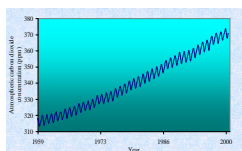


Thames Valley Cocoa Club: 12th February 2013

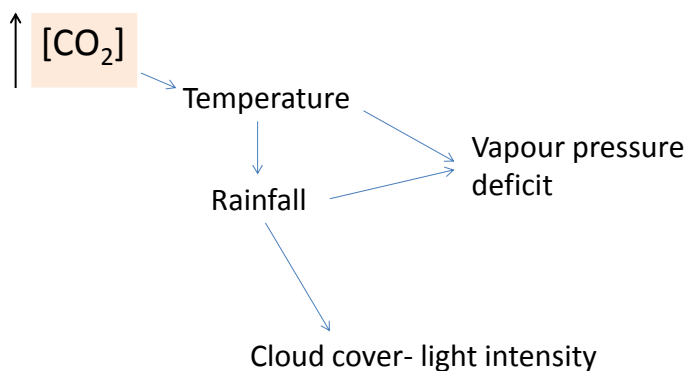


Meeting the challenges of climate change in cocoa cultivation

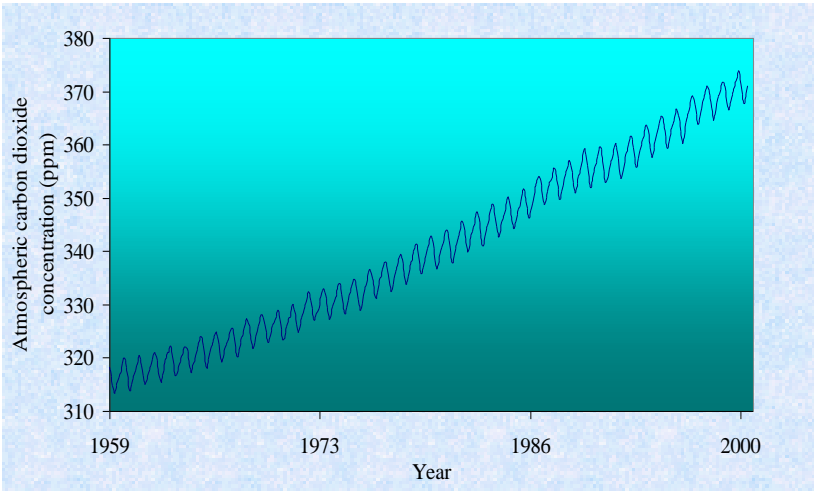
Andrew Daymond



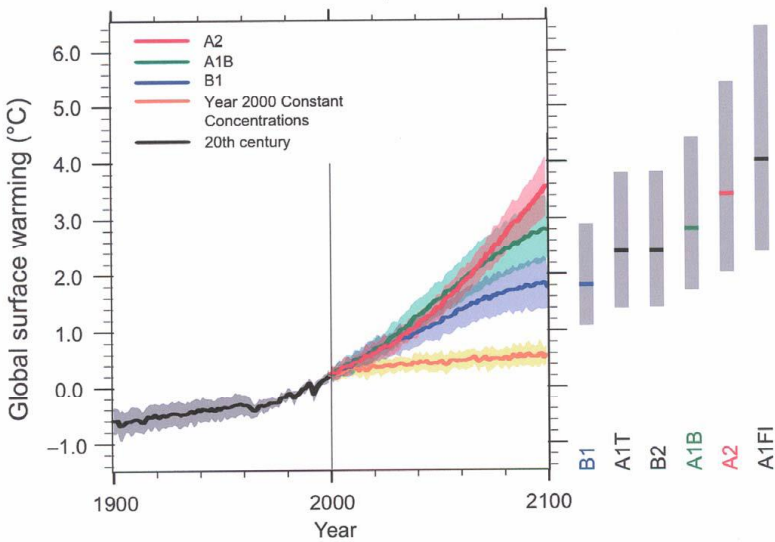
What will be the impact of climate change in cocoa-growing regions?



CO₂ concentrations are rising



Multi-model Averages and Assessed Ranges for Surface Warming



IPCC 2007 Summary for Policymakers, WG1

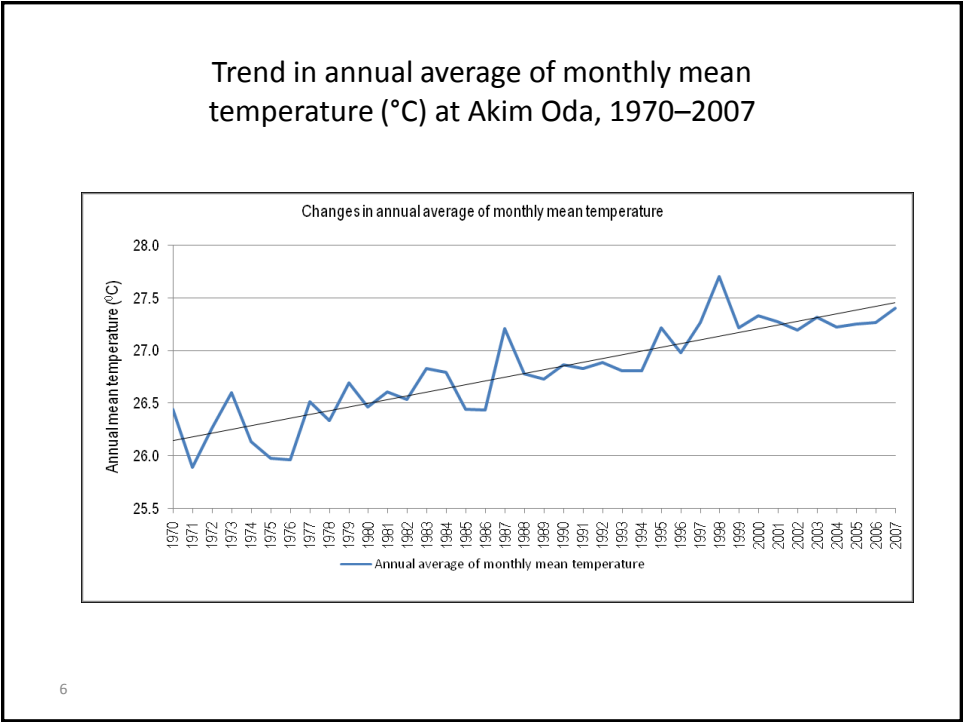
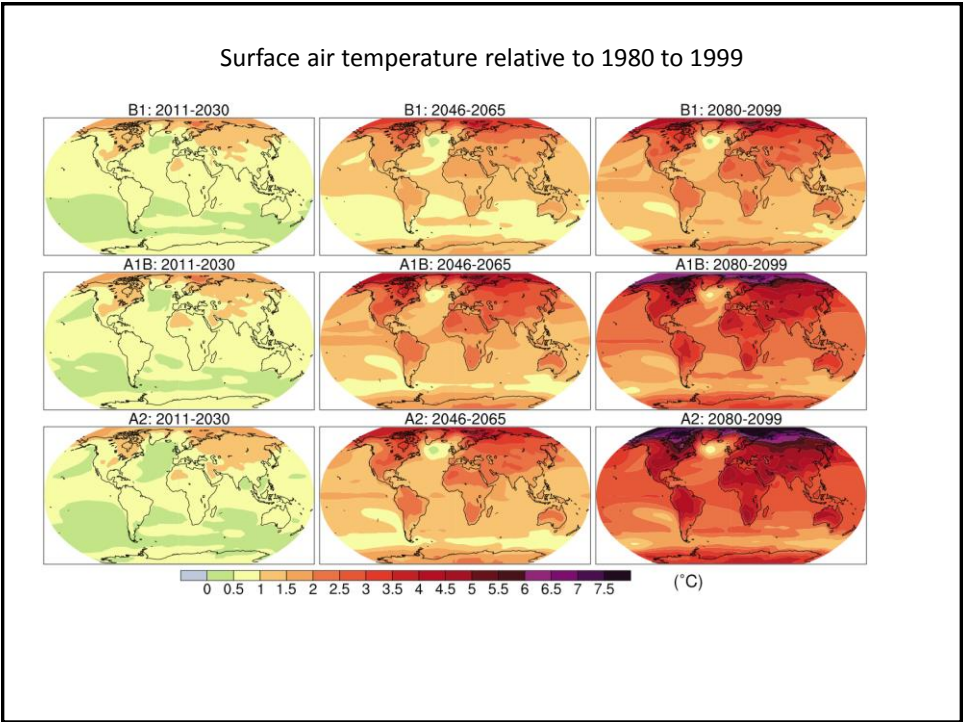
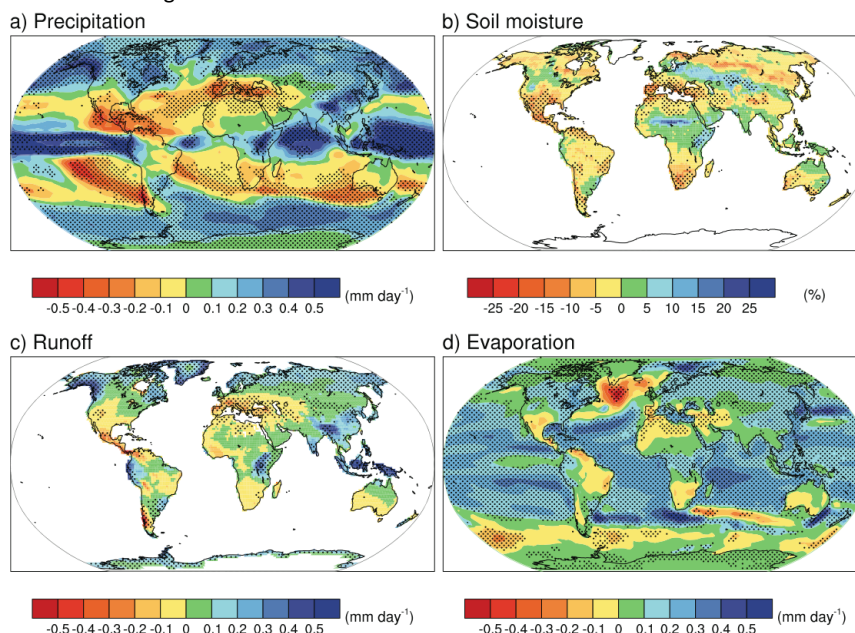


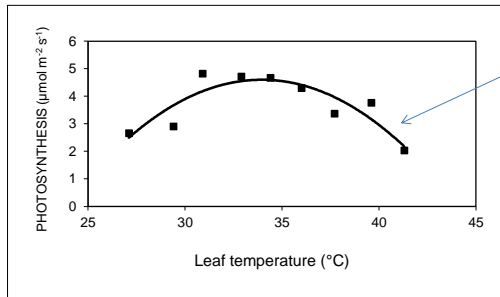
Figure 10.12 A1B scenario 2080-2099 relative to 1980 -1999



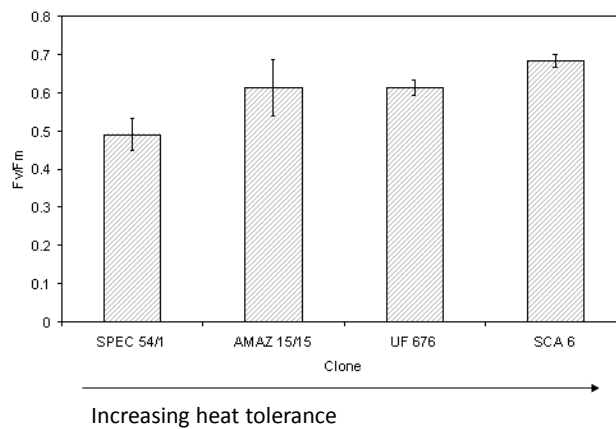
Rising CO₂ concentration

- Numerous studies have shown a stimulation to growth of various crops under high CO₂
- The magnitude of response varies between crops and can vary between varieties of a crop
- Generally the short-term benefit of increased CO₂ is greater than the long-term benefit
- Data from India has shown a stimulus to growth in cocoa under higher CO₂
- Work at Reading is also showing a stimulation in photosynthesis and growth in young cocoa and is considering the interaction between CO₂ and water stress

Rising Temperature



Supra-optimal temperature:
 - Increased photo-respiration
 - Decreased PSII efficiency



The ratio of variable to maximal fluorescence (F_v/F_m) of four clones *in vivo* after a gradual increase in temperature from 31 to 44°C. Values represent the mean of six replicates (+/- s.e.).

Current variability in temperature across cocoa-growing regions

Brazil (BA) West Africa Indonesia India

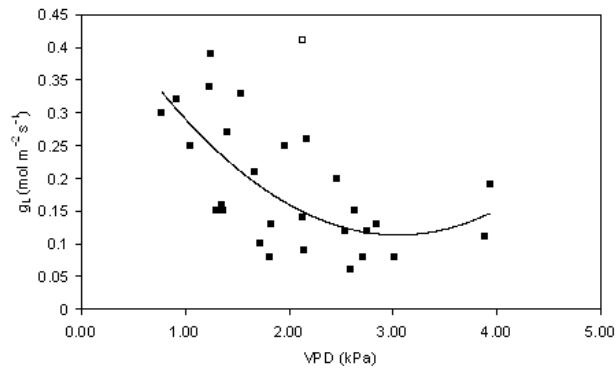


Increase in annual mean temperature

Water stress

- Annual precipitation levels are not predicted to change vastly in main tropic regions
- However, exposure to water stress may increase due to:-
 - Changes in the pattern of rainfall with more heavy downfalls and perhaps longer dry spells
 - Increased evaporation
 - Increased vapour pressure deficit
- Deforestation may have localised effects on rainfall

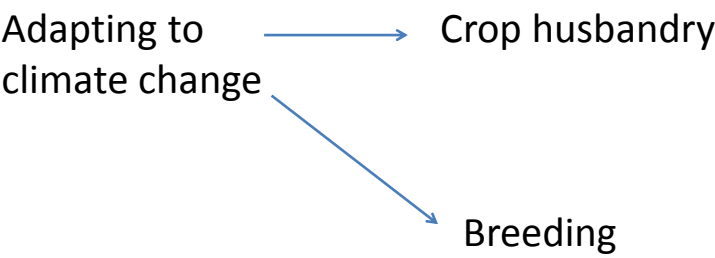




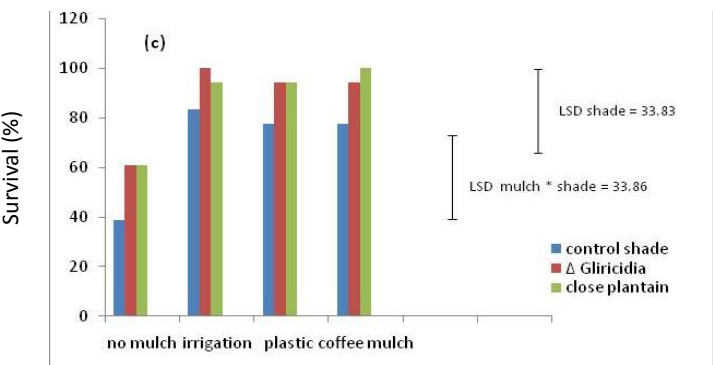
Decrease in stomatal conductance with increased vapour pressure deficit

Genotypic Variability in Tolerance to Water Stress

- Various studies have shown genotypic variation in tolerance to water stress in cocoa
- There is still a need to gain a greater understanding of this subject

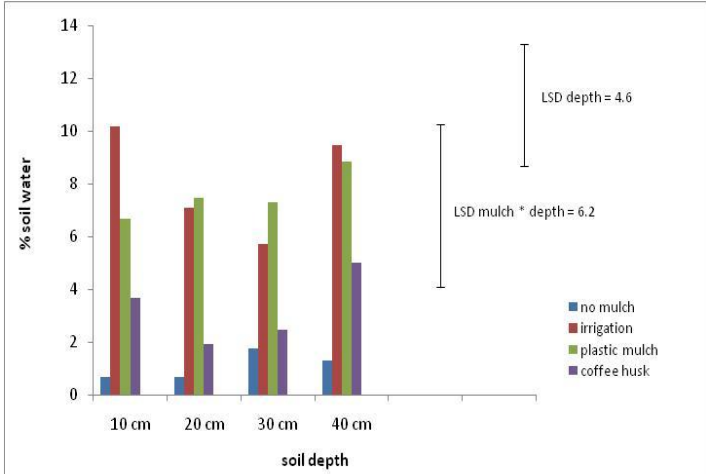


Field survival of young P 30 [POS] cocoa trees under different mulch and shade treatments.



Each bar represents % plants surviving out of 48 (= 100%).
K. Acheampong

Soil water status under the mulch treatments and at different depths during the dry season



Each bar represents the mean value for two plots per treatment each measured twice.

17

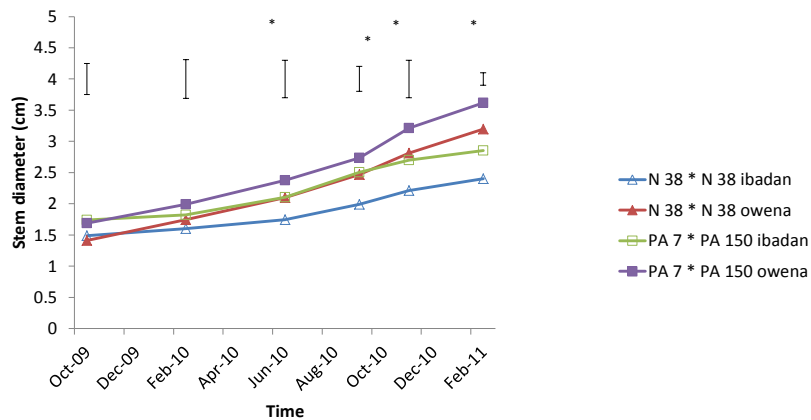
Grafted plants – Rootstock Effects

Scion – different variety (selected for flavour, disease resistance etc)



Graft union

Rootstock (seedling selected for rooting characteristics)



Effect of rootstock on the stem diameter of the clone SPEC 54/1 grown at two locations in Nigeria
[Kayode Ayegboyin]

Shade management

- Shade management likely to become more important

Can be used to ameliorate stress

Wrong type of shade will compete for water



Irrigation

- Irrigation currently only used in a minority of locations; e.g. India, parts of Brazil
- Use of controlled irrigation may become more important, particularly in areas that experience a dry season.

Breeding



- Requires greater knowledge and understanding of the responses of cocoa to climate change variables

Examining the Effects of Climate change Variables on Cocoa



Controlled
environment
greenhouse- allows
control of CO_2 ,
temperature and
water

Funded by Cocoa
Research UK