Climate Impacts and Resilience in Caribbean Agriculture: Climate Proof Screen

Aidan Farrell

_UWI St. Augustine, Trinidad_
Harnessing genetic differences to increase cocoa resilience?

Motamayor et al. (2008) PLoS ONE 3(10): Different colours show different genetic groups
Aims of workpackage 1: Climate Proof Screen

- Assess available methods for identifying differences in resilience to drought and heat stress
- Establish protocols for testing resilience and use these to compare three genetic groups
- Assess the potential impact of climate resilience on current and future cocoa crops (via workpackage 2 & 3)
Three groups: testing three accessions from each

Hybrid: *Trinitario*

Upper Amazon: *Guiana*

Lower Amazon: *Nanay*

Motamayor et al. (2008) PLoS ONE 3(10):
Assessing ‘performance’ in the field and greenhouse

Leaf temperature: Infrared camera (FLUKE 410)

Photosynthesis: Chlorophyll fluorescence (Walz MINI PAM)

Transpiration: Porometer (SC-1 Decagon Devices)
Visual assessment of stress symptoms

0%  10%  50%  70%
Membrane stability test: to assess tolerance to ‘damage’ using leaves from field and greenhouse

Leaf segments immersed in deionised water

Leaf segments exposed to:

30; 35; 40; 45; 55 Celsius
or
0; -1.0; 2.0; -3.0 Megapascals

Then incubated overnight

High conductivity = low membrane stability
Best method for assessing differences in heat stress

In the greenhouse

Max air temperatures were approx. 5°C higher

Transpiration was consistently elevated

Photosynthesis unaffected

Visual assessment unaffected

Membrane stability test was consistent...
The impact of temperature on membrane integrity

![Graph showing the impact of temperature on cocoa performance.](image)

- **'best' group**
- **current group**
- **'worst' group**
Best method for assessing differences in water stress

In the greenhouse

- Stomatal conductance reduced
- Leaf temperature elevated
- Membrane stability test - inconsistent
- Visual index was reduced
- Photosynthesis was reduced...
The impact of moisture content on photosynthesis
Selection for resilience to drought stress has great potential

Several methods available, including low-tech methods that could be implemented through participatory selection.
Acknowledgements

At UWI St Augustine:
Ariel Coolman
Anupa Gobin
Christa Boban
Devan Inderal
Salina Mohammed

At the Cocoa Research Centre:
Prof. Umaharan
Annelle Holder
Staff at the Cocoa Genebank
Figure 1. Localization of the origin of individuals analyzed; colors indicate the inferred genetic cluster to which they belong.

http://127.0.0.1:8081/plosone/article?id=info:doi/10.1371/journal.pone.0003311