Soil Biodiversity: its potential for crop nutrition and disease management

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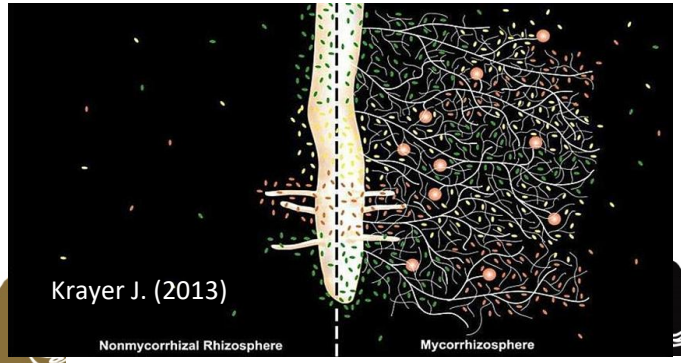
1. Introduction

Beneficial

- **Biofertilizers**: mycorrhizae
  N-fixers
  solubilizers
- **Biocontrollers**
- **Plant growth promoters**
- Streptomyces } main producers
- Penicillium } of antibiotics
- *Saccharomyces cerevisiae* - food and alcoholic beverages



Undesirables

Pathogens

Phytoparasites

Affect food security crops such as:

Rice	*Pseudomonas fuscovaginae* *Pseudomonas syringae* pv. *syringae*)
Corn	*F. verticillioides*; *F. subglutinans* *F. temperatum*
Wheat	*F. graminearum* *F. pseudograminearum*
Potatoes	*R. solanacearum* raza 3 biovar 2
Musaceae	*R. solanacearum* raza 2 biovar 1 *Fusarium oxysporum* f. sp. *cubense* raza 1 *F. Odoratissimum*

(Rivero-González et al., 2017); (Uribe-Cortés et al., 2020); (Kazan y Gardiner, 2018); (Champoiseau et al., 2009); (Gómez et al., 2004; Dita et al., 2017)

Biological equilibria between organisms and plant communities increase and/or conserve organisms unfavorable to pests

Efficient fertilization

Antibiosis

Biological activity

Action Mecanism

Rizosphere Effect

Competition

Relationships plant organisms

- Symbiosis
- Synergies

Resistance induction

PRODUCTIVE CAPACITY OF SOILS

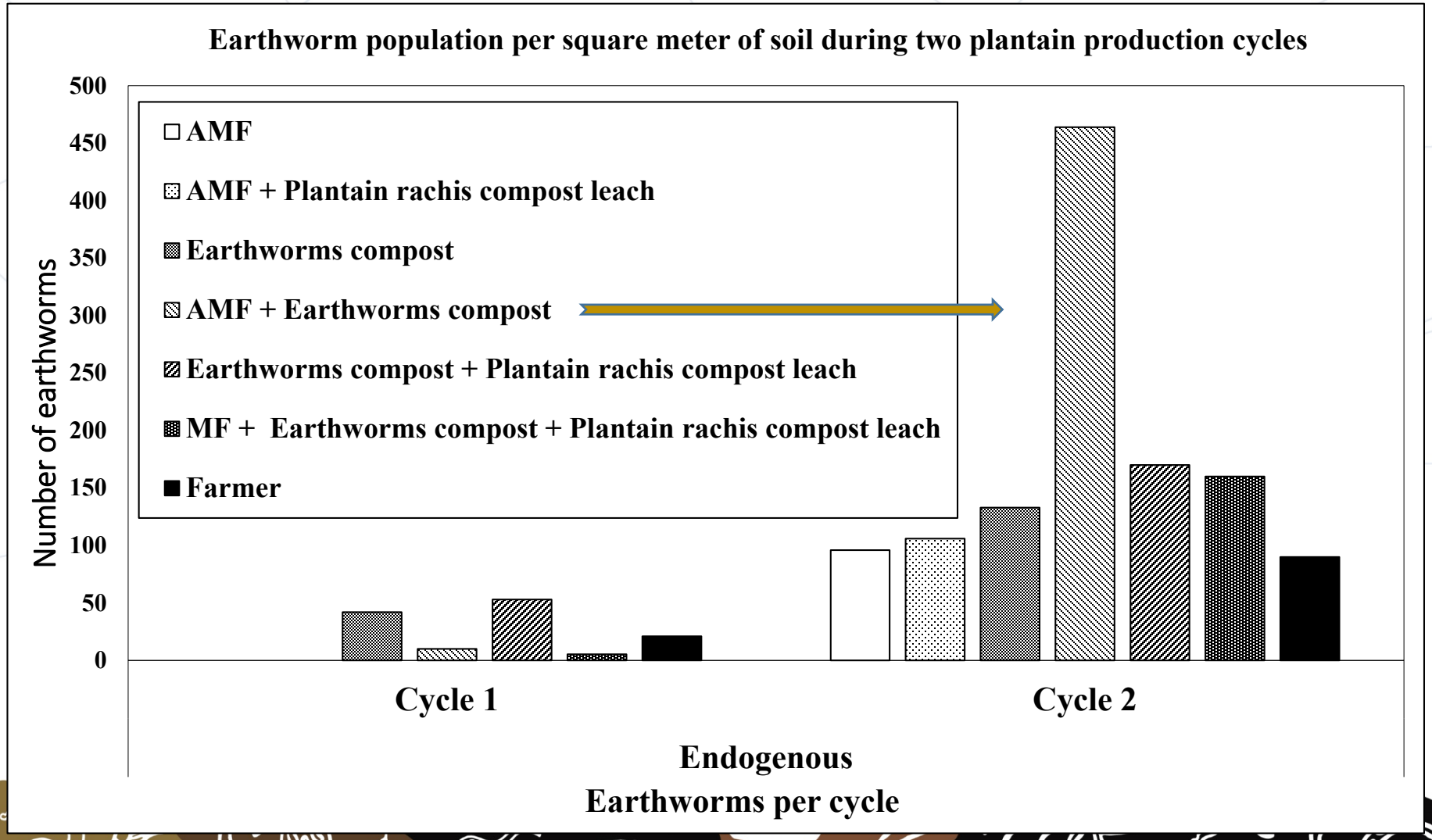
Structure

Nutrient cycling

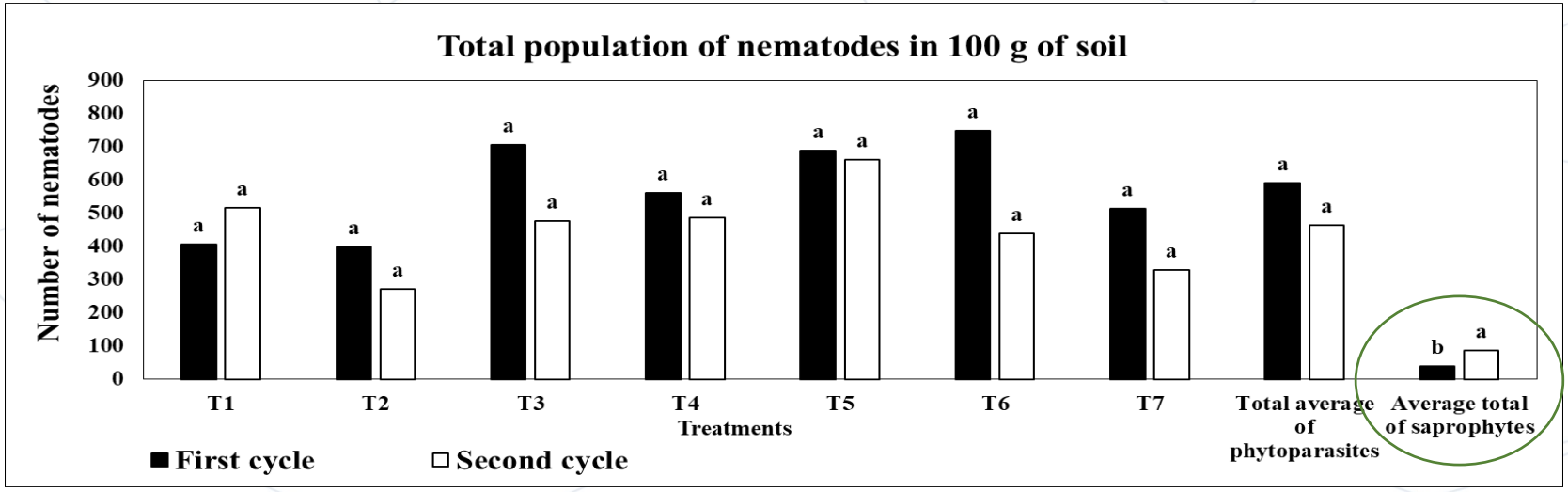
Water storage

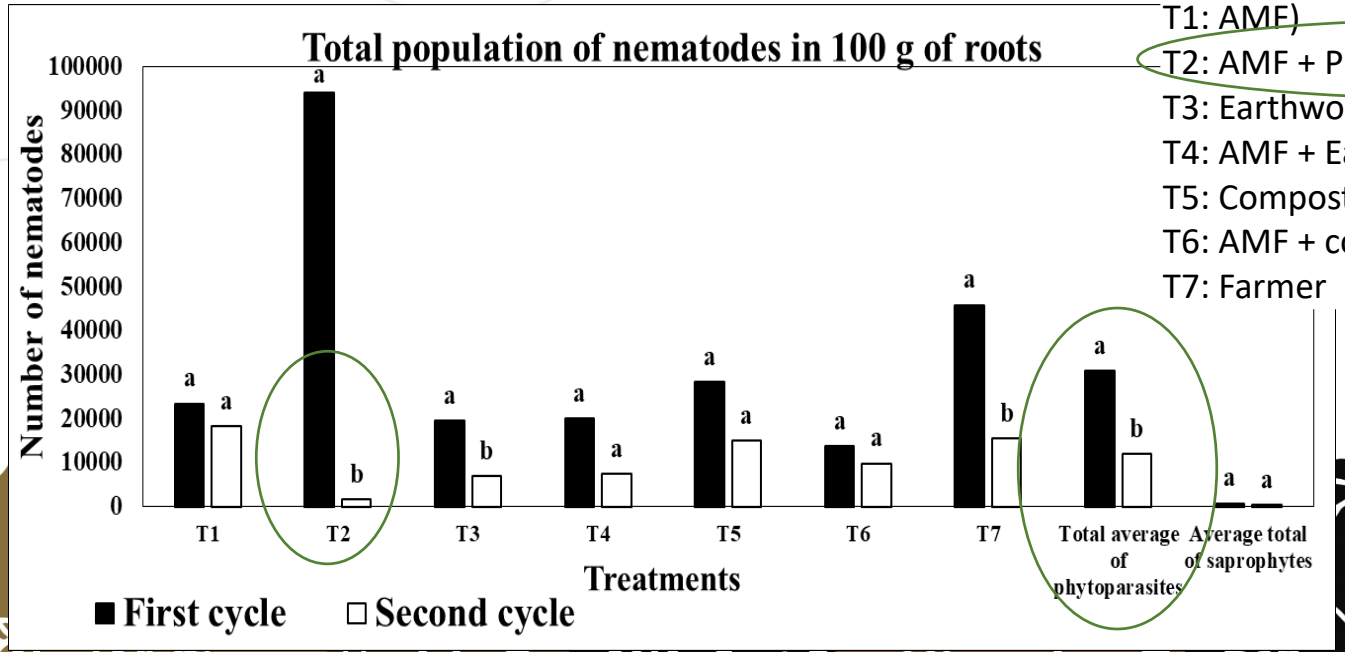
Adaptation to climate change and Climate variability

2. Biodiversity to improve plant nutrition and disease management
Results in different agroecosystems



Nematodes in soil and plantain roots under biofertilizer, compost



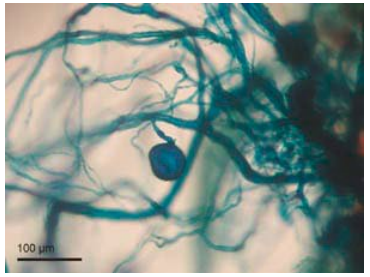


T1: AMF)
T2: AMF + Plantain rachis compost Leach
T3: Earthworms compost
T4: AMF + Earthworms compost
T5: Compost + rachis compost Leach
T6: AMF + compost + rachis compost Leach
T7: Farmer

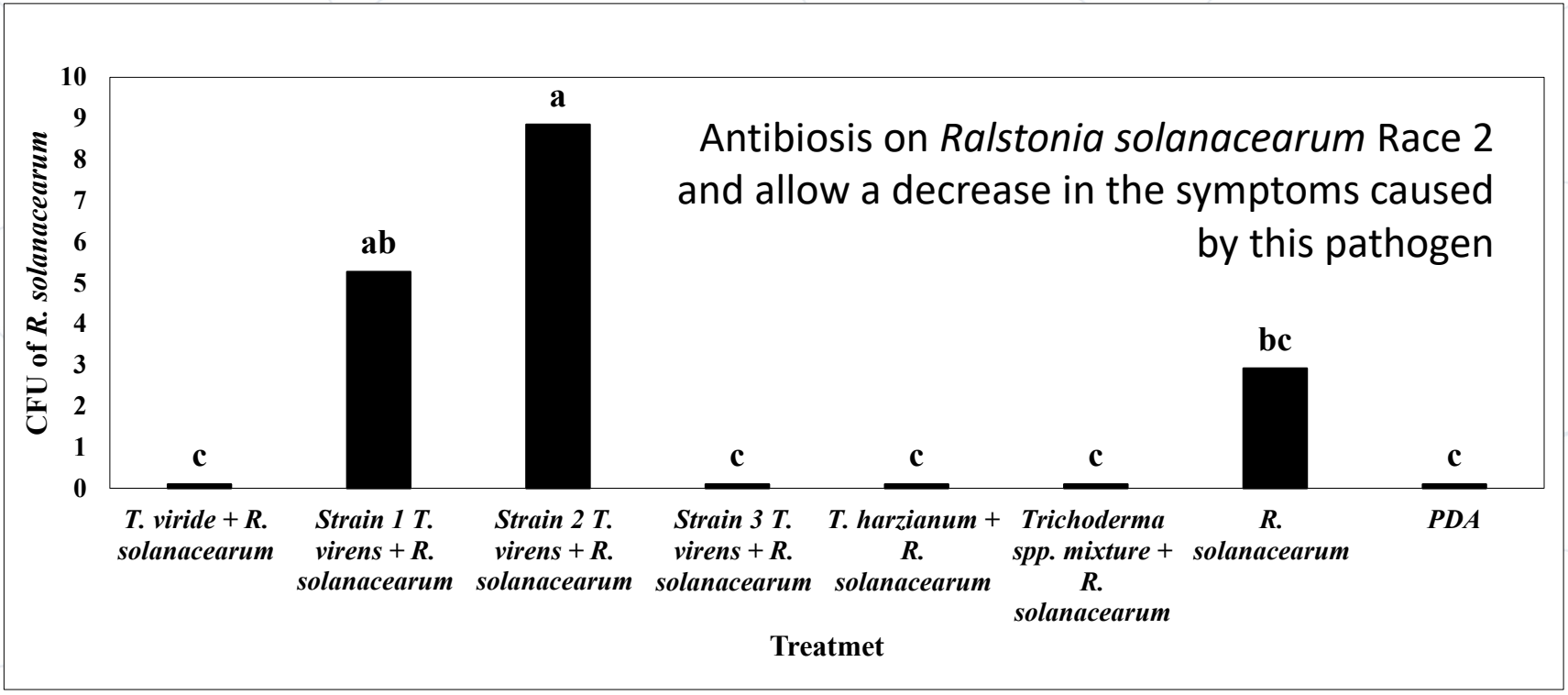
Interaction between arbuscular mycorrhizae and nematodes in bananas

			Nematodes por 10g of root		Nematodes por 100 cc of soil		
Tratamientos	**PFR[1] (g)**	**PSA (g)**	***R. similis***	***Helicotylenchus* spp.**	***R. similis***	***Helicotylenchus* spp.**	**%M**
1. G. fis.	8.9B	2.15B	/	/	/	/	3B
2. G. fis.+ N	9B	1.9B	4652A	33A	8B	10A	0B
3. G. fasc.	13.5AB	2.88AB	/	/	/	/	1B
4. G. fasc. + N	13.9AB	2.95AB	3748A	59A	35A	5A	0B
5. Com.	**21.9A**	**3.95A**	/	/	/	/	**41A**
6. Com. + N	**17.6AB**	**4.15A**	4207A	75A	14AB	23A	**40A**
7. T	15.4AB	2.97AB	/	/	/	/	0B
8. T + N	11.5AB	2.09B	4240A	84A	5B	4A	0B
DMS (∞=0.05)	12.69	1.72	4424	158	25	30	13.4

Increases of more than 30% in root fresh weight and dry weight corm and aerial tissue

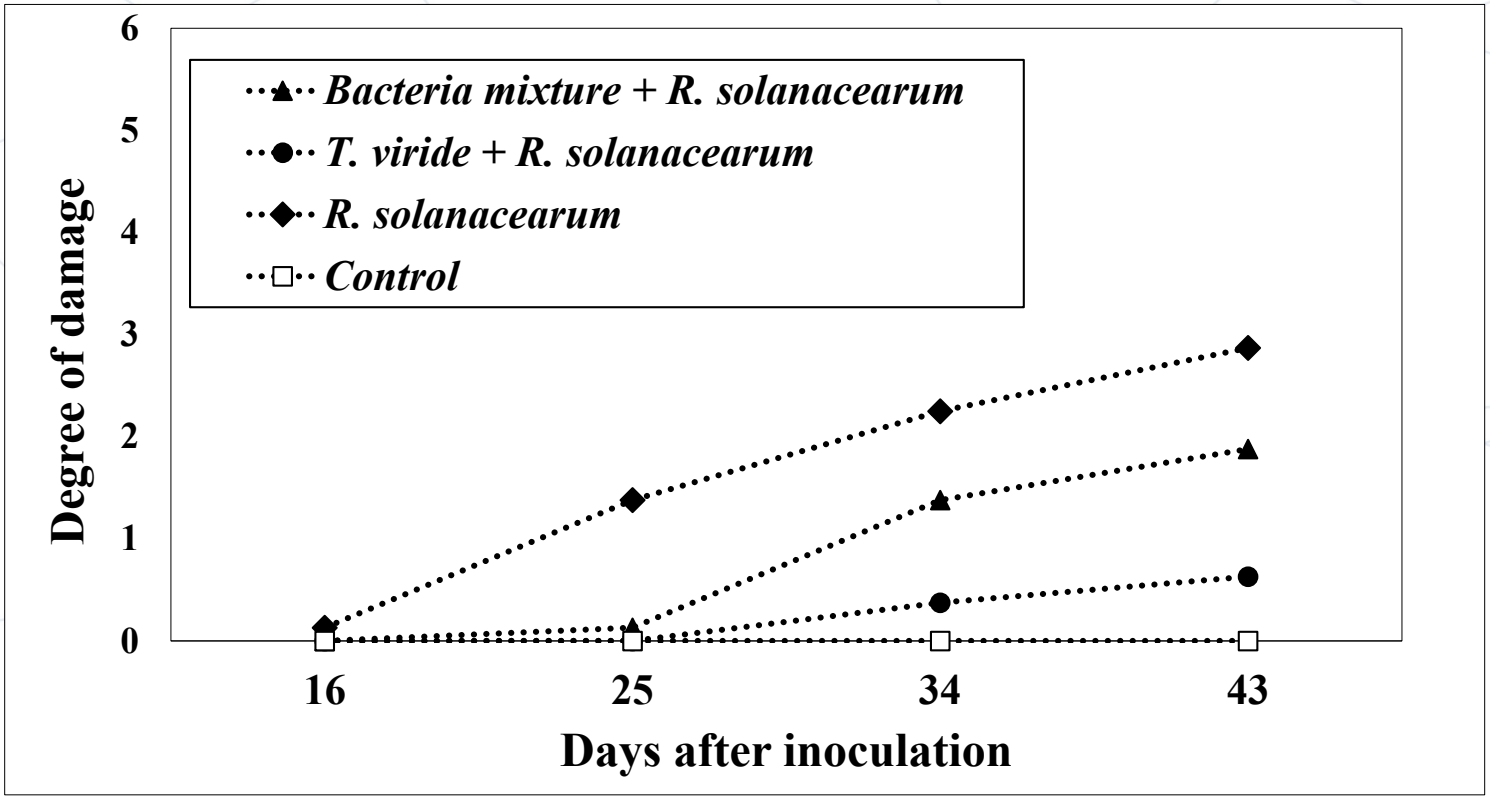


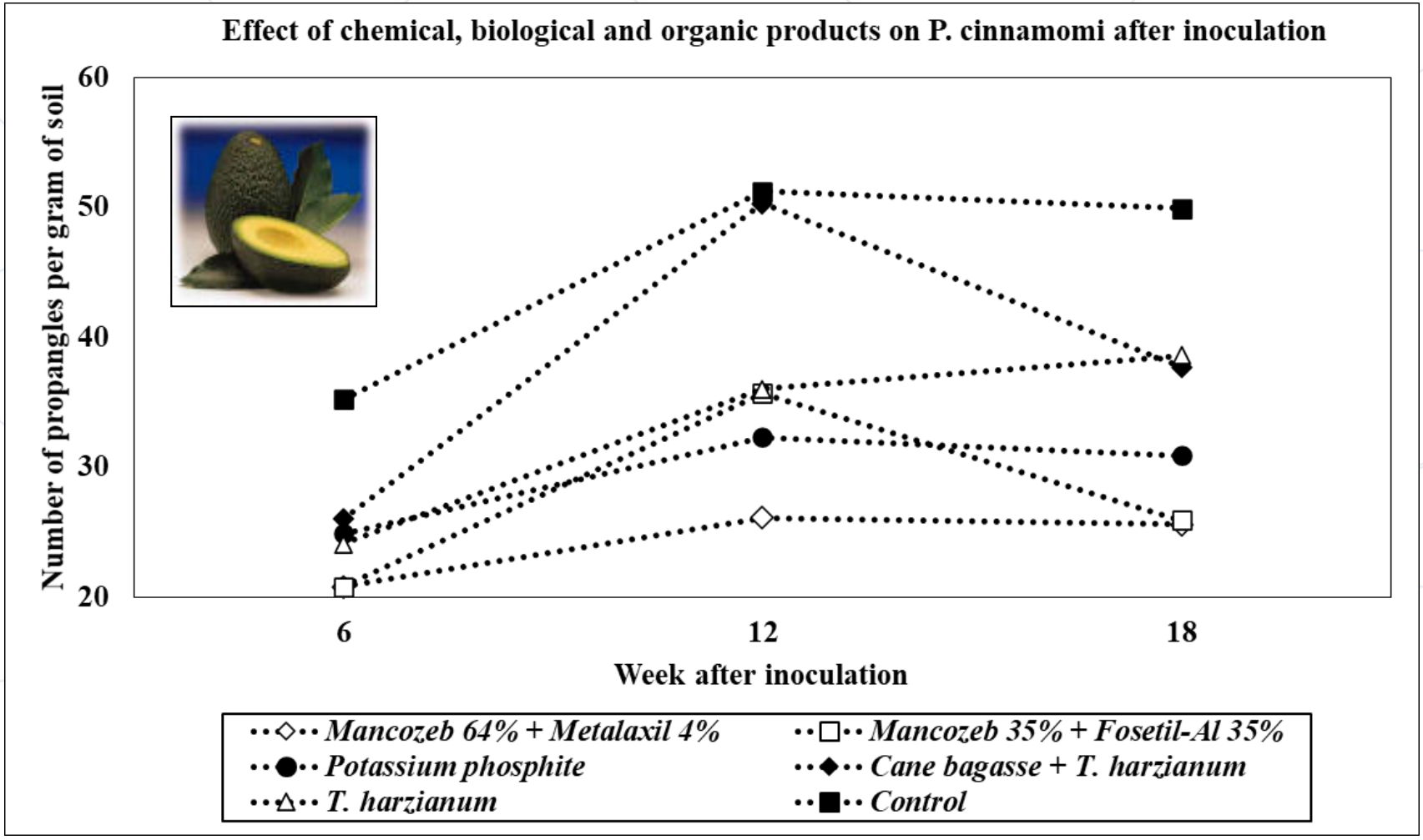
Effect of crude extracts of *Trichoderma* spp. in inhibition in vitro of *R. solanacearum*



Selection of *in vitro* strains
for future greenhouse and field investigations

Effect of biocontrollers on the development of foliar symptoms of moko caused by *R. solanacearum*. Scale 0 (absence) - 6 (plant death)





Highlight the non-contamination with agrochemicals and the reduction of production costs

Biological and enzymatic activity in avocado rhizosphere

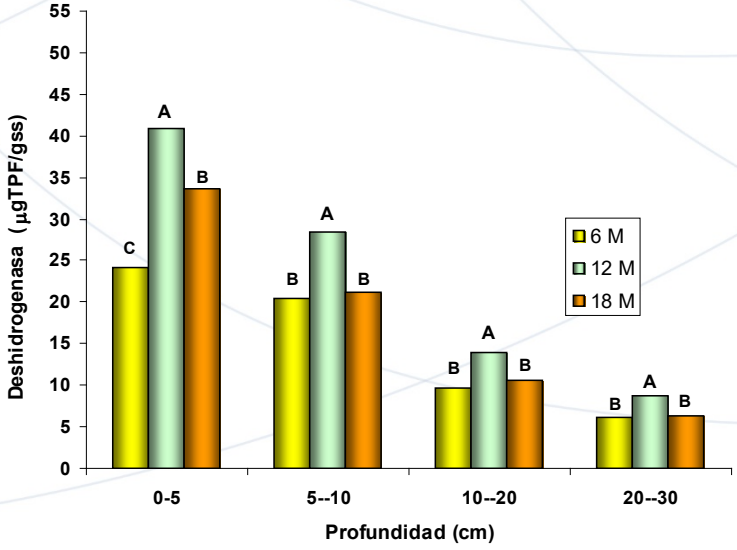
Basal respiration of the soil treated with fungicides, biological and organic products				
Treatment	Average mg-C-CO2 / gss			
	Incubation days			
	15		360	
Control	4,744	a	3,164	a
Fosetil-Al + Mancozeb (D2)	4,466	ab	2,717	b
Cane bagasse	4,397	ab	2,662	b
Cane bagasse + *Trichoderma*	4,392	ab	3,326	a
Fosetil-Al + Mancozeb (D1)	4,176	b	3,131	a
Mefenoxam + Mancozeb (D1)	3,523	c	2,734	b
Mefenoxam + Mancozeb (D2)	3,216	c	2,626	b

Nutrition and disease management with organic amendments

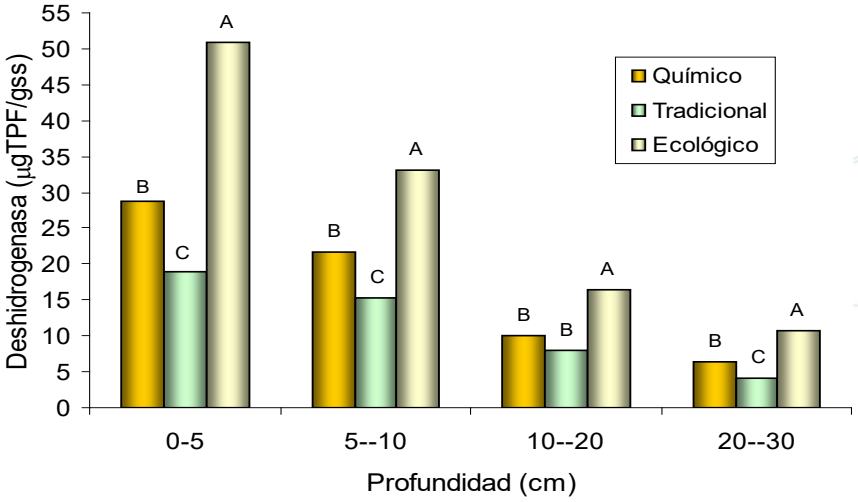
Importance of the biorganic component

Enzymatic activity

Dehydrogenase activity in rhizosphere of 6,12 and 18-month-old banana plants at four soil depths



under three agronomic managements

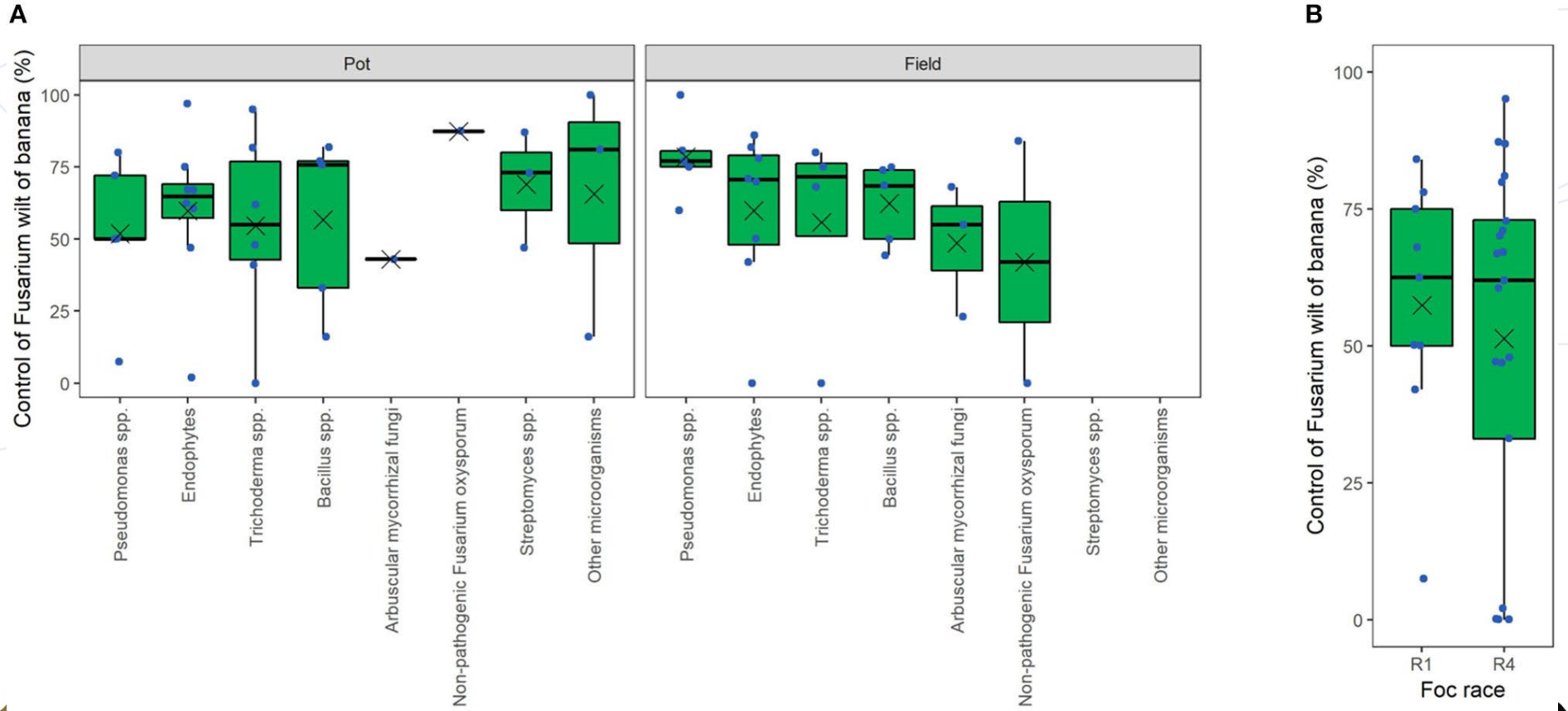


Soil Biodiversity: its potential

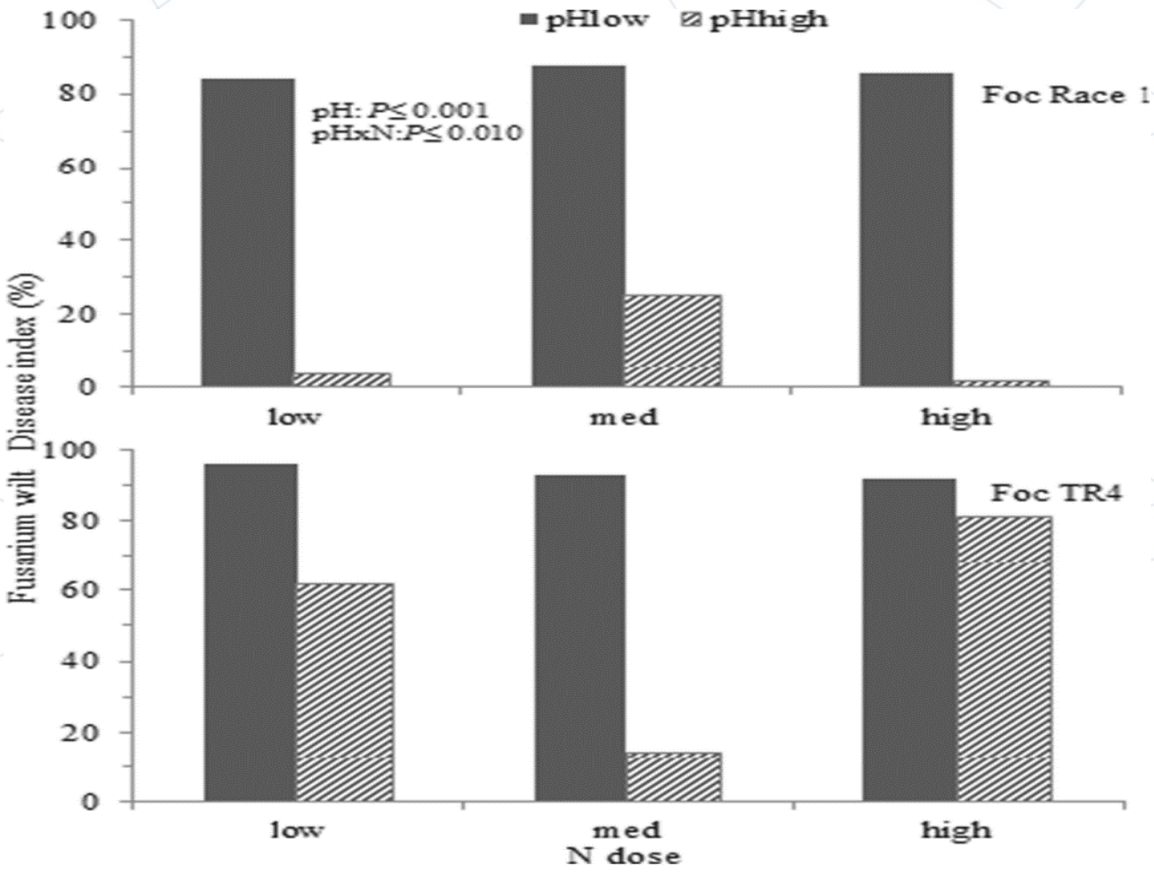
for crop nutrition and disease management

3. Suppressive soils, a management strategy for Fusarium wilt of Musaceae

Diversity of soil biocontrollers on Fusarium in bananas



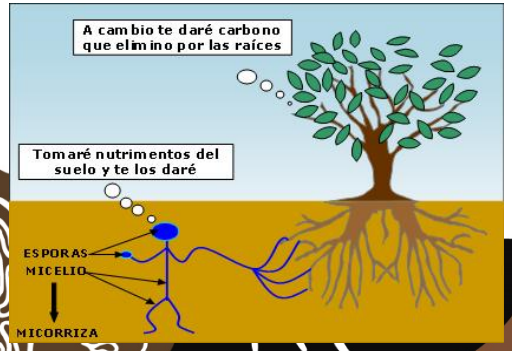
Interaction between pH and N dosage - Fusarium

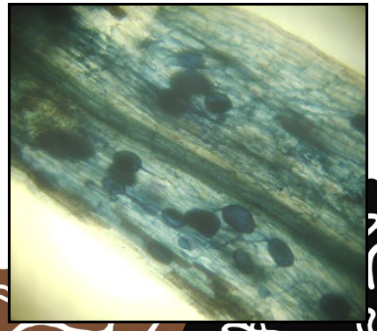


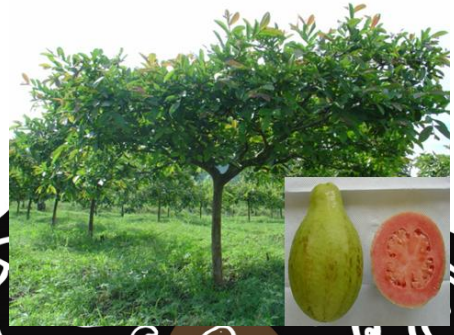
4. Economic evaluation of soil biodiversity benefits

Evaluation of the economic impact on nematode control in guava

Treatment	Cost hectare (USD.ha)	Yield for two years	Internal rate of return (%)	Cost benefit ratio	Additional net profit (USD.ha)
Native mycorrhiza	**1,0**	**5,33**	**48**	**1,75**	**1128,4**
Trichoderma	153,4	**5,56**	**47**	**1,72**	**1168,6**
Commercial compost	49,1	5,19	46	1,70	985,3
Nematode control	48,0	5,18	45	1,68	936,6
Prepared compost	49,1	4,79	40	1,57	579,2
Commercial mycorrhiza	1,0	4,34	36	1,46	219,9
B. thuringiensis	185,9	4,67	36	1,46	318,7
Average farmer	99,0	4,20	32	1,38	0,0
Integrated management	236,2	4,33	31	1,36	0,043







Mycorrhizal diversity in guava

Farm / HMA spore	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Ambispora gerdemannii																															X						
Archaeospora trappei	x				x																																
Intraspora schenckii	x					x																							x								
Acaulospora cavernata		x										x																									
Diversispora spurca	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x		x	x	x			x		x	x			x	x		x	
Entrophospora infrequens					x																																
Glomus aggregatum																														x					x		
Glomus aureum	x	x				x												x						x					x								
Glomus australe							X																														
Glomus botryoides																										x											
Glomus brohultii																				x					x												
Glomus claroideum	x	x	x		x	x		x				x	x	x	x	x	x	x		x		x	x	x		x	x		x		x		x				
Glomus clarum															x				x							x											
Glomus constrictum																	x																				
Glomus coronatum	x		x	x	x	x	x	x							x		x														x						
Glomus coremioides		x				x												x																	x		
Glomus deserticola								x				x																									
Glomus dimorphicum				x	x				x		x																										
Glomus etunicatum	x				x	x	x					x	x			x	x	x				x	x	x	x	x	x		x		x				x		
Glomus fasciculatum			x													x		x											x						x		
G. glomerulatum																										x											
G. intraradices		x	x		x			x								x		x	x				x	x		x											
Glomus invermaium	x																									x											
Glomus lamellosum	x																																				
Glomus macrocarpum	x							x	x								x					x															
Glomus microaggregatum					x	x		x					x		x		x							x													
Glomus microcarpum	x									x								x																			
Glomus minutum	x	x	x												x																						
Glomus monosporum																															x						
Glomus mosseae	x	x		x					x				x			x		x	x	x						x	x			x			x		x		
Glomus proliferum	x						x	x																													
Glomus sinuosum			x		x	x			x	x															x	x											x
Glomus tortuosum			x																																	
Glomus versiforme	x				x				x								x									x			x					x	x	x
Glomus viscosum	x	x				x						x			x	x		x																			
Glomus xanthium		x	x																																		
Glomus sp																		x				x															
Paraglomus brasilianum																																					
Paraglomus occultum																						x	x														

Considerations **Soil Biodiversity:**

its potential for crop nutrition and disease management

It is required to increase the population of native edaphic biota, SSM practices -biofertilization.

Regulation of pathogens or undesirable organisms - Trichoderma in different agroecosystems

The Biorganic Component: Fundamental in the Sustainable Management of Agroecosystems

Metas 1,2,4,5 Metas 1,2,3,4 Metas 5A,5B,5C Metas 1,4,5,6

Being sustainable and competitive is feasible, we have Tools, Methodologies and Research Results. Let's get to work!

Meta 3

Metas 1,2,4,5,8 Meta 3 Meta 10.1 Meta 3

Thank you for your attention

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