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## **Cocoa Swollen Shoot Virus Disease: how can it be prevented, and do shade trees mitigate the severity and help maintaining productivity?**

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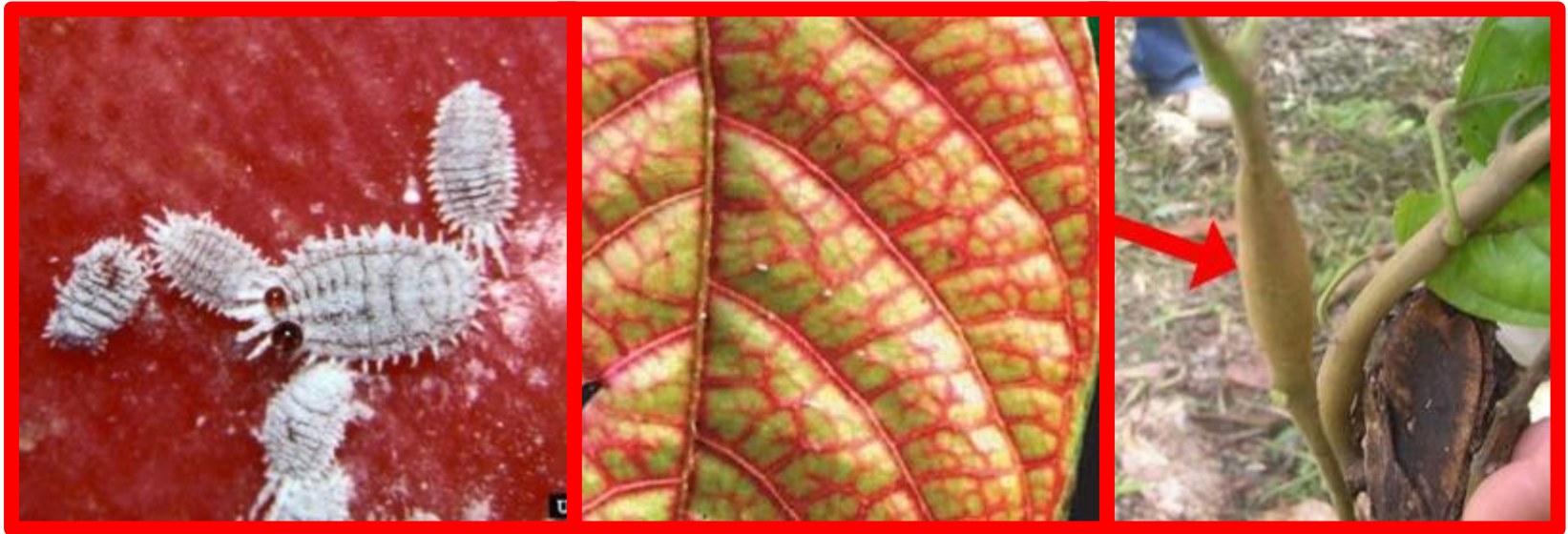
2017 International Symposium on Cocoa Research (ISCR), Lima, Peru  
13-17 November 2017

# Cocoa Swollen Shoot Virus Disease

- West Africa (WA) is the world's most important region for cocoa production (mainly Côte d'Ivoire and Ghana)
- One of the major limitations to cocoa productivity in WA is the Cocoa Swollen Shoot Virus Disease (CSSVD).



# Vector, symptoms and current control



- CSSVD first observed/described in 1922/36, respectively (Steven, 1936)
- Eradication program cut > 300 Mio. infected trees since 1946 (Dzahini-Obiatey, pers. Comm.)
- Despite these efforts, CSSVD still prevalent (Ameyaw *et al.*, 2014)
- Potential control options not implemented by farmers (Ameyaw *et al.*, 2014)

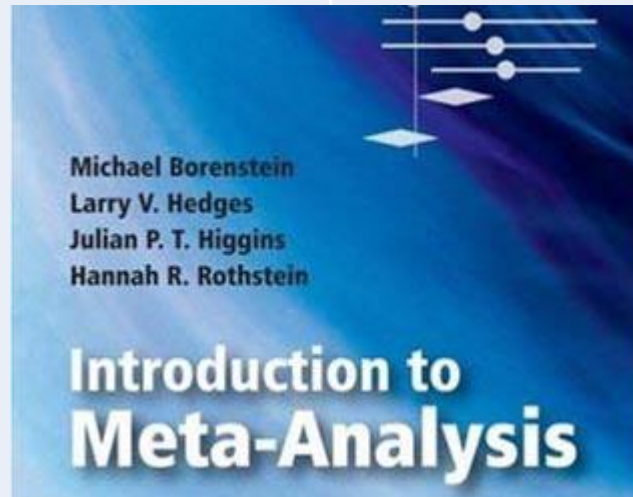
# Work package I

## Output I

Quantitative assessment of main CSSVD control options

### Meta-analysis

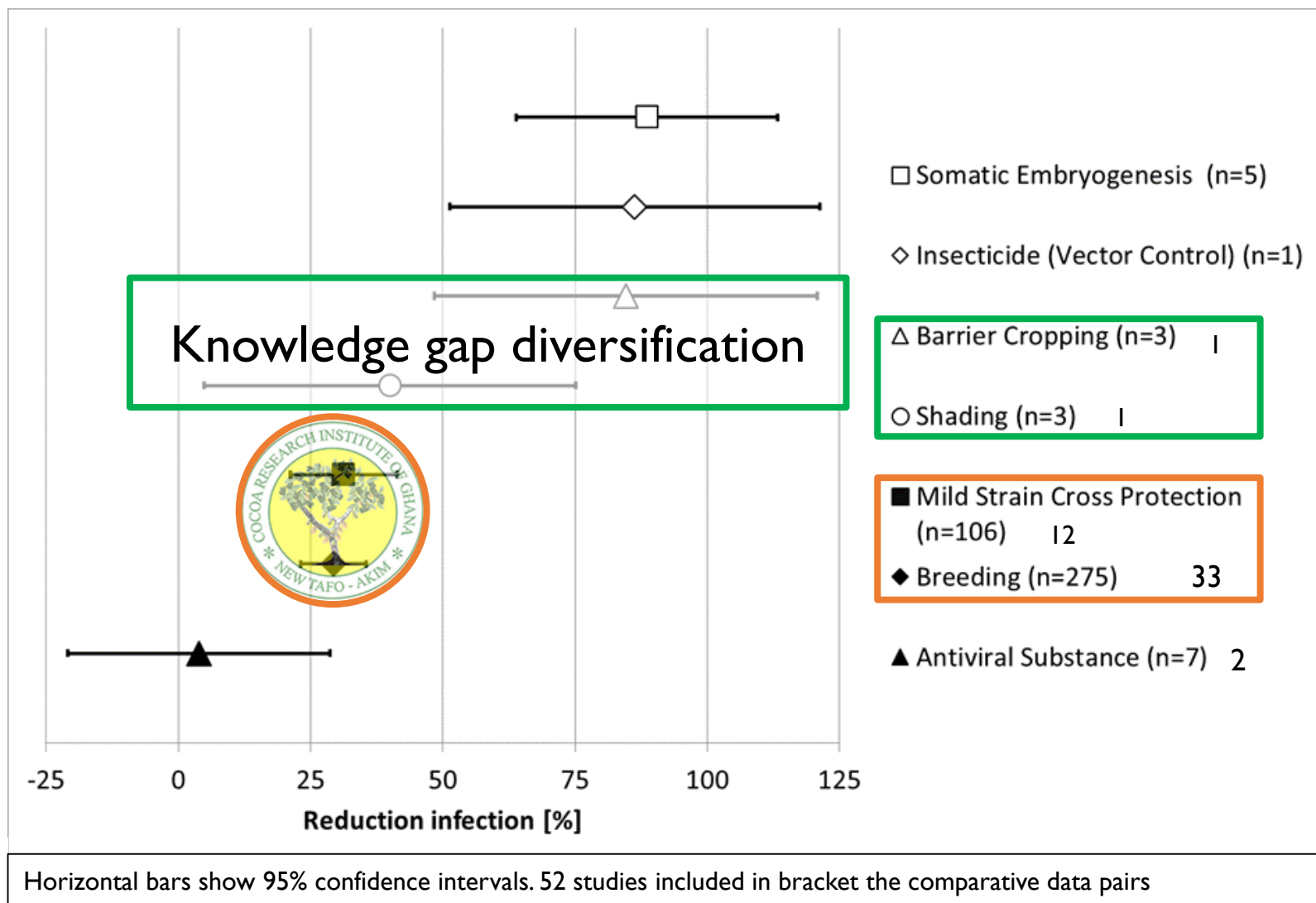
Consolidating  
data from 75  
years of  
research



Bigger picture  
of what is out  
there already

# Result meta-analysis

Mean difference in reduction of infection with CSSVD of improved practices vs. control

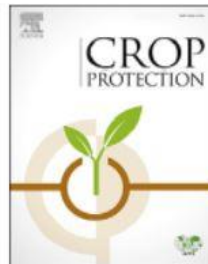




Contents lists available at [ScienceDirect](#)

## Crop Protection

journal homepage: [www.elsevier.com/locate/cropro](http://www.elsevier.com/locate/cropro)



### Combatting Cocoa Swollen Shoot Virus Disease: What do we know?



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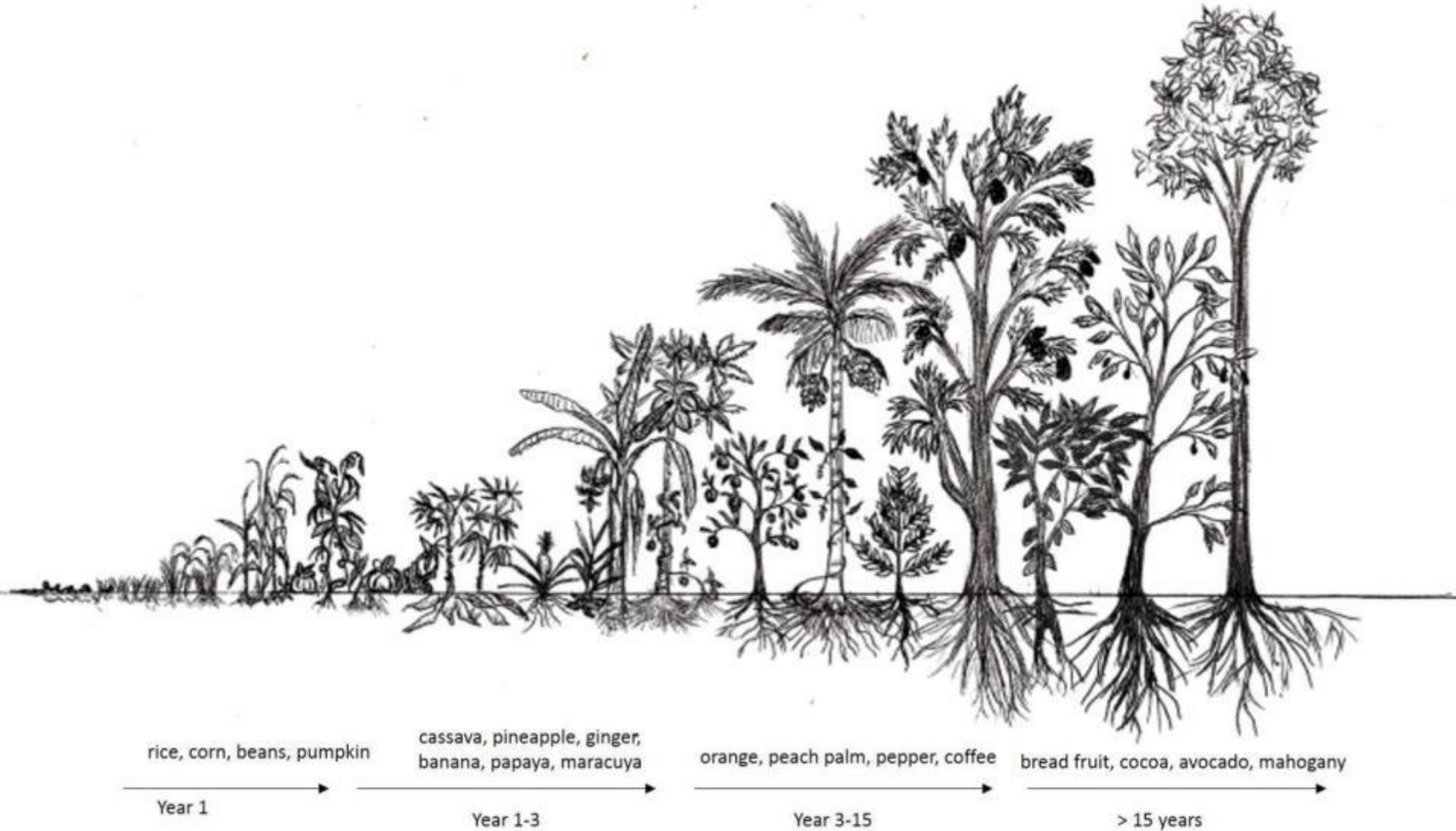
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# Workpackage II

## Can shade reduce CSSVD severity?



# Site selection “Systems study”

## Along shade cover gradient (system)

- Hyp.: shade reduces CSSVD severity, two groups of systems:
  - Full-sun (close to 0% shade)
  - Shade (> 40% shade)



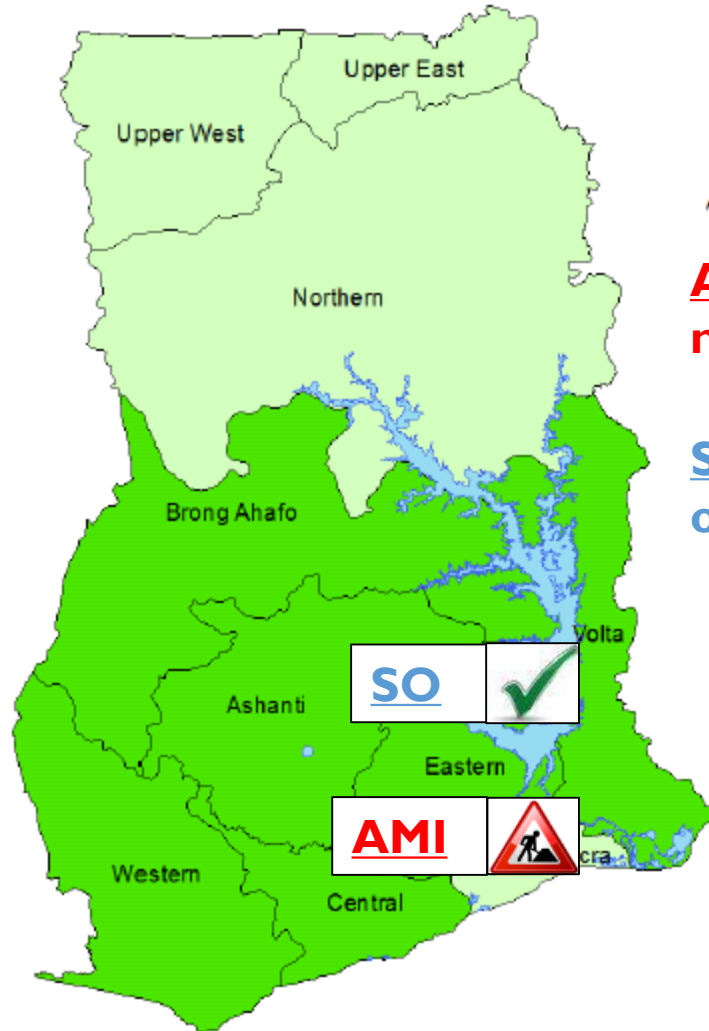


# Site selection “Systems study” (cont.)

## Regions

*Systems study*

- **Eastern**  
(more shade trees)



**AMI: area of mass infection**

**SO: scattered outbreaks**

### Legend

- Water
- Cocoa growing areas
- Non cocoa growing areas



# Methodology “Systems study”

## Data obtained on shade tree/plot level (plot characterization)

| ➤ Assessment of:  | <u>Level</u>    |
|---|-----------------|
| ▪ Shade (visual estimation (Somarriba, 2002))               | Shade tree (ST) |
| ▪ Photosynthetic active radiation (PAR)                     | Plot (P)        |
| ▪ Planting densities and species diversity                  | P & ST          |
| ▪ Biomass and carbon stocks of shade trees                  | ST              |
| ▪ Cocoa: general condition, pests & diseases                | Plot            |
| ▪ CSSVD presence and strain<br>(leaf/bud wood samples, PCR) | Plot            |
| ▪ Soil samples  | Plot            |

# Methodology “Systems study” (cont.)

## Data obtained on cocoa tree level

Selected 20 cocoa trees along 2 transects:

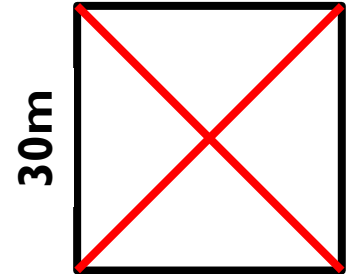
- Assessment of:
  - Severity of CSSVD symptom expression

Each cocoa tree rated each on 10-point scale:

*1 = no symptom, 2 = red vein banding, 3 = chlorotic vein flecking, 4 = chlorotic vein clearing, 5 = green vein banding, 6 = Diffused flecking, 7 = fern pattern, 8 = swollen stem, 9 = dying plant, 10 = dead plant*

(adapted from: Padi et al. 2013)

- One data set from dry season (March/April 2016)
- One data set from rainy season (September 2016)

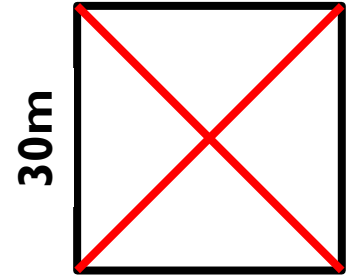


# Methodology “Systems study” (cont.)

## Data obtained on cocoa tree level

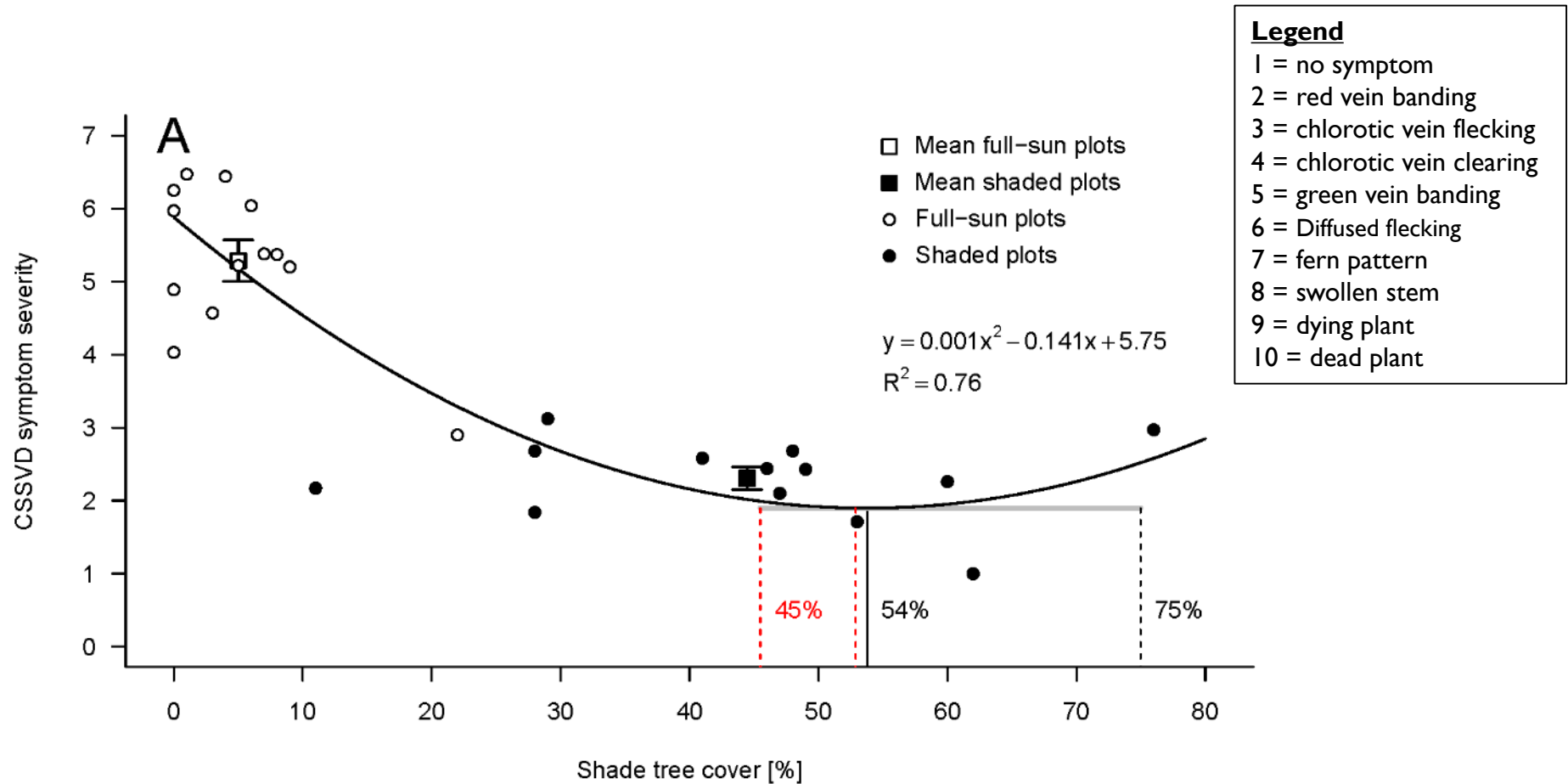
Selected 20 cocoa trees along 2 transects:

- Assessment of:
  - Yield (pod counts)
  - One data set from rainy season (September 2016)



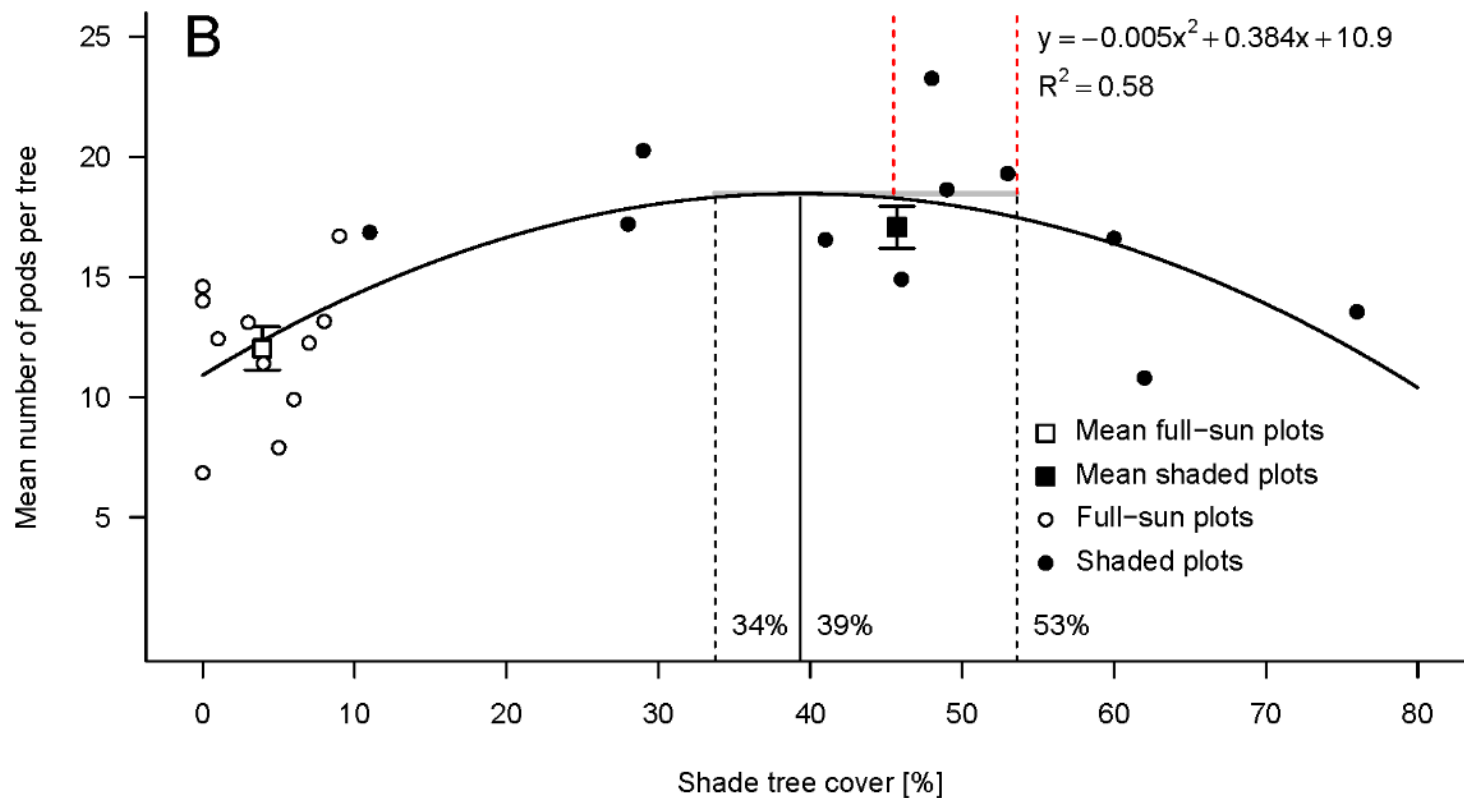
# Results “Systems study”

## Shade significantly reduced CSSVD symptom severity

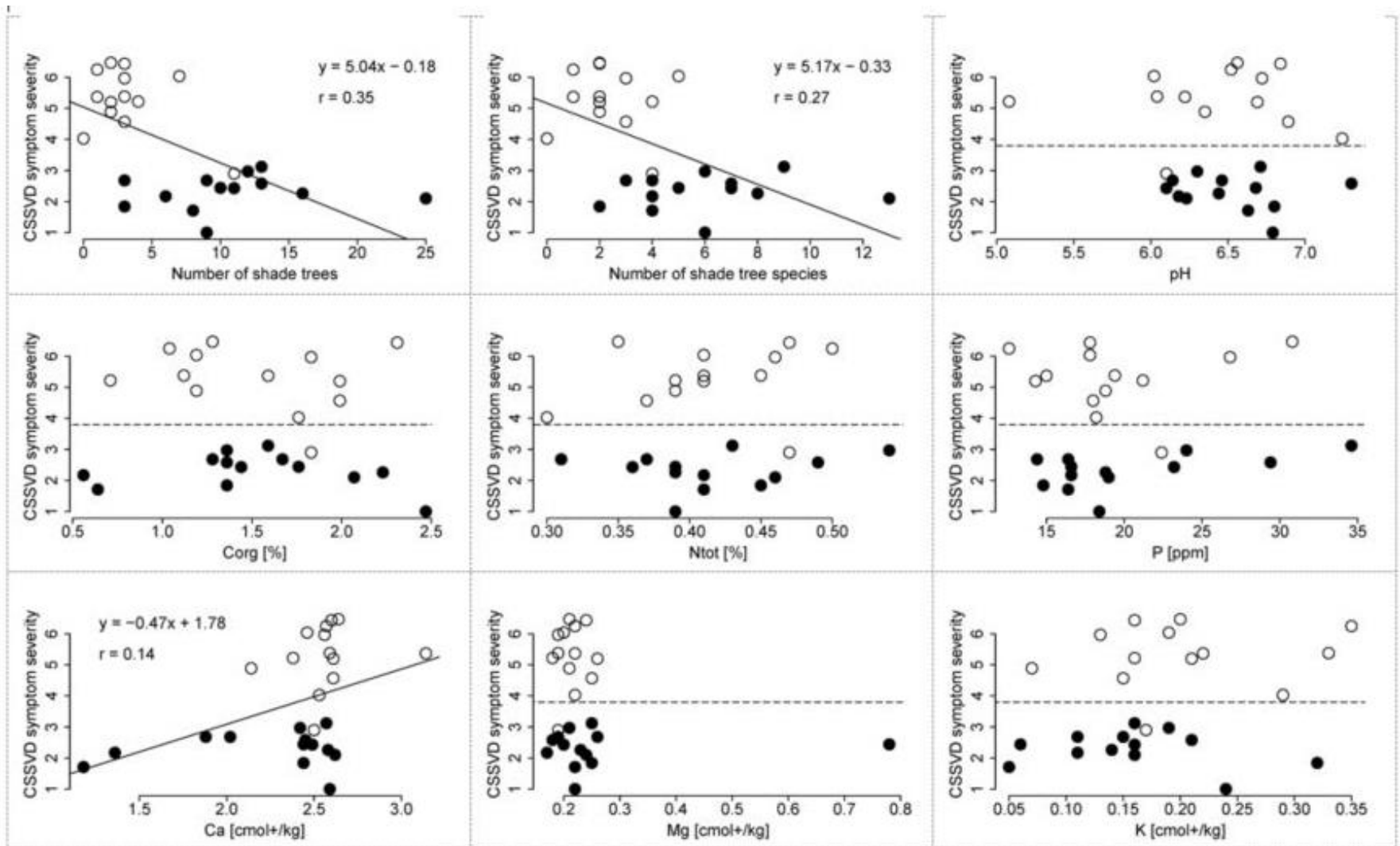


# Results “Systems study” (cont.)

If old, infected cocoa is shaded, the yield-reducing effect of CSSVD is less drastic



# Results “Systems study” (cont.)



# Conclusions

- High number of studies on breeding and mild strain cross infection, include/combine it with shade
- Few number of studies on effect of shade and barrier cropping as well as vector control
- On farm production system study with shade shows:
  - shade reduces severity of CSSVD symptoms
  - In shaded systems the yield reducing effect of CSSVD is lower then in full sun systems

**CRIG is validating results of this study on experimental plots**



# Thank you for your attention!



## Project partners:

**ETH**

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## Funded by:



مؤسسة ساويرس للتنمية الاجتماعية  
Sawiris Foundation For Social Development



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