# Impact of Decreased Water availability on Cocoa tree performance


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# Overview

- Importance of cocoa in West Africa.
- Côte d'Ivoire is projected to experience increased water deficit due to climate variability.
- Predicted declines in rainfall in the cocoa belt.
- Severely impact cocoa cultivation.

# Overview

- Drought is already a REALITY and a THREAT.
- What if Wet areas become more dry due less water reaching the soil during the rainy seasons ??
- What are the possible consequences for cocoa cultivation??

# What I did you?

- Experiment was conducted in a wet area, simulating the effects of reduced rainfall during the wet season.
- To explore how potential reductions in rainfall may affect cocoa performance and yield.
- To investigate the effects of reduced water availability and potassium application on cocoa trees in a 6-year old plantation.

# Methodology

- Description of the experimental setup:

  - Two soil moisture levels: control (no shelter) and sheltered (67% rainfall reduction).

  - Two potassium treatments: with and without K.

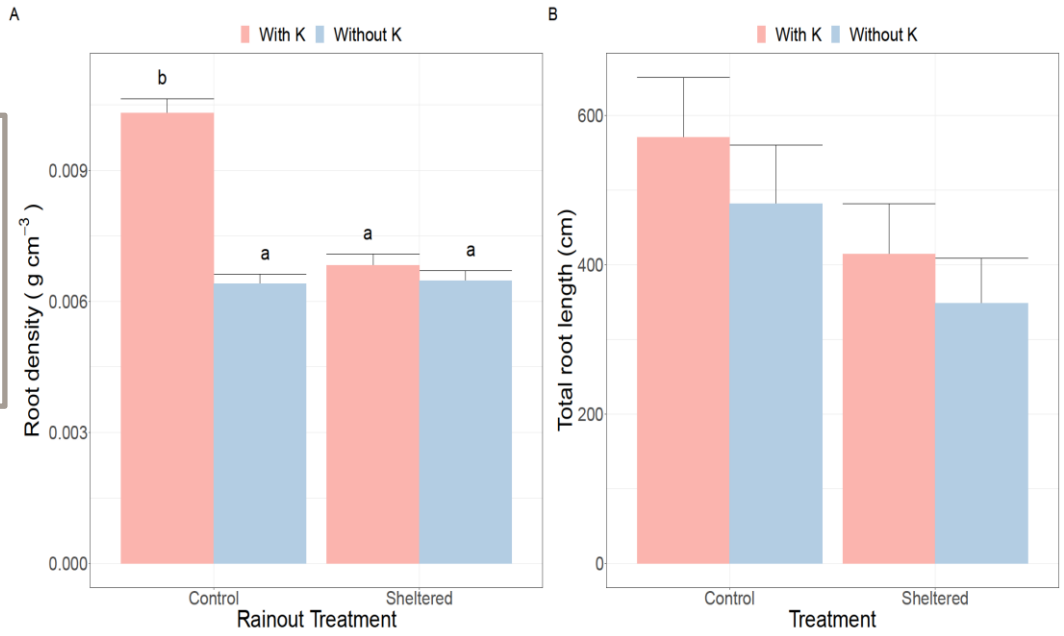
  - Rainfall partitioning

# Effects on Soil and Root System

- Throughfall (62%) and stemflow (3%) are primary sources of soil water.
- Not all rain that falls, reaches the soil.
- 35% directly evaporates from the canopy.

## Why does that matter for cocoa trees?

- Reduction in soil moisture by 9.1%.
- Total root length decreased by ~57%.
- Root mass density decreased by ~50%.

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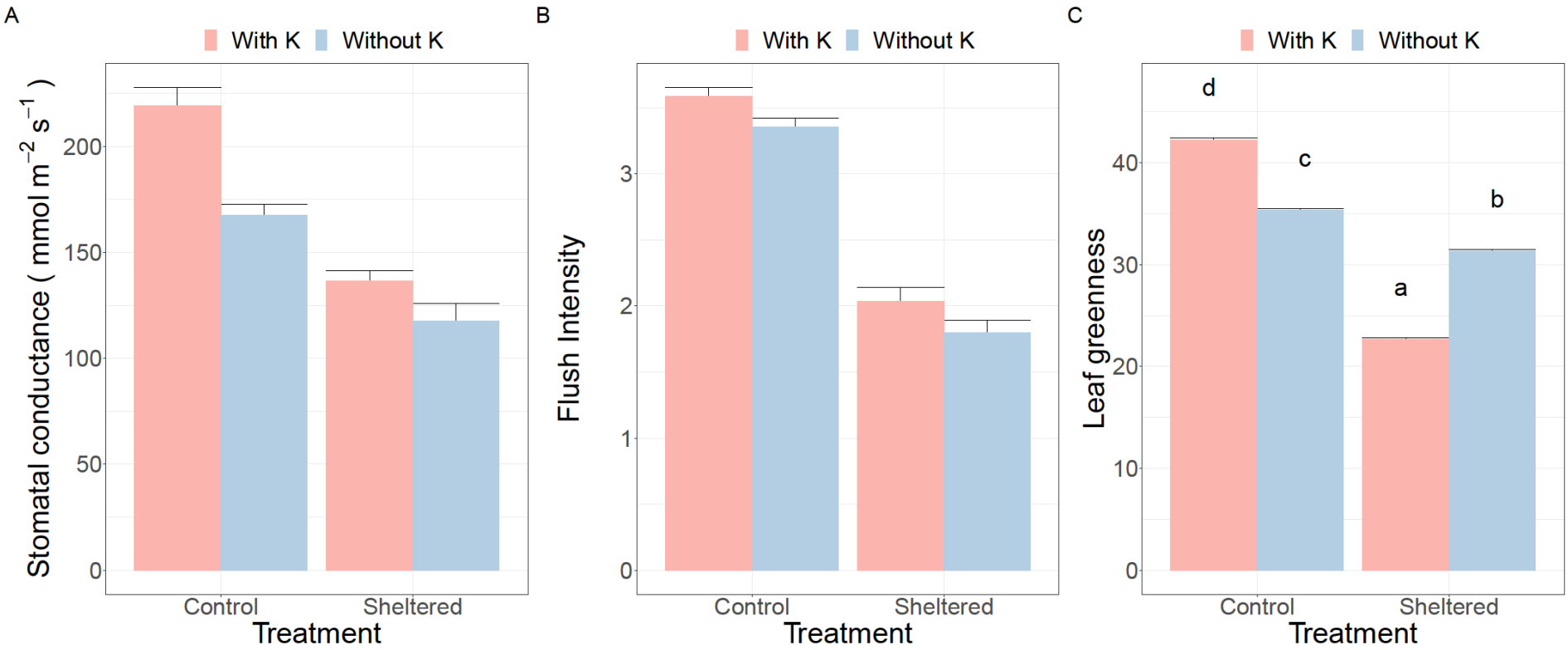
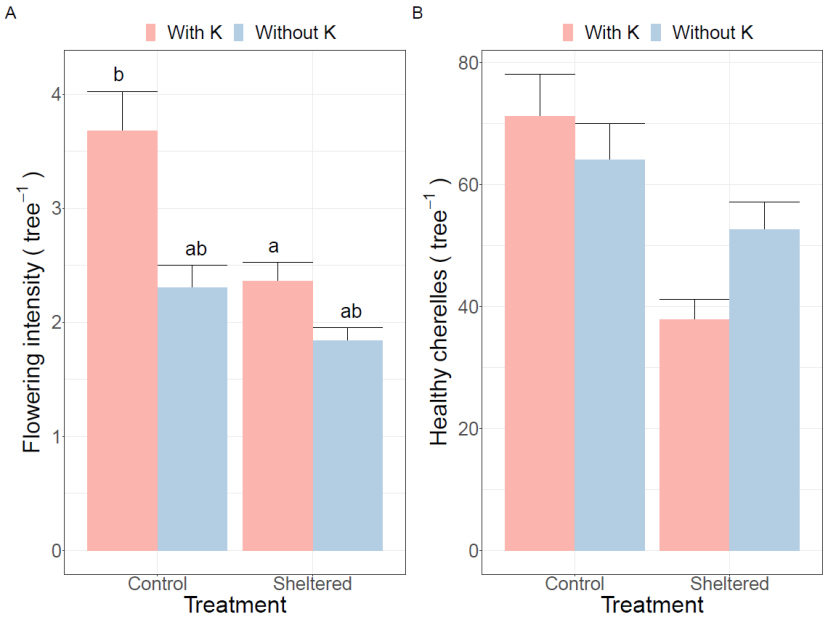
# Impact on Leaf Physiology

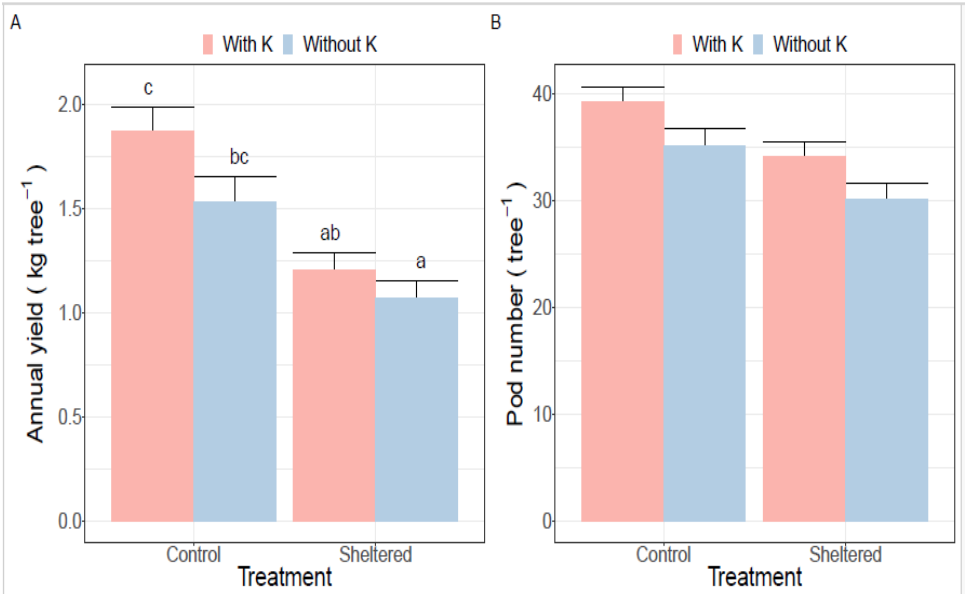
- Decrease in stomatal conductance (Gs) by ~60%.
- Reduction in leaf flush intensity by ~70%.
- Leaf greenness and size reduced by ~48% and ~68% respectively.



# Reproductive Dynamics and Yield

- Flower intensity and production of healthy cherelles significantly reduced.
- Pod and bean numbers per tree decreased, leading to a yield reduction from ~2,100 kg ha-1 to ~1,450 kg ha-1 (~31%).

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# Effect of Potassium Application

- Under control conditions, K increased Gs, leaf size, and greenness, flower intensity, cherelles, yield.
- K application did not consistently alleviated sheltering negative effect.
- Potential, yet limited, role of potassium in enhancing yield under drought.

# What do these results mean for cocoa production and sustainability?

- **Negative Implications**:

Drought would affect cocoa tree, from roots to beans quality.

Limit the effectiveness of K fertilizer.

- **Positive Implications:**

Improve soil management practices in the context of drought intensification.

Implement adaptation strategies to ensure the sustainability of cocoa production (PrIFVAD).

# Take home messages

- Water is the most limiting factor in cocoa cultivation.
- Potassium alone did not mitigate the side effects of water deficit.
- Potassium in combination with irrigation, positively influences cocoa roots, physiology and yields.
- In water-deficit conditions, even if sufficient potassium is present in the soil, the trees may struggle to take it up, limiting its potential to regulate stress

# Thank you