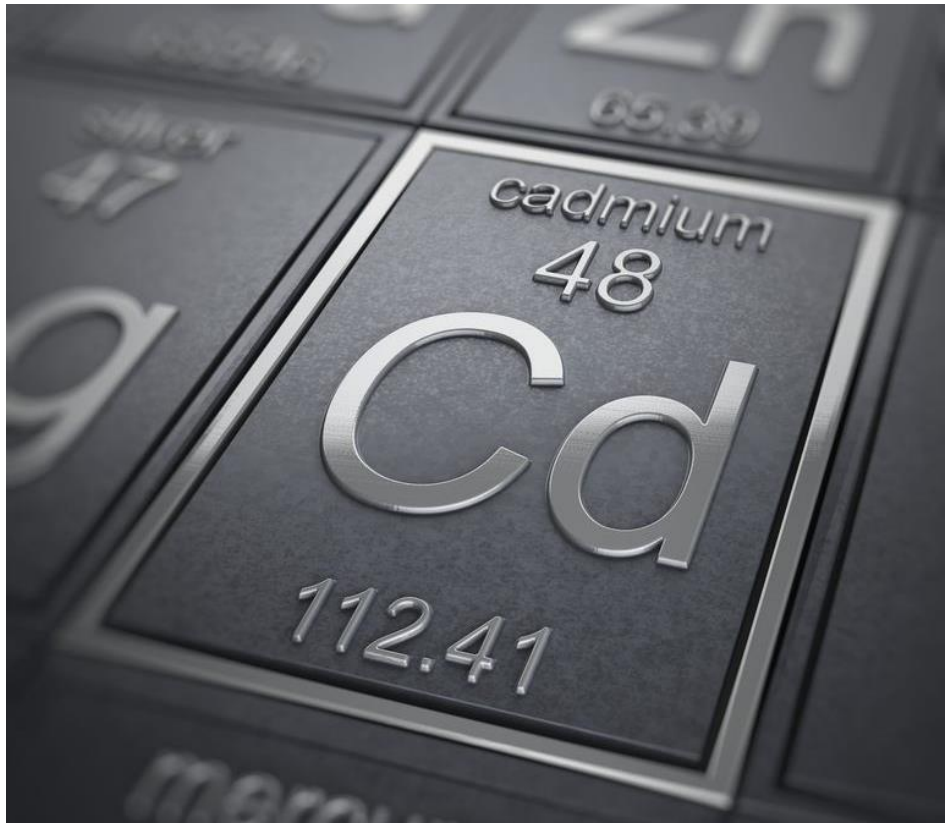


The genetic variation of cadmium (Cd) uptake and bioaccumulation in *Theobroma cacao* L.

Caleb Lewis, Adrian M. Lennon, Gaius Eudoxie, and Pathmanathan Umaharan

Cocoa Research Centre, The University of the West Indies, St. Augustine Campus, The Republic of Trinidad and Tobago.

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)

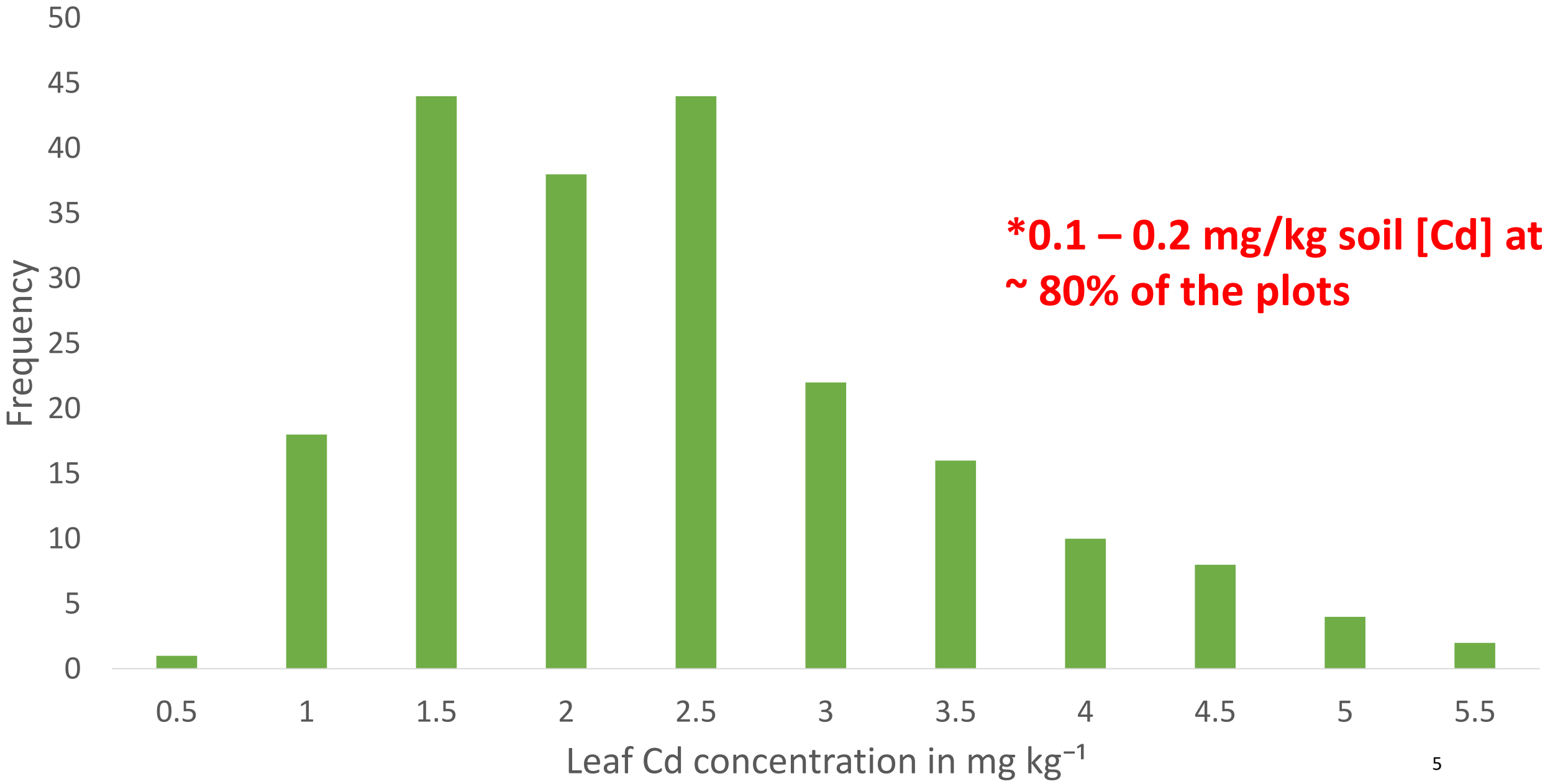
Gap

- The mechanism of Cd uptake and partitioning within the cocoa plant is unknown.


INTERNATIONAL COCOA
GENEBANK, TRINIDAD
AT
UNIVERSITY
COCOA RESEARCH STATION
Field 4a
NURSERY # 1
4ha
PLANTED: 1994

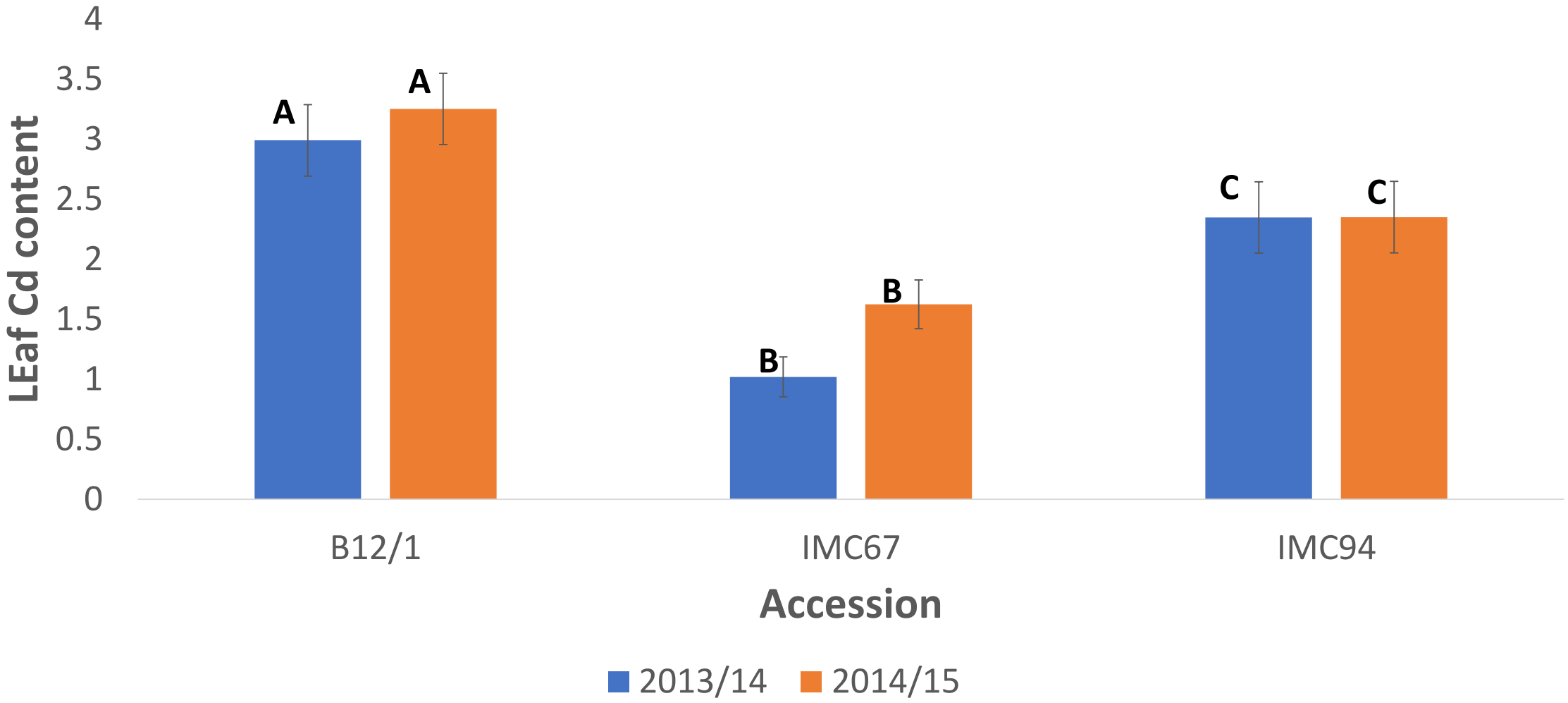

2013/03/11 22:39

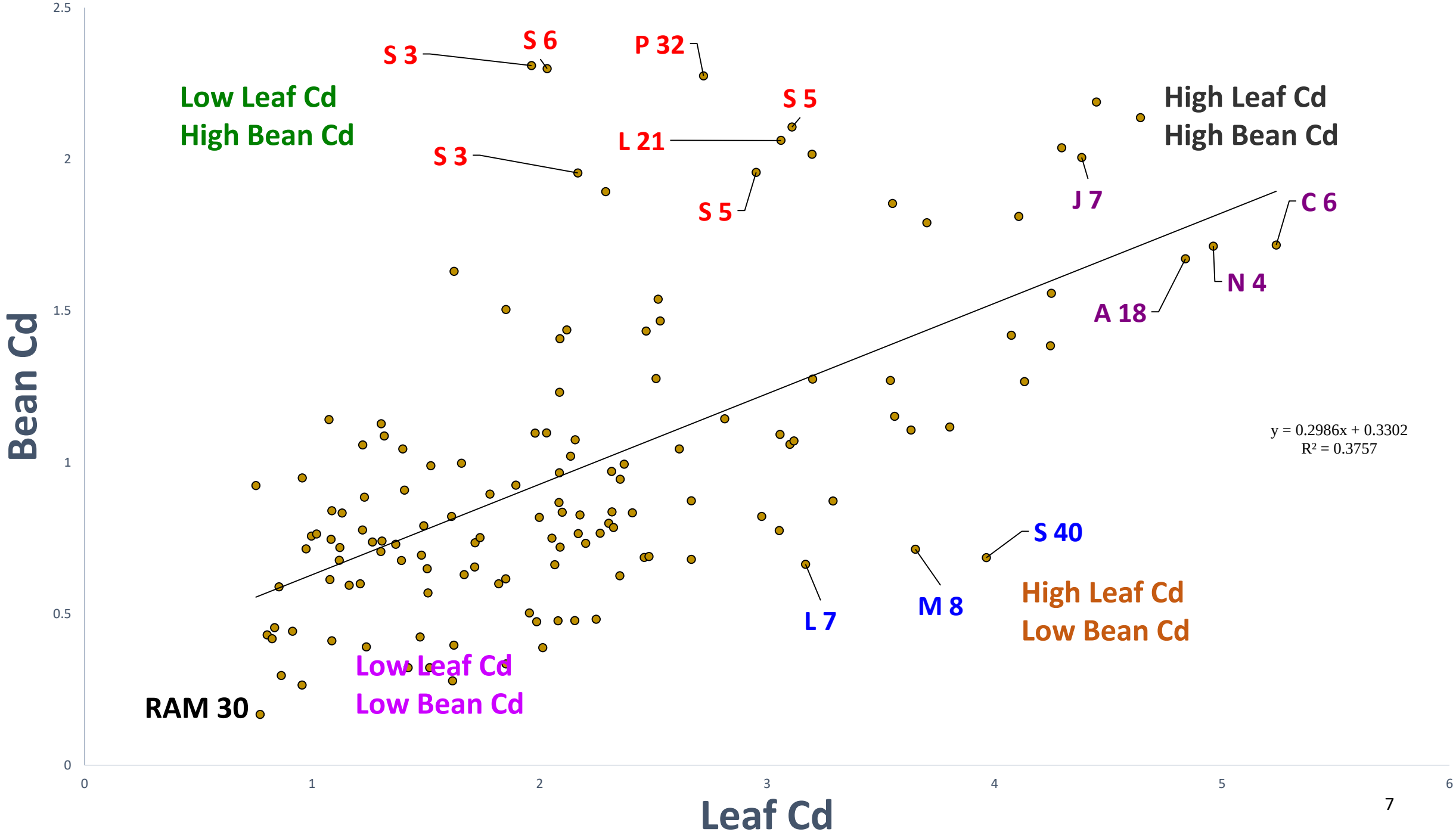
Leaf Cd Frequency



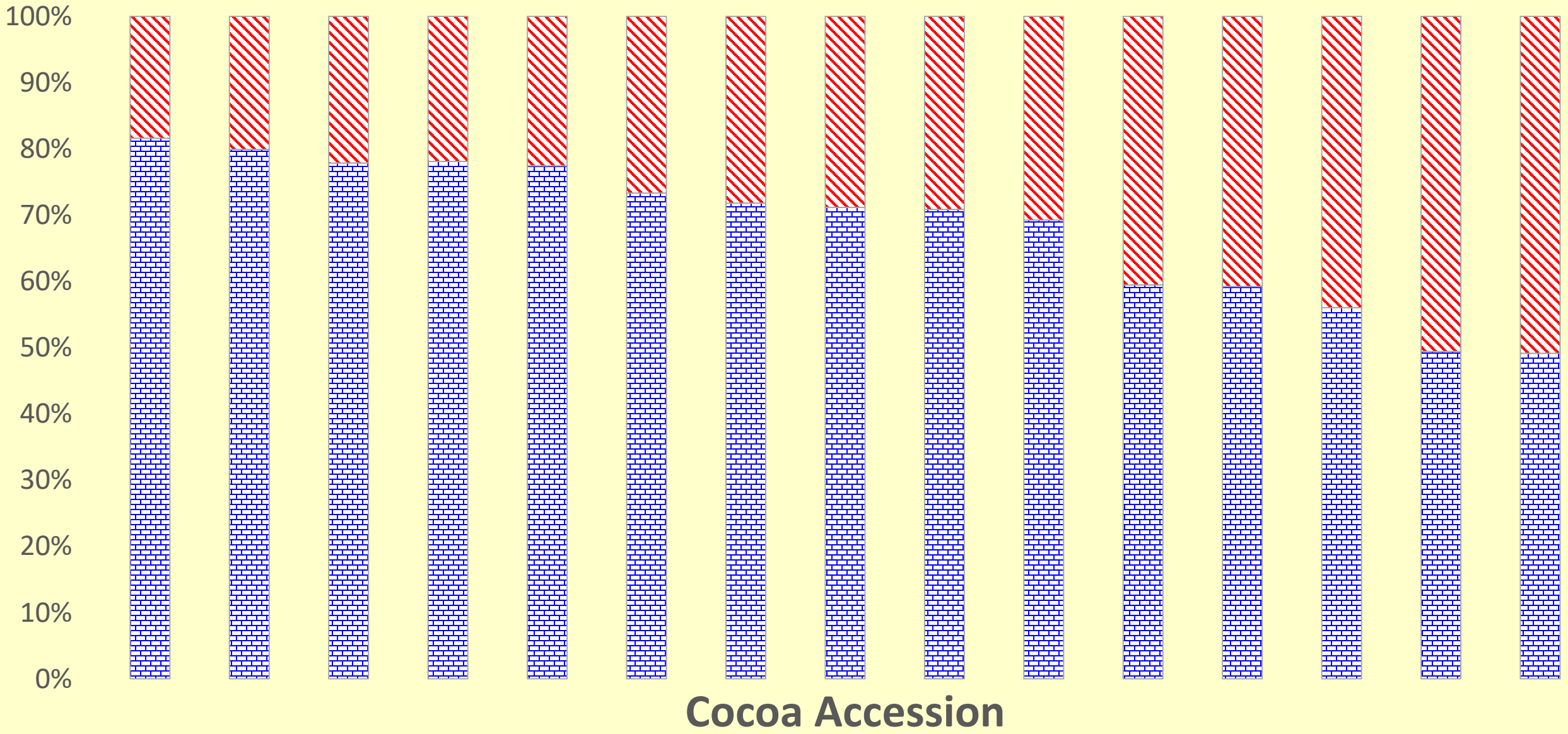
***0.1 – 0.2 mg/kg soil [Cd] at ~ 80% of the plots**

Leaf Cd Vs Time

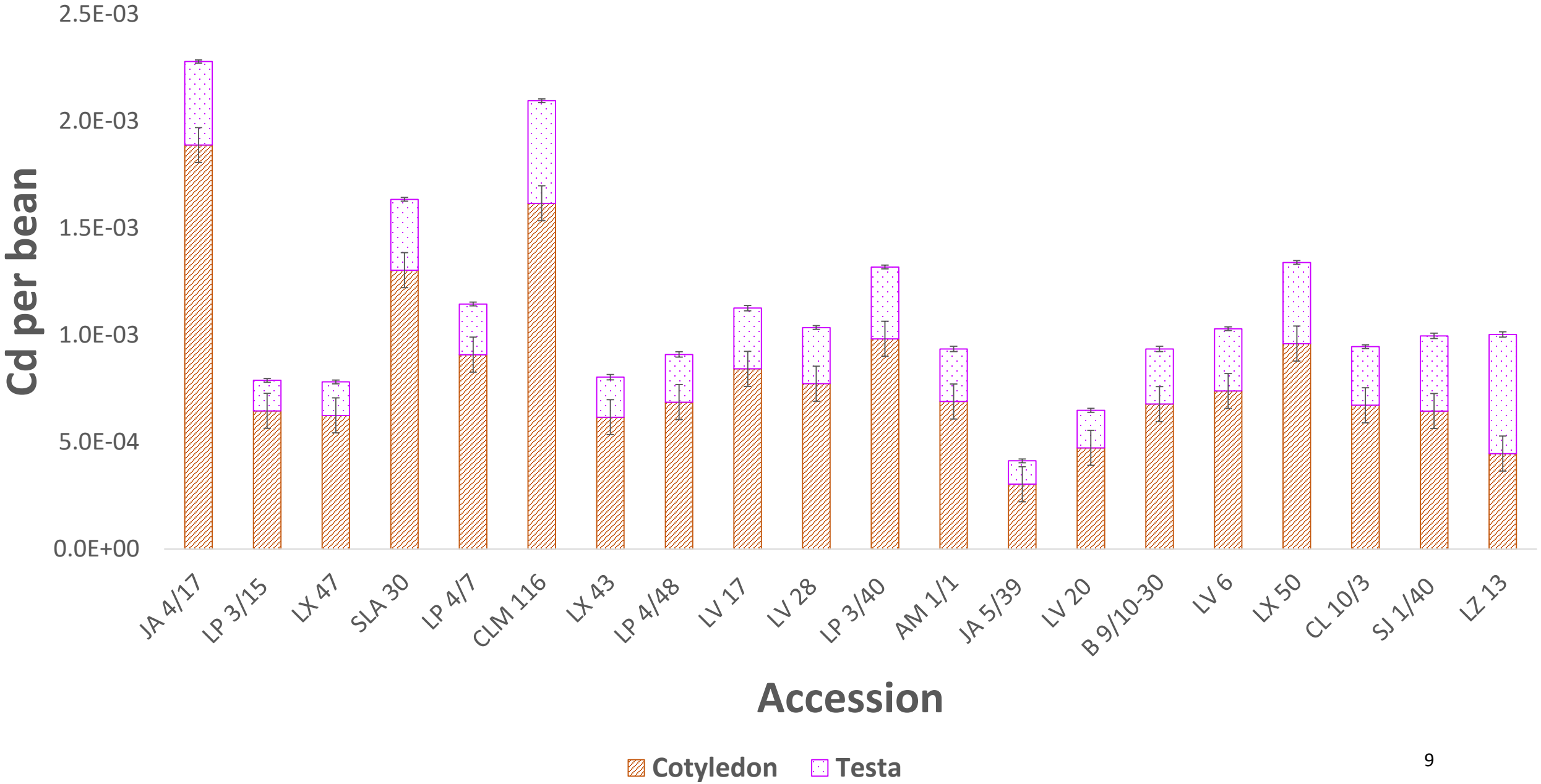



Bean Cd
Leaf Cd
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
S 3
S 6
P 32
Low Leaf Cd
High Bean Cd
S 5
L 21
S 3
S 5
High Leaf Cd
High Bean Cd
J 7
C 6
N 4
A 18
y = 0.2986x + 0.3302
R² = 0.3757
S 40
High Leaf Cd
Low Bean Cd
M 8
L 7
Low Leaf Cd
Low Bean Cd
RAM 30

Bean/ Leaf Cd Ratio



Testa/ Cotyledon Ratio



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

Acknowledgements

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