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# Heterosis from eucalypt single and multi-cross hybrids

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Hybridizing is one of the most important ways to genetically improve eucalypts; especially to tropical species. Because of the high efficiency of asexual using hybrid heterosis, the current planting eucalypt varieties in most tropical areas in the world are hybrids. It's well known that crossing different eucalypt species in different ways can create hybrids with different characters. But, it's unclear what kind of species matings tend to create more heterosis. Here we systematically made and tested hybrids of: pure species by pure species (single cross), pure species by hybrids (three-way cross), hybrids by hybrids (double cross). The tropical eucalypt species we used as parents include: *Eucalyptus urophylla*, *E. grandis*, *E. pellita*, *E. tereticornis* and hybrids between them. The field testing results found: the overall performance of tree volume was: single cross > three way cross > intraspecies cross > double cross. Their 4-year advantages over intraspecies cross were: 29.9%, 8.0% and -12.5%. The coefficient of variation of the 4 types were: 55.3%, 61.2%, 64.0% and 67.1%. As for the survival rate, 4-year result was: double cross (72.6%) > three way cross (71.6%) > single cross (70.8%) > intraspecies cross (54.0%). This shows that the interspecies hybrids had similar environmental adaption, and they were all significantly higher than that of intraspecies cross. The single and multi-cross hybrids had similar coefficient of variation on survival rate. Combining with the results on family and individual tree level heterosis frequency and magnitude, we found that single-cross has more heterosis on volume growth while multi-cross has more heterosis on adaption. Genetic parameter analysis showed that single-cross hybrids have both high additive and high dominant heritability. But the heritability value on different species combinations can be very different. Three way-cross hybrids had the highest additive heritability, but very low dominant heritability. The double-cross hybrids had high dominant heritability, but very low additive heritability.

**Keywords:** eucalypt, heterosis, hybrid, single-cross, multi-cross

