

Soil health research strategies for managing Fusarium wilt of banana in Brazil

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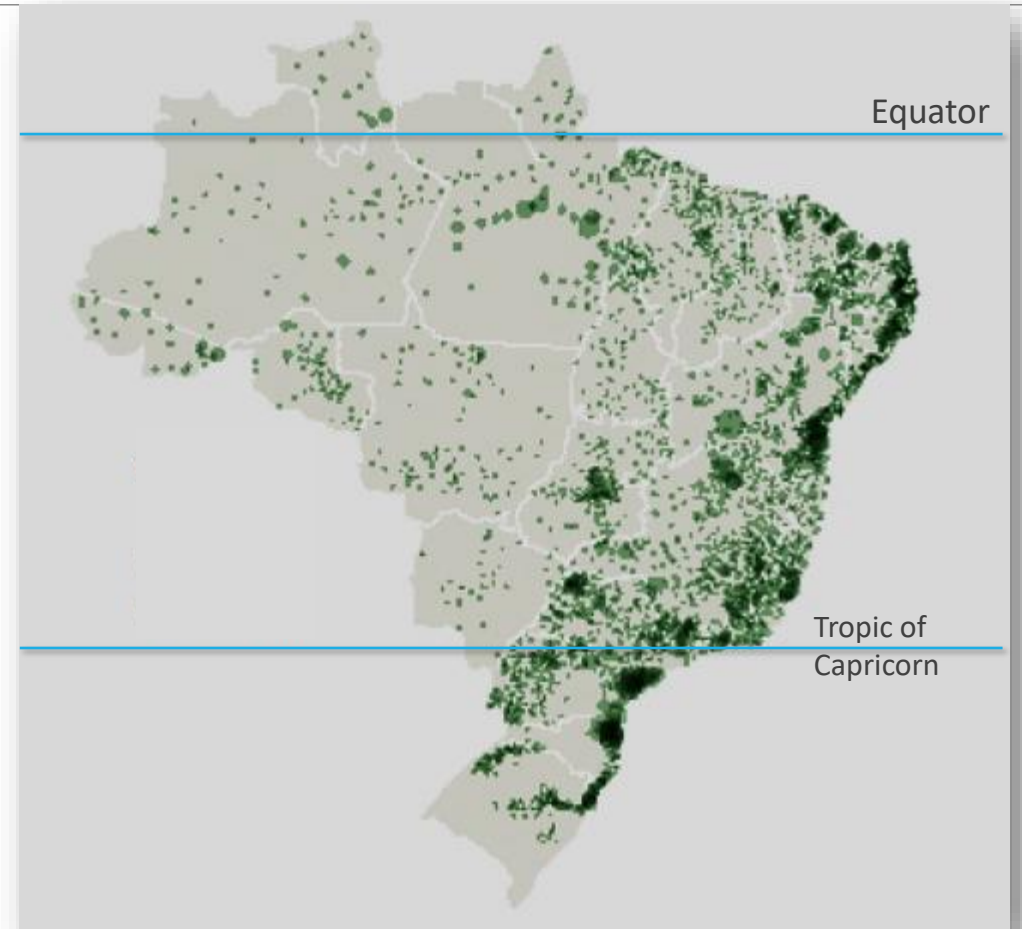
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Miguel Dita – Alliance of Bioversity International and CIAT, Colombia

Banana in Brazil

- 🍌 500,000 hectares
- 🍌 7 million t/year
 - ➡ 6% of the world's bananas
- 🍌 Exports 0.3% of world trade



Introduction

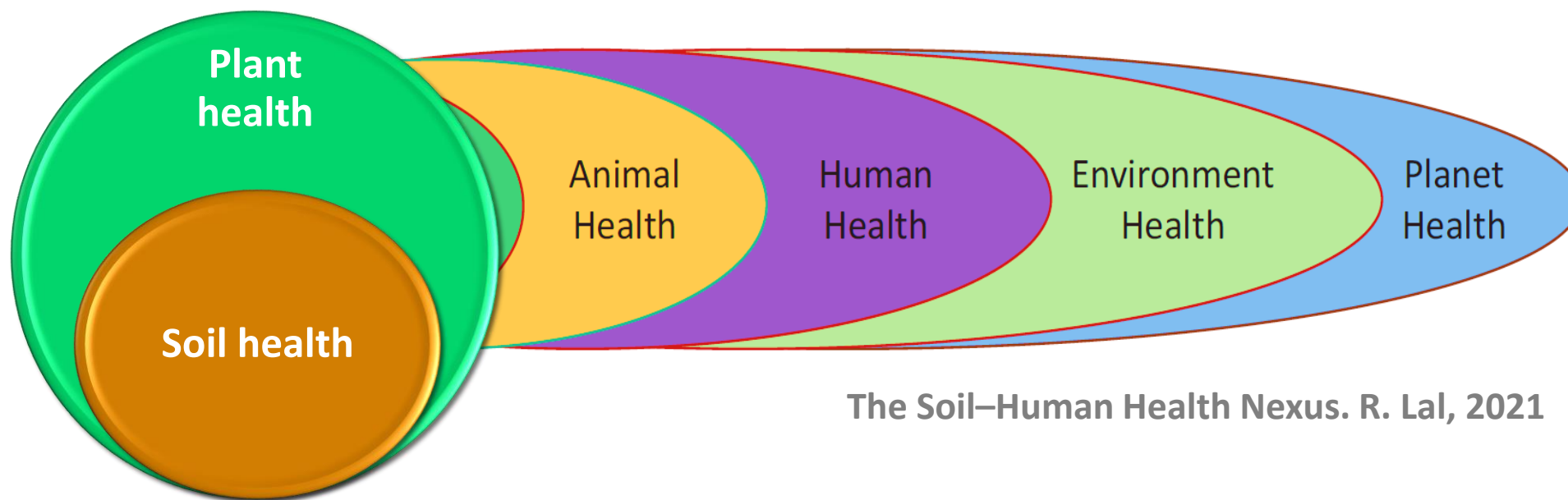
- Fusarium wilt is the major disease of banana in Brazil
- Race 1
 - ‘Maçã’ (*Silk*, AAB)
 - ‘Pacovan’ (AAB)
 - ‘Prata’ and ‘Prata anã’ (*Pome*, AAB)
- Tropical Race 4



LAI Teixeira, 2018

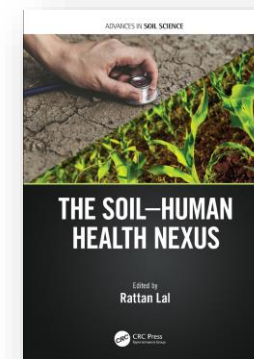
Introduction

- Can plant health be impacted by soil health?



The Soil–Human Health Nexus. R. Lal, 2021

One health concept: the health of soils, plants, animals, people and the environment is one and indivisible.



Soil Management & Fusarium wilt of banana

- Edaphic conditions
 - ↳ Driving factor to speed up or suppress FWB epidemics
- Almost only the plant's nutritional requirements shape soil management

Soil Management → soil health

Soil health → plant health

Soil health research strategies for managing Fusarium wilt of banana in Brazil

- Our research approaches
 1. Identify potential biotic and abiotic soil predisposing factors associated with FWB
 2. Create contrasting environments by managing soil health factors to evaluate FWB

Biotic and abiotic soil predisposing factors associated with FWB

- Identification and description of the main areas affected by FWB in São Paulo, Brazil

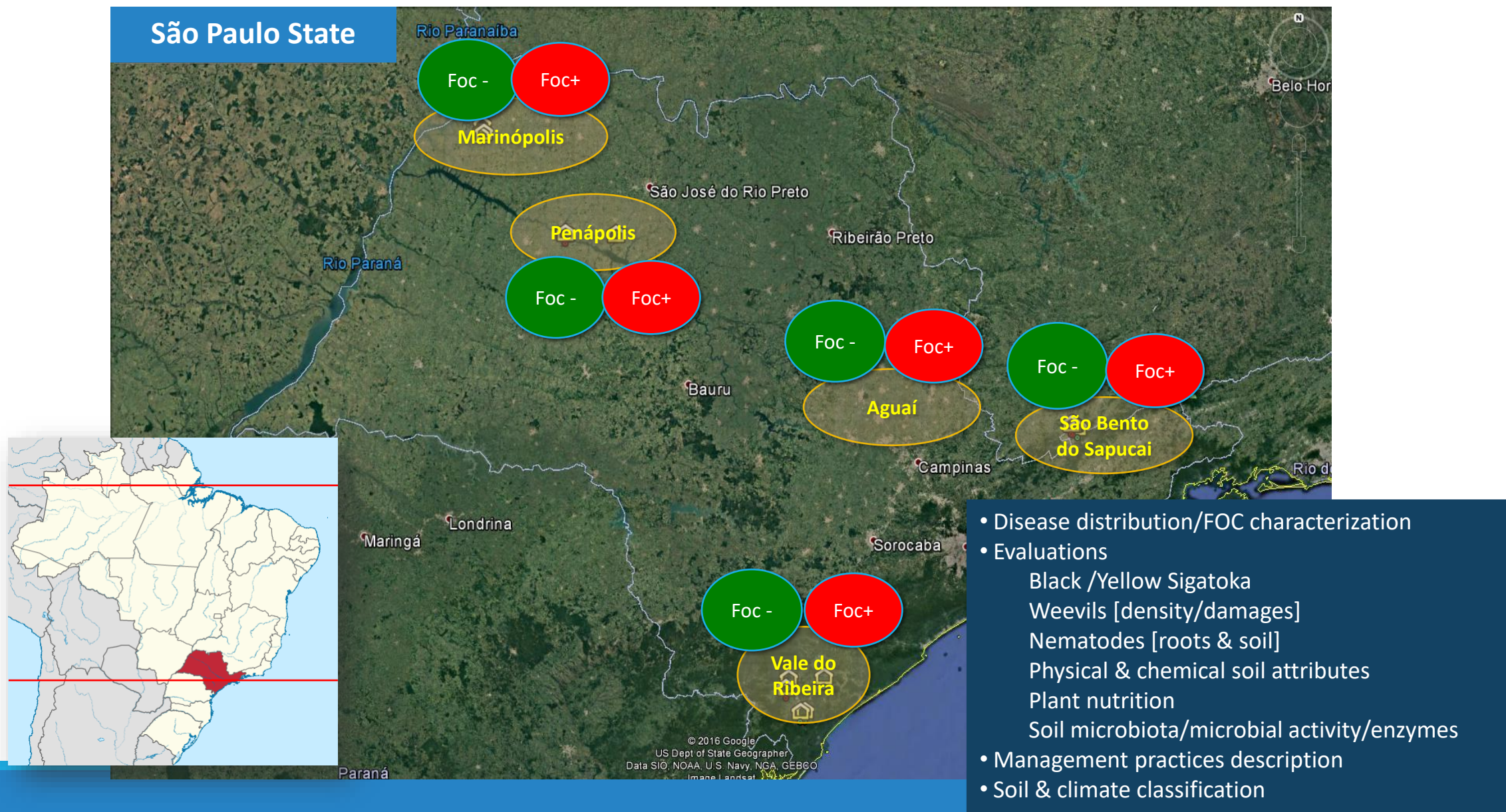


Two surveys in production areas

Relate plant health to biotic and abiotic factors



Soil attributes & FWB



- Eldorado Farm at Vale do Ribeira



- Foc-infested (Foc+) and healthy (Foc-) areas



Mosaic of drone images; base map: GoogleEarth. Teixeira, 2022.

Soil attributes & FWB

- Collecting rhizospheric soil → DNA extraction



- Collecting FOC samples → Characterization of isolates



- Measuring root penetration resistance



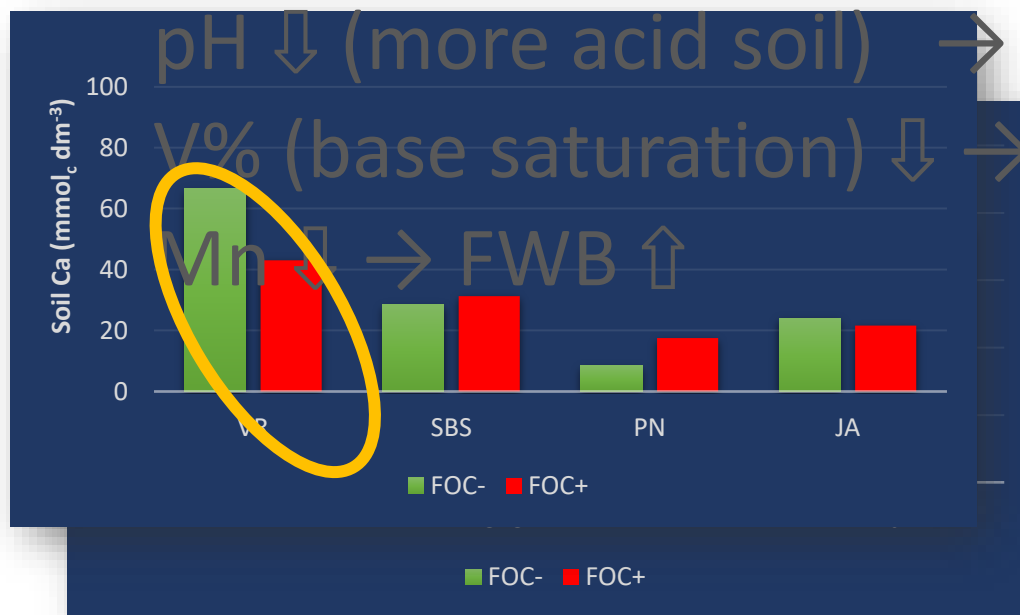
- Collecting soil samples → chemical attributes



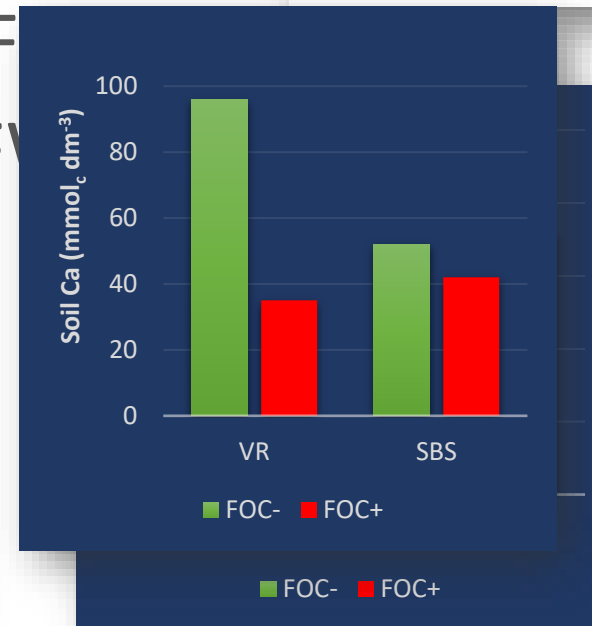
Soil & FWB - results

- Cavendish and 'Prata'

Ca ↓ → FWB ↑



Survey 1



Survey 2

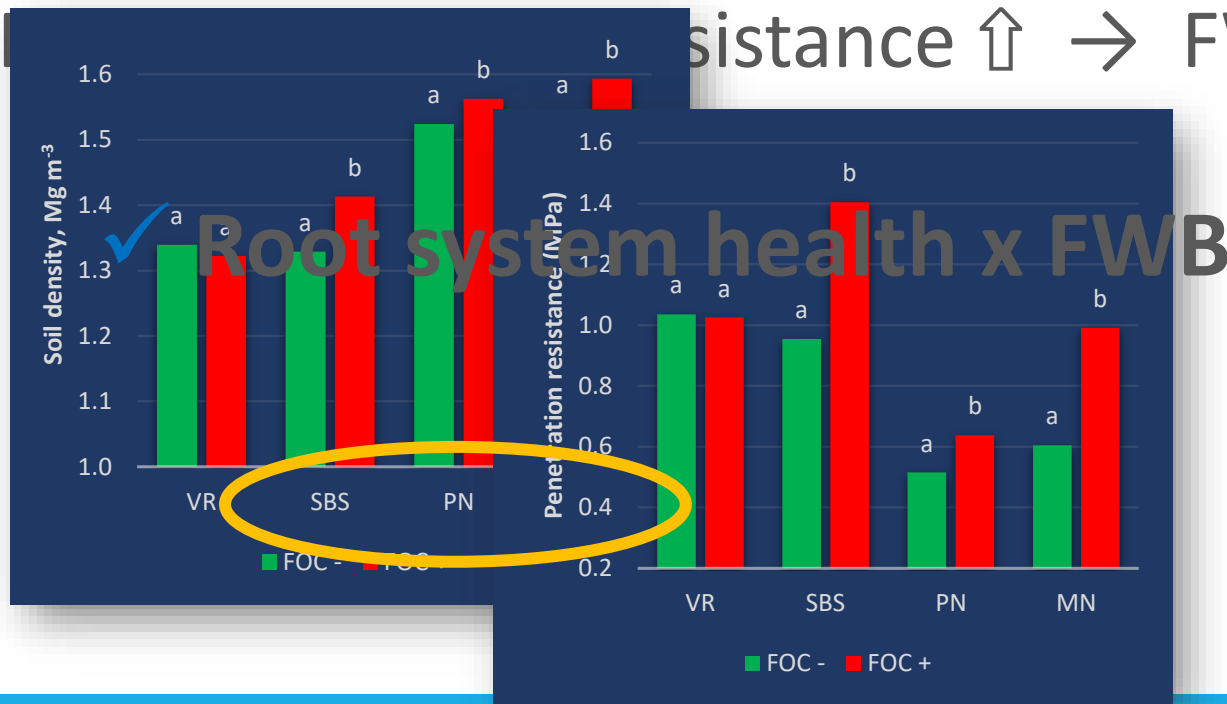


Soil & FWB

- ‘Maçã’ and ‘Prata’

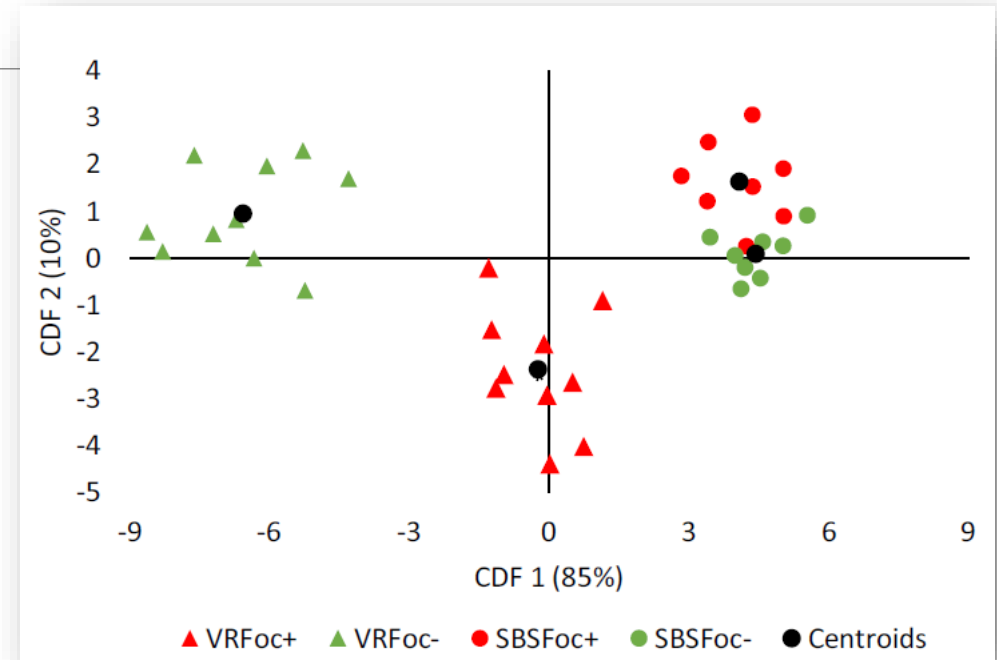
Soil density $\uparrow \rightarrow$ FWB \uparrow

Penetration resistance $\uparrow \rightarrow$ FWB \uparrow



Soil & FWB

- Soil chemical attributes X FWB
 - ✓ Multivariate analysis
 - Canonical Discriminant Analysis (CDA)



Teixeira et al., 2021

- ✓ Vale do Ribeira: P, Ca and base saturation (axis 1)
- ✓ São Bento: root penetration resistance (axis 2)

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- Two research approaches

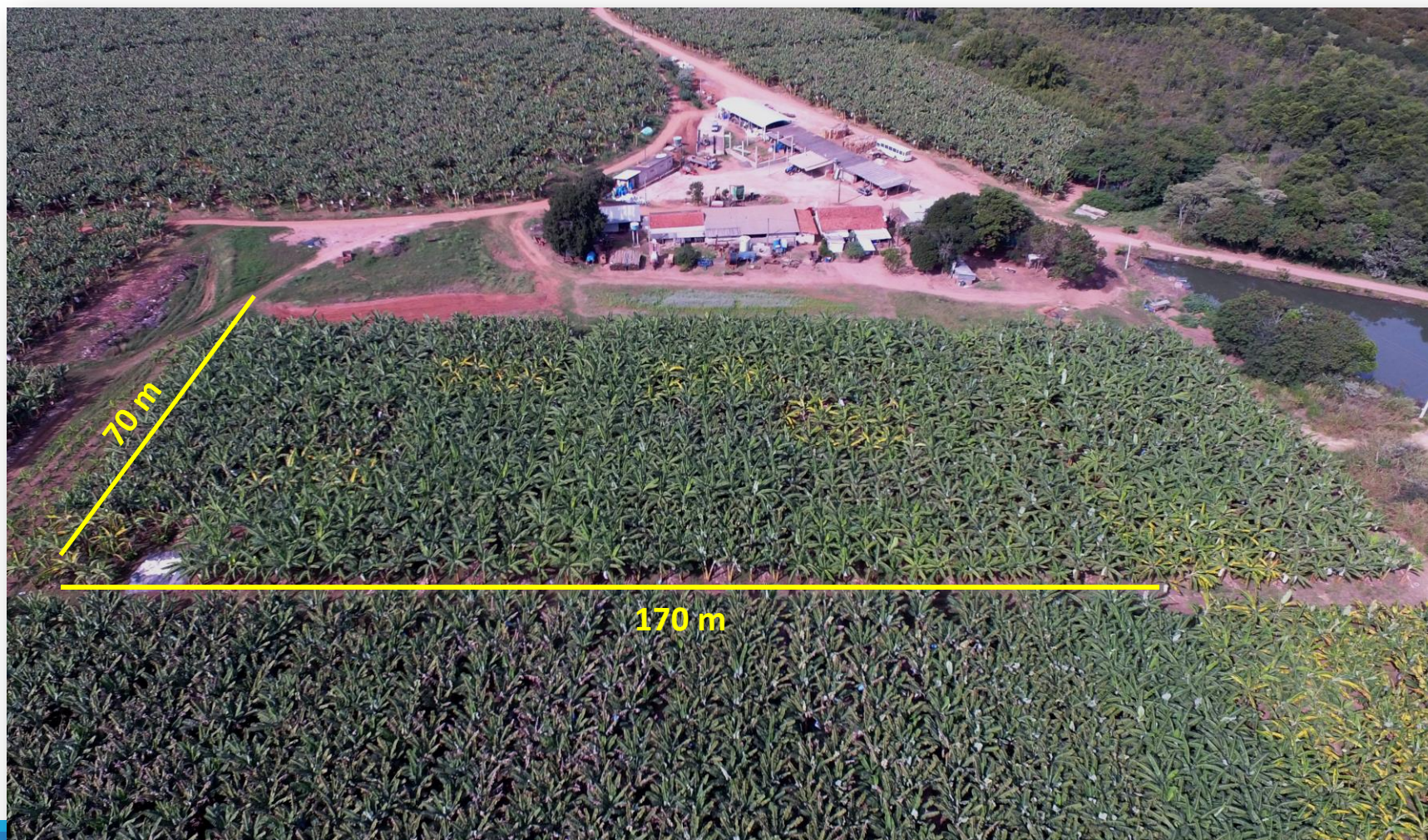
1. Identify potential biotic and abiotic soil predisposing factors associated with FWB
 - ✓ Soil pH, Ca, P, base saturation
2. Create contrasting environments by managing soil health factors to evaluate FWB
 - ✓ Root penetration resistance, soil density
 - ✓ Banana weevil
 - ✓ Nematodes
 - ✓ ...

Soil management practices



Location	Coordinates	Type of farm
Jaíba, MG	15°S; 43°W; 470m	Plantation
Aguaí, SP	22°S; 47°W; 660m	Plantation
Registro, SP	24°S; 47°W; 27m	Small-scale family producer/plantation
Corupá, SP	26°S; 49°W; 130m	Small-scale family producer

Aguaí, SP



L. Teixeira/IAC

Vale do Ribeira, SP



L. Teixeira/IAC

Vale do Ribeira, SE

	Full (T3)	Control
Cobertura vegetal	<i>Crotalaria spectabilis</i> no plantio	No
Fuente de N	Nitrato de calcio	Ureia
Fuente de P	Termo fosfato(18% P ₂ O ₅)	SFT
Abono orgânico	2 kg/planta en la siembra + 4 X/año	No
<i>Trichoderma</i> - inoculación de las vitroplantas	30 y 15 dia antes de la siembra	No
<i>Trichoderma</i> -inoculación de las plantas en producción	En la siembra + 4 X/año	No
Silício en la siembra	1 ton/ha	No

Vale do Ribeira, SP

• Results

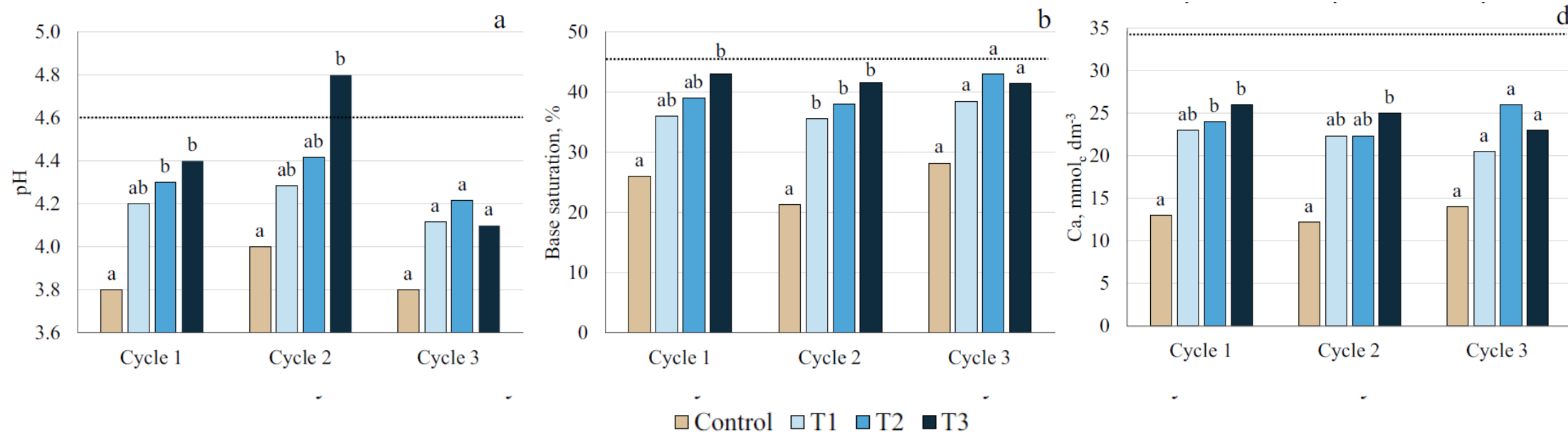
Tropical Plant Pathology
<https://doi.org/10.1007/s40858-022-00493-1>

ORIGINAL ARTICLE

Effectiveness of soil management practices on Fusarium wilt of banana in the Ribeira Valley, Brazil

Luiz Teixeira¹ · Edson Nomura² · Erval Damatto Jr² · Henrique Vieira³ · Charles Staver⁴ · Miguel Dita⁴

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Vale do Ribeira, SP

• Results

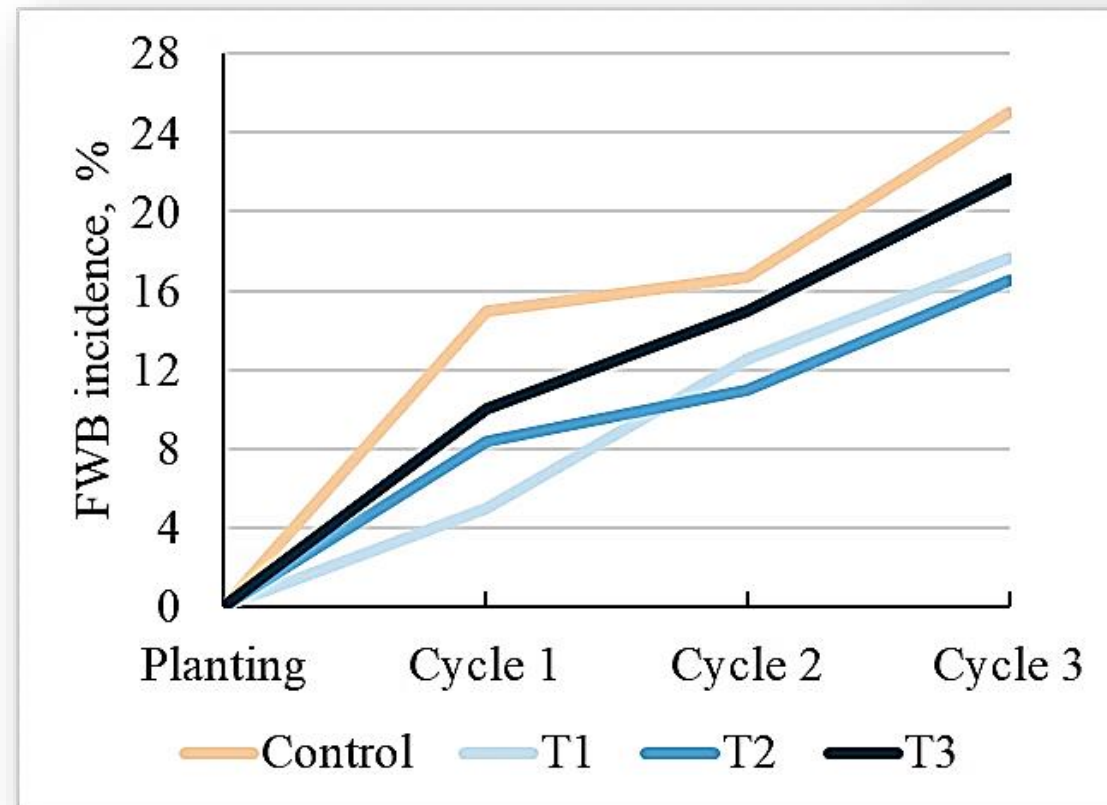
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Soil health research strategies for managing Fusarium wilt of banana in Brazil

- Research approaches

1. Identify potential biotic and abiotic soil predisposing factors associated with FWB
2. Create contrasting environments by managing soil health factors to evaluate FWB
3. There is no silver bullet!



Complex problems require complex solutions

Integrated & site-specific soil management practices

- Site selection
- Plant layout
- Soil analysis
- Soil preparation
- Planting material
- Soil acidity control and its effects
- Soil health oriented fertilization
- Fertilization with soil/plant monitoring
- Application of organic materials
- Cover crop management and green manures
- Crop rotation in orchard renewal
- Beneficial microorganisms
- Knowing and managing physical imitations
- ...



Thanks to all who participate with us in this effort!

SECRETARIA DE AGRICULTURA E ABASTECIMENTO



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¡Gracias!
Thanks!
Merci!

