

Efficiency of multi-trait genomic selection in two contexts of *Eucalyptus* breeding

Jean-Marc Bouvet ^{*† 1,2}, Tahina Rambolarimanana ³, Garel Makouanzi ⁴,
Lolona Ramamonjisoa ³, Jean Michel Leong Pock Tsy ⁵, Tuong-Vi
Cao-Hamadou ¹, Philippe Vignerou ¹

¹ Unité Mixte de Recherche Amélioration Génétique et Adaptation des Plantes méditerranéennes et tropicales (AGAP) – AGAP – Cirad, Unité Mixte de Recherche AGAP, Campus de la Valette, 34000, Montpellier, France

² Dispositif en Partenariat "Forêts et Biodiversité à Madagascar" (DP Forêts et Biodiversité à Madagascar) – Immeuble Fofifa-DRFGRN, 101, Antananarivo, Madagascar

³ Ecole Doctorale Gestion des Ressources Naturelles et Développement, Ecole Supérieure des Sciences Agronomiques, Université d'Antananarivo (ESSA) – ESSA, Ecole Doctorale Gestion des Ressources Naturelles et Développement, Ecole Supérieure des Sciences Agronomiques, Université d'Antananarivo, Antananarivo, Madagascar, Madagascar

⁴ Ecole Supérieure des Sciences Agronomiques et Forestières (ENSAF) – 2ENSAF, Ecole Supérieure des Sciences Agronomiques et Forestières, Université Marien NGOUABI, République du Congo, Congo - Brazzaville

⁵ Département des Recherches Forestières et de Gestion des Ressources Naturelles, (FOFIFA, DRFGRN) – FOFIFA, DRFGRN, Département des Recherches Forestières et de Gestion des Ressources Naturelles, Antananarivo, Madagascar, Madagascar

In this study we explore the performance of multi-trait genomic selection (MT-GS) using the single-trait version (ST-GS) as the baseline. We implemented the approaches in two *Eucalyptus* breeding schemes.

In Congo, where commercial plantations of *E. urophylla***grandis* are dedicated to pulp production, we considered height increment between 8 and 18 months (H8_18), critical trait to avoid weed competition, and volume at 55 months (V55), the target trait, to analyse the interest of MT-GS. We used 3303 SNP to define the relationship matrices and to estimate breeding values of 1130 cloned hybrid progenies. The prediction accuracy was estimated through a cross validation process (75% of tree in the training set). For H8_18, the accuracy was 0.354 and 0.370 for ST-GS and MT-GS respectively. For V55, the accuracy attained 0.414 and 0.424 for ST-GS and MT-GS respectively. Although MT-GS presented higher accuracies, estimates were not significantly different. This result was explained by the low heritability of V55 and H8_18 ($h^2=0.26$ and $h^2=0.13$) and the relatively high genetic correlation ($\rho_a = 0.77$).

In Madagascar, where *E. robusta* small-scale plantations are grown for fuel wood, the volume at 49 months (V49), the total lignin (TL) and the holo-cellulose (Holo) are the targeted traits for breeding. 2919 SNP were used to define the relationship matrix and estimate breeding values of 415 individuals of a provenance trial. Accuracies were estimated through the same procedure. For V49, the prediction accuracy attained 0.30 for both ST-GS and MT-GS. For TL, the prediction accuracy was near zero whatever the approach (0.05 for ST-GS and 0.04 for MT-GS).

*Speaker

†Corresponding author: jean-marc.bouvet@cirad.fr