The genetic variation of cadmium (Cd) uptake and bioaccumulation in *Theobroma cacao* L.

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Genetic variation as a tool for Cd mitigation

- Grafting high Cd varieties on low Cd varieties has been shown to reduce Cd accumulation in the shoots of the high Cd variety (Chao et al. 2012; Sugiyama et al. 2007).

- Proteins involved in Cd accumulation have been identified - HMA 2, 3, 4; Nramp 1, 5, 6; PCS.

- Breeding programmes that target loss of function genes (e.g. mutant screening, TILLING) (Chen and Ma 2016).

- Work mainly done in Arabidopsis, rice, Noccaea caerulescens (pennycress).
The mechanism of Cd uptake and partitioning within the cocoa plant is unknown.
Leaf Cd Frequency

*0.1 – 0.2 mg/kg soil [Cd] at ~ 80% of the plots
Leaf Cd Vs Time

Accession

B12/1
IMC67
IMC94

2013/14
2014/15

Leaf Cd content
y = 0.2986x + 0.3302
R² = 0.3757
Bean/Leaf Cd Ratio

Cocoa Accession

Leaf Cd  Bean Cd
The Cotyledon/Testa ratio ranged between 0.4 to 0.7.
Conclusions

• ICGT is the ideal site to screen for genetic variation in Cd bioaccumulation

• Variation of leaf and bean Cd between accessions probably due to genetic variation

• Multiple regulatory points during the journey of Cd from the soil to the cotyledon

Future Work

• Study of a larger number of accessions to identify the major pathways of Cd accumulation in cocoa
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