I	24-28,000	>4	49.9
II	28-32,000	3.7-4.0	41.0
III	32-36,000	3.3-3.7	33.3
IV	36-40,000	2.8-3.3	25.9
V	40-44,000	<2.8	18.5

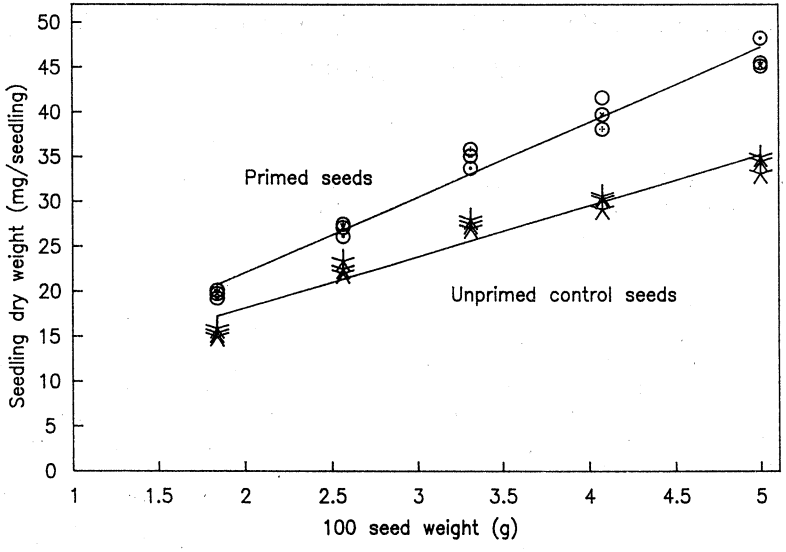

Figure 1. Seedling dry weight of primed and unprimed *Pinus radiata* seeds of different weight grades after 40 d growth in the glasshouse. Correlation coefficients were 0.98 and 0.97 for primed and control seeds respectively.

In common with several other crops (e.g., tomato, Argerich and Bradford, 1989; wheat, Nath *et al.*, 1991), primed seed of *Pinus radiata* do not store well under high moisture conditions, however priming after artificial ageing treatment was very effective in restoring the germination rates of still viable deteriorated seed.

We conclude that the commercial potential for salt priming of *Pinus radiata* seed is well worth exploring. Although salt treatment cannot be expected to compensate for small seed size, it may offer considerable potential for alleviating the effects of other seed quality problems.

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