MORPHOLOGICAL AND PHYSIOLOGICAL CHANGES IN DEVELOPING *PINUS RADIATA* D. DON SEED AND THE EFFECTS OF EARLY CONE COLLECTION AND POST-HARVEST TREATMENT ON SEED QUALITY

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To Mum and Dad who have always inspired
me to pursue knowledge

ABSTRACT

Morphological and physiological changes in developing **Pinus radiata** D. Don seed and the effects of early cone collection and post-harvest treatment on seed quality

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This study aimed to characterise the sequence of cone and seed development, investigate morphological and physiological changes occurring during artificial ripening and assess the potential of artificial ripening in commercial practice.

In general, the results show that cone and seed development of Pinus radiata exhibit a pattern similar to other coniferous species, but seed development and the acquisition of germinability proceed at a rate much faster than the maturation of the cone itself. Seed germinability is attained in June when cone dry weight and size are at maximum; cone colour and specific gravity changes occur much later, thus lessening the effectiveness of these two parameters as indices of maturity. Therefore, a cone with a green colour and high specific gravity does not necessarily contain poorly germinable seeds.

The aquisition of germination capacity is closely associated with the level of moisture within the seed. The seed requires a low level of moisture to switch on the germination programme. A moisture level of between 20 - 25% is suggested as the 'required' level. The seed needs to remain at this critical moisture level for a period of time to allow the developing seed to complete the process of switching. The more developed the embryo and megagametophyte, the better the germination performance. Immature seeds collected in March are not capable of germinating despite desiccation during artificial ripening.

Artificial ripening of P. radiata seed for three weeks substantially improves the germinability of early collected seeds (April and May). For the late collected seeds (June onwards) artificial ripening has little scope to improve it since initial germination was high. Although further storage has little effect on the final germination, it reduces the speed of germination indicating a process of deterioration. During artificial ripening, no further development of embryo and megagametophyte of the early collected seed is observed nor are there any increases in dry weight. Moreover, the main protein complement of the seeds remains proportionally the same irrespective of time of collections and artificial ripening. These suggest that artificial ripening of P. radiata seed is a maturation process rather than a developmental one.

The practical implications of these findings are potentially good. Brown cone colour is no longer a pre-requisite indicator to commence cone harvesting. Infact cone collection as early as autumn/winter is justifiable provided that the cones are allowed to dehydrate at a temperature not exceeding 20°C for at least six weeks, or until the specific gravity drops below 1.00 because at this point seed extraction can be successfully done by the kilning method. Cone storage for more than nine weeks would not be advisable since the seed will begin to deteriorate owing to unfavourable storage conditions. At this stage seed should be extracted from the cones and stored separately at 5°C.

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