

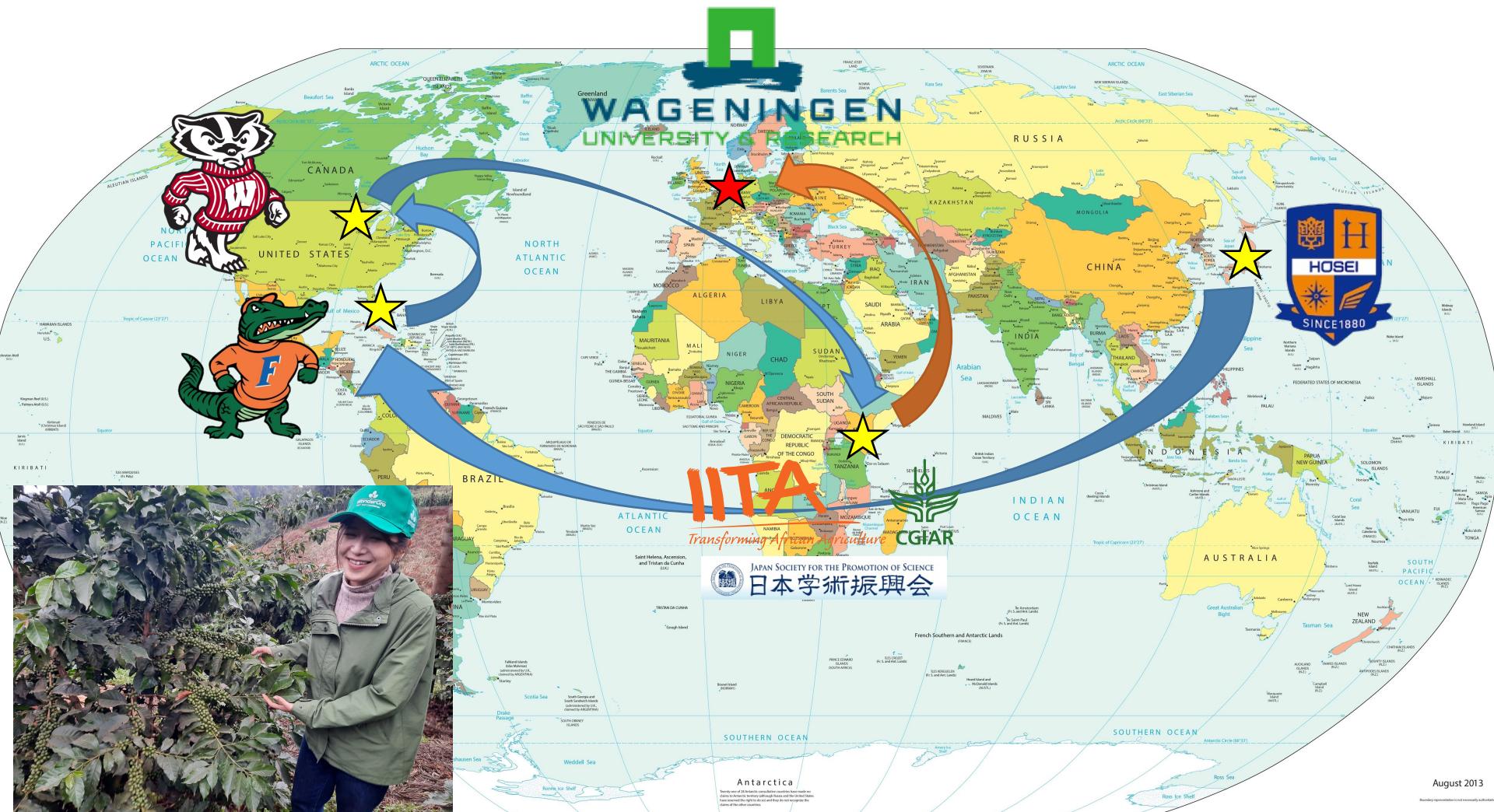
Plant parasitic nematodes and food security in Sub-Saharan Africa

Kanan Saikai
Aug 30th, 2022

Today I will talk about...

- Who is Kanan Saikai?
- Africa and food security
- The importance of plant parasitic nematodes in Sub-Saharan Africa
- NemAfrica
- Biocontrol agents as management of coffee nematodes
- Breeding Better Banana (BBB) program
- “Wrap and Plant” technology

Who is Kanan Saikai?



Africa and food security



Provided by Dr. Danny Conye

Plant parasitic nematodes are the threat of food security in SSA.



NemAfrica



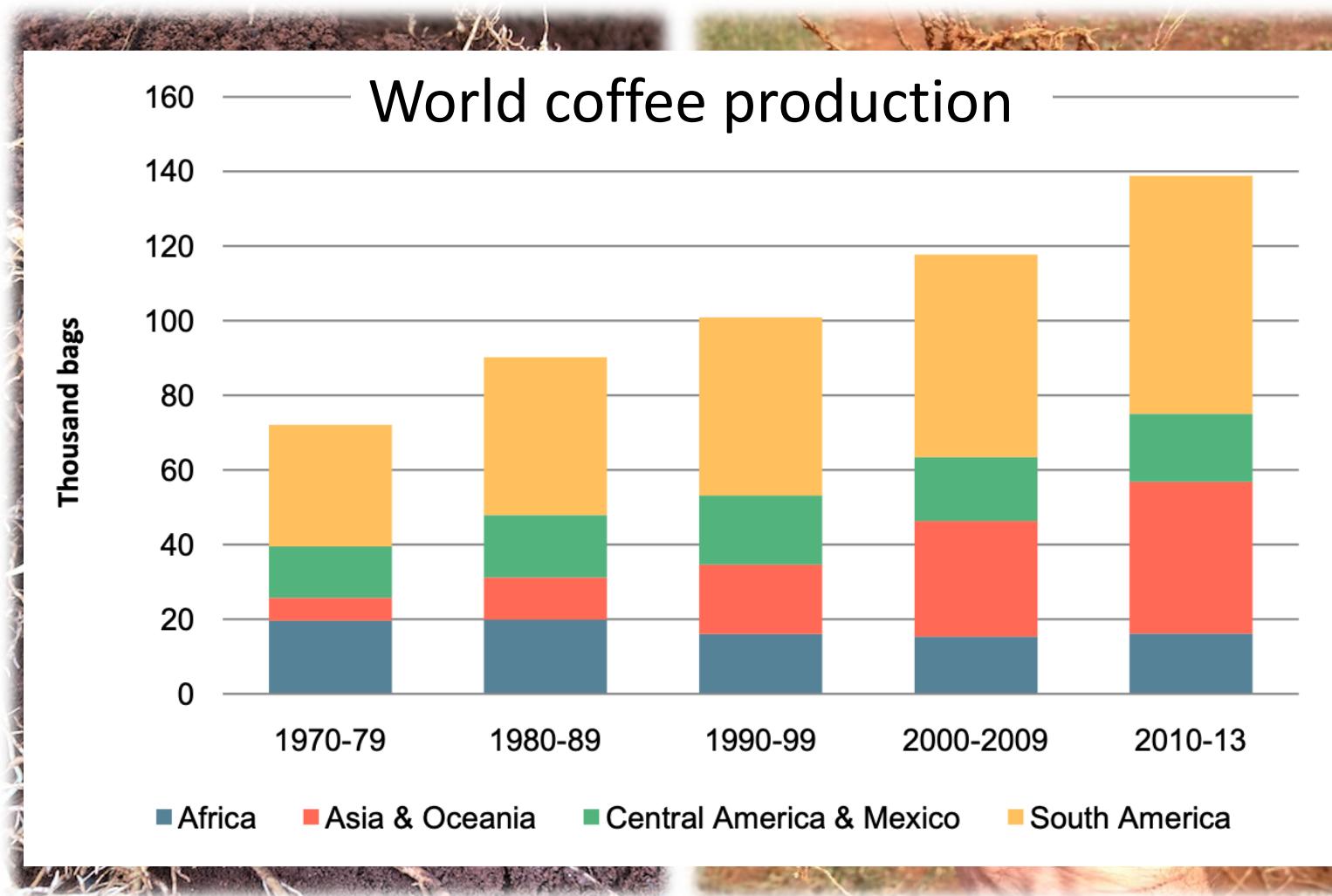
Project 1:

Can biocontrol agents control RKN on coffee?

And their impact on soil health conditions?



Coffee is under the threat from nematodes.



Citation: International Coffee Organization. 2015.

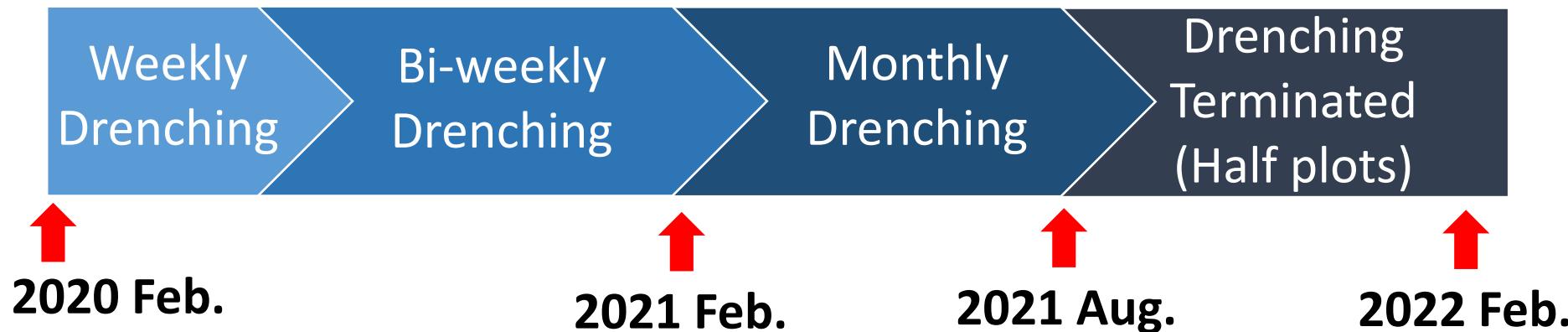
Can we use *Trichoderma* and *Purpureocillium* to manage nematode pests on mature coffee trees?

Drenching:

4×10^8 spores/ 20L *T. asperellum*

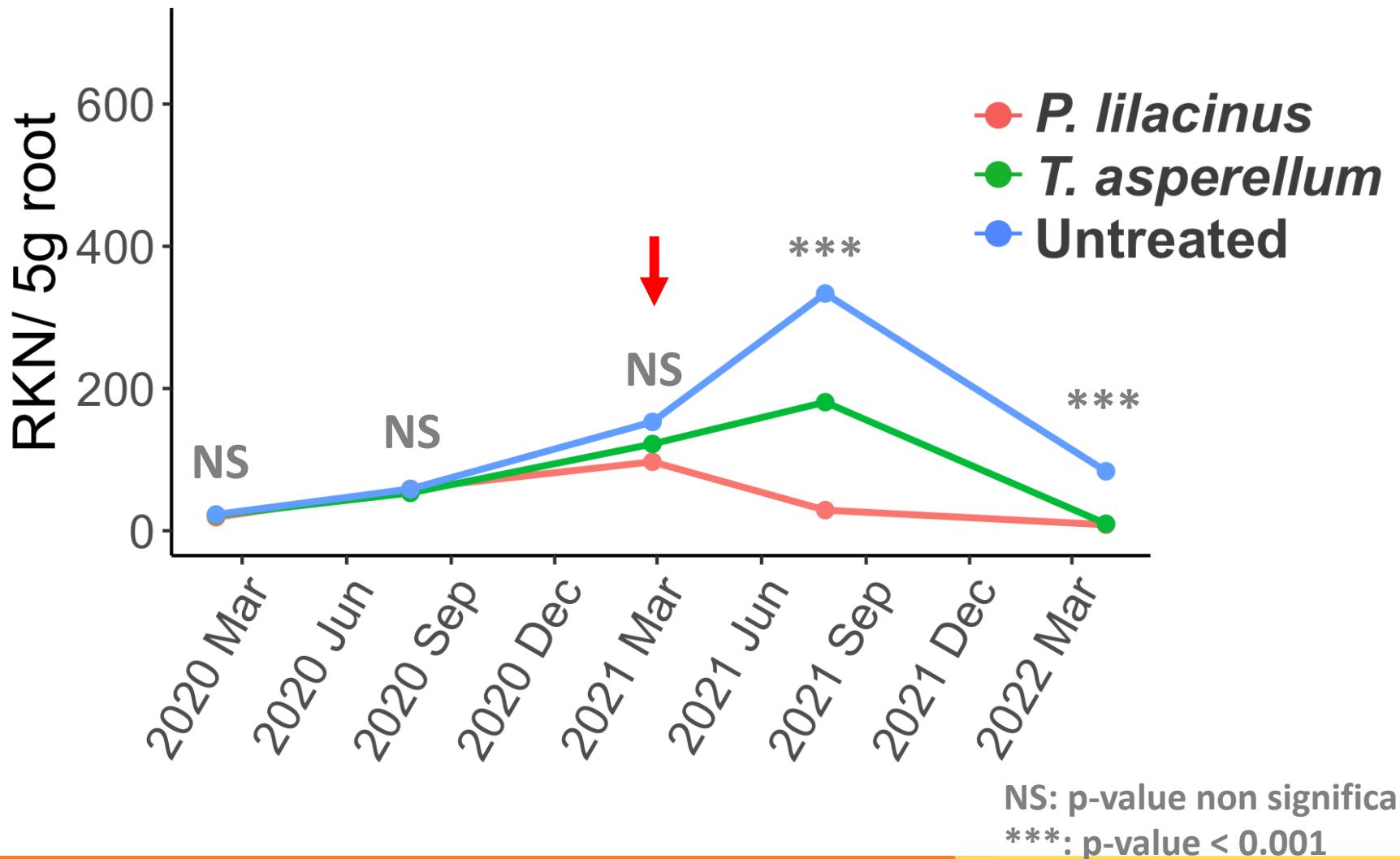
4×10^8 spores/ 20L *P. lilacinus*

20L water

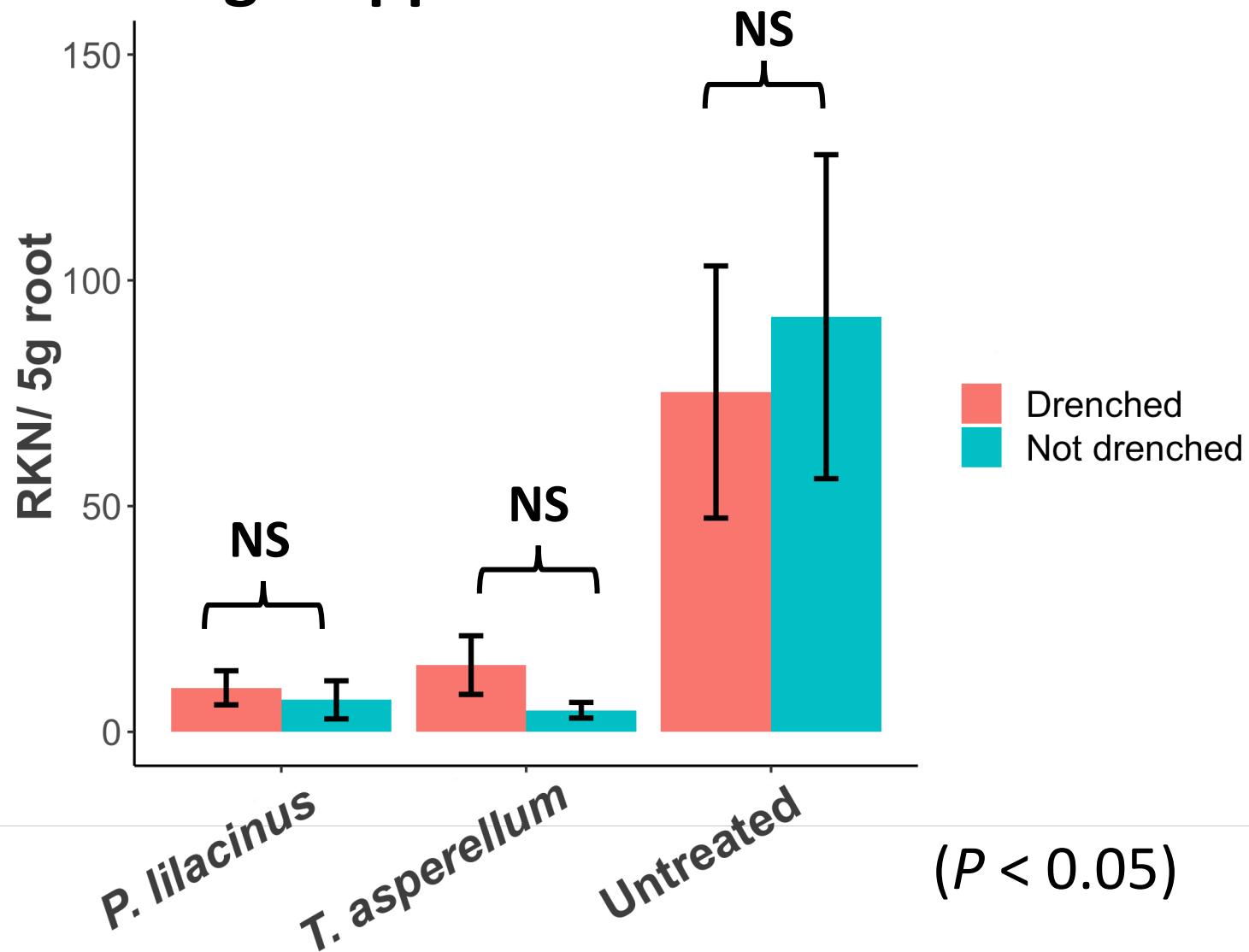


Fungal colonization
in roots confirmed

Took us 1 year to find fungal colonization in roots, and effects of biological agents on RKN in roots!

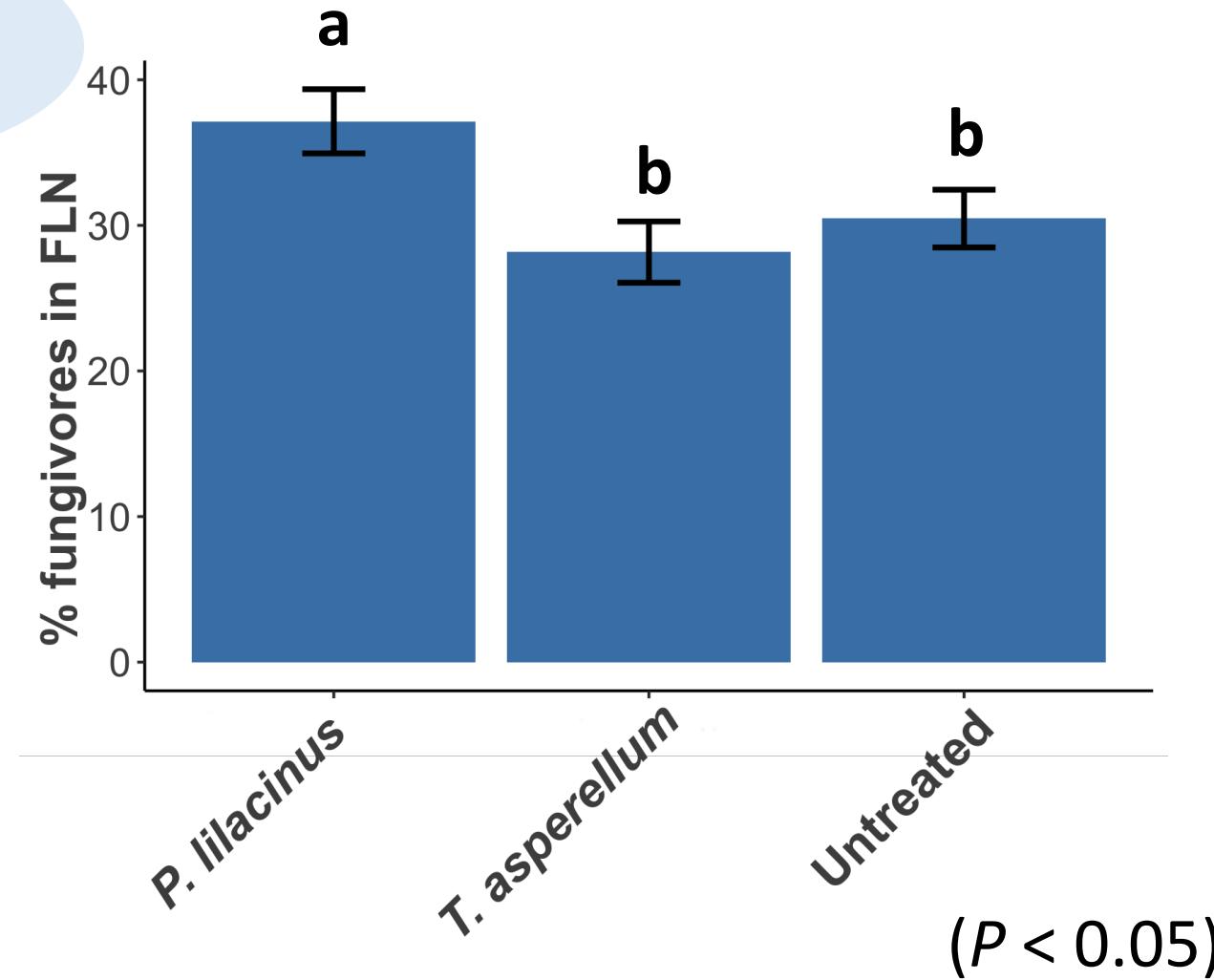


The suppression of bioagents persisted for 6 months after drenching stopped.



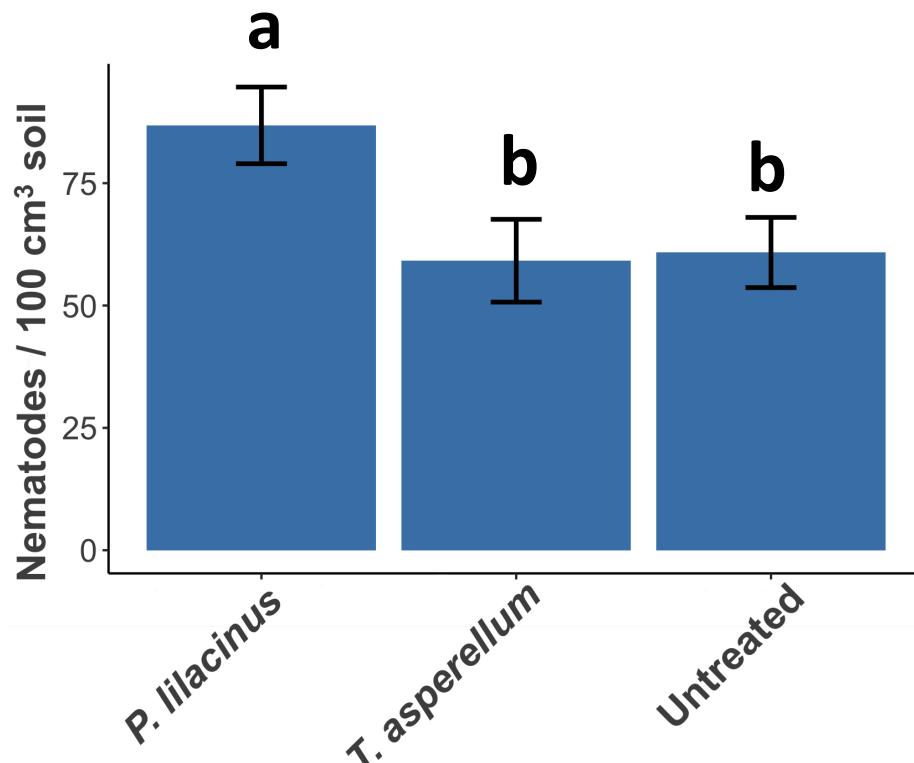
More fungivores with *P. lilacinus*.

Slower
decomposition

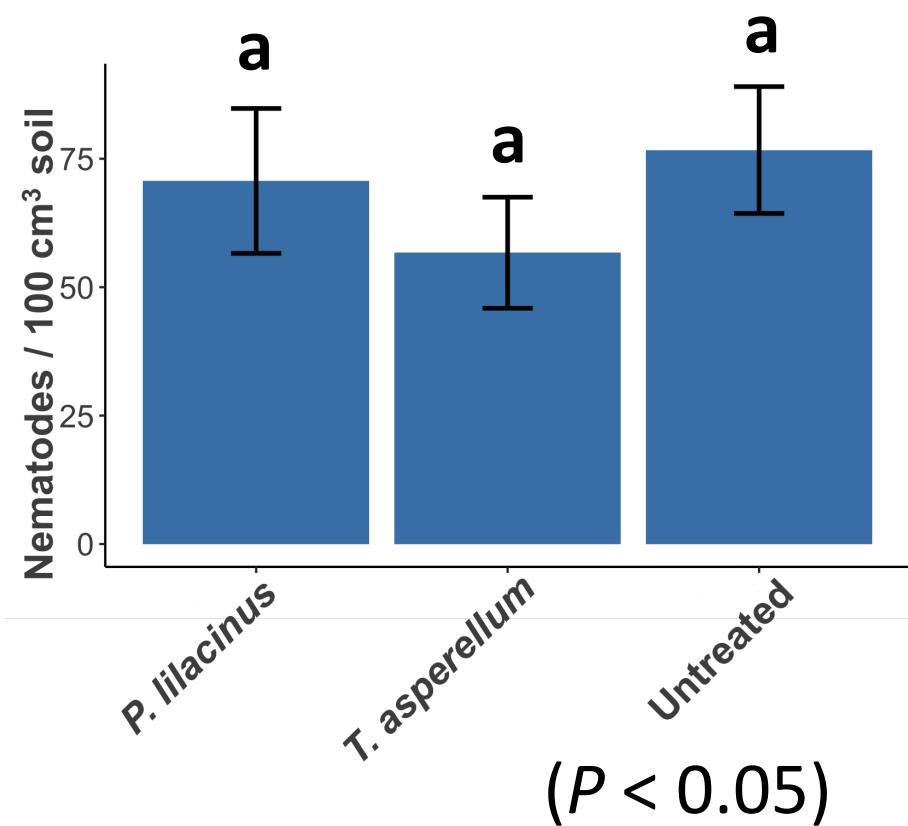


How *P. lilacinus* is affecting fungivores is genus specific.

Aphelenchus

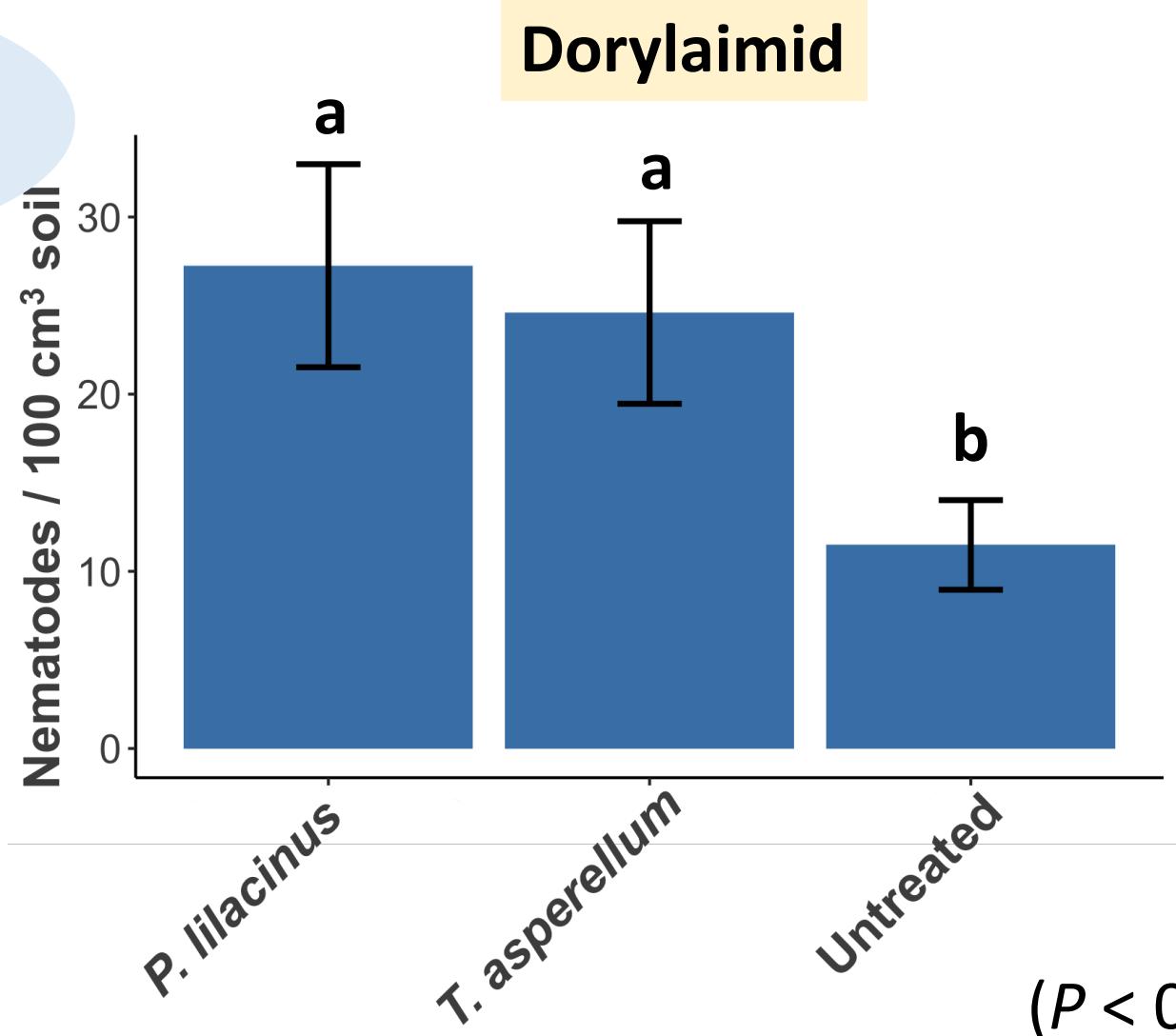


Aphelenchooides



More Dorylaimid with both bioagents.

More stable environment



Some positive changes with bioagents on soil health conditions.

Less stressed and disturbed

Maturity Index

Maturity Index 2-5

Channel Index

Enrichment Index

Structure Index

	P-value	<i>P. lilacinus</i>	<i>T. asperellum</i>
Maturity Index	0.23	-	-
Maturity Index 2-5	0.06	↑	↑
Channel Index	0.99	-	-
Enrichment Index	0.06	↑	→
Structure Index	0.06	↑	↑

More fertile and stable

More N-enriched

Project 2: Towards more efficient nematode resistance screening in banana

BREEDING
BETTER
BANANAS



Nematode pests as constraints to banana production.



Banana plants
toppled over



Root necrosis &
death



Infected seed

Current nematode screening needs improvements.

EVALUATING HOST PLANT REACTION OF MUSA GERMPLASM

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primarias individuales. Nematópica 31:297-301.

Se evaluó un nuevo método para seleccionar fuentes de resistencia a *Radopholus similis* en un gen

Evaluation of a method to simultaneously screen Musa germplasm against multiple nematode species

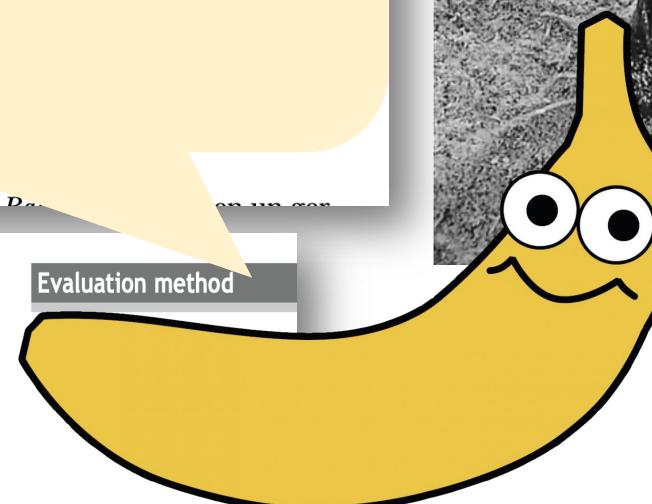
D.L. Coyne and A. Tenkouano

There is no doubt the importance of nematode pests as constraints to *Musa* production (Gowen et al. 2005). However, emphasis on plant-parasitic nematodes affecting *Musa* has focused on the epidemiology, management and identification of resistance against *Radopholus similis* (Cobb) Thorne. Evidence indicates that resistance to *R. similis*

Severn-Ellis et al. 2003). Using such methods, several *Musa* genotypes with resistance to *R. similis* (Pinochet 1996) have been identified. However, the process of identifying resistance remains time consuming.

The ability to rapidly screen many landraces or genotypes developed by

Evaluation method



How do we approach?

In vitro system



Macro-propagated plant system

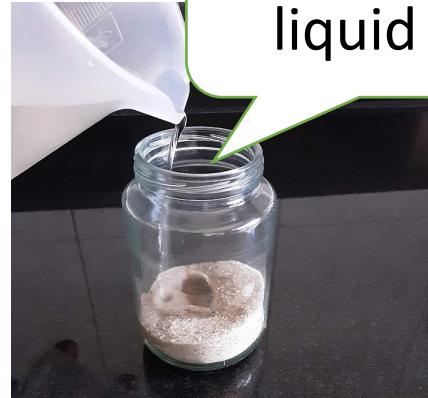


Joseph Kisitu
(Uganda)



Emmanuel Olajide
(Nigeria)

In vitro system using river sand saturated with MS solution.



Add liquid MS



Transfer banana TC & inoculate 50 *R. similis*



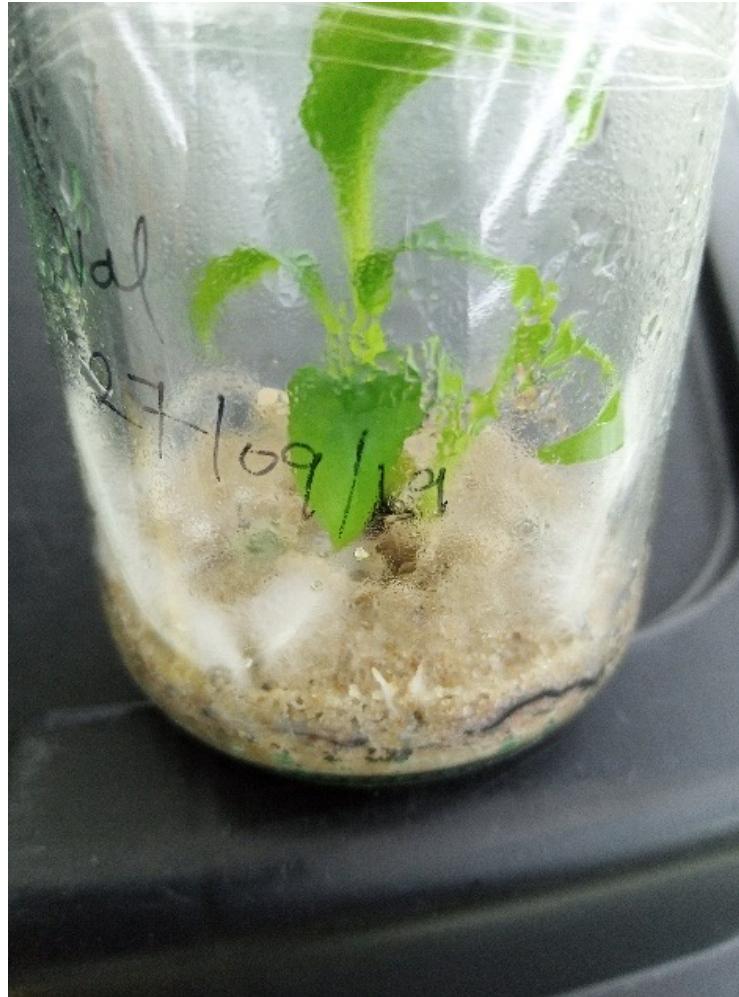
Nematode reproduction at 30 & 60dpi



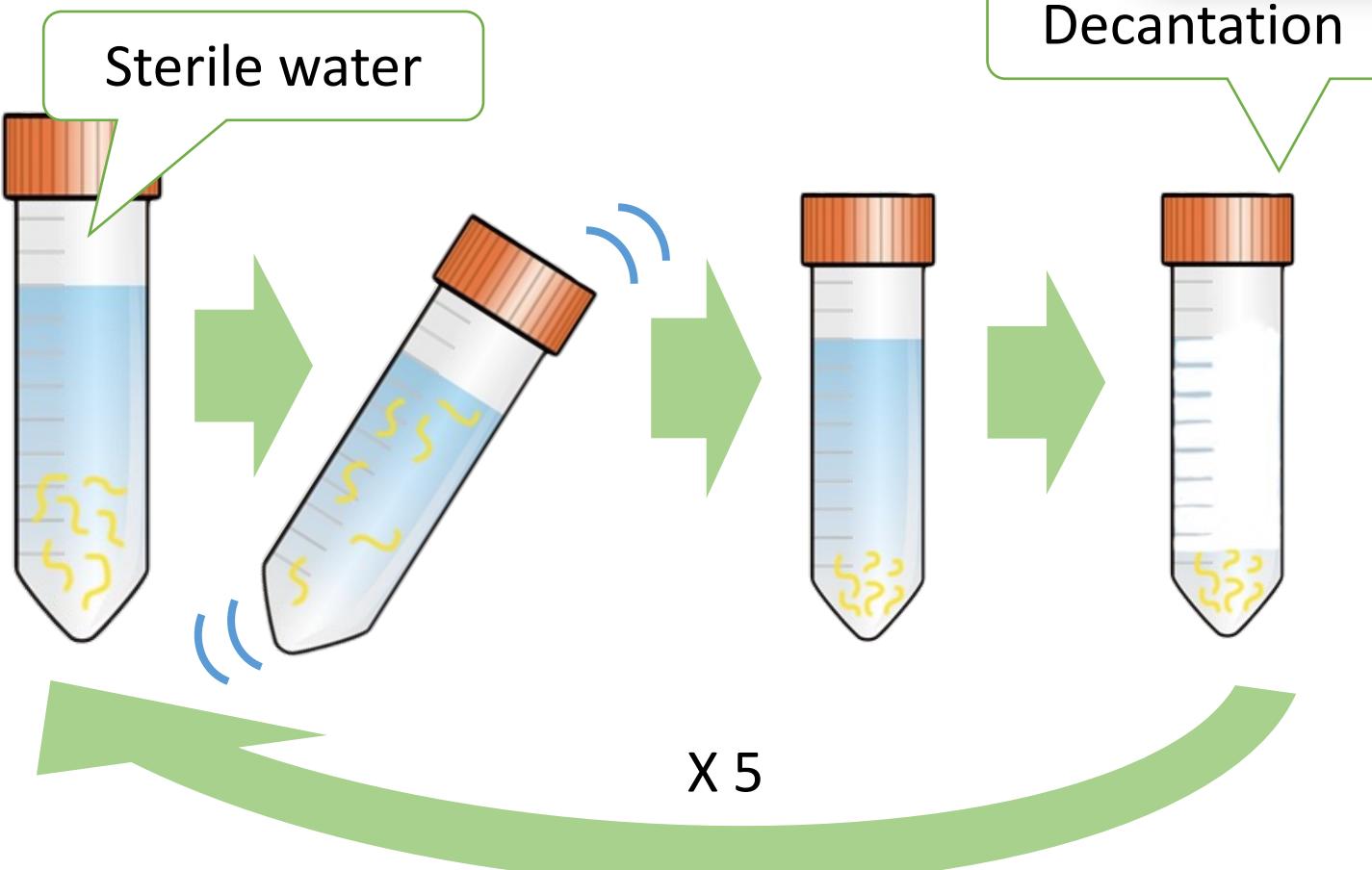
Nematode penetration at 7dpi

Absorb off excess MS, cover and autoclave

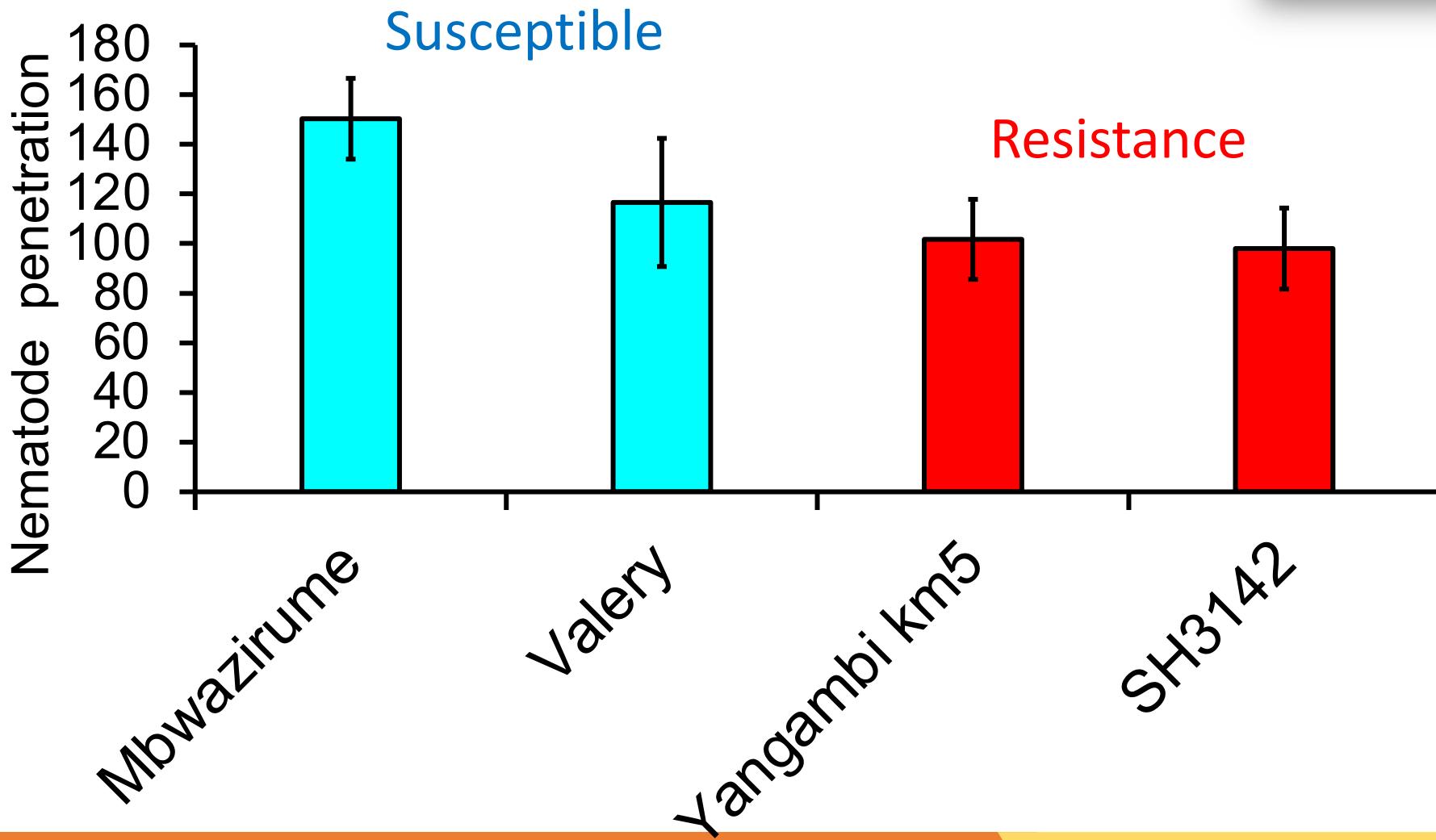
Nematode sterilization protocol was developed to prevent contaminations.



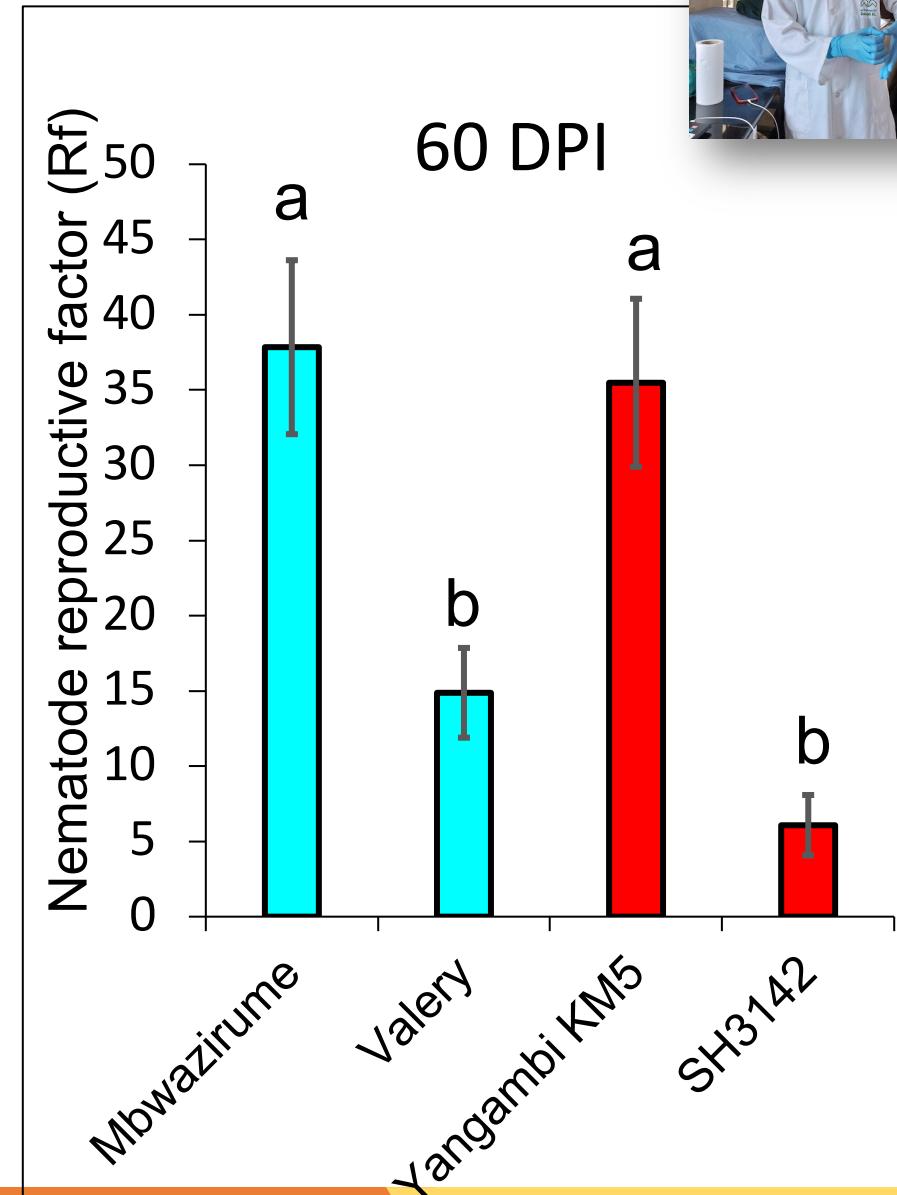
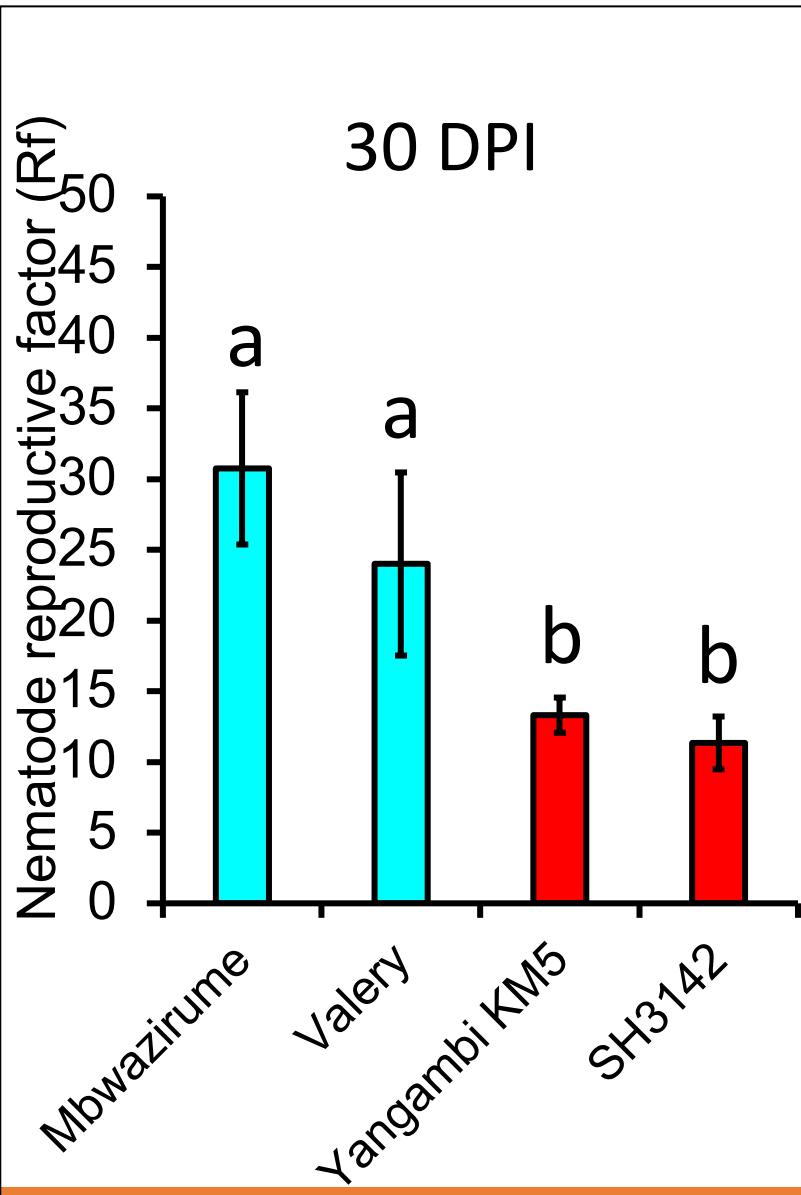
Nematode sterilization protocol was developed to prevent contaminations.



No significant difference in root penetration by *R. similis* at 7 DPI.



Penetration ≠ Reproduction.



Macropropagation offers disease free materials at cheaper cost.



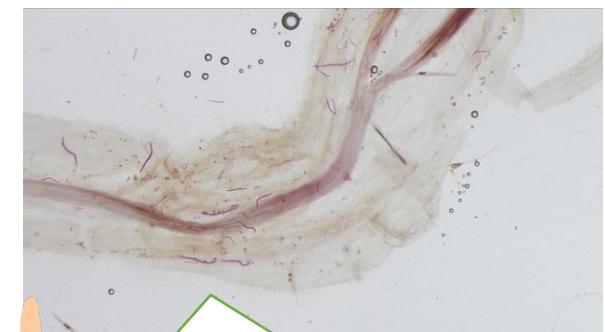
At a three leaf stages



Transplant to SAP media, inoculate with 200 *R. similis*



Agbagba	Susceptible
Yangambi KM5	Resistant
Pisang lilin	Resistant
SH 3142	Resistant
Pisang jari buaya	Resistant



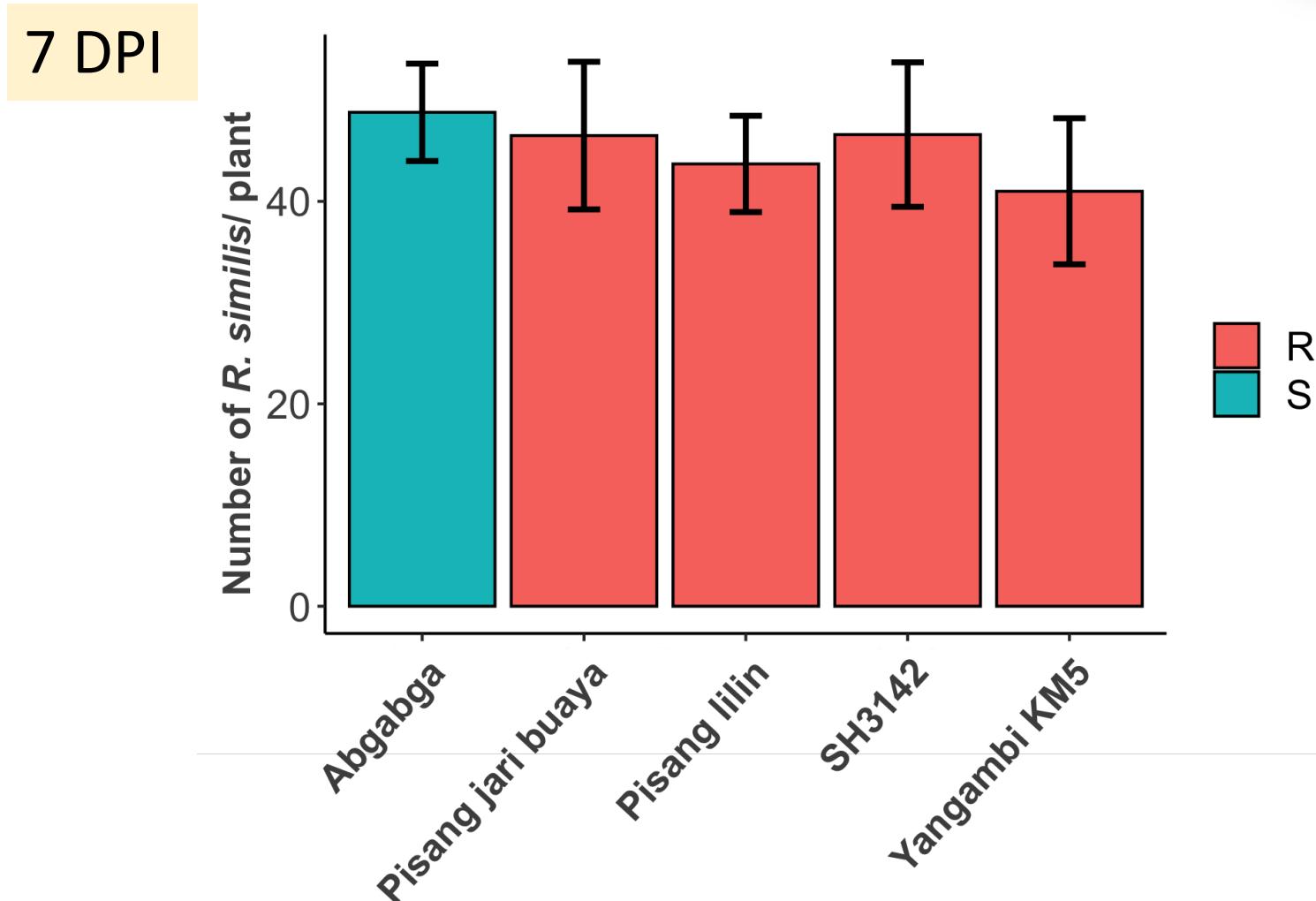
Nematode reproduction at 30 & 60dpi



Nematode penetration at 7dpi



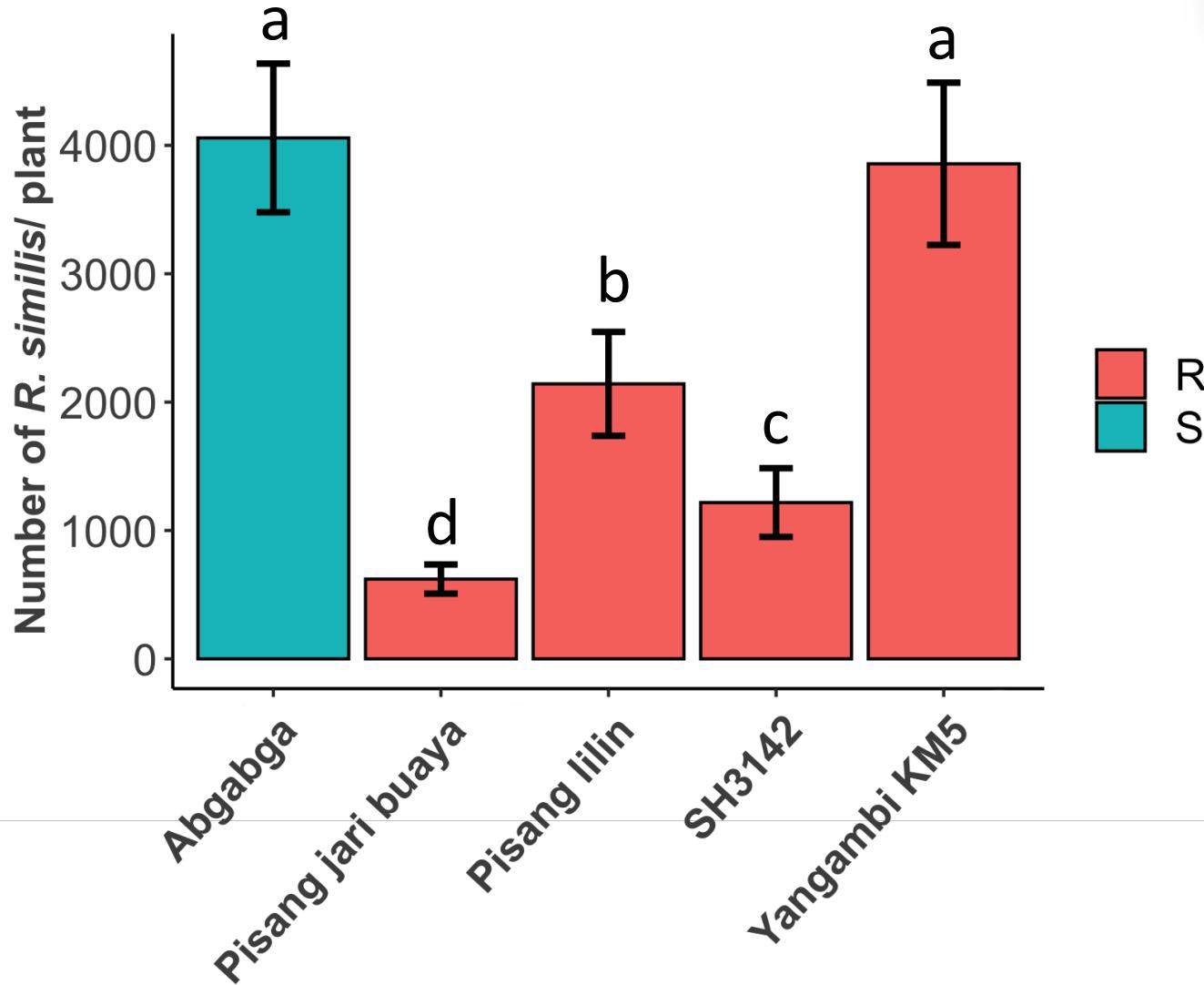
Once again, penetration ≠ reproduction.





Once again, penetration ≠ reproduction.

60 DPI



Project 3: “Wrap and Plant” – a novel nematode management



nature sustainability

ARTICLES

<https://doi.org/10.1038/s41893-022-00852-5>



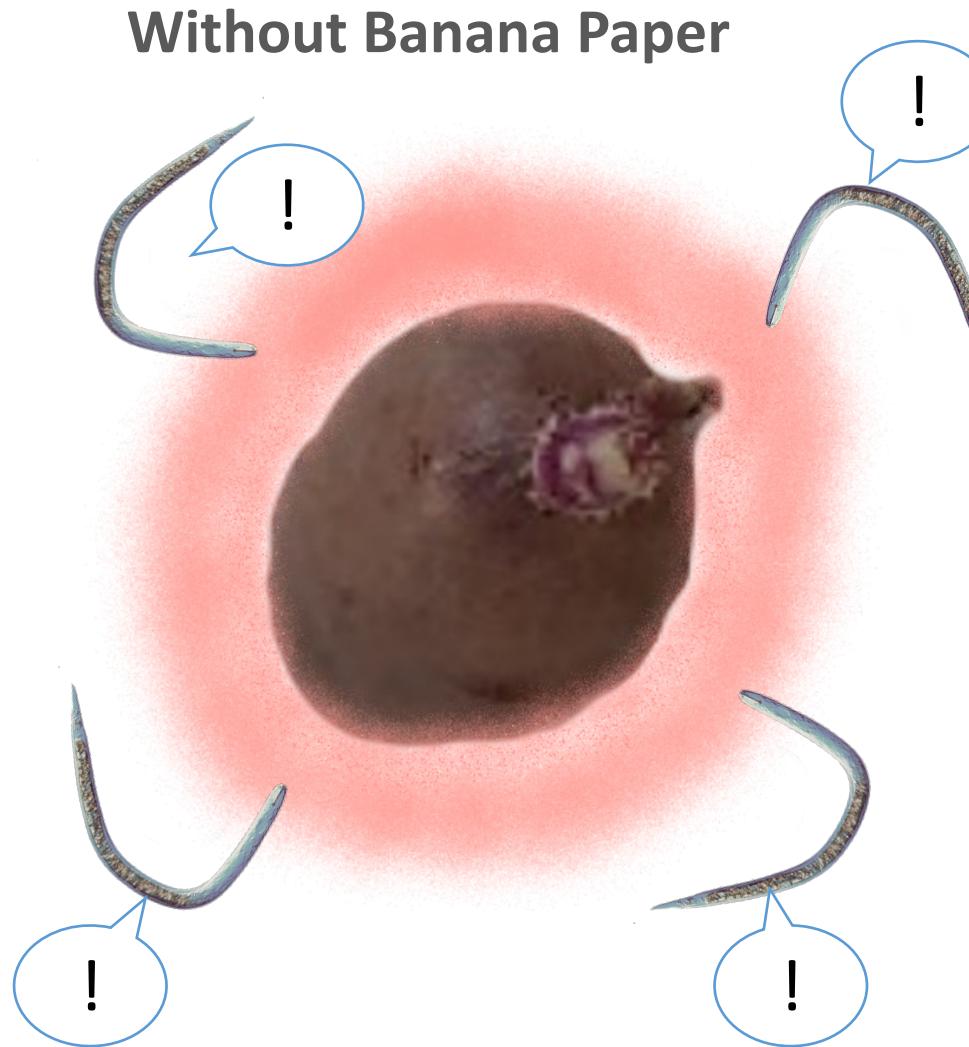
OPEN

Wrap-and-plant technology to manage sustainably potato cyst nematodes in East Africa

Juliet Ochola^{1,2}, Laura Cortada^{3,4}, Onesmus Mwaura¹, Meklit Tariku¹, Shawn A. Christensen⁵, Margaret Ng'ang'a², Ahmed Hassanali², Tahira Pirzada¹, Saad Khan⁶, Lokendra Pal¹, Reny Mathew⁸, Dick Guenther⁸, Eric Davis⁸, Tim Sit⁸, Danny Coyne^{1,4}✉, Charles Opperman¹✉ and Baldwyn Torto¹✉

Renewable eco-friendly options for crop protection are fundamental in achieving sustainable agriculture. Here, we demonstrate the use of a biodegradable lignocellulosic banana-paper matrix as a seed wrap for the protection of potato plants against potato cyst nematode (PCN), *Globodera rostochiensis*. Potato cyst nematodes are devastating quarantine pests of potato globally. In East Africa, *G. rostochiensis* has recently emerged as a serious threat to potato production. Wrapping seed potatoes within the lignocellulose banana-paper matrix substantially reduced *G. rostochiensis* field inoculum and increased potato yields by up to fivefold in Kenya, relative to farmer practice, whether or not impregnated with ultra-low doses of the nematicide abamectin (ABM). Markedly, ABM-treated banana paper at ~1,000 times lower than conventional recommendations reduced PCN inoculum. Assays and analyses revealed that the lignocellulose matrix disrupts parasite–host chemical signalling by adsorbing critical PCN hatching and infective juvenile host location chemicals present in potato root exudate. Recovery experiments confirmed adsorption of these host location chemicals. Our study demonstrates the use of waste organic material to sustainably manage PCN, and potentially other crop root pests, while increasing potato yields.

How “Wrap and Plant” work?



How “Wrap and Plant” work?

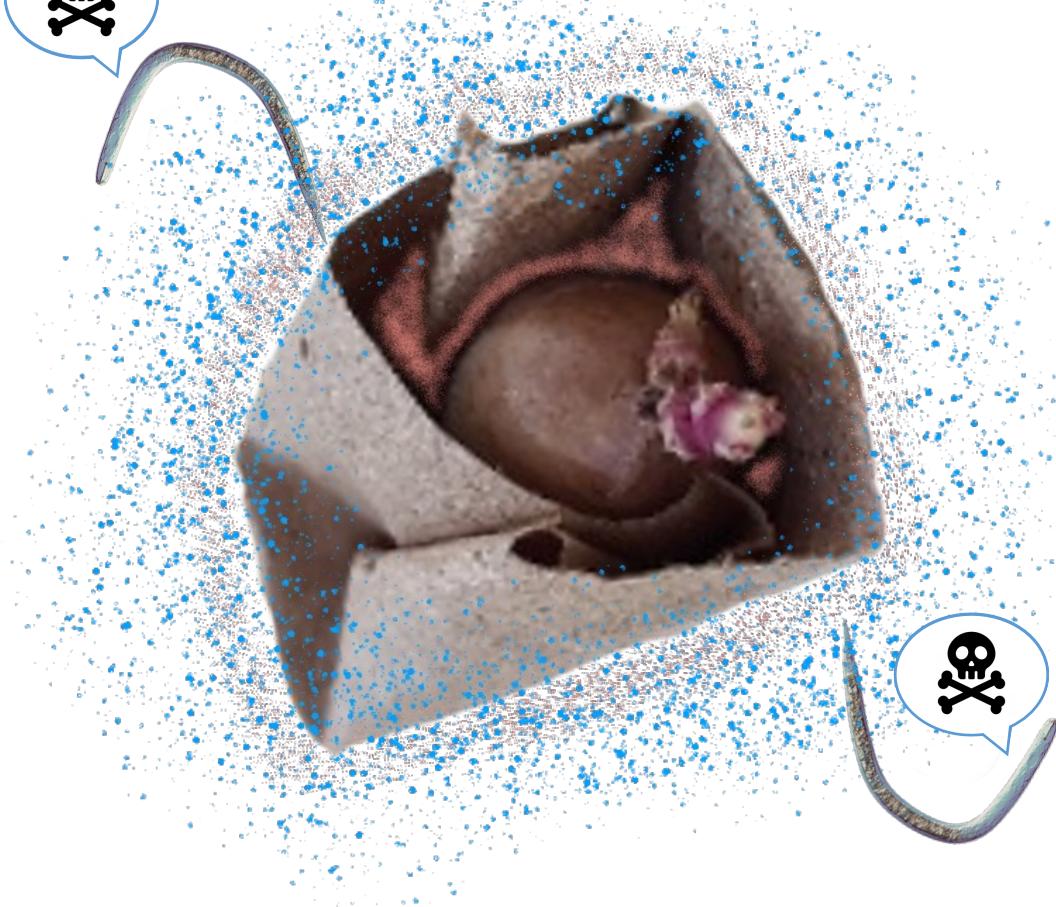


Abamectin

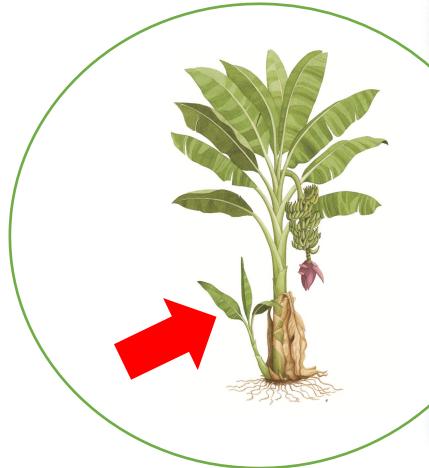


Fluopyram

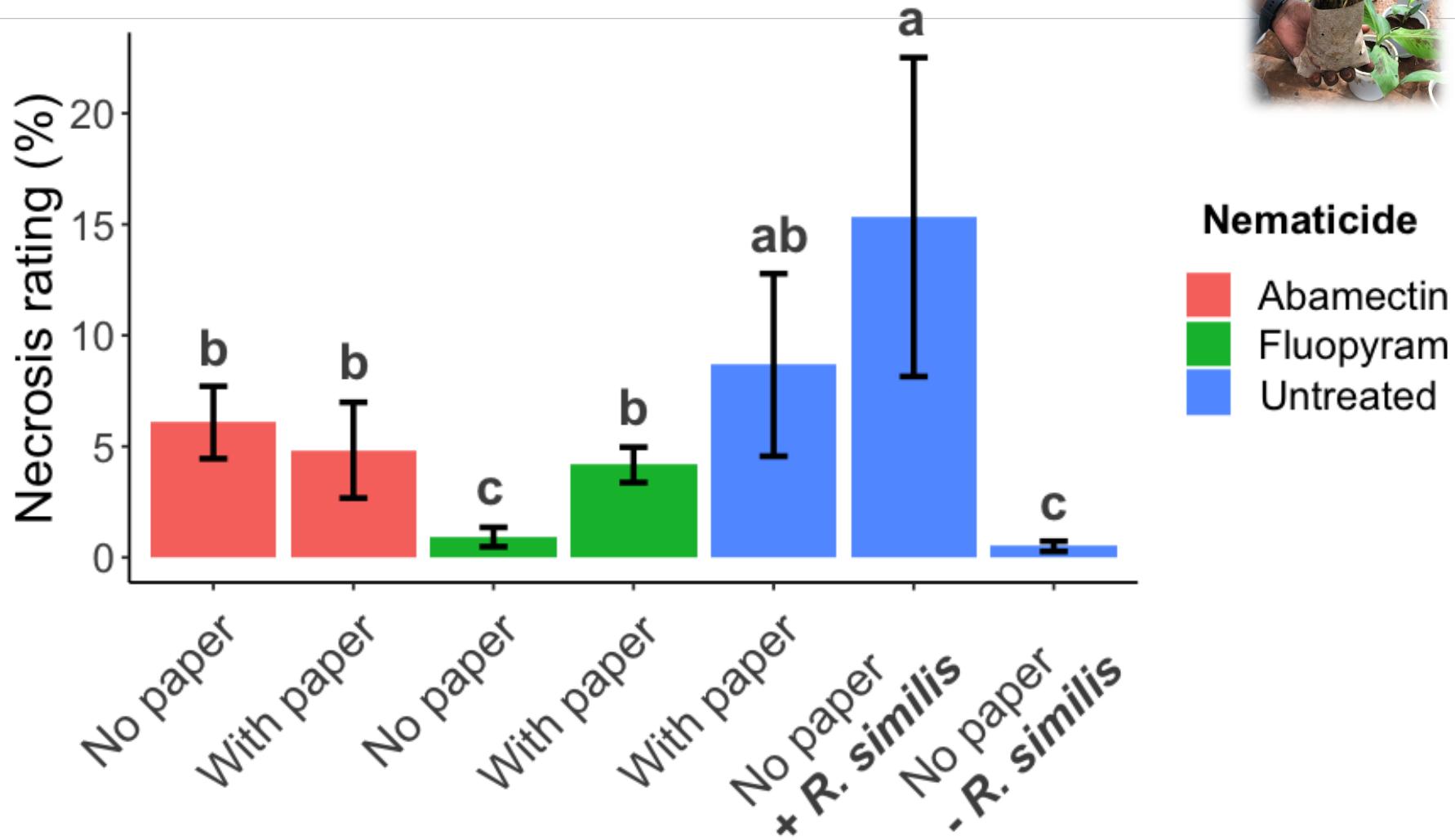
With Banana Paper



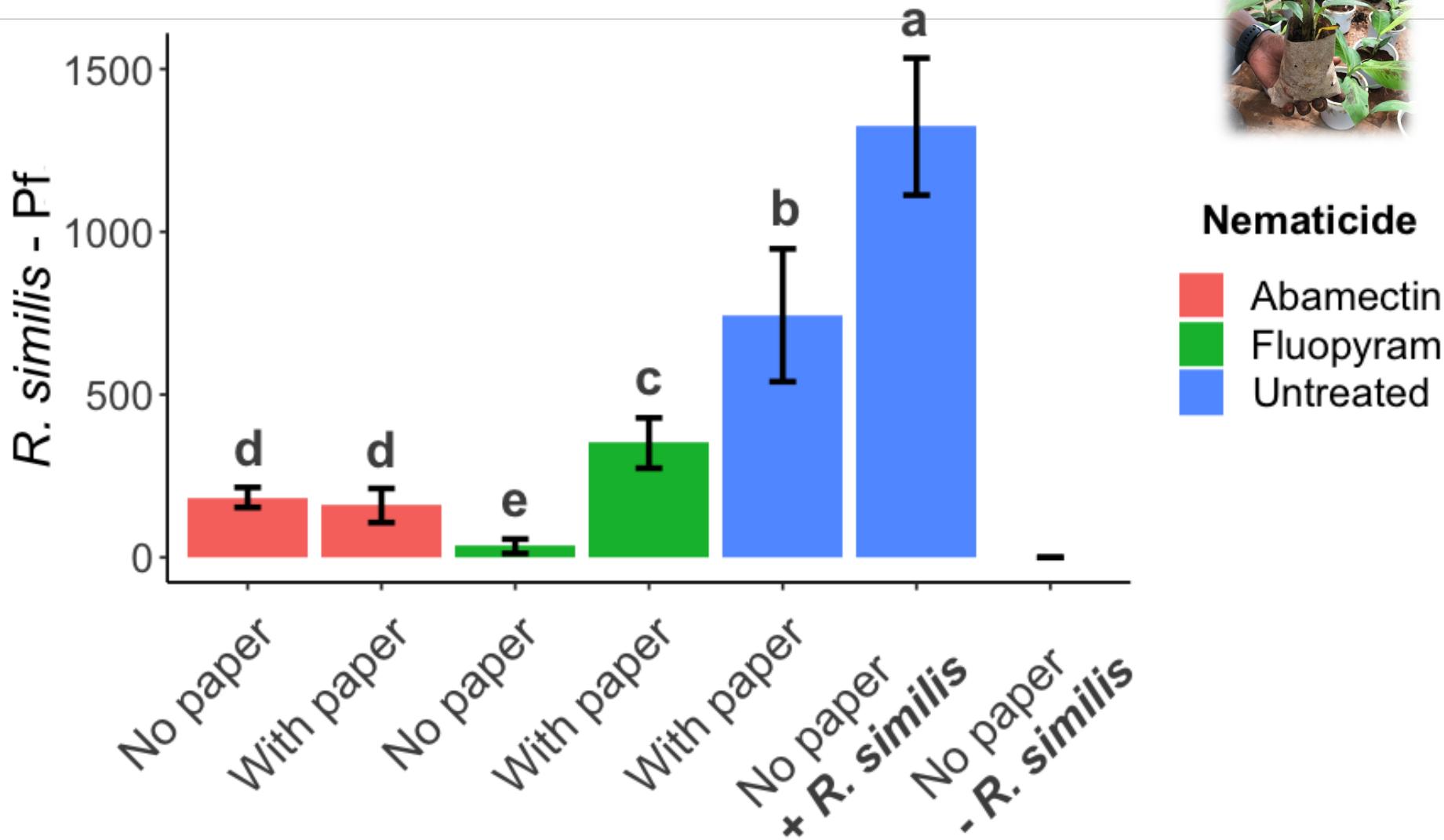
Does "Wrap and Plant" work to control other nematode pests?



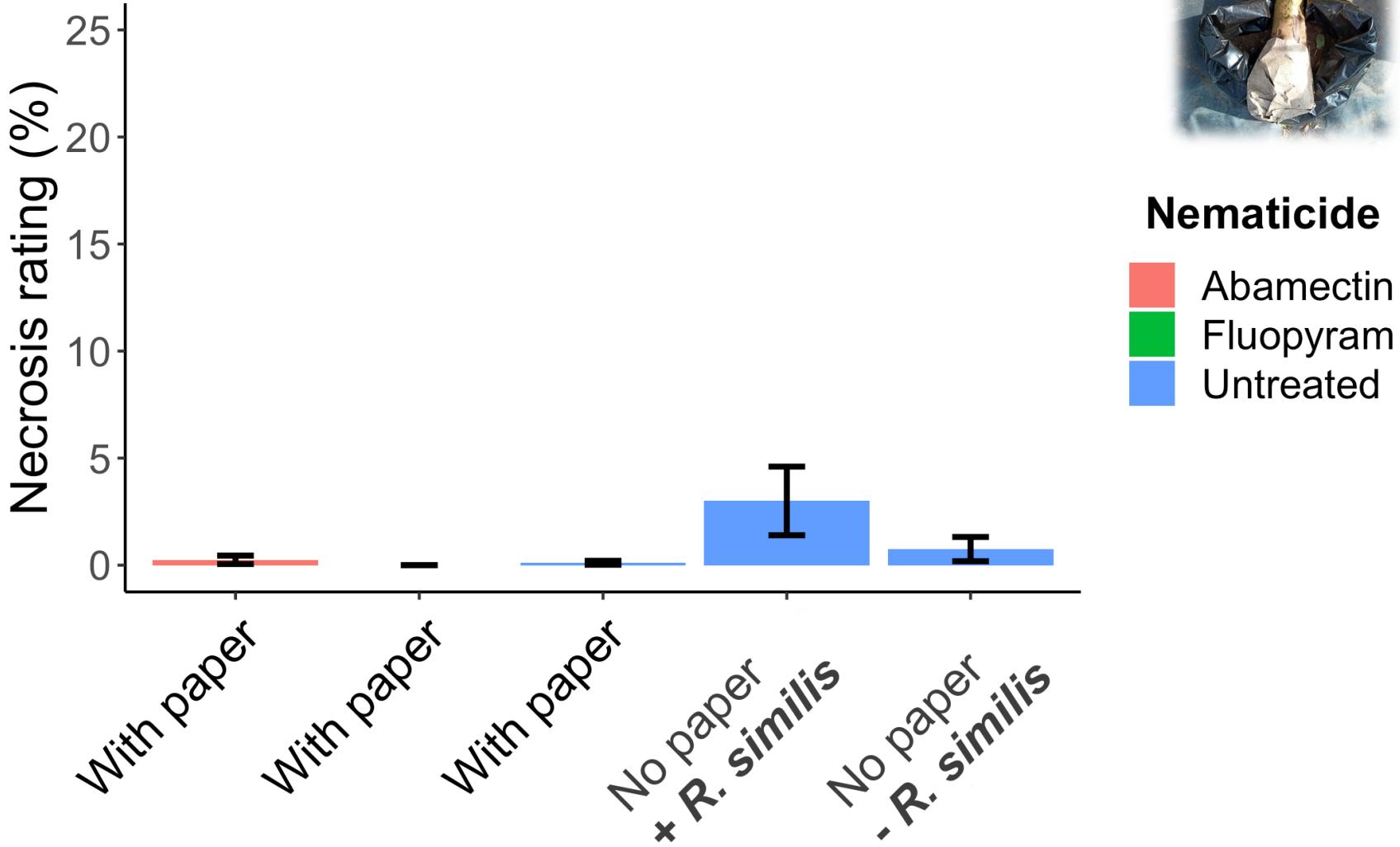
Less necrosis for TC wrapped with a banana paper.



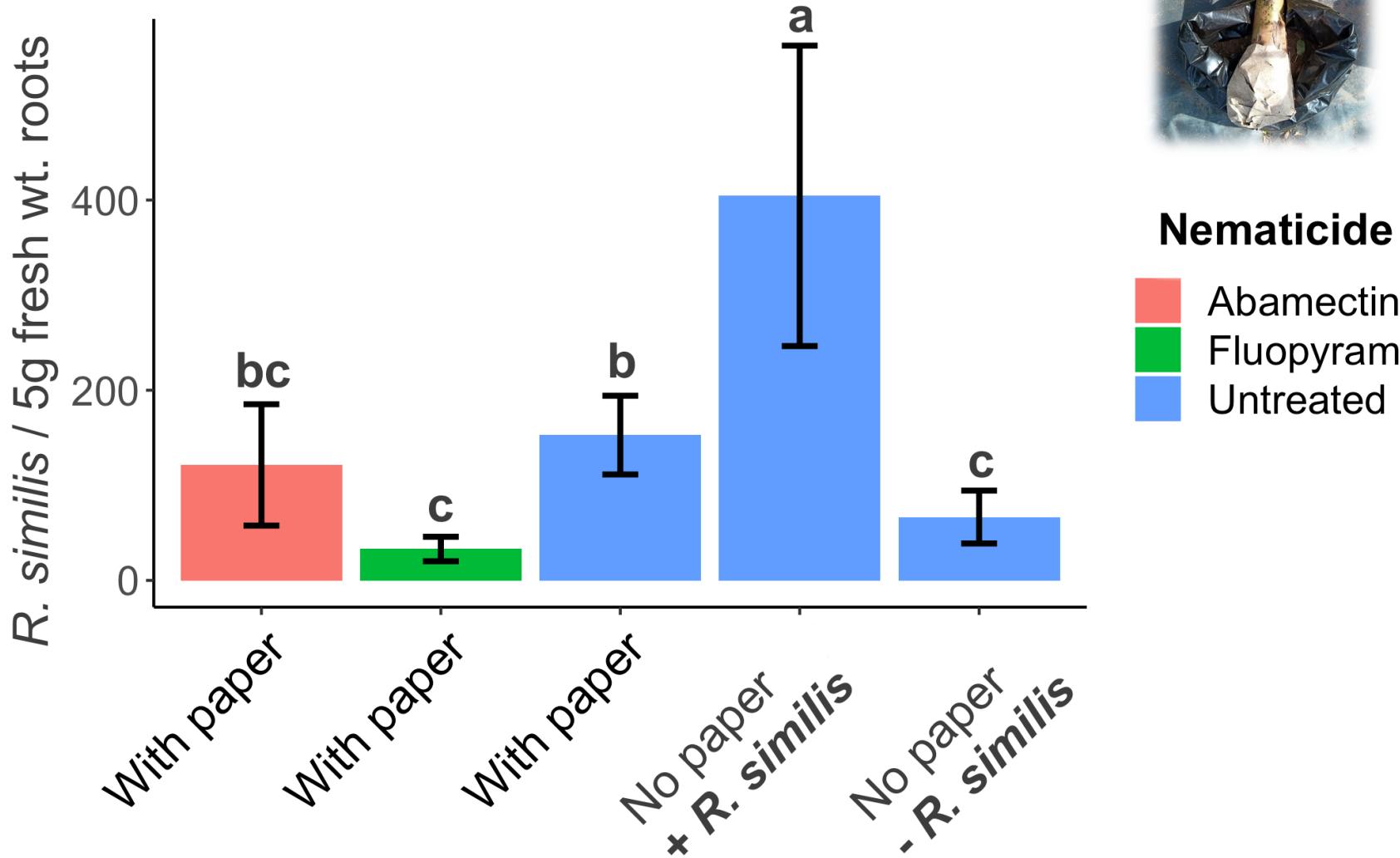
The number of nematodes was reduced for TC wrapped with a paper.



Again, less necrosis for paper treatments.



Even untreated banana paper is suppressing the nematode infection.



This is only digests of a few projects... There are a lot more that we do!



Acknowledgement

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