Alianza

Bioversity International

CIAT
Centro Internacional de Agricultura Tropical
Desde 1967 Ciencia para cultivar el cambio

IHC2022, date (19 August 2022)
International symposium on banana: **Celebrating banana organic production**

Tools for the management of the banana bunchy top disease in small holder systems

Aman B. Omondi

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Partners

ISABU – Institut des Sciences Agronomiques du Burundi

IITA – Research to Nourish Africa

Ministry of Agriculture

UAK – Université d'Agriculture de Kétou

cirad

Funding

The University of Queensland – Australia

CGIAR – Research Program on Roots, Tubers and Bananas

Team

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Faride Athindehou

Chabi Modeste

Adjalla Christian

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Musa spp : Banana and plantain

Musa-related species:
(PINTEREST, Author unknown)

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Banana Bunchy Top Disease

BBTD vector – Banana aphid

Bunchy-top morphology

Early symptoms of BBTD

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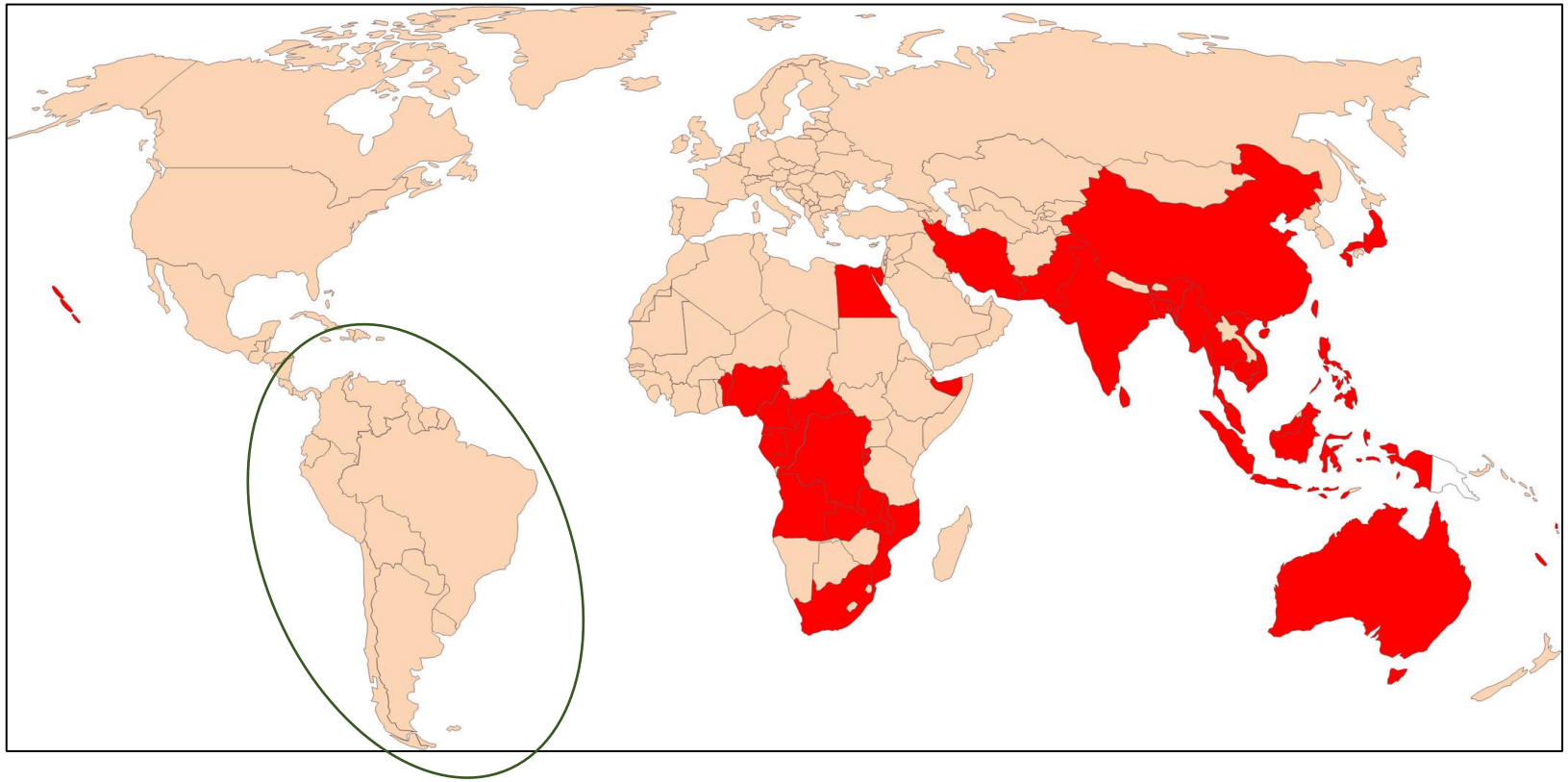
Bunchy Top Disease in Africa (worldwide)



Rapidly spreading in Africa

- Spreading in banana/plantain area
- Three new country reports in 2020/2021
- Rapid reduction of productivity
- Loss of clean seed in informal sources
- Loss of regional seed business

Jekayinoluwa *et al.*, 2020

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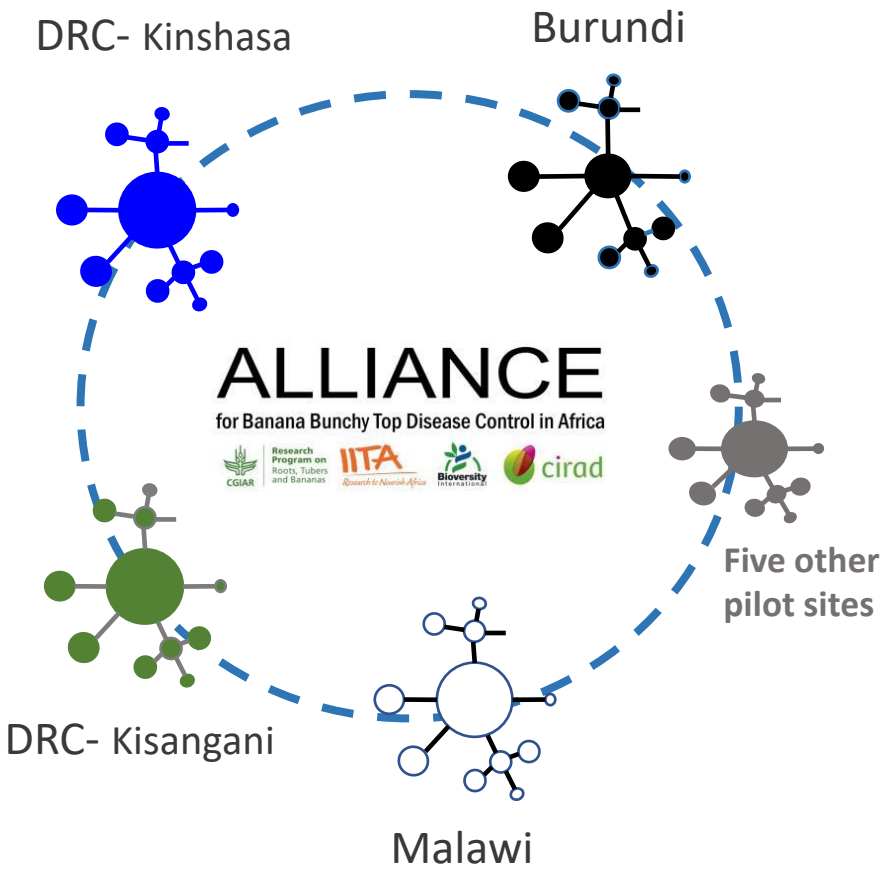
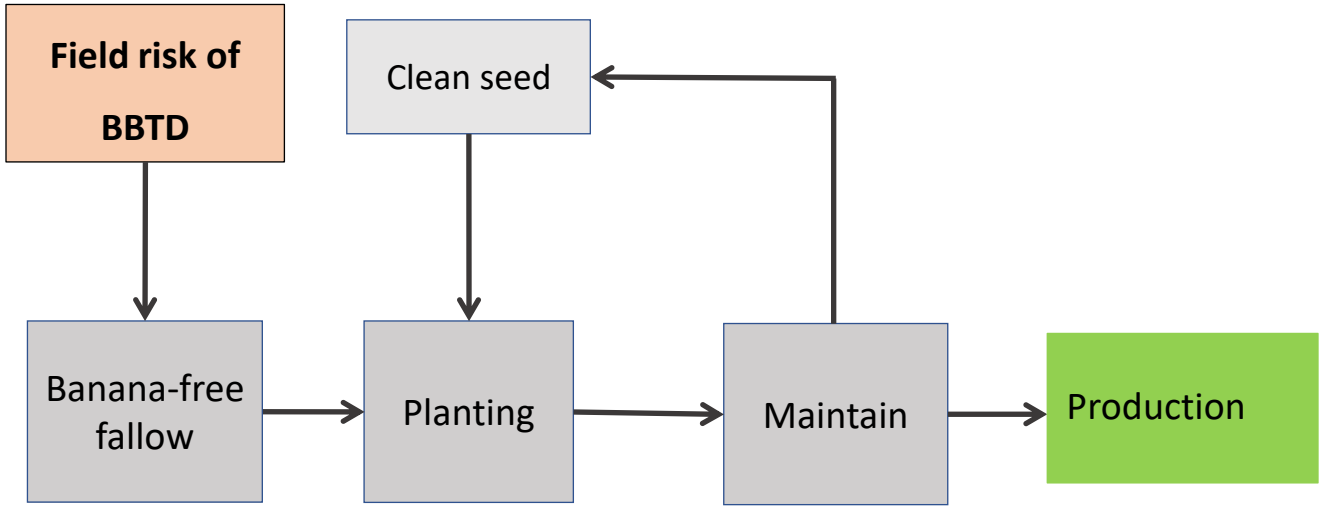
The Learning Alliance (2013 – 2021)



The learning Alliance for BBTD control



The community recovery approaches to recovery

Community approaches

- What is the priority?
- How can control be made more efficient?
- How can control be made more acceptable?
- Group dynamics, gender, inheritance, seed systems?

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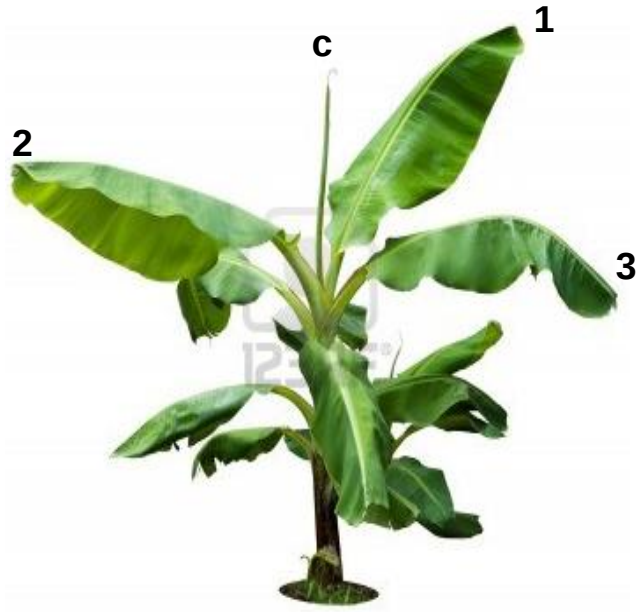
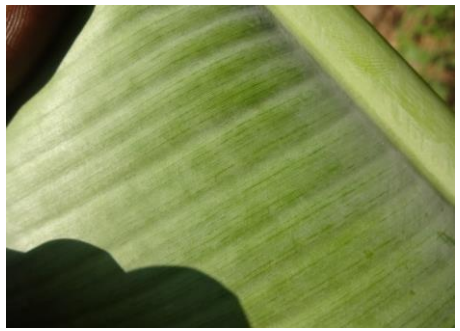
BBTD detection - symptoms



Leaf reference and detection of BBTD



'Morse-code' streaks

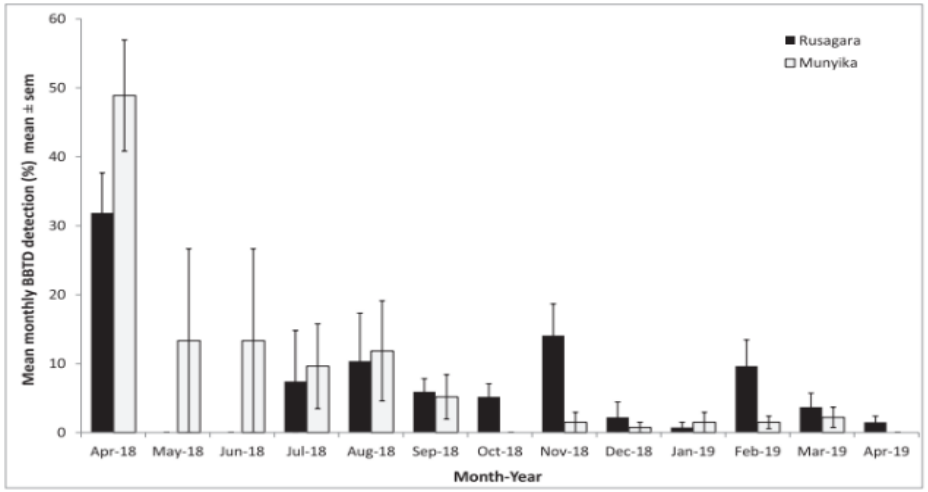
'J-hooks symptom'

Marginal chlorosis

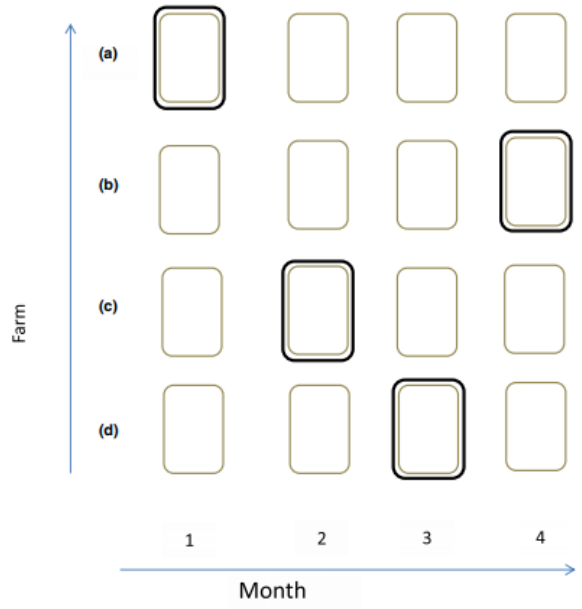
Progressive dwarfing – **bunchy top**

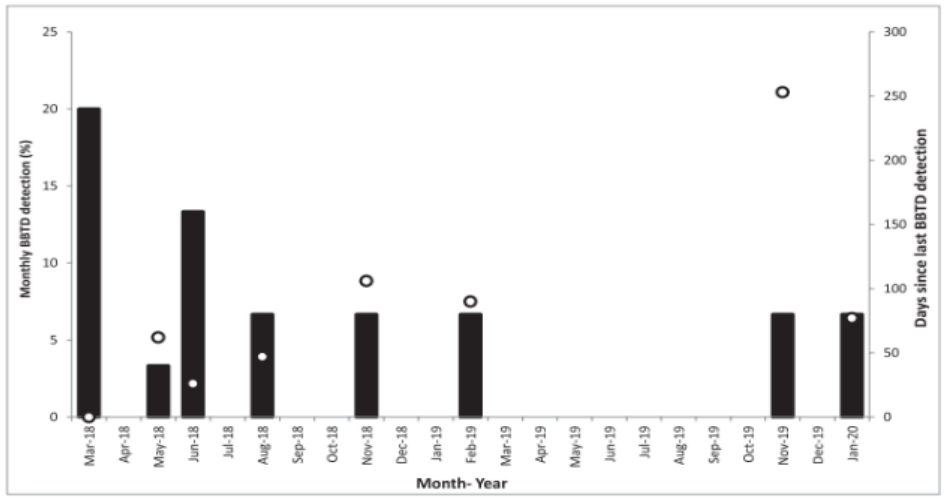
Allen 1987

Detection: Scouting and rogueing



Rapid reduction of disease pressure, need for plant elimination





Declining frequency of new disease detection with time

Omondi et al (2020), *Plant Pathology*

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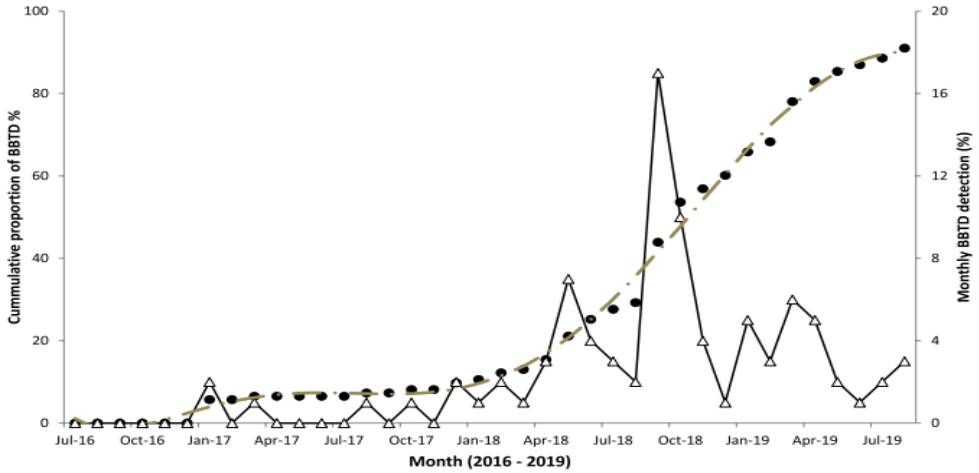
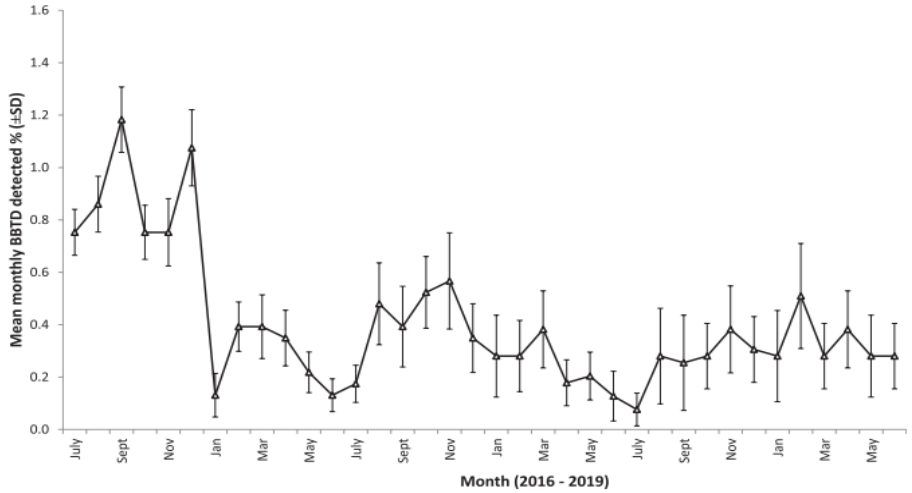
Rogueing: Fidelity and consistency

Lower frequency, lowlands, higher disease pressure > 60% BBTD



Non managed garden: 50% in Y2, 90% Y3, seasonal trends

Highland, high frequency, coordination between gardens



Managed gardens: declining BBTD levels, <1%

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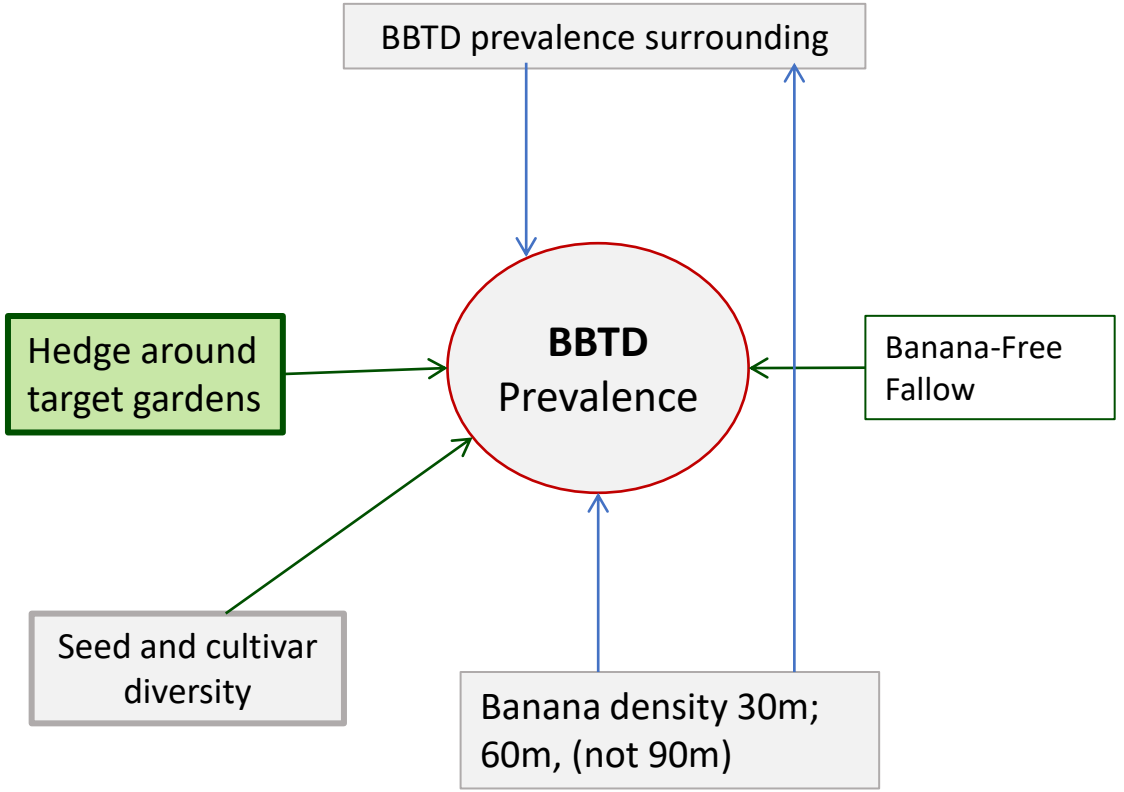
Context: Spatial disease risk assessment

Approach

- UAV-based mapping canopy coverage and area
- Ground assessment of canopy and crop management
- Focus: Garden and 100m buffer around
- Association of disease incidence (disease event)

Backyard gardens

Open field gardens



Key correlates to disease prevalence

Dato *et al*, (2021) *Plos One*

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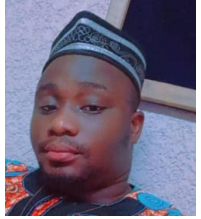
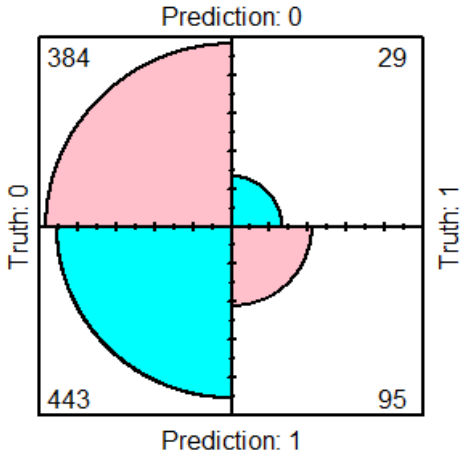
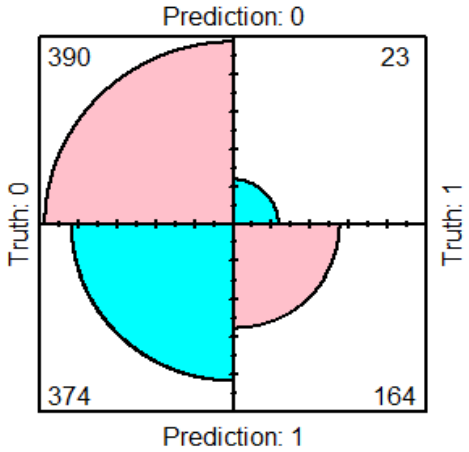
AI-supported BBTD detection

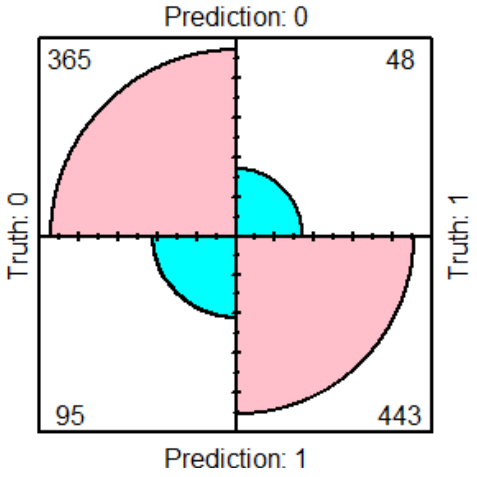




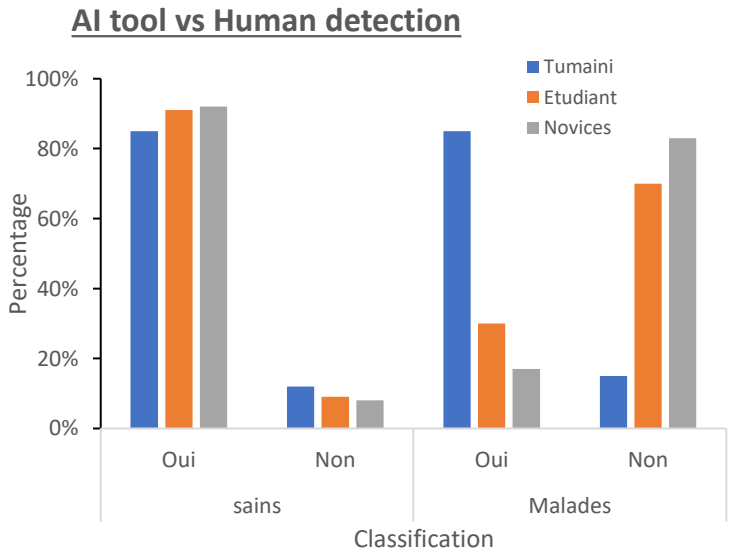
A: Expert vs novice



B: Expert vs Student



C: Expert vs TUMAINI tool



Consistency of TUMAINI APP

Variable		Probability	Interpretation
Distance 3m, 6m		P≤ 0.476 (ns)	Ai detection does not vary by distance
Camera 4MP, 16 MP, 48 MP		P≤ 0.001	Capacity of device significantly influences detection by TUMAINI
Time window Morning/ Afternoon	4 MP	P≤ 0.002	Light significantly influences the detection at 4MP
	16 MP	P≤ 0.298 (ns)	Brightness (time) did not significantly influence detection using 16 MP or 48 MP camera
	48 MP	P≤ 0.478 (ns)	

Selveraj *et al.* (2019): TUMAINI APP

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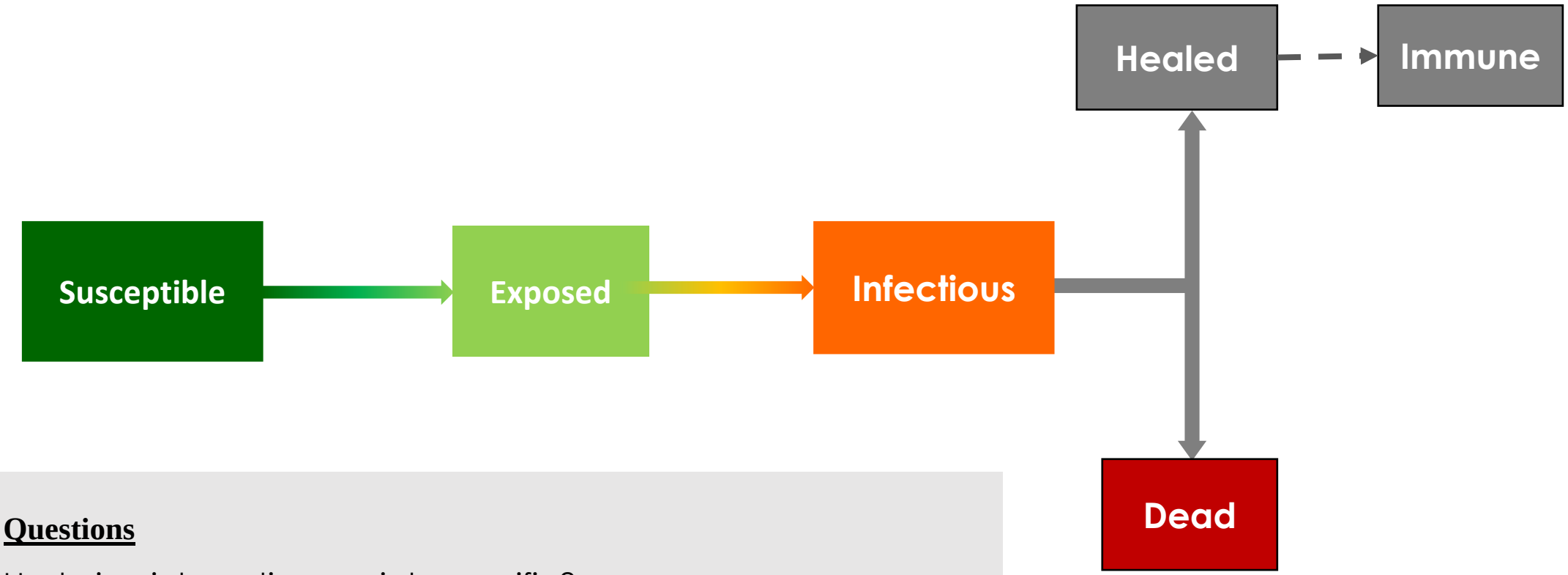
Disease detection, epidemiology



Questions

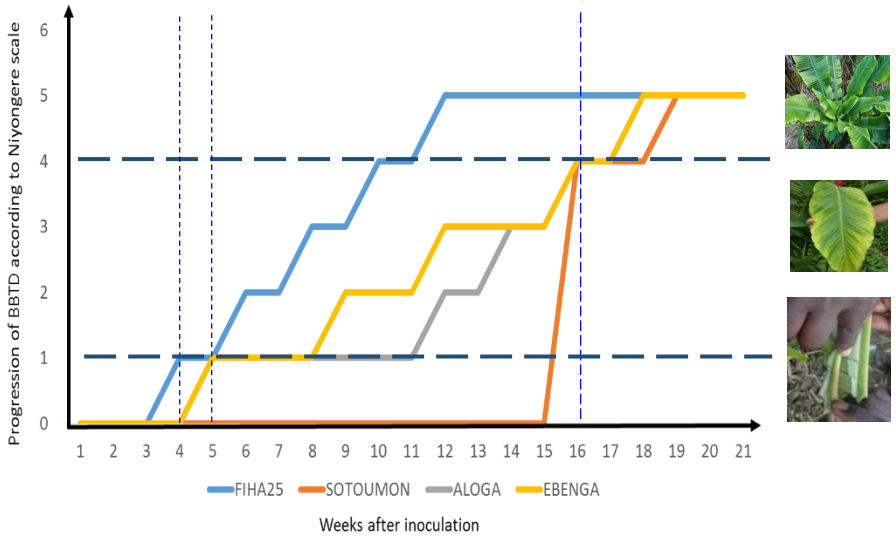
Host-virus interaction, variety specific?

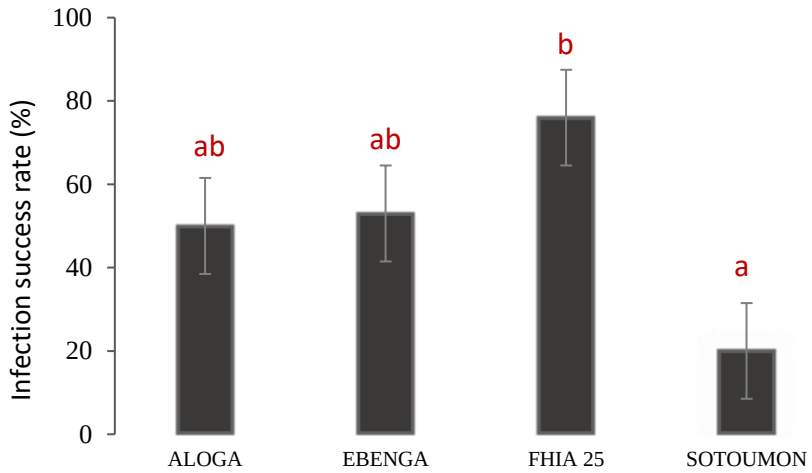
How does infectiousness relate with symptom expression?

How would these affect rogueing practice?

Jeger *et al.*, 2015; Chabi *et al.*, (*in preparation*)

Results: Diversity in expression of BBTD





Observations

- Variety-specific symptom expression
- Asymptomatic plants were generally PCR –ve
- Varietal specific symptom progression
- Varietal differences in infection success and symptom expression
- *Soutoumon* missed **typical early symptoms**
- Only symptomatic plants were **infectious**

Chabi *et al.*, (*in preparation*)

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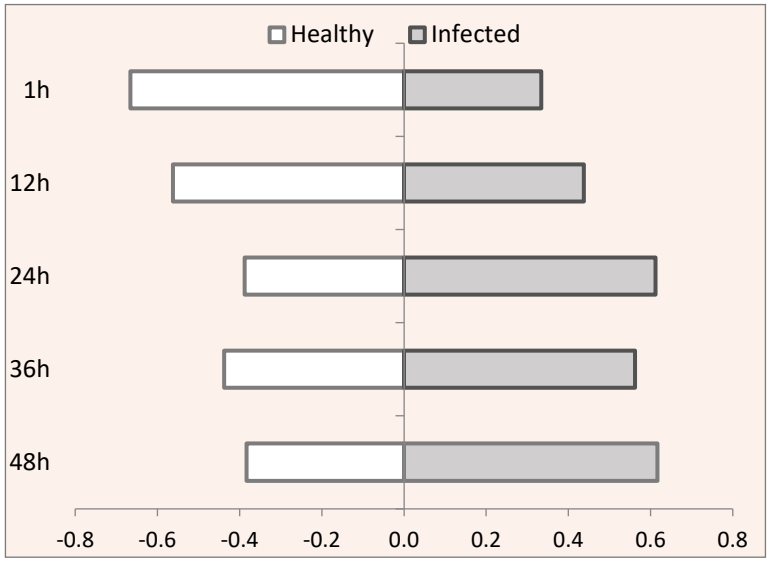
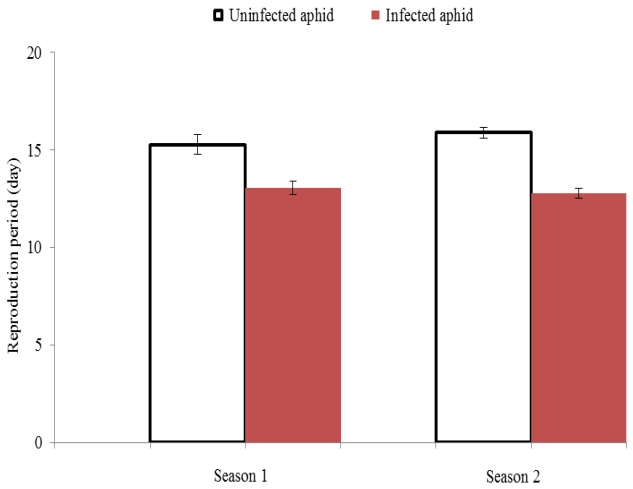
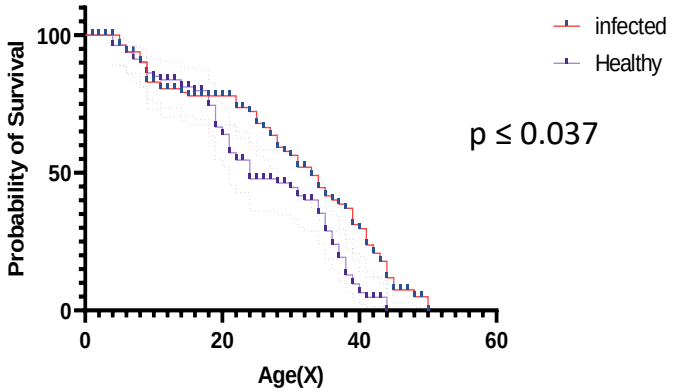
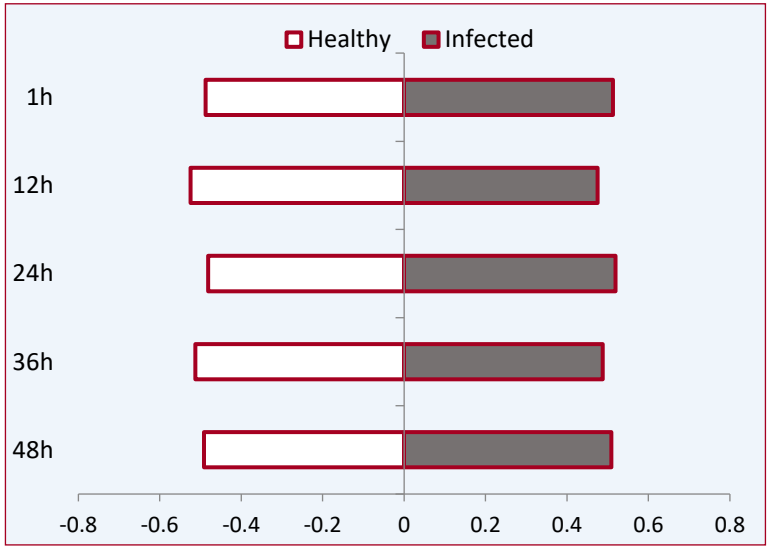
Relaxed roguing: Influence of infected plants



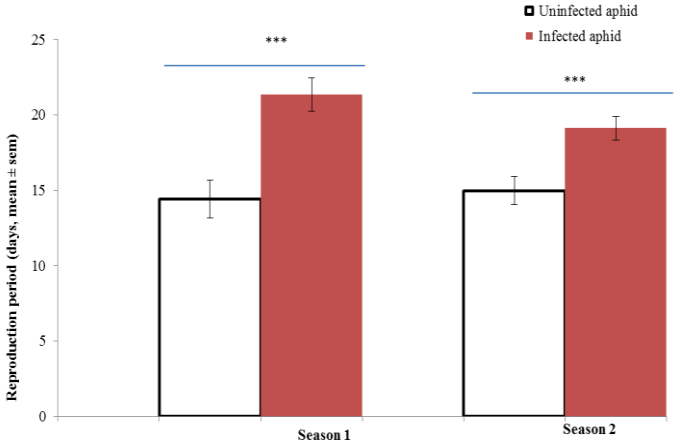




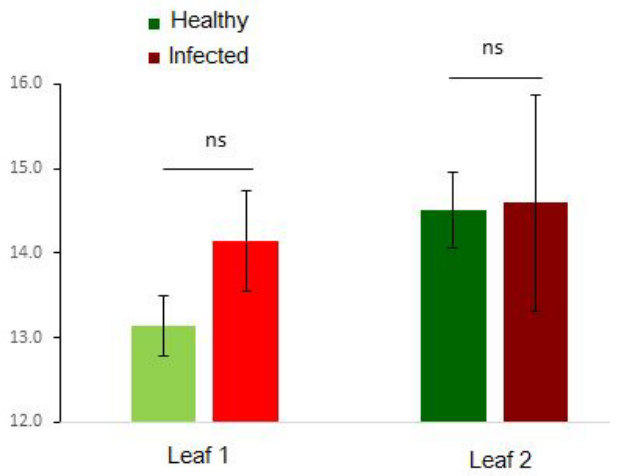
Fitness advantages of vectors reared on infected banana, no nutritional difference detected



Disease and vector preference



Increased vector fecundity on diseased plants



Crude protein, Lipid content
Not significantly different

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Reflections

- **Modelling** BBTV epidemiology: approaches to effective BBTD management
- **Cropping mixtures** could augment BBTD control approaches to facilitate management.
  - support natural enemies of vectors,
  - reduced dispersal of vectors
- **Seasonal variation** on infection risk and expression
- **Scouting protocols**, detection accuracy and fidelity
- **Delayed roguing/ asymptomatic hosts** could influence the scale of dispersal of disease and aphids: the production of alate generations
- Refining scouting tools to supplement inexperienced human detection.

Thank you !

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