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RAIZ's eucalypt genetic improvement program: The path taken and new challenges

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RAIZ is a forest and paper research institute, part of The Navigator Company, a Portuguese pulp and paper company. Its eucalypt genetic improvement program started in the mid-1980s, focused mainly on *E. globulus*, which is well suited to the local soil and climate conditions and has outstanding wood qualities for pulp and paper production. Initially, main selection criteria were growth, survival to drought conditions, wood density and pulp yield. Cloning was the main form to transfer results into operational plantations and, as a result, rooting ability was also a key trait for successful large-scale nursery plant production. These requirements were maintained for several decades during which the program has achieved substantial gains and the *E. globulus* clonal forest was a reality. Meanwhile, interspecific hybridization has been tested mainly to achieve higher drought and pest resistance. As a result, the clonal program includes several hybrids. Currently, 11 clones, including three hybrids, are in nursery large-scale production, with operational gains of 30-50% over unimproved stocks, in terms of pulp produced per hectare. In the last decade, more than 250 controlled-crosses were carried out, including 70 inter-specific crosses. More than 400 new clones, including 50 hybrids, and approximately 400 seed lots, including 100 hybrids and other species lots, have been tested across over 140 sites. Advanced BLUP analysis techniques are used since mid-1990's to support strategic planning decisions, including more than 125,000 records for survival, 85,000 records for height and diameter, 57,000 pilodyn and 6,000 NIR records, collected from 219 trials, and covering about 45,000 individual genotypes. Nevertheless, efforts to face climate changes must be intensified, especially to mitigate the effects of drought and pests that currently affect a substantial portion of the forest estate. In the last 3 years, more than 100 new genotypes were selected from hybrids progeny trials involving species such as *E. grandis*, *E. viminalis*, *E. saligna*, *E. rudis*, *E. urophylla*, and *E. tereticornis*. Their multiplication and testing are undergoing, and results are expected within 5 years. In addition, an expanded approach to further diversify and strengthen of eucalypt genetic pool is being implemented, introducing species like *E. cladocalyx*, *E. gomphocephala*, *E. benthamii*, *E. melliodora*, *E. saligna*, or *E. dunnii*, aiming to enhance resilience to environmental challenges and ensuring the sustainability of Portugal's eucalypts forests.

Keywords: E. globulus, hybrids, clonal forestry, genetic gains

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