

PROJECT TITLE

The quest for climate smart varieties: phenotyping the banana biodiversity

CONSORTIUM

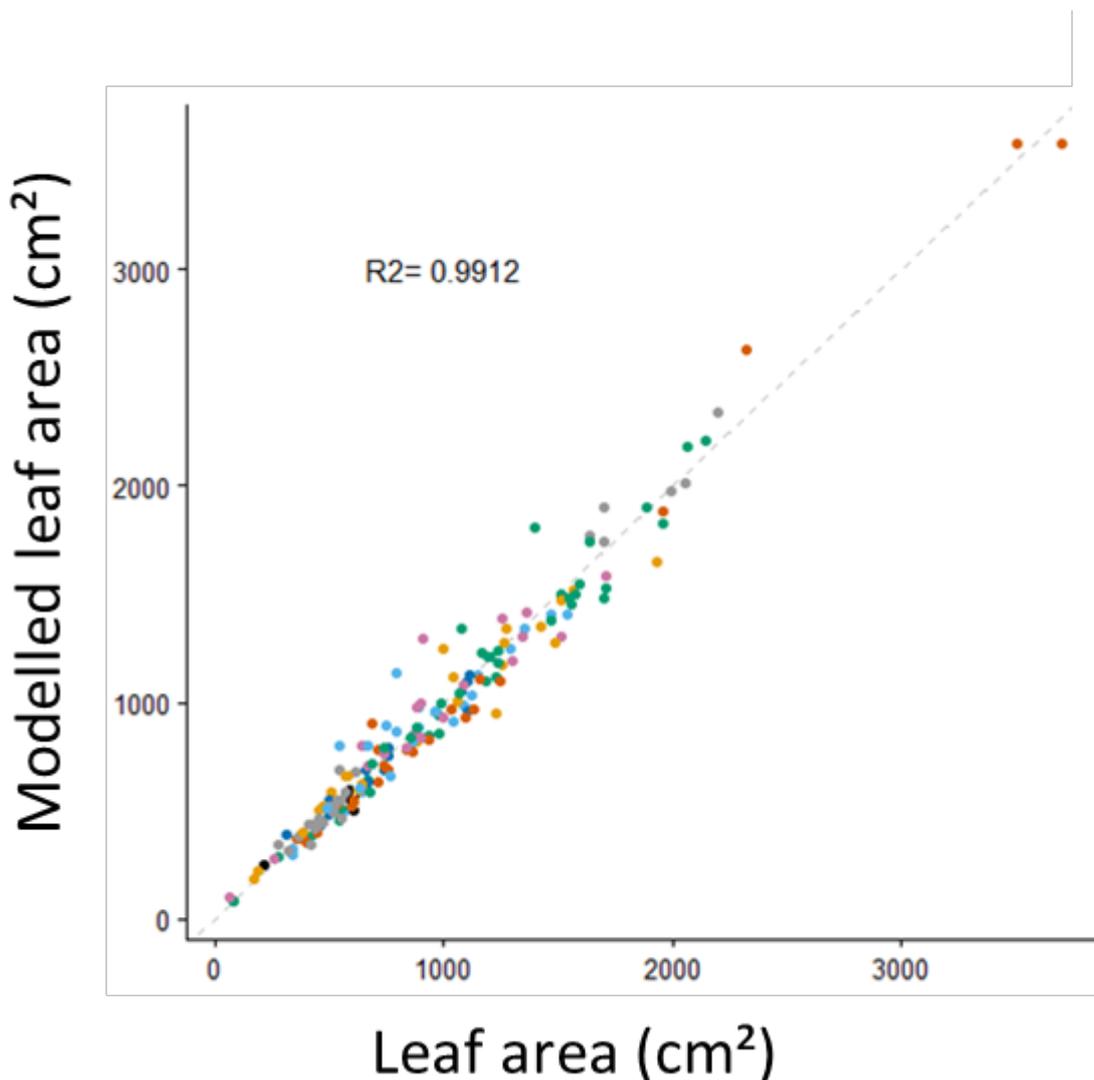
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SUMMARY OF THE REPORT

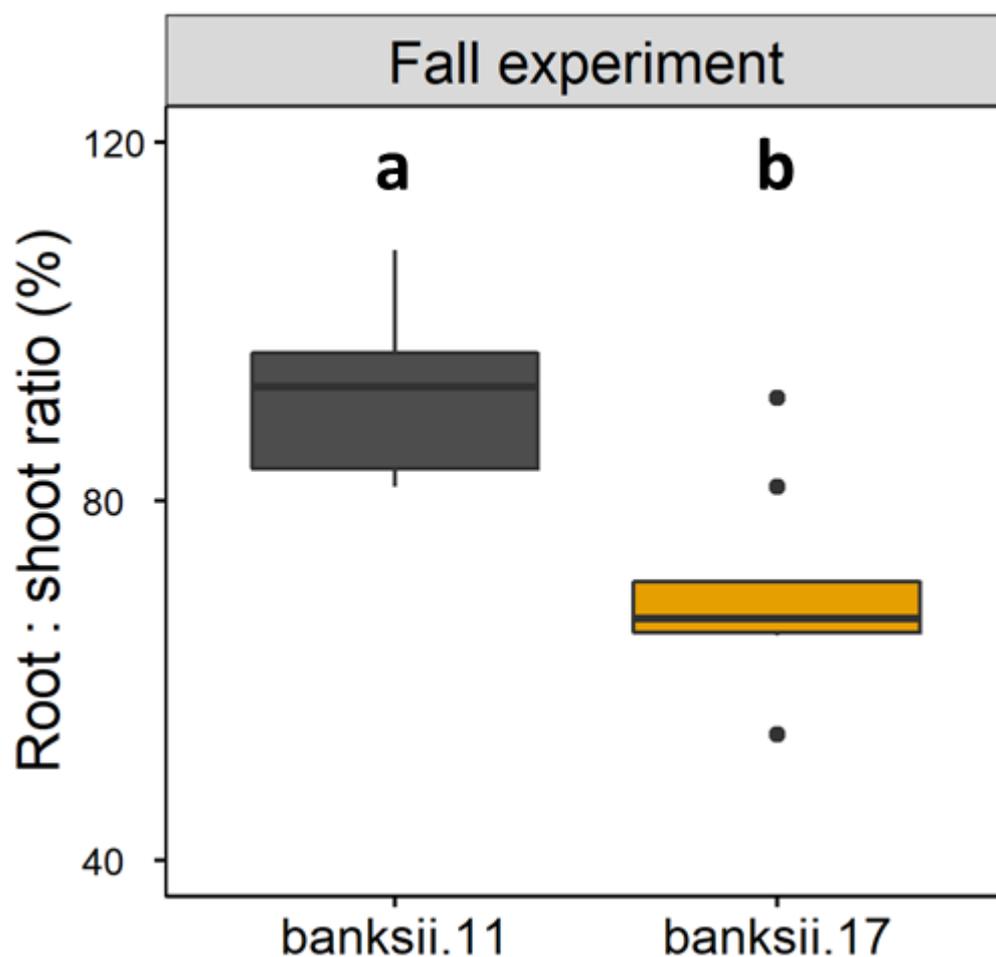
Banana (*Musa* spp.) is an essential staple crop. World production is estimated at 126 million ton, of which only 15% is for export to Western countries (FAOstat, 2016). The other 85% is cultivated for local markets or home consumption and this production usually lacks irrigation (Ortiz & Swennen, 2014). Most modern banana cultivars are triploid hybrids coming from one or both diploid ancestors: *M. acuminata* (AA) and *M. balbisiana* (BB). There exist different combinations of these ancestral genomes, of which the triploids AAA, AAB and ABB are the most common.

Plants adapt their stomatal aperture towards the prevailing environmental conditions, with the aim to obtain the ideal balance between carbon uptake and water loss. High light intensity and low VPD are the most common environmental factors enhancing stomatal opening. Water deficit, on the other hand, is majorly restricting light induced stomatal opening by ABA synthesis. However, stomatal sensitivities to light, VPD and soil water potential depend on the environment and might differ both intra- and interspecific (Drake et al., 2012; Gholipour et al., 2010; Halperin et al., 2017; McAusland et al., 2016; Parent et al., 2010). For example genotypes with higher sensitivity to soil water deficit will act conservatively and reduce transpiration already strongly upon mild water deficit (Halperin et al., 2017; Negin & Moshelion, 2017).

In the Bananadyn, we obtained access to M3P platforms hosted at INRAE. We phenotyped important banana cultivars (AAA and ABB) and the wild *M. acuminata* (A) and *M. balbisiana* (B) ancestors. In total, 15 accessions have been phenotyped. Continuous weight measurements combined with high-throughput imaging resulted in excellent growth prediction and detailed time courses of transpiration, derived transpiration responses to light, VPD and soil water potential.



A genetic variability was detected for light-induced morning transpiration rate, root to shoot ratio, photosynthetic efficiency and soil water potential sensitivity. Even within the same subspecies significant variability was detected (Eyland et al; in review). The example for the root to shoot ratio can be seen in figure 2.



In addition, we confirmed the differences in stomatal light responsiveness by infrared gas exchange analysis and VPD sensitivities by combining the multi-lysimeter setup with infra-red gas exchange (IRGA) measurements. We suggest that two water use strategies can be identified: accessions with a conservative behaviour which save water at the expense of carbon assimilation, and accessions with risk-taking behaviour which assimilate more carbon but deplete water more rapidly.