

Viability of deficit irrigation pre-exposure in adapting Robusta coffee to drought stress

Sseremba G., Tongoona P.B., Musoli P., Eleblu J.S.Y., Melomey L.D., Bitalo D.N., Atwijukire E., Mulindwa J., Aryatwijuka N., Muhumuza E., Kobusinge J., Magambo B., Kagezi G.H., Danquah E.Y., Kizito E.B., Kyallo G., Iyamulemye E. and Arinaitwe G. <https://doi.org/10.3390/agronomy13030674>
Contact: National Coffee Research Institute, gsseremba16@gmail.com

Introduction

Coffea canephora has high but inadequately exploited genetic diversity. This diversity, if well exploited, can sustain coffee productivity amidst climate change effects (Aquino *et al.*, 2022). Drought and heat stress are major global threats to coffee productivity, quality, and tradable volumes. It is not well understood if there is a selectable variation for drought stress tolerance in Robusta coffee half-sibs as a result of watering deficit pre-exposure at the germination stage.

Materials/Methods

Half-sib seeds from selected commercial clones (KR5, KR6, KR7) and a pipeline clone X1 were primed (Aswathi *et al.*, 2022) with deficit watering at two growth stages followed by recovery (Plate 1) and later evaluated for tolerance to watering deficit stress in three different temperature environments by estimation of plant growth and wilt parameters.

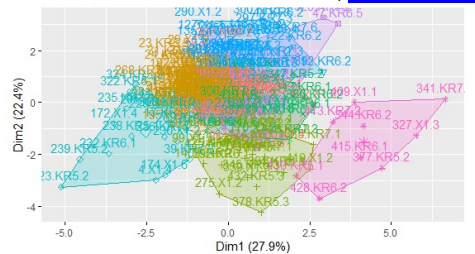


Figure 1: Clusters among Robusta coffee half-sibs for tolerance to deficit watering.

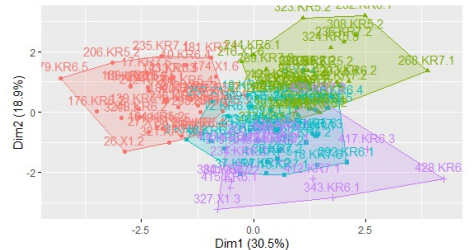


Figure 2: Clusters among the half-sibs for recovery from watering deficit stress.



Plate 1: Coffee plants being re-watered after water deficit priming.

Results/Discussion
Significant clustering of half-sib individuals ($p < 0.05$) was obtained (Figures 1 and 2).

In order of decreasing tolerance, the 10 most promising individuals for drought and heat tolerance were identified as: 14.KR7.2, 25.X1.1, 35.KR5.5, 36.KR5.6, 41.KR7.5, 46.KR6.4, 47.KR6.5, 291.X1.3, 318.X1.3, and 15.KR7.3. The significance of difference in tolerance to watering deficit stress with stress-primed plants exhibiting better tolerance and recovery than controls suggest a potential of breeding for resilience to drought stress in *C. canephora* using the half-sib selection approach.

Conclusion/Perspectives: Watering deficit pre-exposure improves subsequent tolerance to the stress in Robusta coffee half-sibs; maternal origin or family of the half-sib influenced the response to priming stress. The findings inform on the potential of utilizing genetic diversity created by the outcrossing nature of Robusta coffee in breeding for resilience to drought and high temperature stresses and other desired market traits.

References:

Aquino, S.O.; Kiwuka, C.; Tournebize, R.; Gain, C.; Marraccini, P.; Mariac, C.; Bethune, K.; Couderc, M.; Cubry, P.; Andrade, A.C.; *et al.* Adaptive potential of *Coffea canephora* from Uganda in response to climate change. *Mol. Ecol.* 2022, 31, 1800–1819. <https://doi.org/10.1111/mec.16360>.
Aswathi, K.P.R.; Kalaji, H.M.; Puthur, J.T. Seed priming of plants aiding in drought stress tolerance and faster recovery: A review. *Plant Growth Regul.* 2022, 97, 235–253. <https://doi.org/10.1007/s10725-021-00755-z>.