# IPC's and Brassinosteroids to Prolong Health and Improve Fruit Yield and Quality in Newly Planted Trees Under HLB

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# Overview

- IPCs as a successful tool
- Potential of Brassinosteroids to protect young citrus plants
- Can we combine IPCs and Brs?

# Young vs Mature Citrus Trees
## Different biology, different requirements

**Mature trees**

- Already affected by HLB.
- Declining production.

**Young trees**

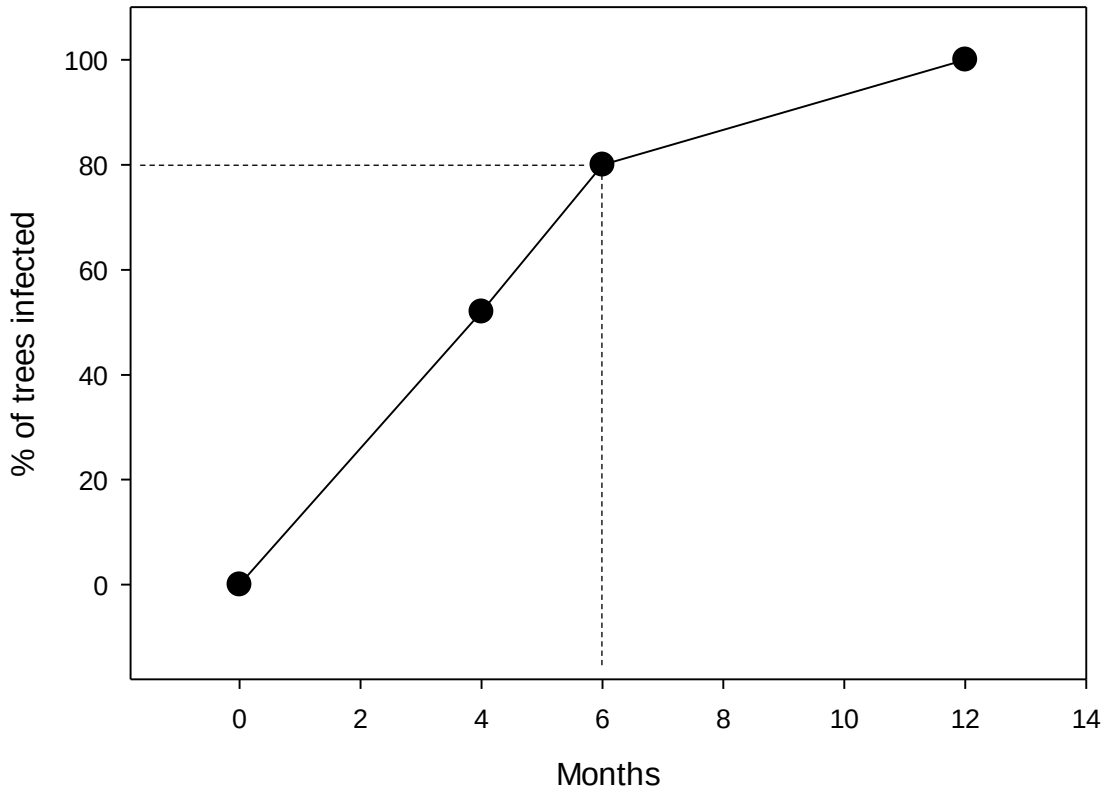
- Planted healthy, HLB-free
- They are not producing yet.

**Desired goals**

- Maintain trees productive and improve their health.
- **Improve fruit yield and quality.**

- Keep trees free from disease until they enter production age **or longer**.

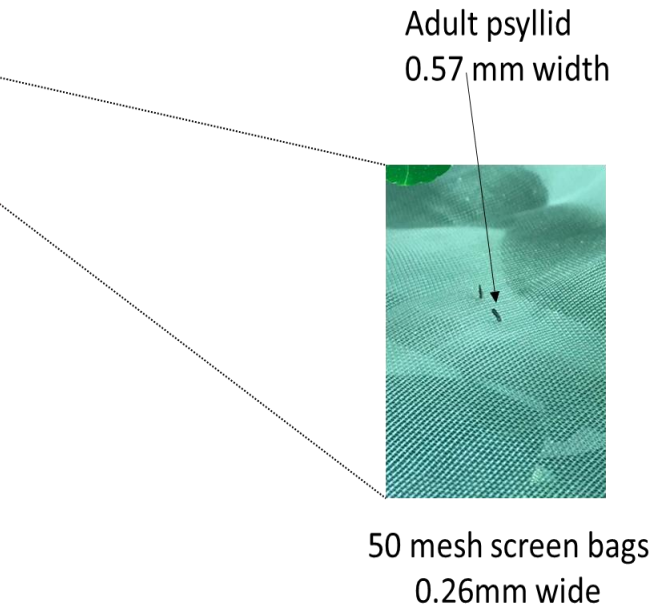
# The rate of HLB infection in a non-protected, newly planted citrus grove




In less than 6 months, most newly planted trees in a grove tested positive for HLB

Data from non-protected trees at SWFREC Immokalee

# Individual Protective Covers for **Young Trees**



Valencia trees on
Cleopatra rootstock

Trees exposed to infection

Feb 2018 | Feb 2020 | Aug 2020 | Feb 2021 | Feb 2022

**30 months** | **6 months** | **12 months**

Initial Planting

1st bloom

IPC removal

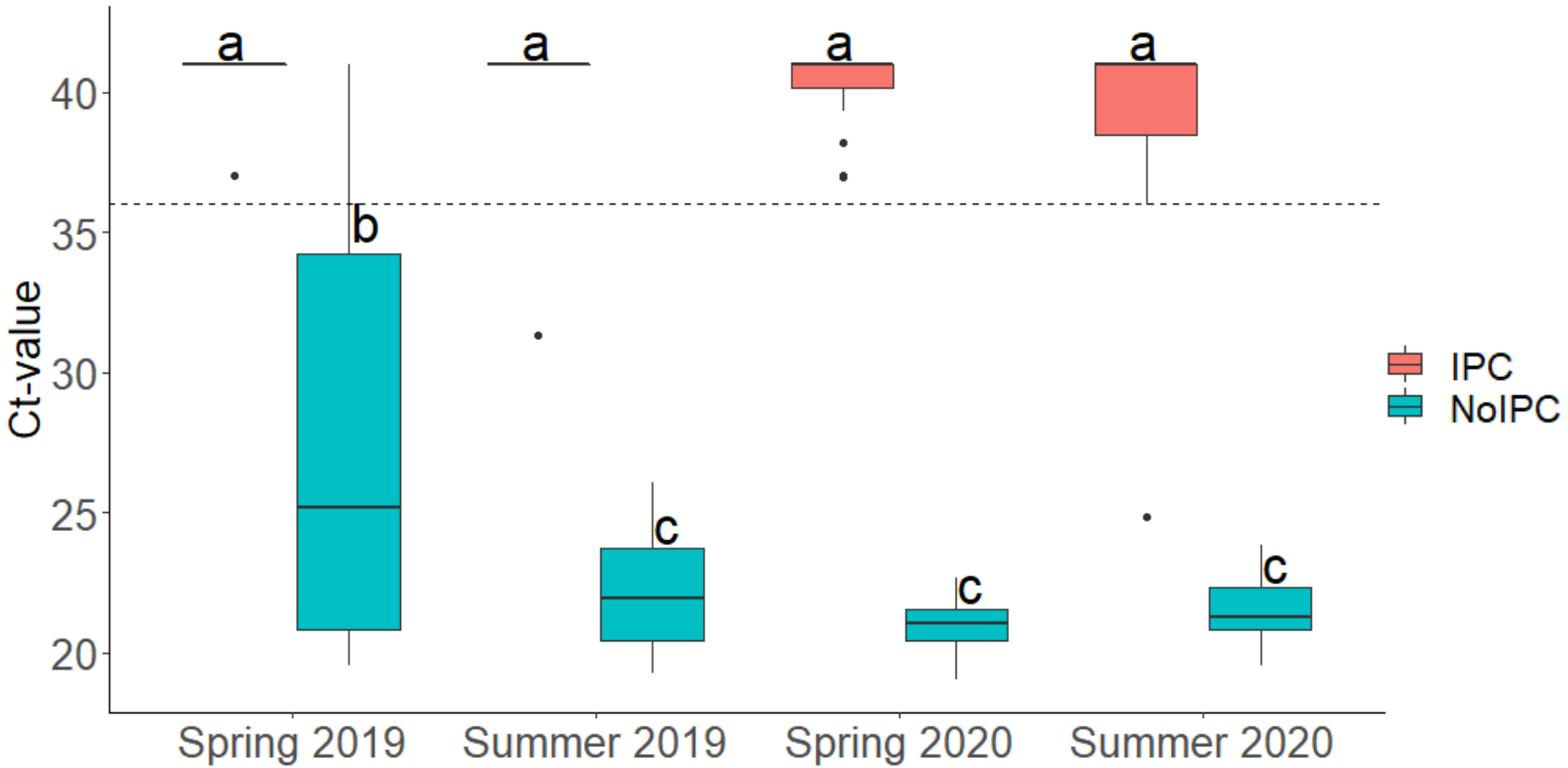
**1st fruit harvest**
New bloom

**2nd fruit harvest**
New bloom

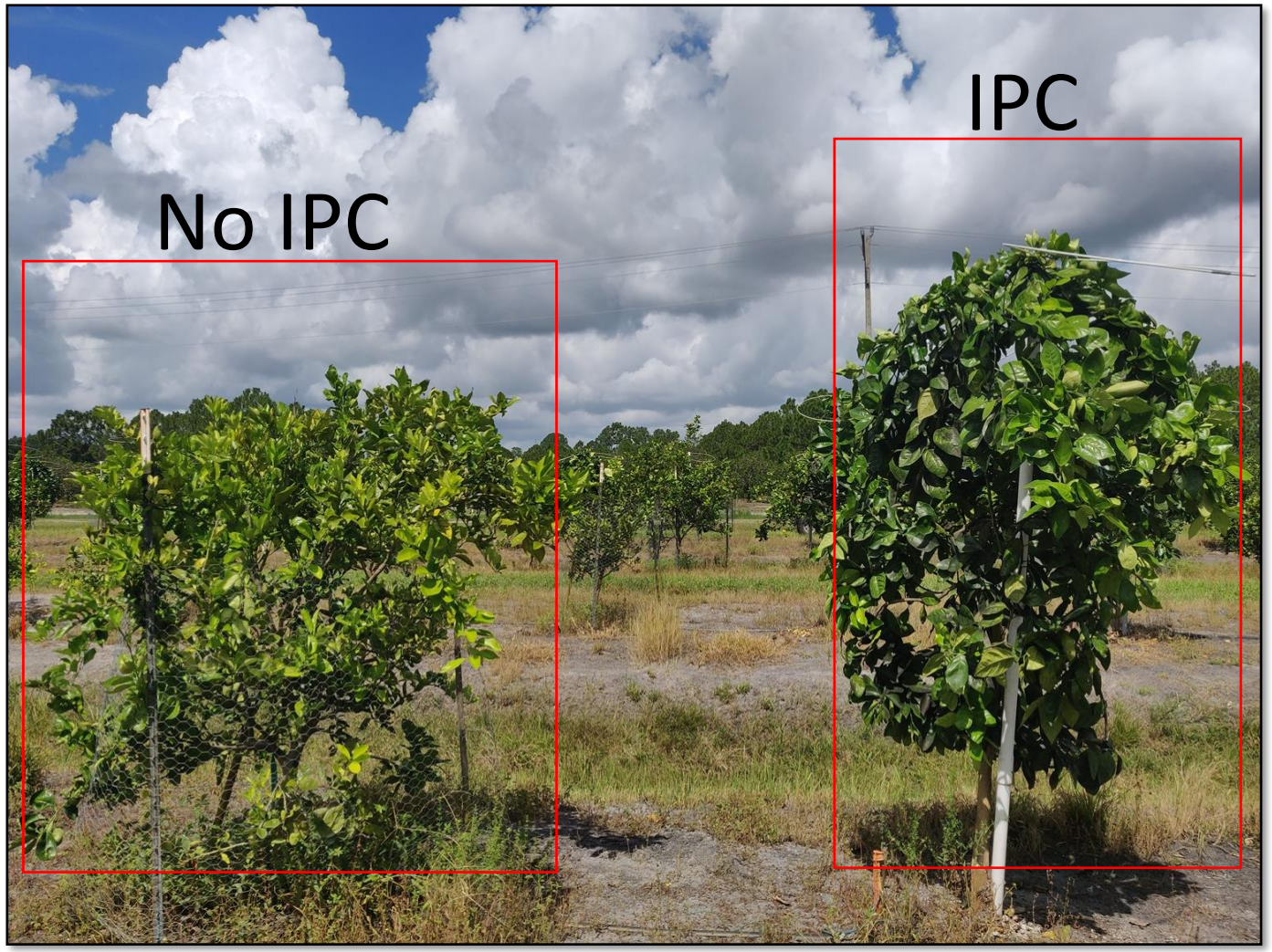
Fruit quality analysis

Fruit quality analysis

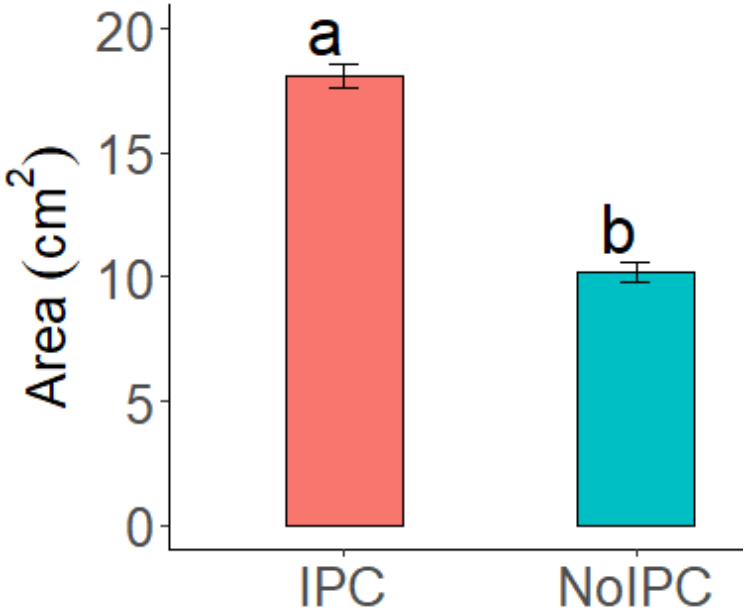
# IPCs prevented *C*Las infection



# Tree growth improved with IPCs



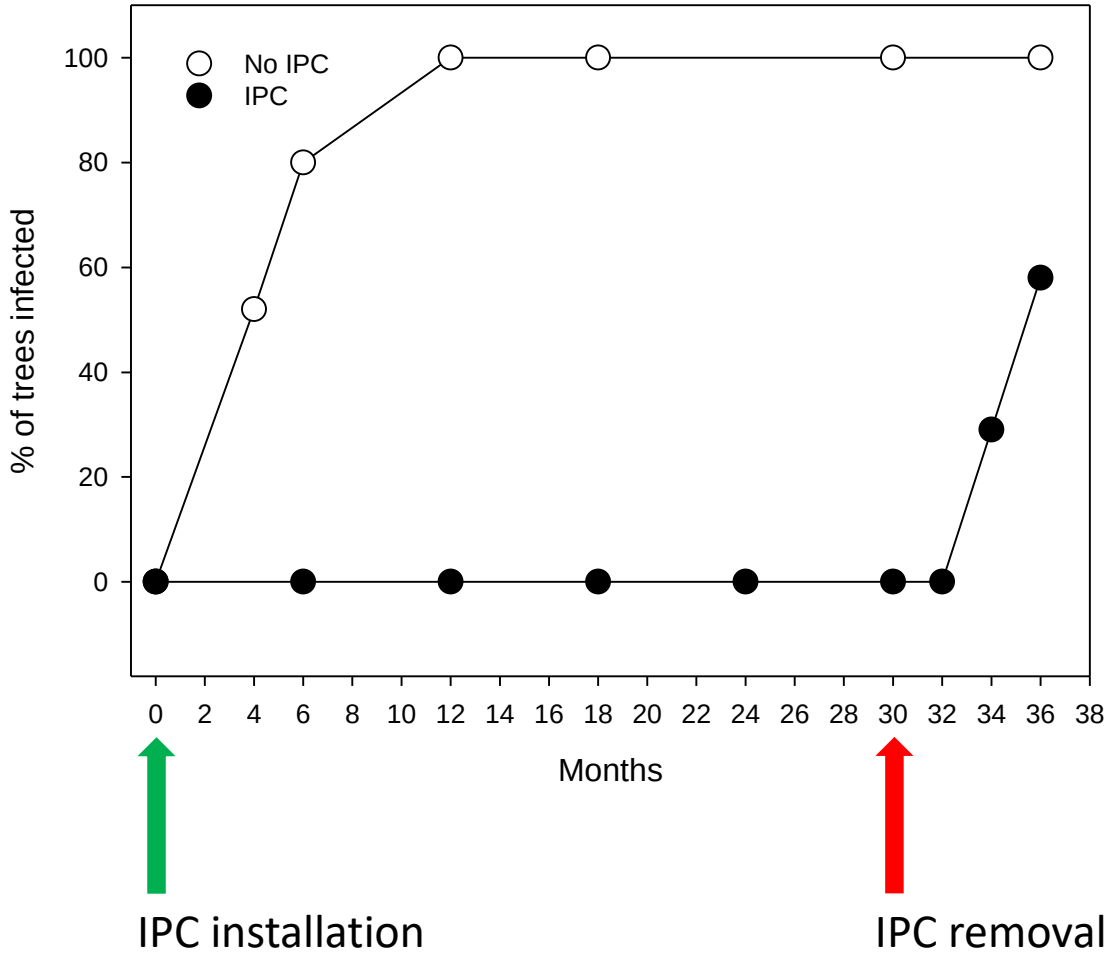

Trees with and without IPCs after IPC removal
(Summer 2020, 30 months after initial planting)




Individual leaf area
(Summer 2020)

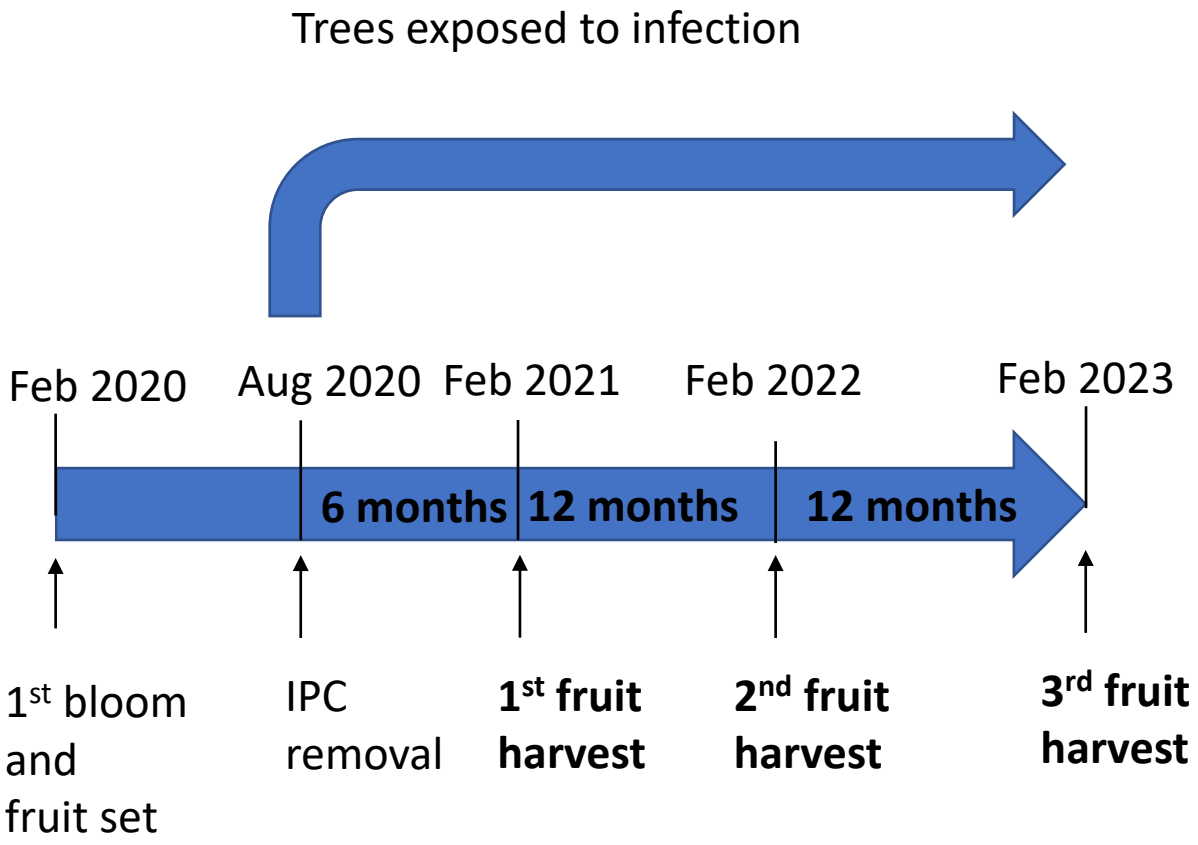
*(Pic credit: Susmita Gaire)*

# The rate of HLB infection after IPC removal



# August 2020


(Pic credit: Susmita Gaire)


Trees exposed to infection
Feb 2020
Aug 2020
Feb 2021
Feb 2022
Feb 2023
6 months
12 months
12 months
1st bloom and fruit set
IPC removal
1st fruit harvest
2nd fruit harvest
3rd fruit harvest


# Fruit quality was improved by IPCs

| Factor | 6 months after IPC removal **2020-2021 SEASON** Brix (%) | TA (%) | 18 months after IPC removal **2021-2022 SEASON** Brix (%) | TA (%) | 30 months after IPC removal **2022-2023 SEASON** Brix (%) | TA (%) |
|---|---|---|---|---|---|---|
| **No IPC** | 7.5 b | 0.6 | 7.0 b | 1.1 | 6.4b | 1.1 |
| **IPC** | **10.9 a** | 0.8 | **9.6 a** | 0.84 | **7.6a** | 0.9 |
| **P-value** | 0.009** * | 0.294 | 0.01* | 0.1 | 0.01* | 0.1 |

- **Young trees**

- Planted healthy, HLB-free
- They are not producing yet.

- **Mature trees**

- Already affected by HLB.
- Declining production.

- **Healthy fruit-bearing trees after IPC removal**

- Producing high quality fruit for 2 years
- Declining fruit quality as they get infected.

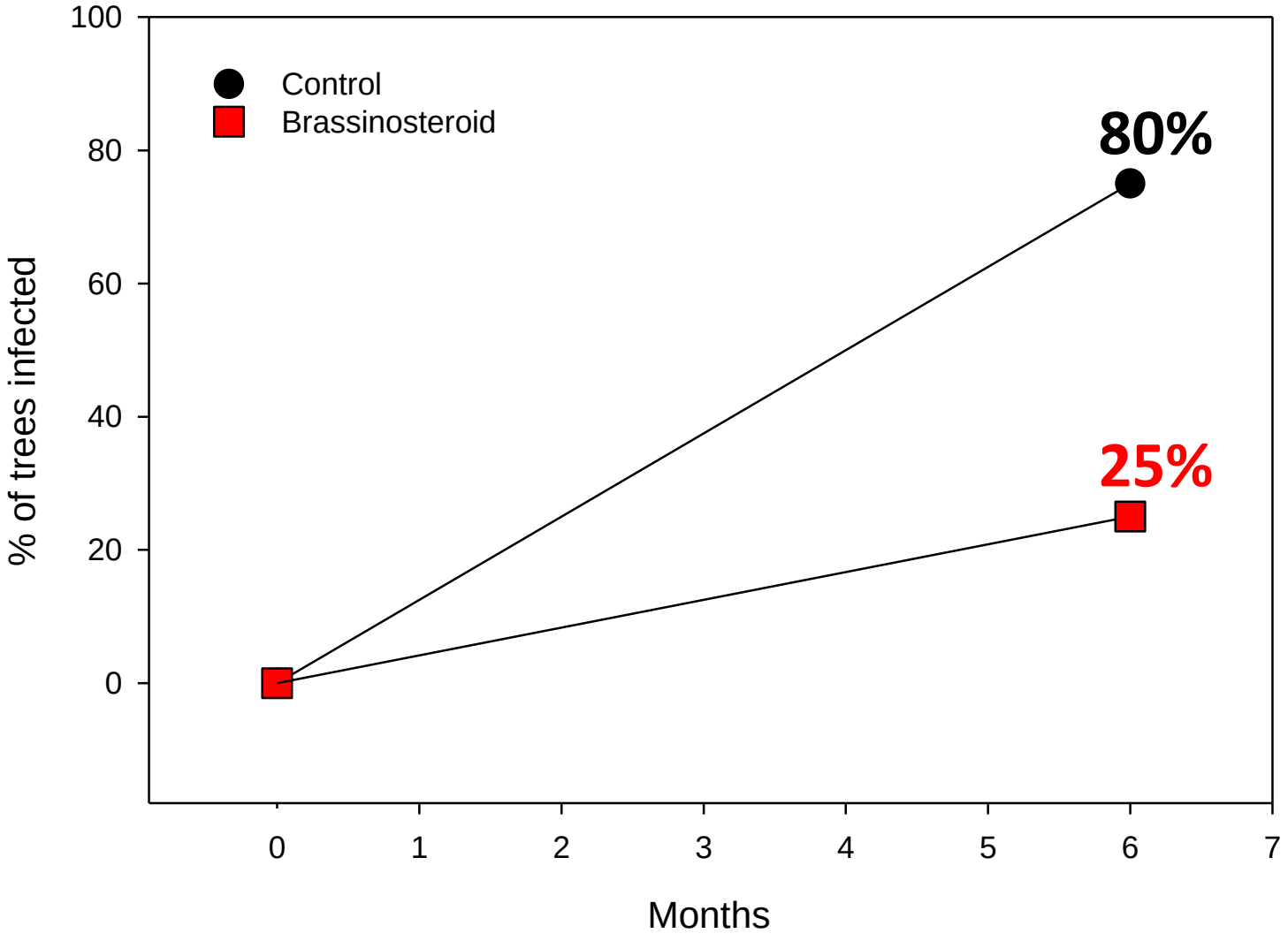
# CAN WE **MAINTAIN TREE HEALTH** OVER TIME? HOW ABOUT **FRUIT QUALITY**?

**Desired goals**

- **Keep trees free from disease** until they enter production age **or longer**.


- **Maintain trees productive** and improve their health.
- **Improve fruit yield and quality.**

**Brassinosteroid reduce rate of HLB infection**
in trees
non covered with IPCs



# Can we combine both systems?

IPC until tree starts to bear fruit

IPC removal

Br treatment
Once per month
@ 6,28 fl oz per 100 gallons water

# USDA-NIFA ECDRE
# Combining Individual Protective Covers (IPCs) and brassinosteroids to prolong health and improve fruit yield and quality in newly planted trees under HLB (Grant #2022-06727)


TEAM

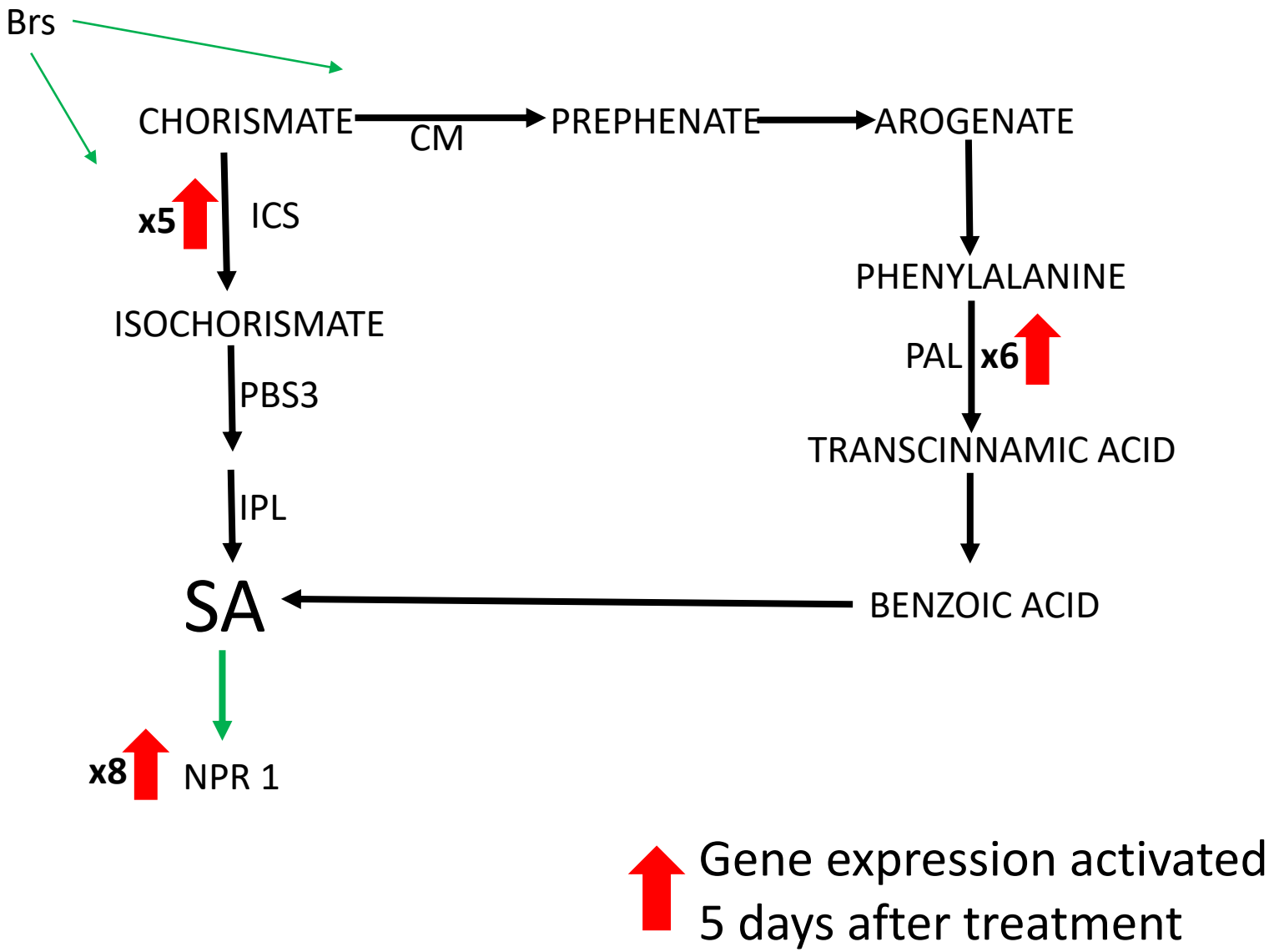
- Dr Fernando Alferez (PI-PD)
- Dr Ute Albrecht (CoPI)
- Dr Ozgur Batuman (CoPI)
- Dr Jawwad Qureshi (CoPI)

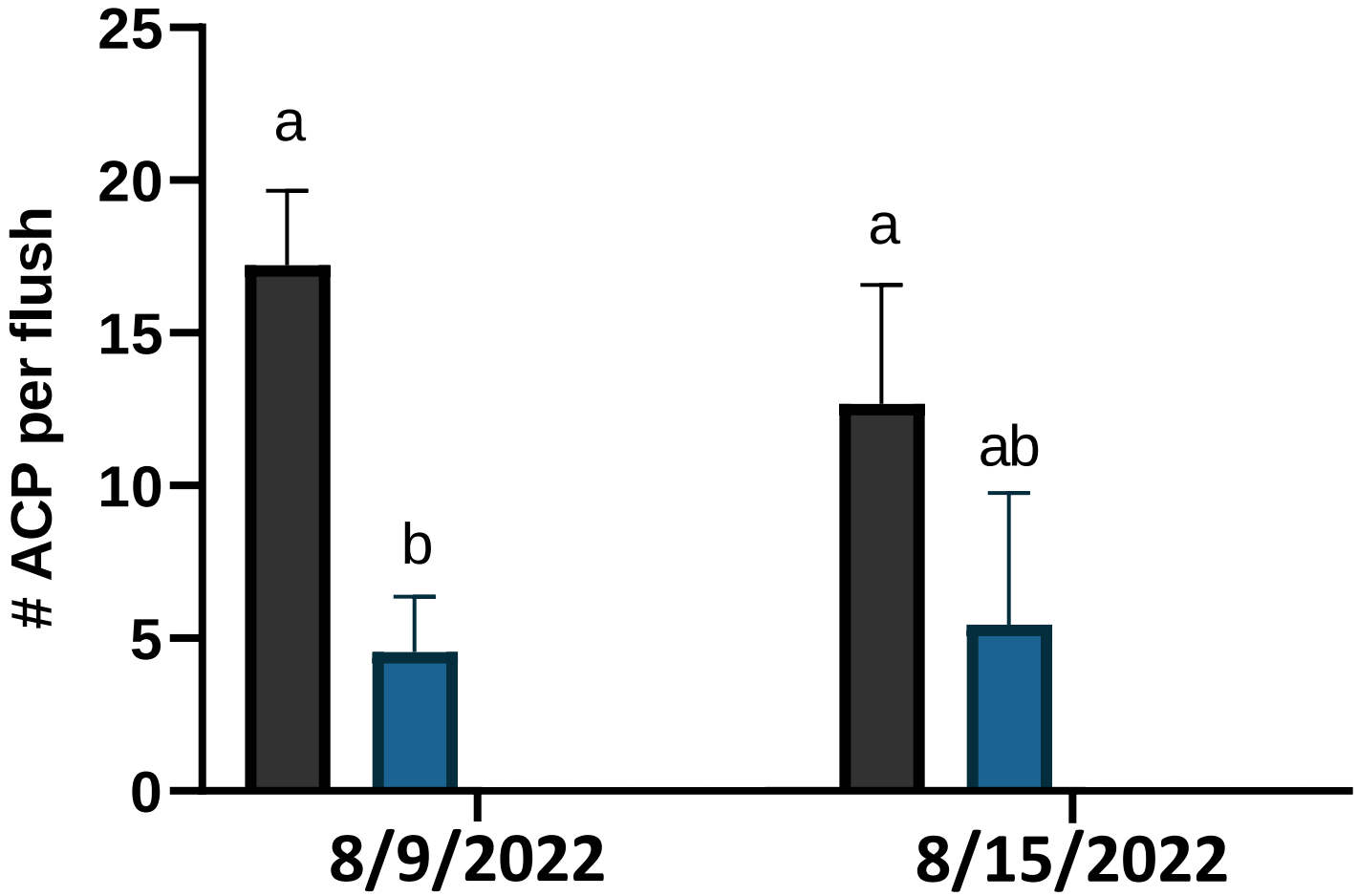
- Dr Saoussen Ben Abdallah (Postdoctoral associate)
- Ms student coming soon!

# Objectives

- 1. Study the effects of IPCs, Brs, and their combined use on tree physiology, fruit yield and quality, HLB incidence, and disease progression
- 2. Study the effects of Brs on the biology and behavior of the HLB vector (ACP) and on reducing incidence and pathogen transmission
- 3. Assess the effects of the combined system (IPC+Brs) on the incidence of other pests and diseases

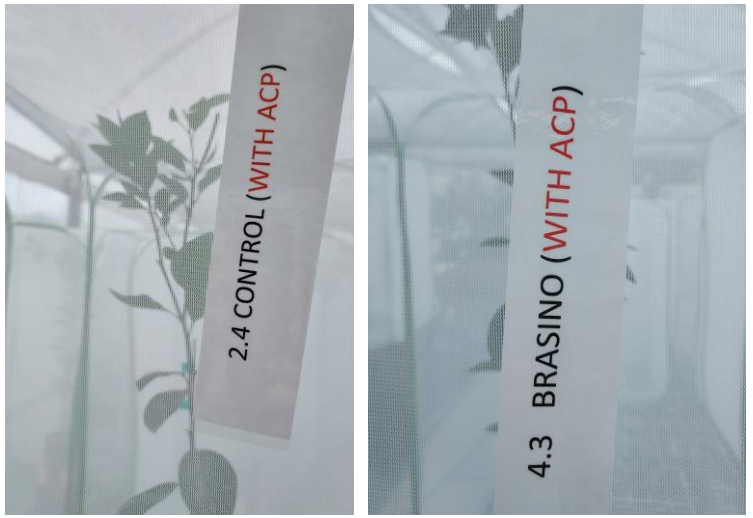

Deciphering the role of Brs
on citrus plant immunity

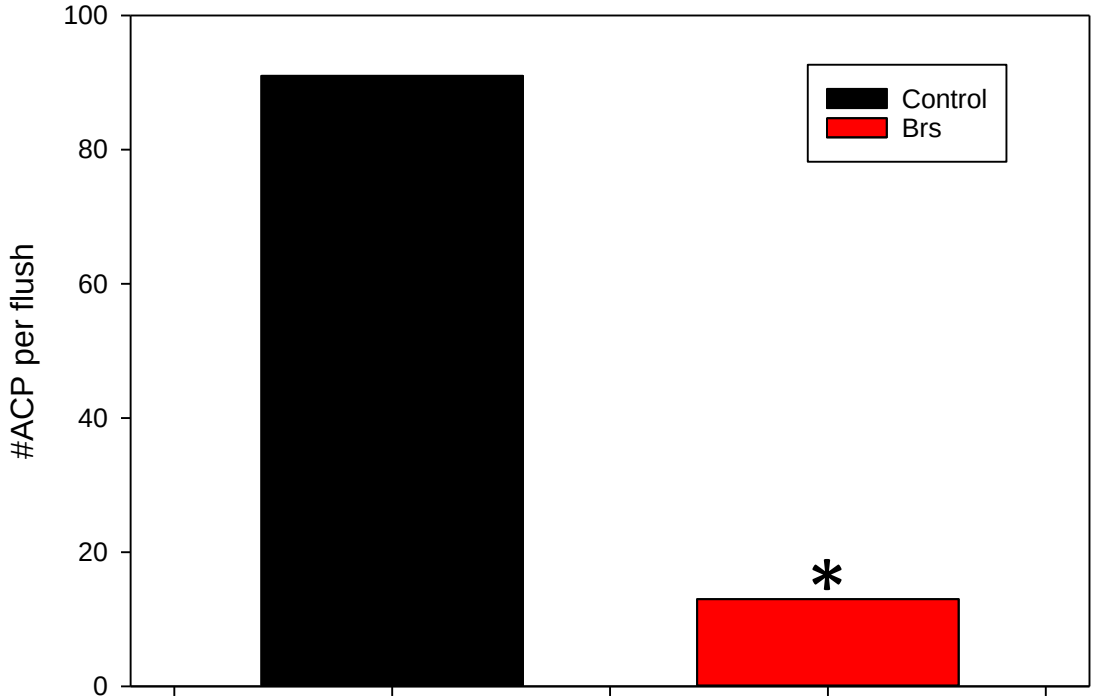

Brs
CHORISMATE
CM
PREPHENATE
AROGENATE
x5
ICS
PHENYLALANINE
ISOCHORISMATE
PAL
x6
PBS3
TRANSCINNAMIC ACID
IPL
SA
BENZOIC ACID
x8
NPR 1
Gene expression activated
5 days after treatment


# ACP per flush
25
20
15
10
5
0
a
b
a
ab
8/9/2022
8/15/2022

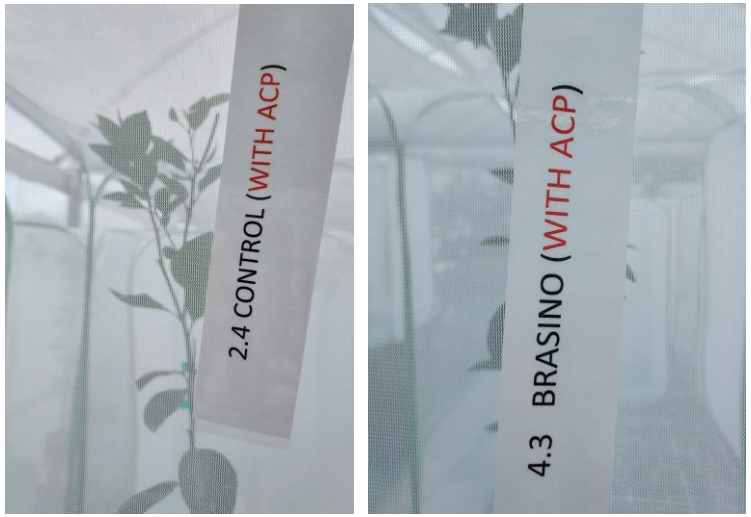
2 (Control)

4 (B)

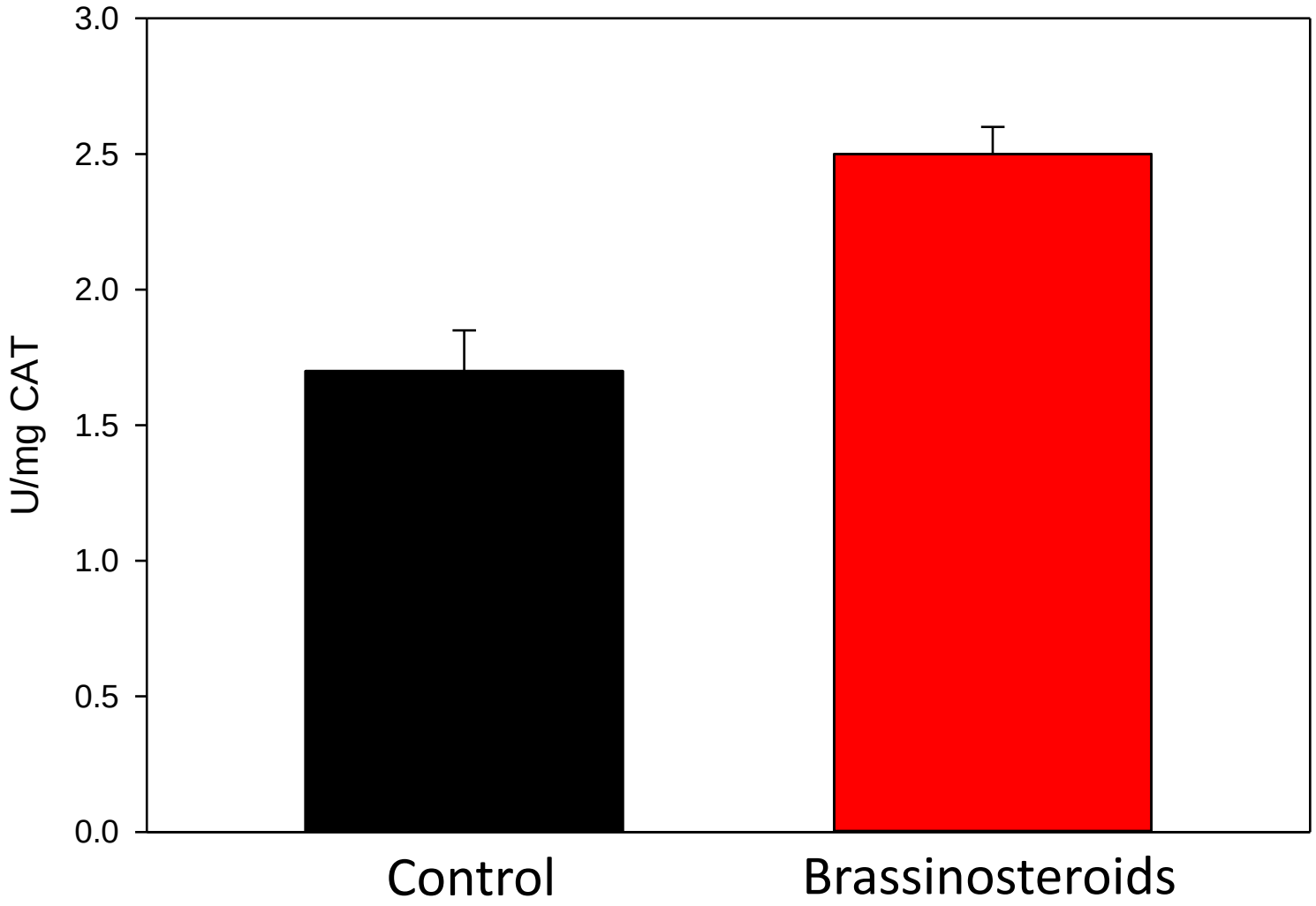

2.4 CONTROL (WITH ACP)
4.3 BRASINO (WITH ACP)

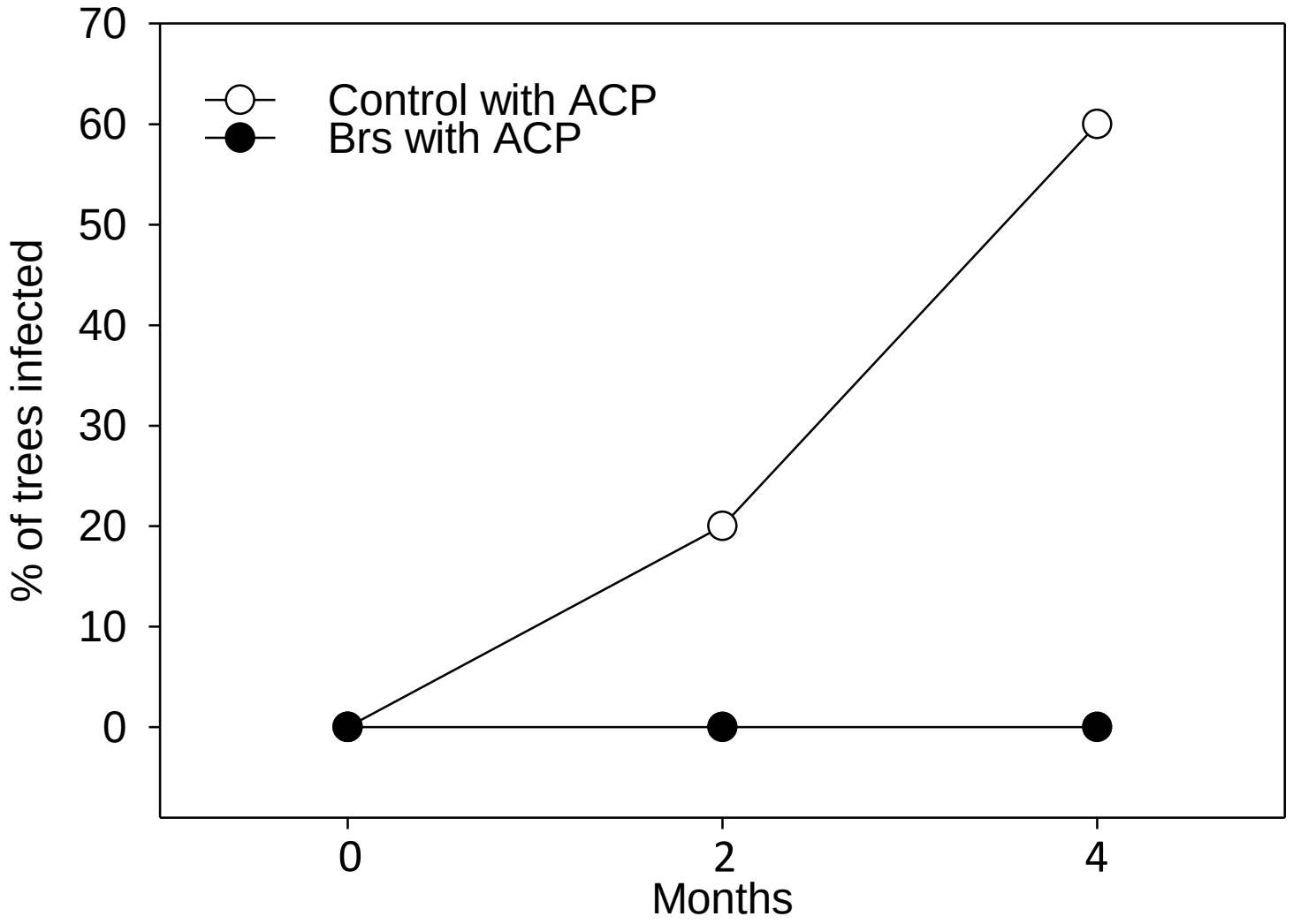



After 6 weeks



# ROS Detoxification is improved




70
60
50
40
30
20
10
0
% of trees infected
Control with ACP
Brs with ACP
0
2
4
Months

# Brassinosteroid treatment after IPC removal is a feasible possibility

- The trees are healthy and still young at that time
- Our data suggest that Br treatment may still be effective in protecting the trees for more than 1 month after application (this would allow to reduce number of applications)
- We are now working to know if Brs will improve fruit quality further and avoid the decline in Brix over time


- Dr Ute Albrecht
- Dr Ozgur Batuman
- Dr Jawwad Qureshi
- Dr Mongi Zekri