THE IMPACT OF CLIMATE CHANGE VARIABLES ON VEGETATIVE AND REPRODUCTIVE DEVELOPMENT OF SIX GENOTYPES OF CACAO

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CLIMATE CHANGE
-impacts on cacao

- Atmospheric CO₂ concentration is predicted to rise to about 700 ppm by 2100

- In West Africa, temperature increase projections for 2100 range between 3 and 6 °C

- Increased variation in precipitation, changes to the intensity and length of wet and dry seasons

- Considering its importance relatively little research on how climate change will impact on cacao
EXPERIMENTAL SET UP

- Clones of 6 genotypes grown to flowering under ‘normal’ conditions
- Grown under elevated CO$_2$ and water deficit treatments for ~ 2 years in greenhouses
- Photosynthetic measurements
- Manual pollinations – pod and bean measurements
- Destructive harvest – aboveground biomass
- Clones: CL19/10, ICS 1, IMC 47, POUND 7/B, SCA 6, SPEC 54/1
- Elevated CO$_2$ significantly increased photosynthetic rate.
- The reduction in photosynthesis due to water deficit was less in ECO$_2$ compared to ACO$_2$.
- Water deficit reduced photosynthesis and stomatal conductance – limiting water loss from the tree.
• Water use efficiency significantly increased in trees grown at ECO₂. Greater carbon uptake per unit water loss.
• Quantum efficiency- interaction between CO₂ and water treatment. Increase in QE in response to ECO₂ and water stress. Potentially beneficial if growing cocoa under shade to alleviate high temperature stress.
Vegetative growth

- Stem diameter increment greater under elevated CO₂ at early stages of treatment
- At end of experiment, greater vegetative biomass accumulated under elevated CO₂
Pod yield components

- Lag in effect of CO₂
- Total pod weight increase at ECO₂ but bean weight unaffected in year 2
- Negative effect of water stress in year 1
Bean analysis

- Genotypic variation in response
- Interaction between CO$_2$ and water treatment in POUND 7/B

**TOTAL FAT CONTENT**

**POUND 7/B**
- Ambient CO$_2$
- Elevated CO$_2$

**SCA 6**
- Ambient CO$_2$
- High CO$_2$
DEVELOPING A PLATFORM FOR CLIMATE CHANGE RESEARCH ON CACAO
- FUNDED BY COCOA RESEARCH UK

• Identification of traits underlying resilience to water deficit
• Development of method to screen for high temperature tolerance
• Study interactions of high temperature x elevated CO₂ and high temperature x water deficit
• Development of a physiological model for cacao

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