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"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

The use of biodiversity to fight climate change: unravelling the diverse mechanisms in banana for drought and heat tolerance

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Abstract

Due to climate change, global temperatures are predicted to continue to rise resulting in a higher evaporative demand and in anomalies in weather patterns. These environmental factors influence plant functioning and have major impacts on crop yields. Banana (Musa spp.) is worldwide the most produced fruit, but commercial plantations are dominated by one very drought sensitive variety. However, of the worldwide banana production, 85 % is for home consumption and this small-scale production is rain fed. Optimal banana production requires continuous and abundant water, while many agro-eco zones have one or two dry seasons. These become more difficult to predict, shift in time and tend to be more extreme. This not only makes it farmers difficult to predict planting and harvesting dates, but can lead to major yield losses if drought occurs during key physiological stages. On the long term it will force farmers to quit the perennial growing strategy and force them into (bi)annual production systems. To spread the risk of yield loss, one possible solution is to increase the intra-crop diversity. This way, local seed systems can offer every year satisfactory diversity and guarantee yield. While high water-consuming varieties can grow fast with a short drought avoiding crop cycle, more drought tolerant varieties can withstand extreme weather conditions and safeguard food security.

Bioversity International hosts the largest germplasm bank worldwide with over 1600 accessions. This project aims to gain fundamental insight in drought tolerance at the physiological and genetic level. 116 gene bank accessions have been screened for growth-temperature responses under current and future climates simulated in our BananaTainer (a 40 FT growth container). Variety-specific transpiration has been measured on our phenospex platform and modelled in function of the fluctuating environmental variables soil water content, light intensity and vapour pressure deficit (VPD). The underlying genes and mechanisms of the different suitable accessions is being elucidated by a transcriptomics and proteomics approach. This will give insight in which genes and alleles play a key role in expressing the drought tolerance and avoidance phenotypes.

Keywords: Banana, biodiversity, climate change, drought tolerance, molecular mechanisms, phenotyping, transpiration

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