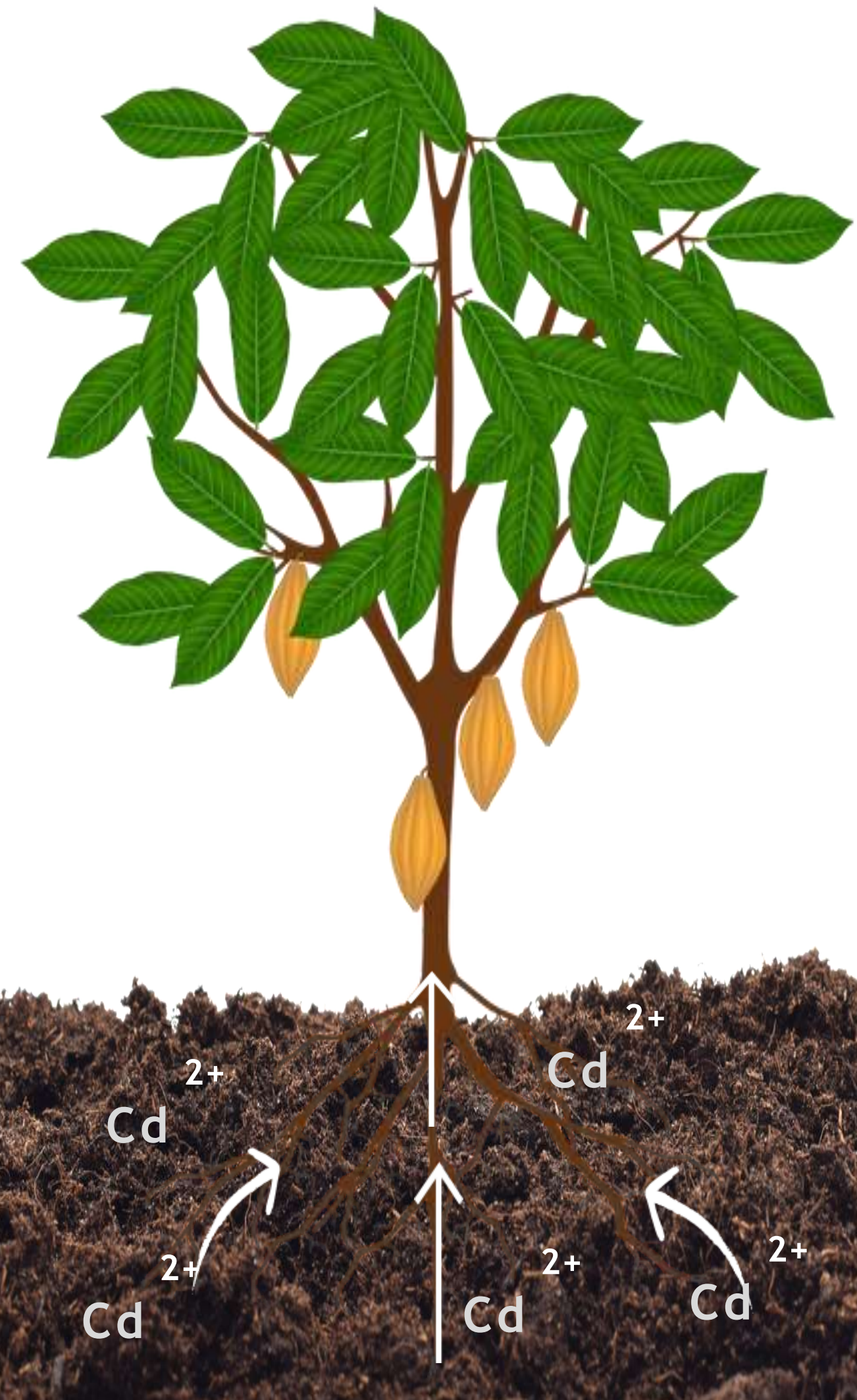


# The Effect of Soil and Foliar Zn & Mn Applications on the Uptake of Cd Levels in Cacao Grown on Cd-Rich Soils

**Authors:** Gideon Ramtahal; Path Umaharan; Chelsea Roberts; Anaika Fernandez; Leshawn Gopee; Dreavon Edwards; Anilinda Anamalay

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# AGENDA

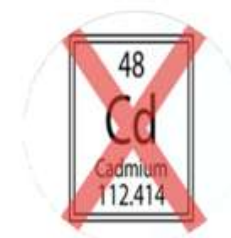
- Cadmium (Cd) & Cacao
- Mitigation Strategies: Cd
- Methodology: Foliar Application: Zinc (Zn) & Manganese (Mn)
- Results
- Summary
- Conclusion/Recommendation





## Food Safety Limits

CADMIUM IN COCOA



# Cadmium & Cacao



# CADMIUM MITIGATION STRATEGIES: CACAO

## *Soil amelioration*



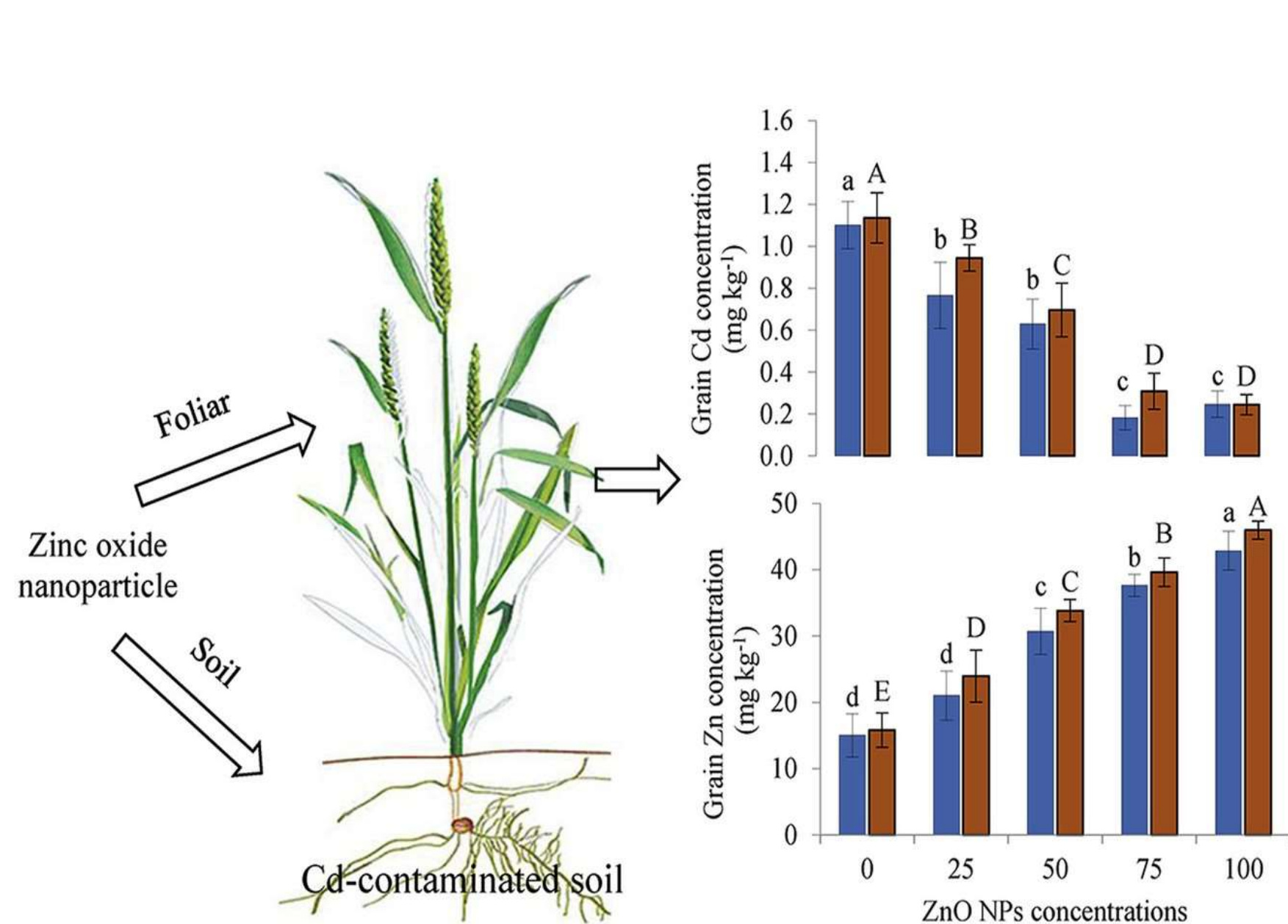
## *Genetic*



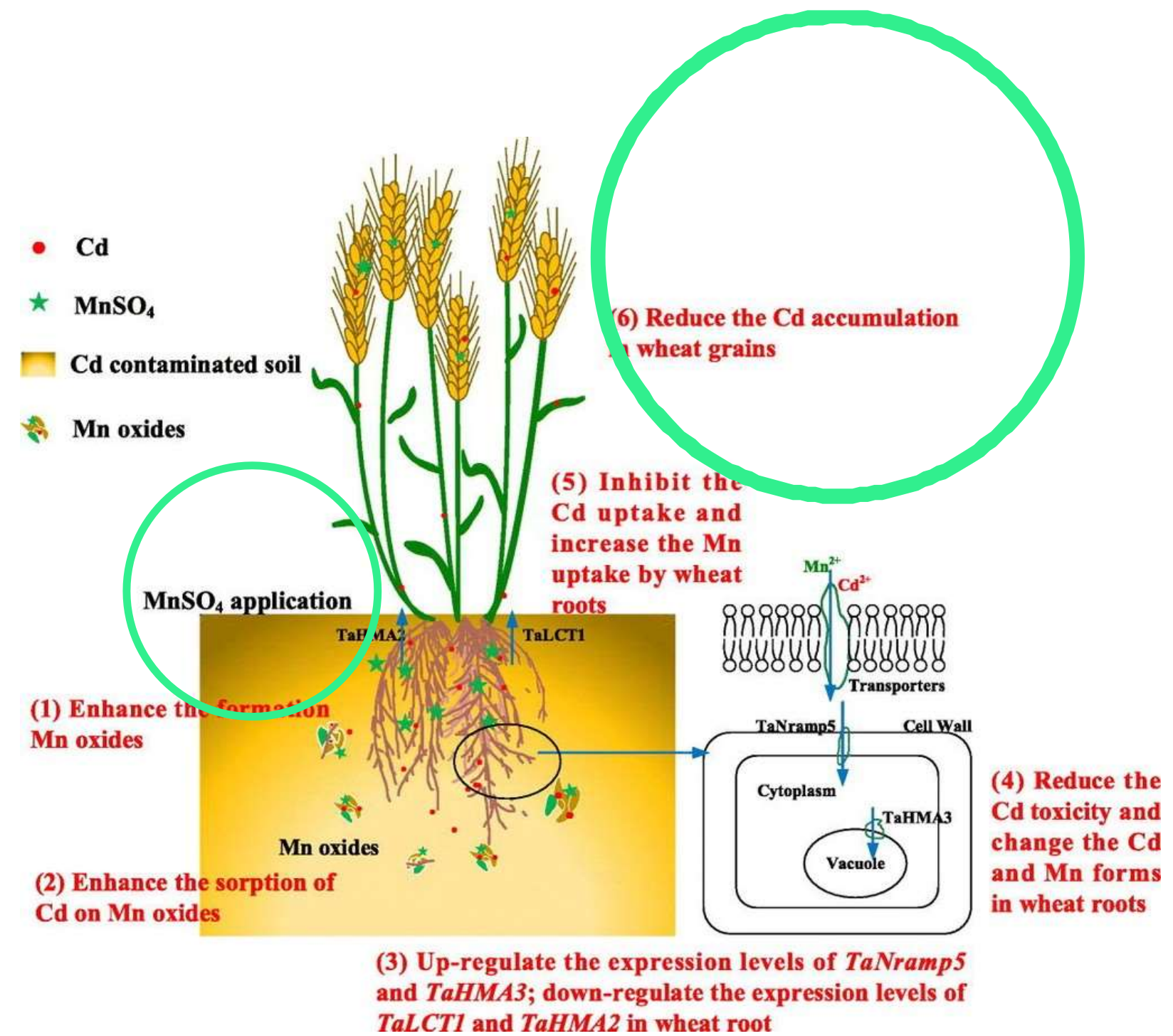
## *Post-harvest*



# LITERATURE REVIEW: The effect of soil & foliar application of Zn & Mn on Cd uptake in rice & wheat

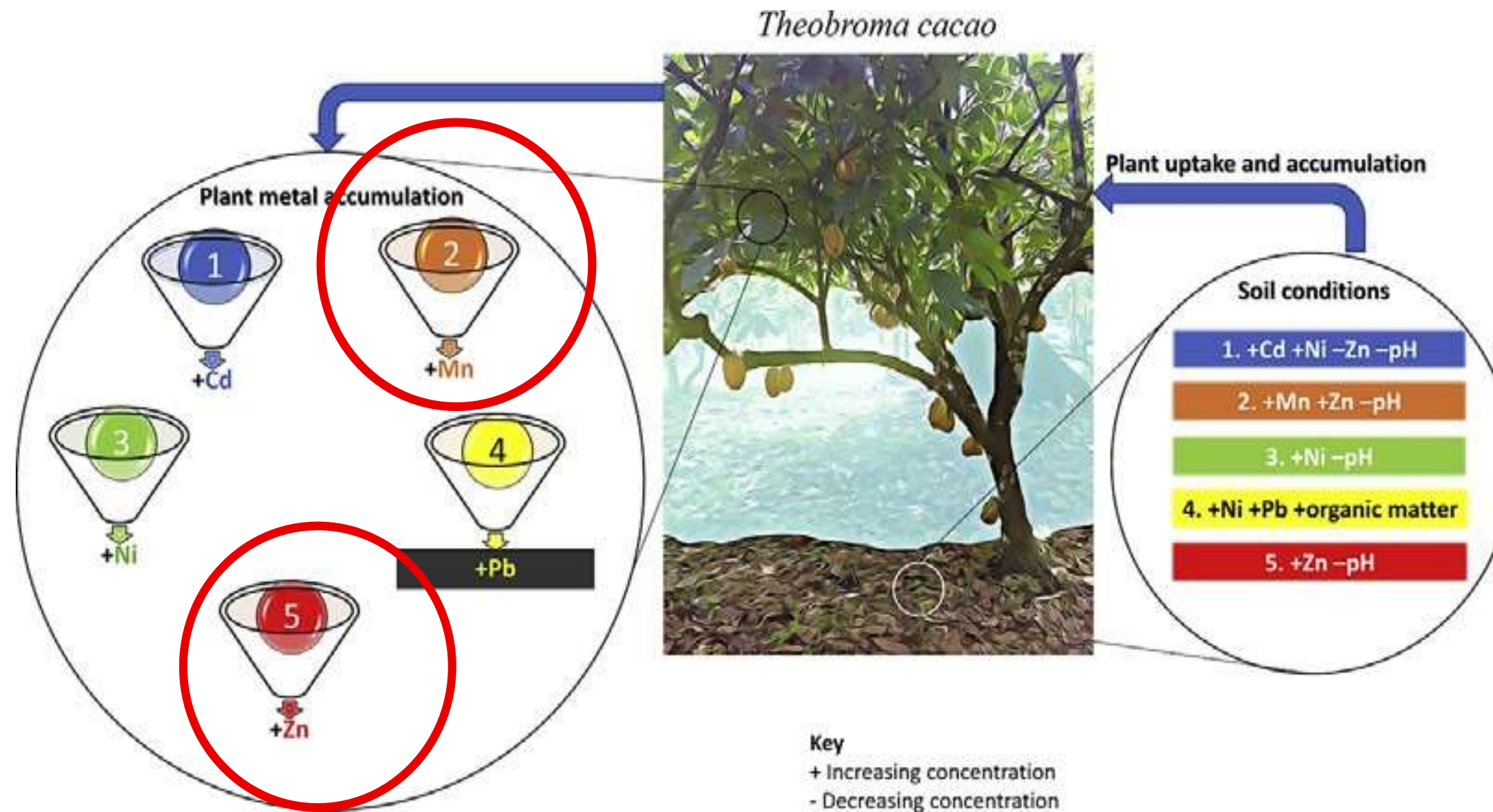


RICE– Hussain et al., 2018



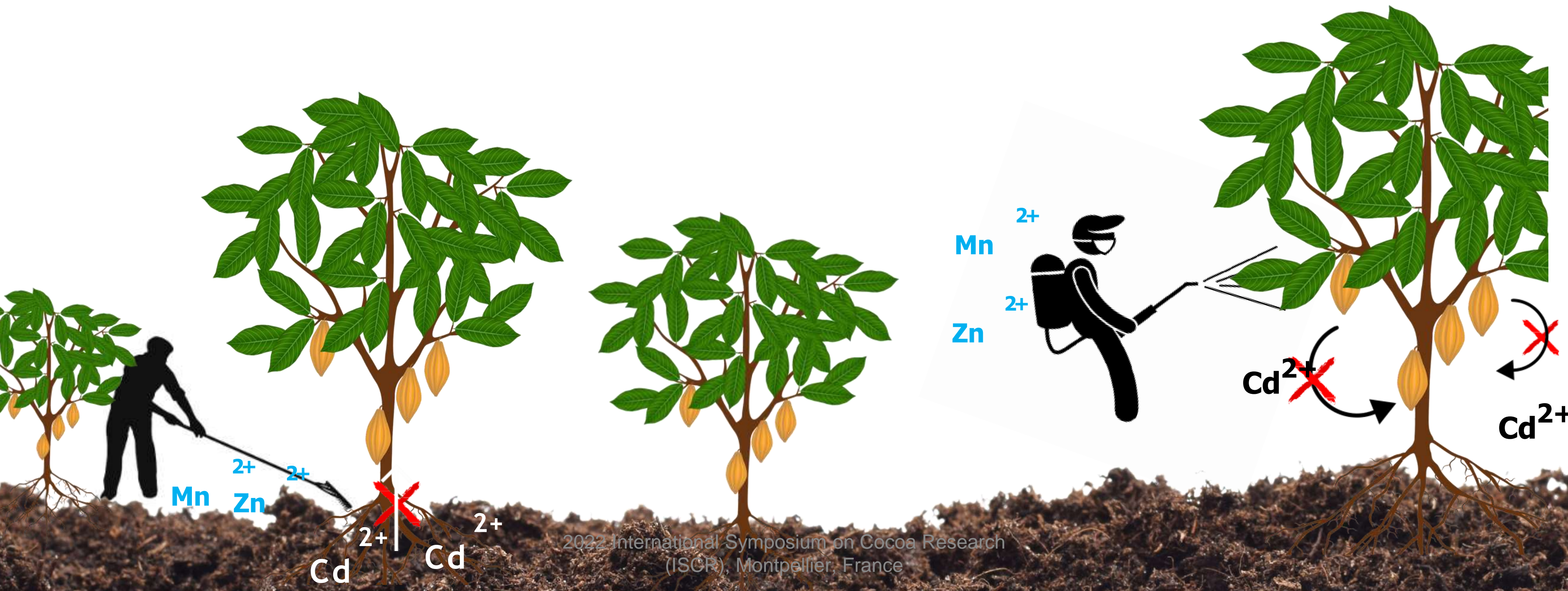
WHEAT– Huang et al., 2022

# LITERATURE REVIEW: Cd/Mn/Zn Relationships in Cacao



Lewis et al., 2021

# Soil & Foliar Application of Zn & Mn to Reduce Cd Uptake in Cacao?



# METHODOLOGY

## Greenhouse Trial: Soil & Foliar application of Zn & Mn



Low Zn/Mn Cd-rich soil



Single variety rooted cacao cuttings

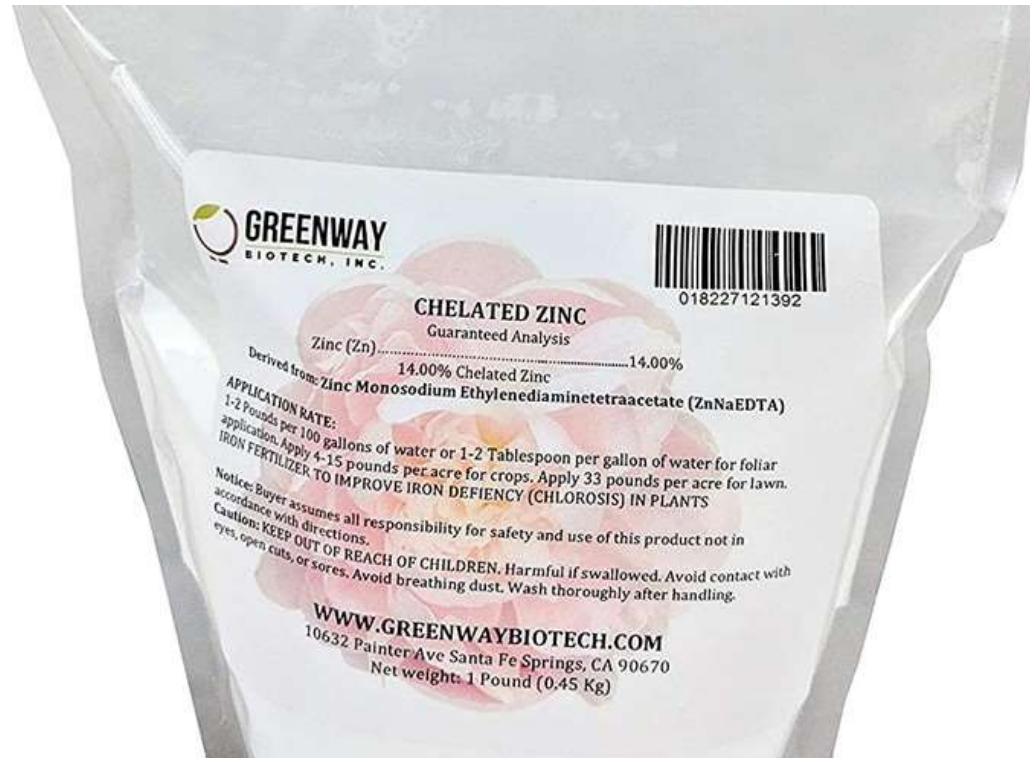


Completely randomized block design



# METHODOLOGY

## Greenhouse Trial: Soil & Foliar application of Zn & Mn



Zn-EDTA & Mn-EDTA

Rate: 10-15 kg/ha  
1-2 tbsp/gallon

- Application done with a spray can
- Leaf samples (interflush 2) taken every 2 months for an 8 month period.



# RESULTS: GREENHOUSE TRIAL

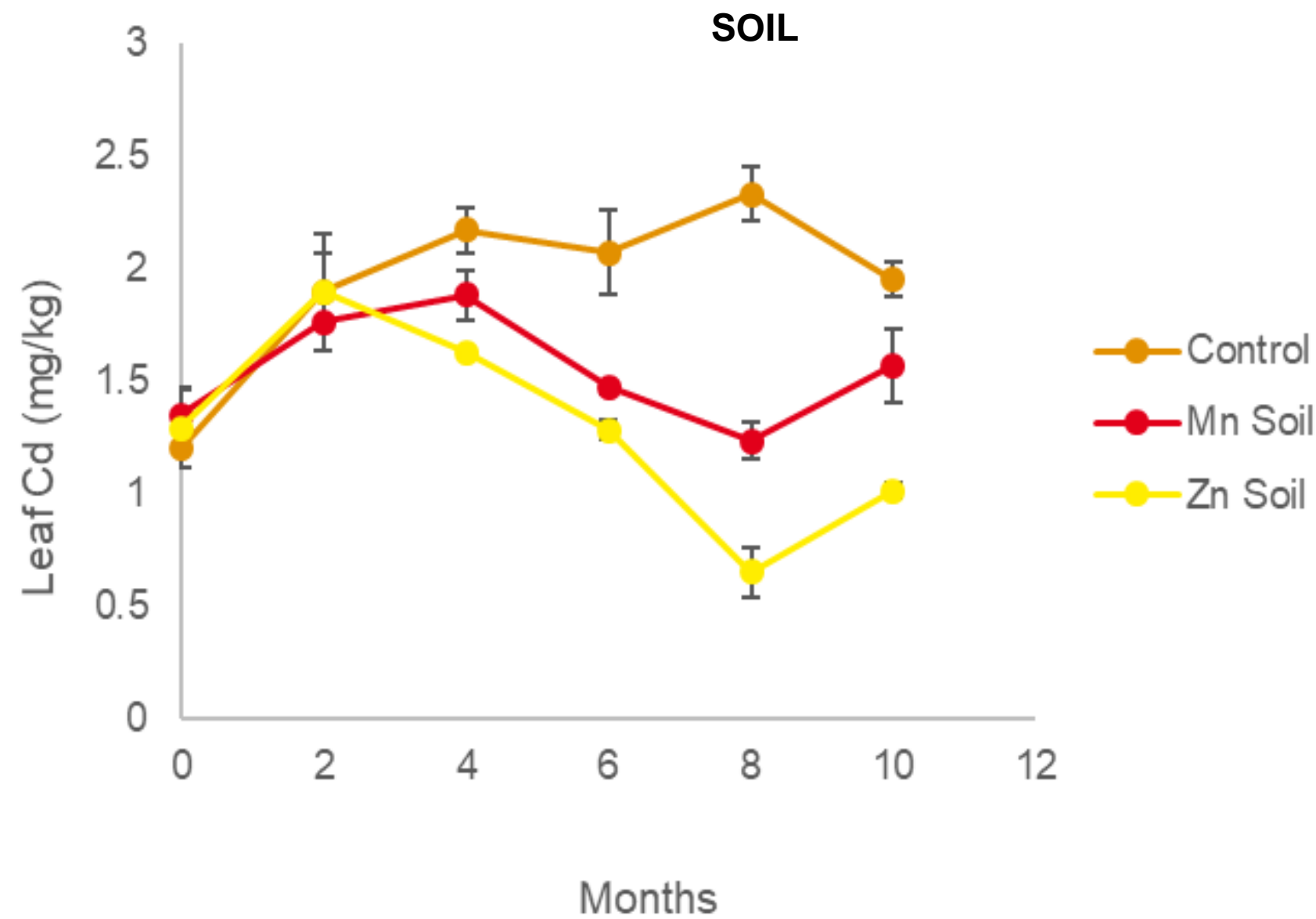


Fig 1. Effect of Mn & Zn soil applications on Cd uptake in cacao leaves

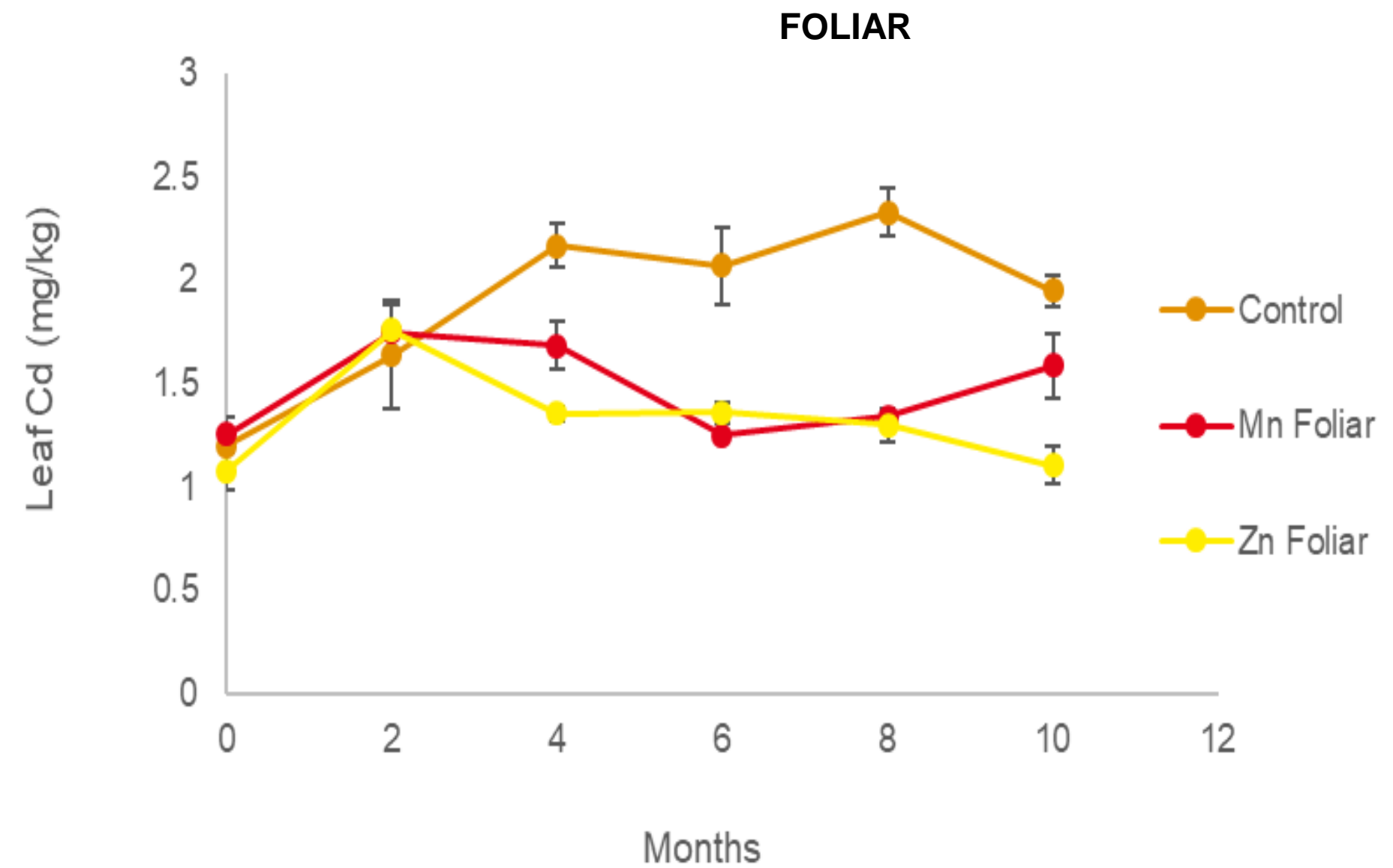


Fig 2. Effect of Mn & Zn foliar applications on Cd uptake in cacao leaves

# METHODOLOGY

## Field Trial: Foliar application of Zn & Mn



Cacao farm with low Zn/Mn Cd rich soil



14 year old cross-grafted TSH varieties



Completely randomized block design  
with guard trees

# METHODOLOGY

## Field Trial: Foliar application of Zn & Mn



Zn-EDTA & Mn-EDTA

Rate: 10-15 kg/ha  
1-2 tbsp/gallon

- Application done with a mist blower
- Leaf samples (interflush 2) taken every month for a 5 month period.



# RESULTS: FIELD TRIAL

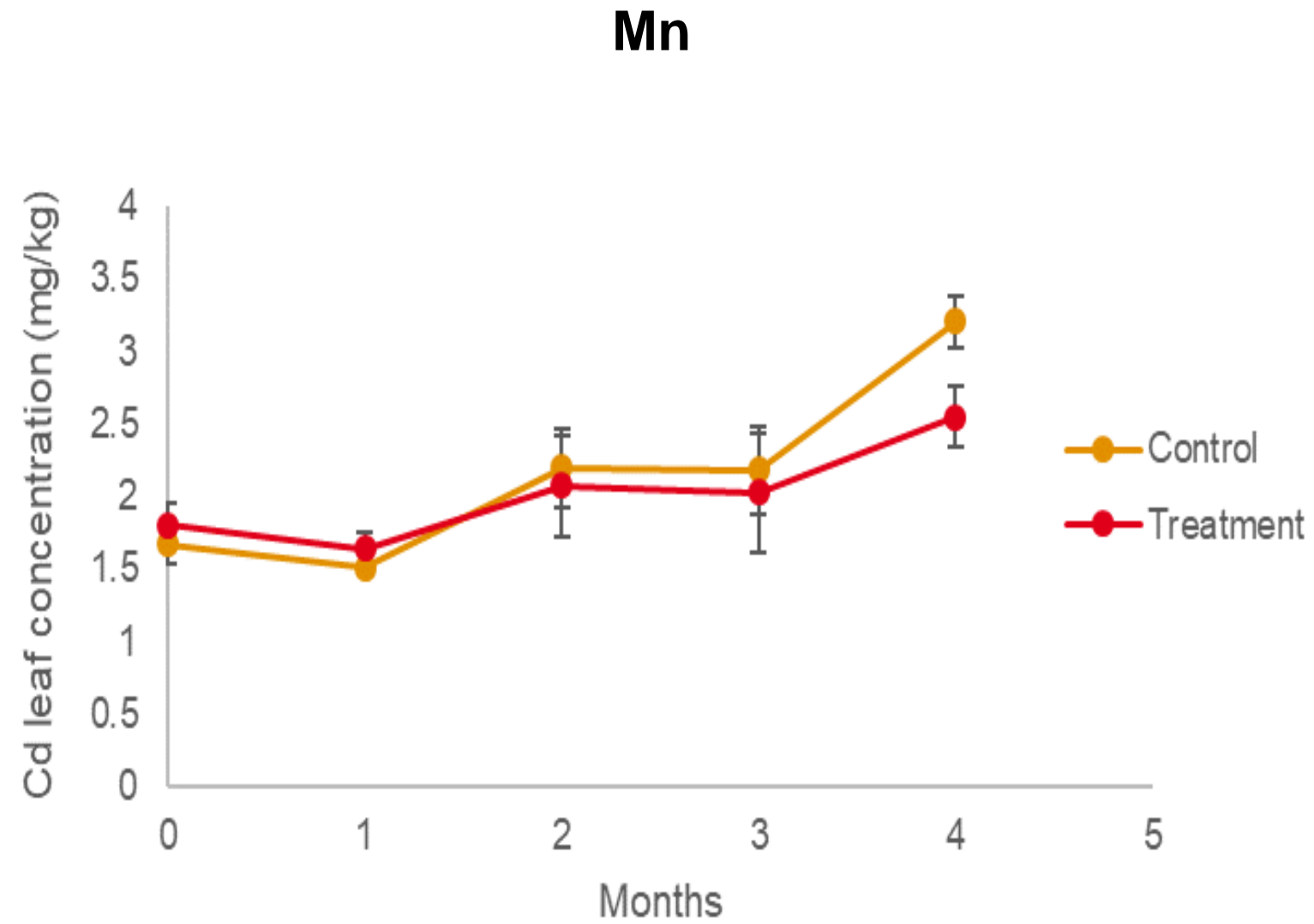


Fig 3. Effect of **Mn** foliar application on Cd uptake in cacao leaves

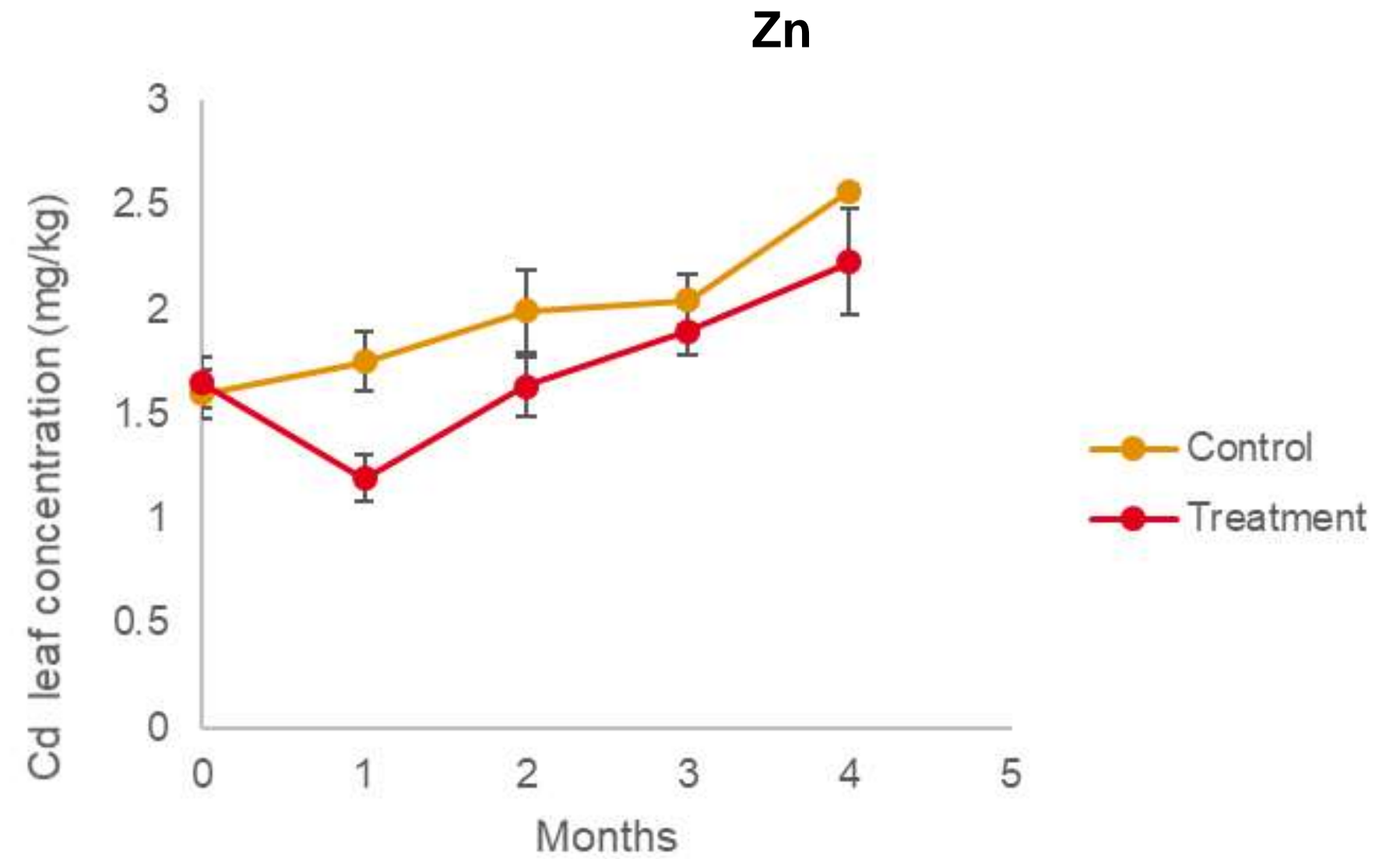


Fig 4. Effect of **Zn** foliar application on Cd uptake in cacao leaves

# SUMMARY

- **Greenhouse soil and foliar applications of both Mn & Zn** reduced Cd uptake in cacao leaves compared to control- *Zn soil treatment observed to be more effective*
- **Field Zn foliar application** reduced Cd levels in cacao leaves with a noticeable decrease after 1 month of application- *the effectiveness diminished over time.*
- **Field Mn foliar application-** no immediate effect, however a difference in Cd uptake compared to control after month 3.
- **Field soil applications of Mn and Zn-** based on initial greenhouse studies, may be more effective as a treatment to reduce Cd uptake in cacao- *further studies required*

# Conclusion/Recommendation

- **Zn & Mn soil and foliar application is an effective approach to reduce Cd levels in cacao leaf tissue-** *may offer an alternative approach to farmers*
- **Rate/method of application should be optimized-** *in order to improve effectiveness of treatment*
- **Cacao bean Cd levels should also be evaluated**

# ACKNOWLEDGMENTS



2022 International Symposium on Cocoa Research  
(ISCR), Montpellier, France



# THANK YOU FOR YOUR ATTENTION

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