Potassium application to alleviate drought stress in cassava production

A growth chamber based carbon-13 pulse labelling experiment

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Context

- Cassava roots are an important staple crop
- Climate change will increase dry spell frequency
- Drought will affect cassava production

- Can potassium help alleviating drought stress?
- How can we measure water stress with stable isotopes?

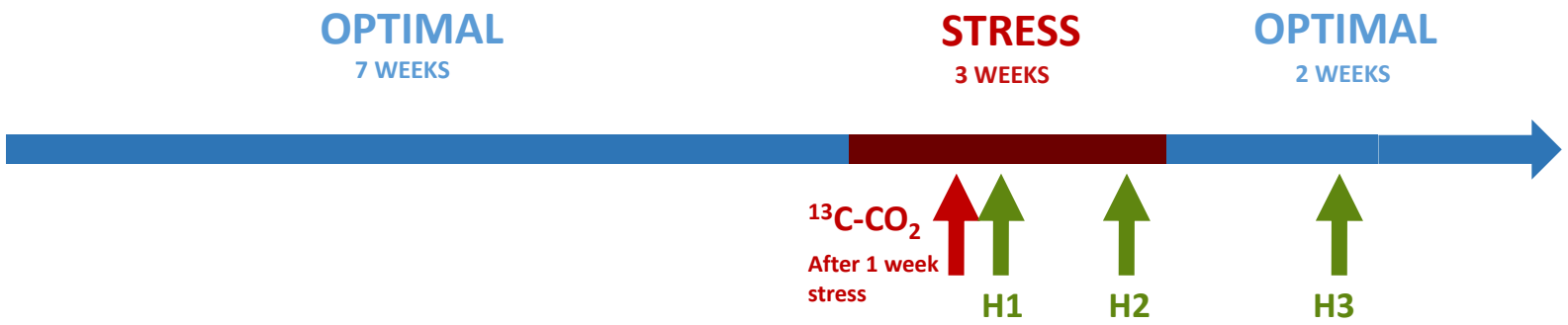
→ ^{13}C-CO_2 pulse labelling experiment

Experiment

- Control plants harvested before labelling
  - Check for natural abundance levels of $\delta^{13}C$
  - Is $\delta^{13}C$ related to water stress in cassava?
- ^{13}C Labelled plants harvested at different periods
  - Can we see a difference in distribution of assimilates under stress?
  - Does potassium increase carbon allocation to roots?

Methods

- 2 fertilizer solutions (from beginning):
  - K+ (1.437 mM K^+)
  - K- (0.359 mM K^+)
- 2 water treatments (during 3 week stress period):
  - 100 % of pot capacity
  - 50 % of pot capacity
- **^{13}C-CO_2 pulse label** applied after 1 week of drought stress
- 3 harvest (H) times (8 hours, 9 days and 24 days after labelling)



First results

- Water use of K+ plants in initial phase 5% lower then for K- plants

→ K+ to avoid water use when root system is not yet fully developed?

- Natural abundance $\delta^{13}C$ of upper parts (bulk) in optimally watered plants 1.5‰ lower than for water stressed plants

→$\delta^{13}C$ as proxy for water stress in cassava

- Newly assimilated ^{13}C found in roots already at first harvest

→Shorter sampling times needed to see translocation

- Lower stem part contained up to 30% of new assimilates – roots only 14%

→Lower stem as intermediate storage organ?

What could be improved

- A **more drastic potassium treatment** is advised
  - No differences in leaf potassium content could be found
- **More harvesting times closer to labelling** to measure translocation speed to the roots
- Sampling for different (non)-structural carbon pools to follow mobile and less mobile assimilates
- High variability in cassava growth should be counteracted with **more replicates** and more **homogeneous planting material**