

Seed storage and testing

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SEED STORAGE CHARACTERISTICS

A basic understanding of the factors influencing seed longevity, the storage requirements of different species, and the methods used to test seed viability is fundamental to successful seedbanking. Although long-term storage is not always the role of a seedbank, it remains important to develop facilities and expertise worthy of the time and resources expended in collecting seeds.

Seeds of different species have different storage characteristics. Research on more than 9000 plant species has demonstrated that seeds can be grouped according to their storage behaviour into three broad categories – orthodox, recalcitrant and intermediate. Orthodox seeds are the most common and most agricultural crops produce orthodox seeds, as do plants growing in mediterranean, temperate and arid regions.

Orthodox seeds undergo a drying phase as they mature on the plant and usually contain around 20–30% water when mature and ready to collect. After collection, orthodox seeds survive further drying to at least 5% water content. This enables them to be stored at freezing temperatures without harm, since there is insufficient water for lethal ice-crystals to form. Most orthodox seeds live for many years, even under less than ideal storage conditions. There are several verifiable reports of museum samples of seeds living for over 100 years, and a few reports of germinable seeds greater than 1000 years

old, based on carbon dating of archaeological samples of seeds buried in soil.^{1,2,3} Although there are as yet few long-term studies (greater than 10 years) providing data on longevity of seeds stored under genebank conditions, mathematical models that have been developed to predict seed longevity suggest that under ideal storage conditions, seeds of some orthodox species may live for many hundreds of years.

Recalcitrant seeds are short-lived, commonly surviving for only a few days or weeks after reaching maturity. These seeds are generally produced by trees growing in tropical or temperate regions and, unlike orthodox seeds, do not undergo a drying phase during maturation, but continue to develop towards germination throughout their short life. Recalcitrant seeds are characterised by high water contents at maturity (greater than 40%) and an inability to survive drying below around 20–30% water content. As a result, recalcitrant seeds cannot be stored at freezing temperatures, and are very difficult to store for any length of time. Many large-seeded hardwoods, such as *Acer pseudoplatanus* (sycamore), *Castanea sativa* (chestnut) and numerous species of *Quercus* (oak) and *Araucaria* produce recalcitrant seeds. Relatively little is known of recalcitrant storage behaviour in Australian seeds.

Intermediate seeds have properties somewhat in between those of orthodox and recalcitrant seeds. These seeds survive drying to around 10–15% water content,