

Introducing Biodiversity in Banana Systems

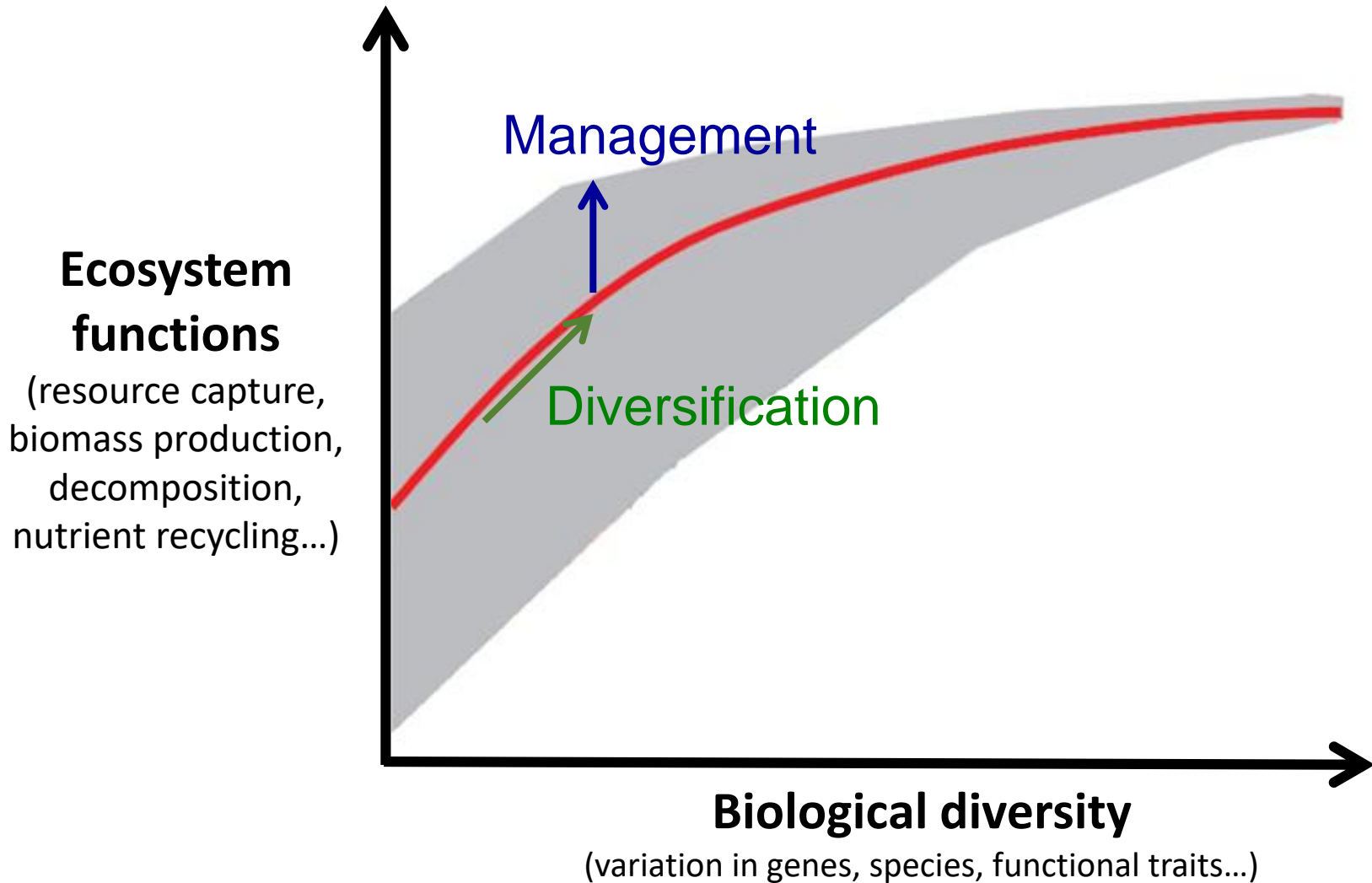
Role of the cover crops in the biological control of pests and diseases for a sustainable banana production



Presented by Tran Quoc Hoà
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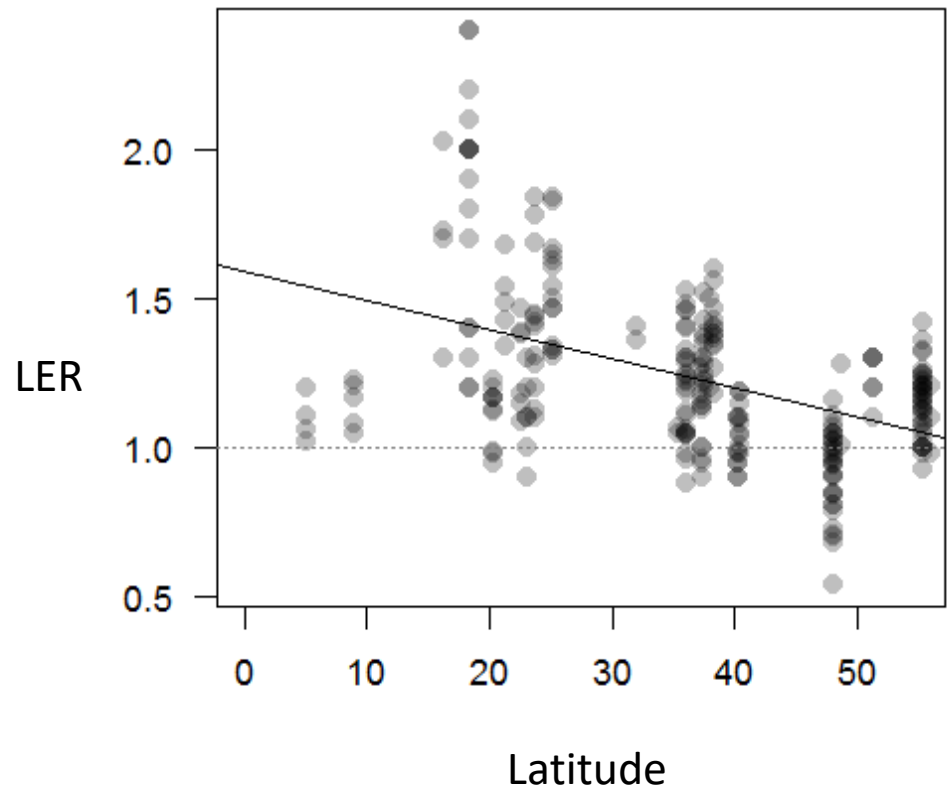
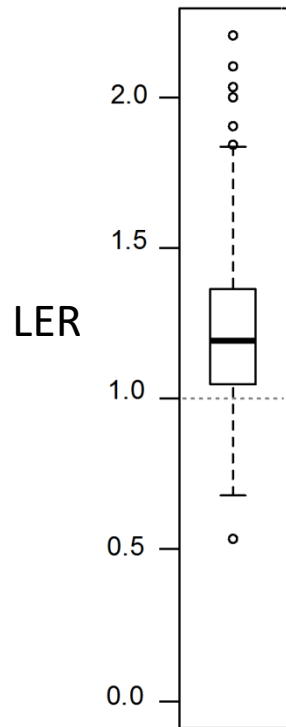


Biodiversity & Ecosystem functions

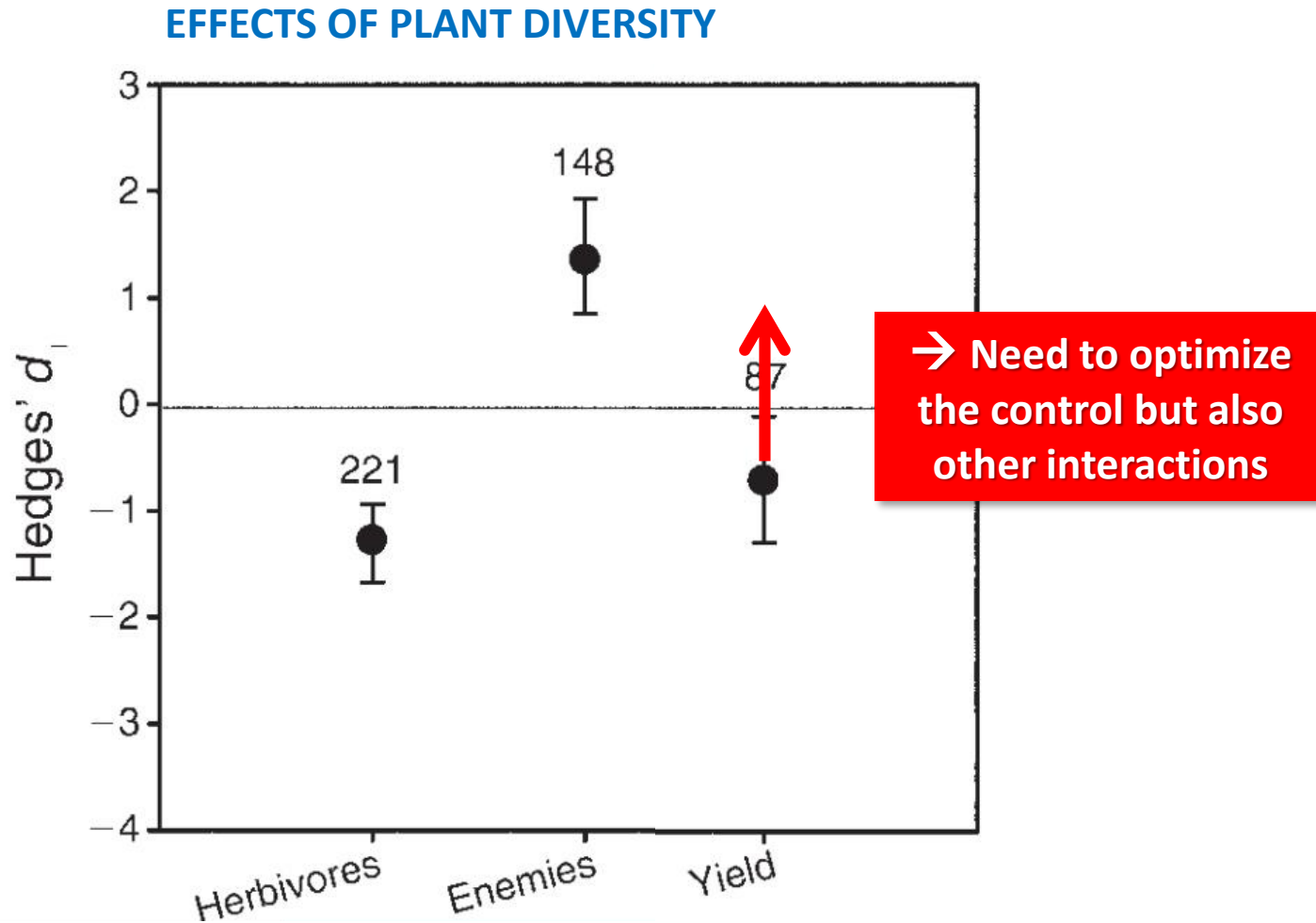


Global effect of biodiversity in literature

Analysis of the Land Equivalent Ratio (LER)
(36 studies, 248 responses)



In the case of pests control





(Cameroon)

All diversified systems do not enhance
all ecological services

Biodiversity is not the silver bullet

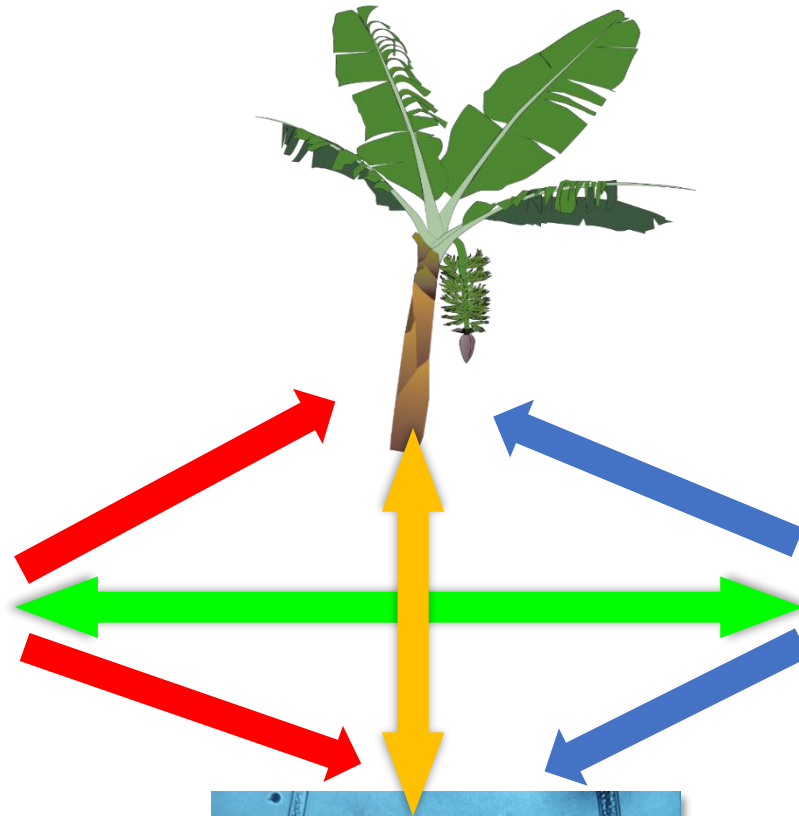


Taking into account complex interactions

**Organized
Biodiversity**



**Natural
Biodiversity**



Pests & Diseases

Mycosphaerella fijiensis



**BLACK
SIGATOKA**

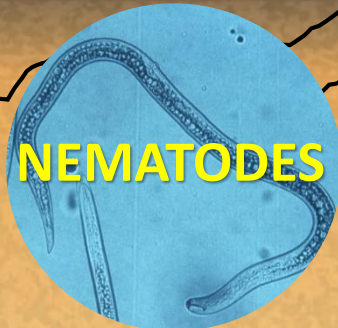
**Conventional intensive
(Cavendish) banana
cultivation**



WEEDS



**Panama
TR4**



NEMATODES



**WEEVIL
BORER**

Cosmopolites sordidus

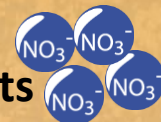


**DEGRADED
SOILS**

**Soil erosion
& compaction**




**Loss of
mineral nutrients**



Fusarium oxysporum f. sp.
Cubense Tropical Race 4

Radopholus similis
Pratylenchus coffeae

A photograph of a diverse agricultural system. In the foreground, a banana plant with large, vibrant green leaves stands on the left. To its right, a corn plant is visible, showing its characteristic tassels. The ground is covered with a dense layer of green plants, including what appears to be a legume with small yellow flowers. In the background, more greenery and a few taller, thin trees are visible against a sky filled with soft, white clouds. The overall scene depicts a healthy, multi-species crop system.

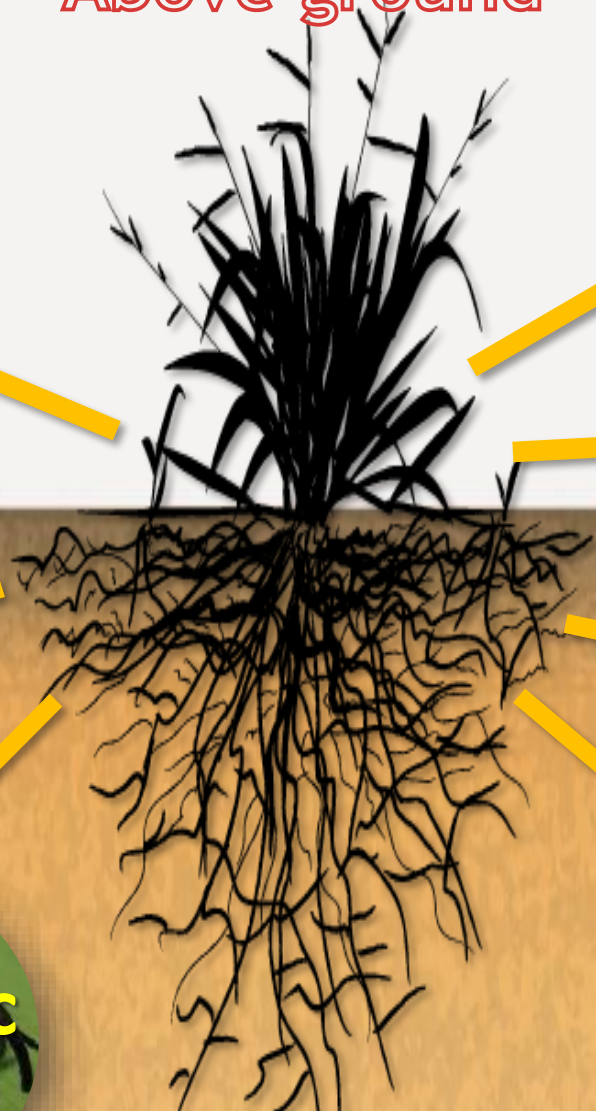
What effects can we expect from plant diversity to control P&D in banana systems?

Multifunctionality of cover crops

Above ground



Below ground



3 ways to control plant-parasitic populations

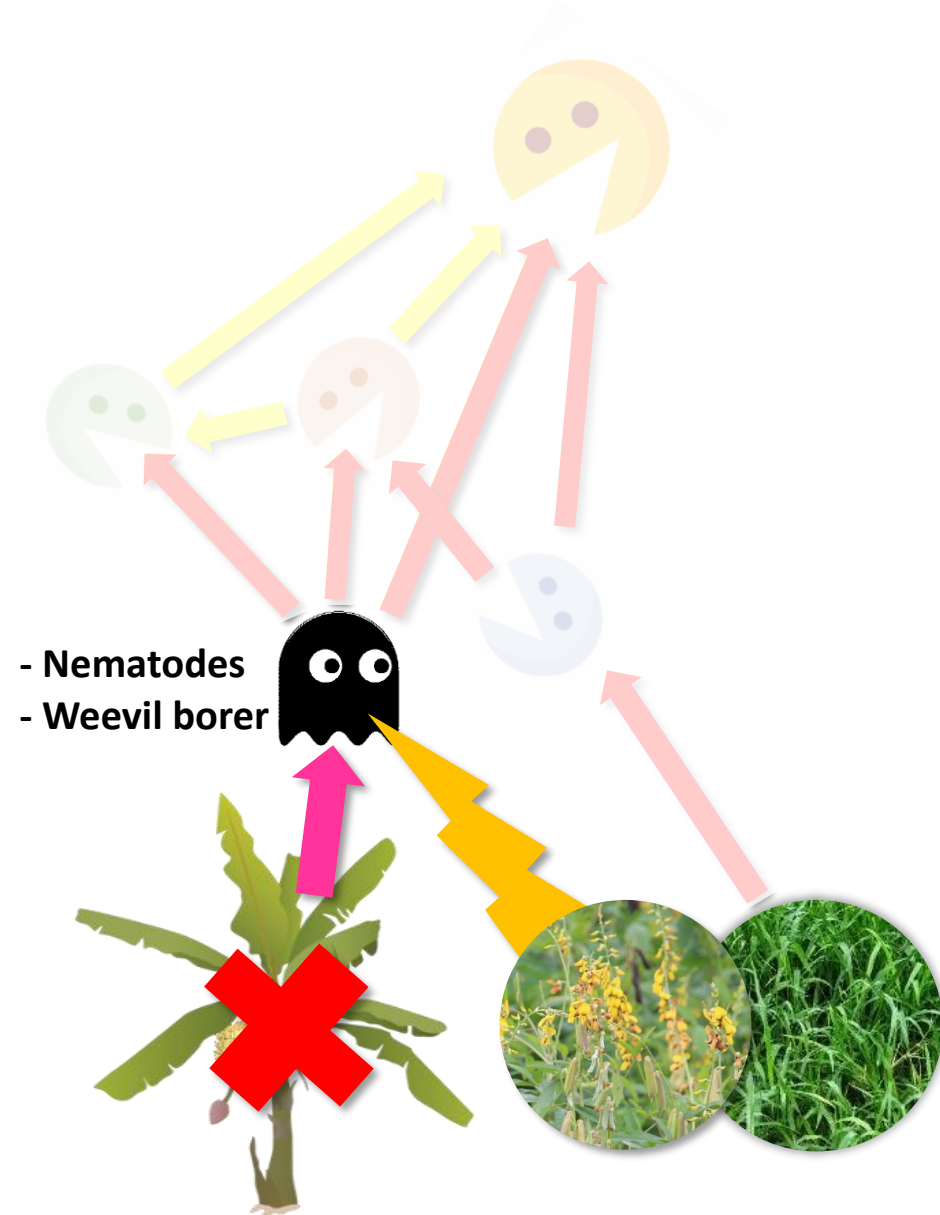
■ BOTTOM-UP

↳ Suppress Resources

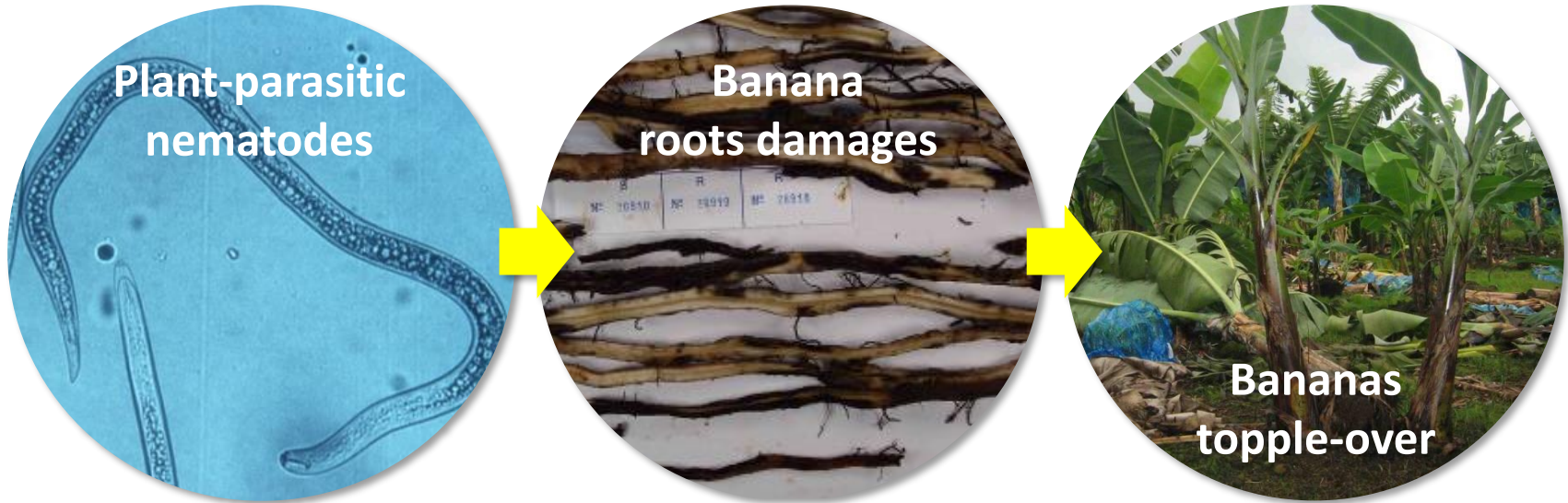
■ TOP-DOWN

↳ Enhance Predators

■ BIOCIDAL EFFECT

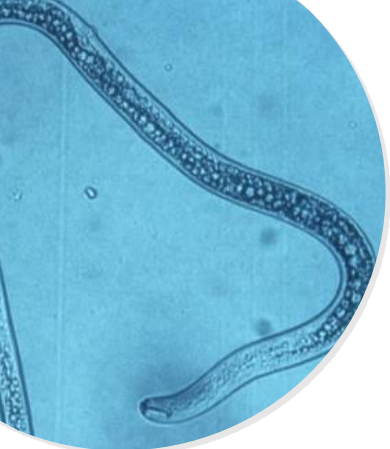


Nematodes control

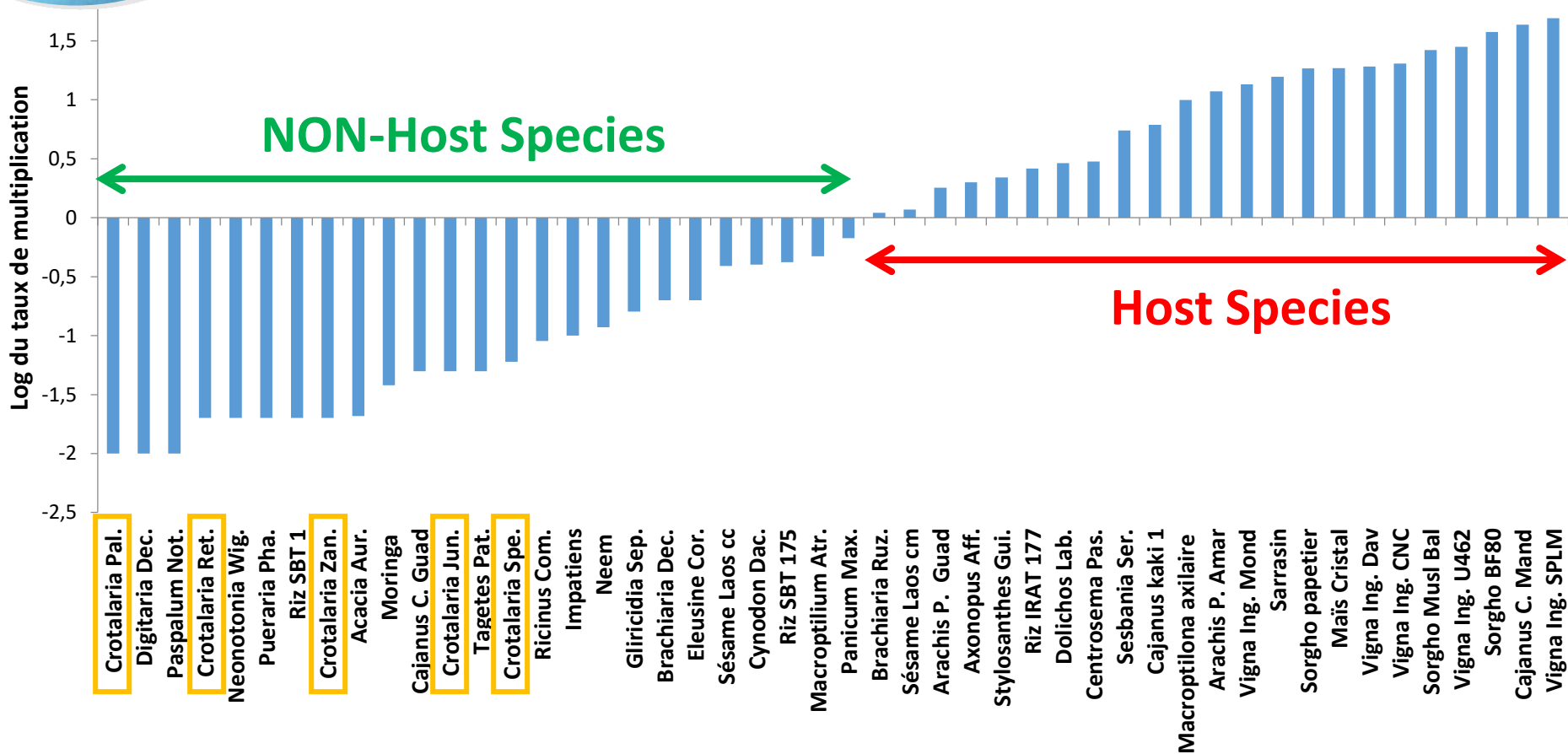


Suppress the resources during a fallow period

- ➔ Installation of cover non-host crops of plant-parasitic nematodes AND also by using biocidal species



Multiplication rate of plant-parasitic nematodes (*Radopholus Similis*)



Crotalaria sp. => Biocidal species

Producers use of *Crotalaria* sp. + *Brachiaria* sp. during fallow period



3 ways to control plant-parasitic populations

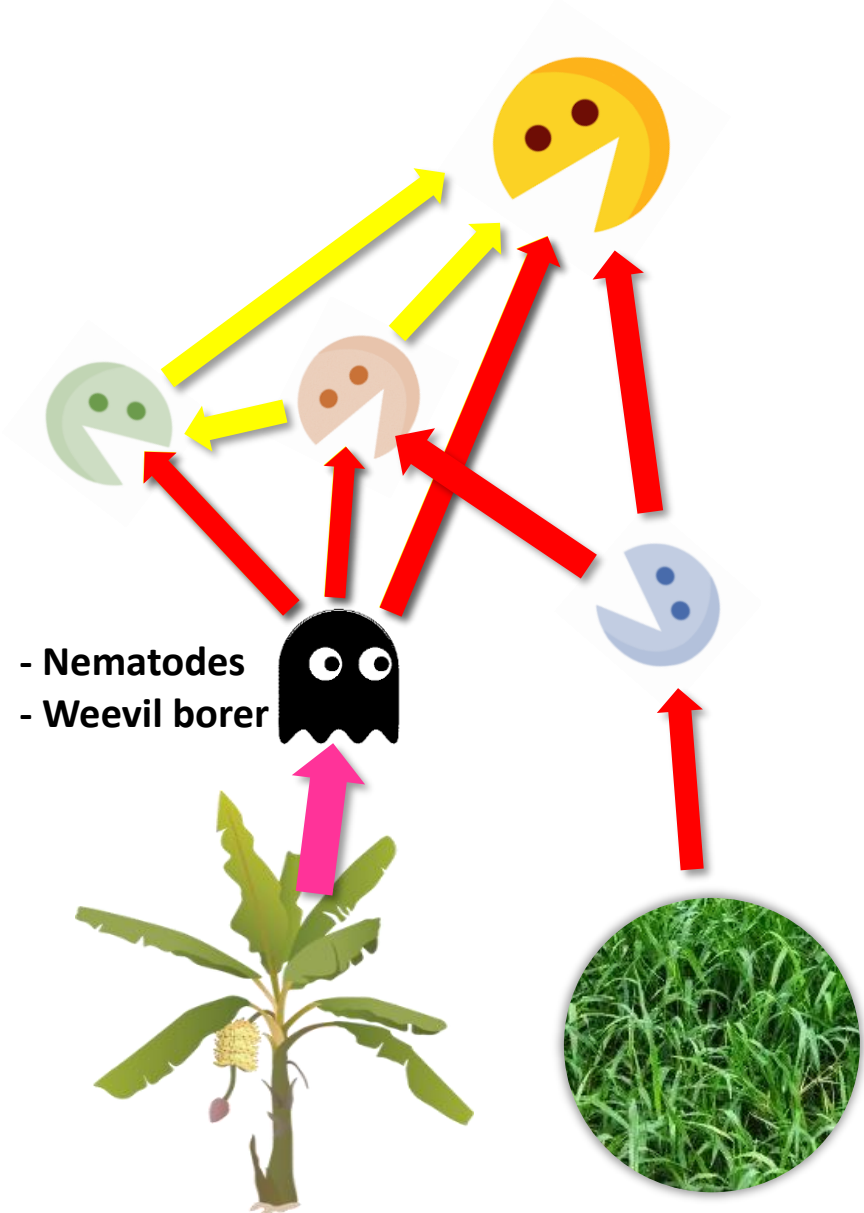
■ BOTTOM-UP

↳ Suppress Resources

■ TOP-DOWN

↳ Enhance Predators

■ BIOCIDAL EFFECT



Nematodes control

TOP-DOWN => Enhance predators

Comparison of free-living soil nematodes communities :



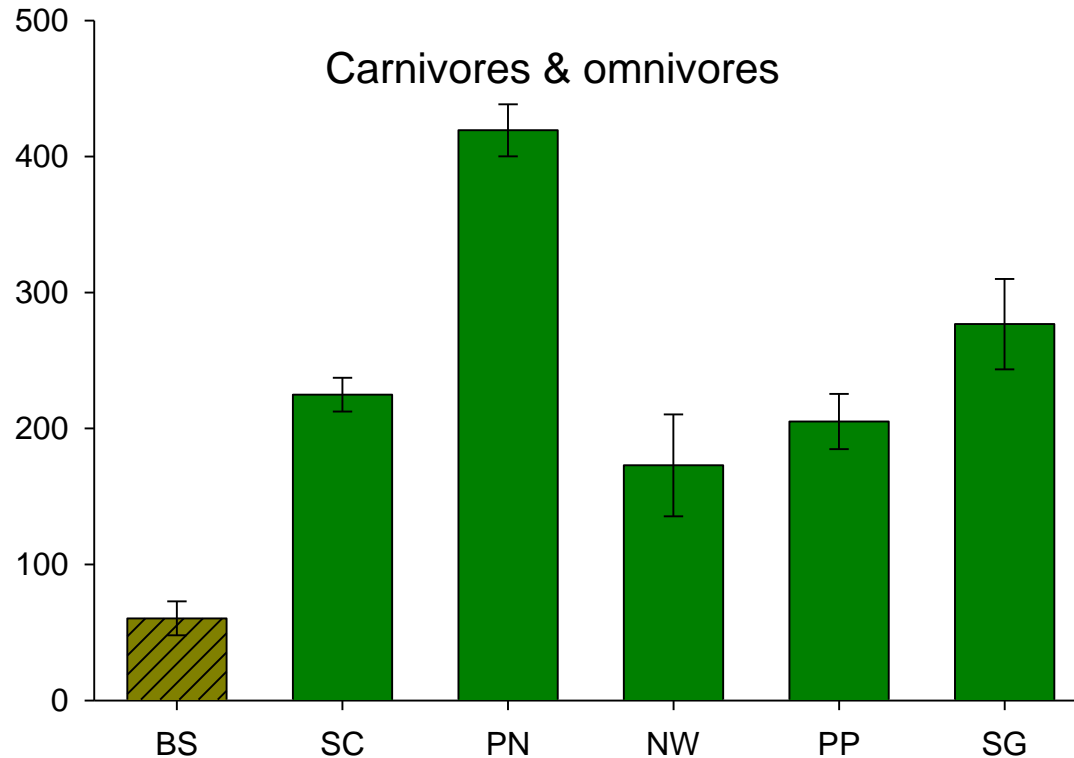
Bare soil

VS



with cover crops

Nb. / 100g of soil



BS: Bare Soil
SC: Spontaneous Cover
PN: *Paspalum N.*
NW: *Neonotonia W.*
PP: *Pueraria P.*
SG: *Stylosanthes G.*

Djigal et al. 2011

→ **Cover crops increase predators populations**

⇒ **Positive effect on biodiversity and food webs**

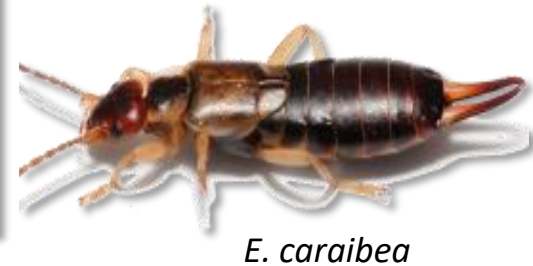


Weevil borer control

TOP-DOWN => Enhance predators

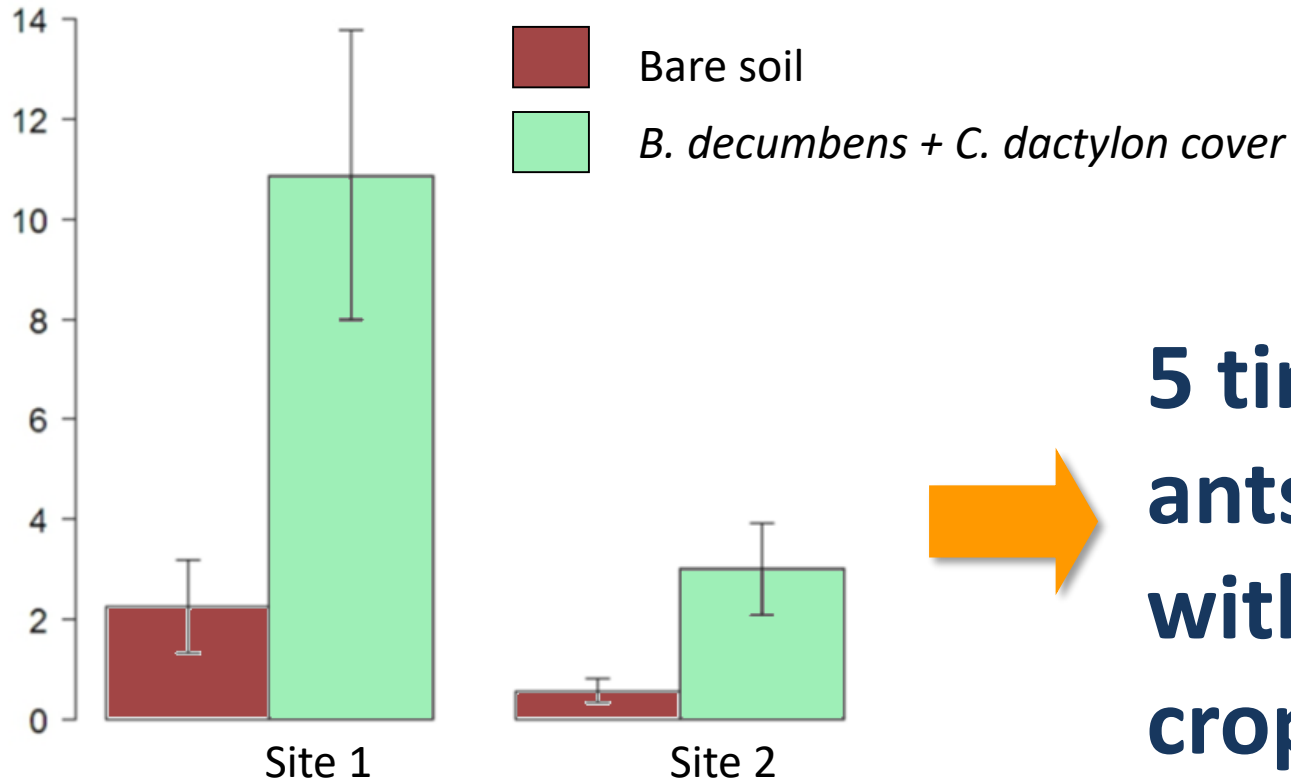
In soil litter, general predators contribute to weevil borer control:

- Ants
- Earwigs...



Captures of ants

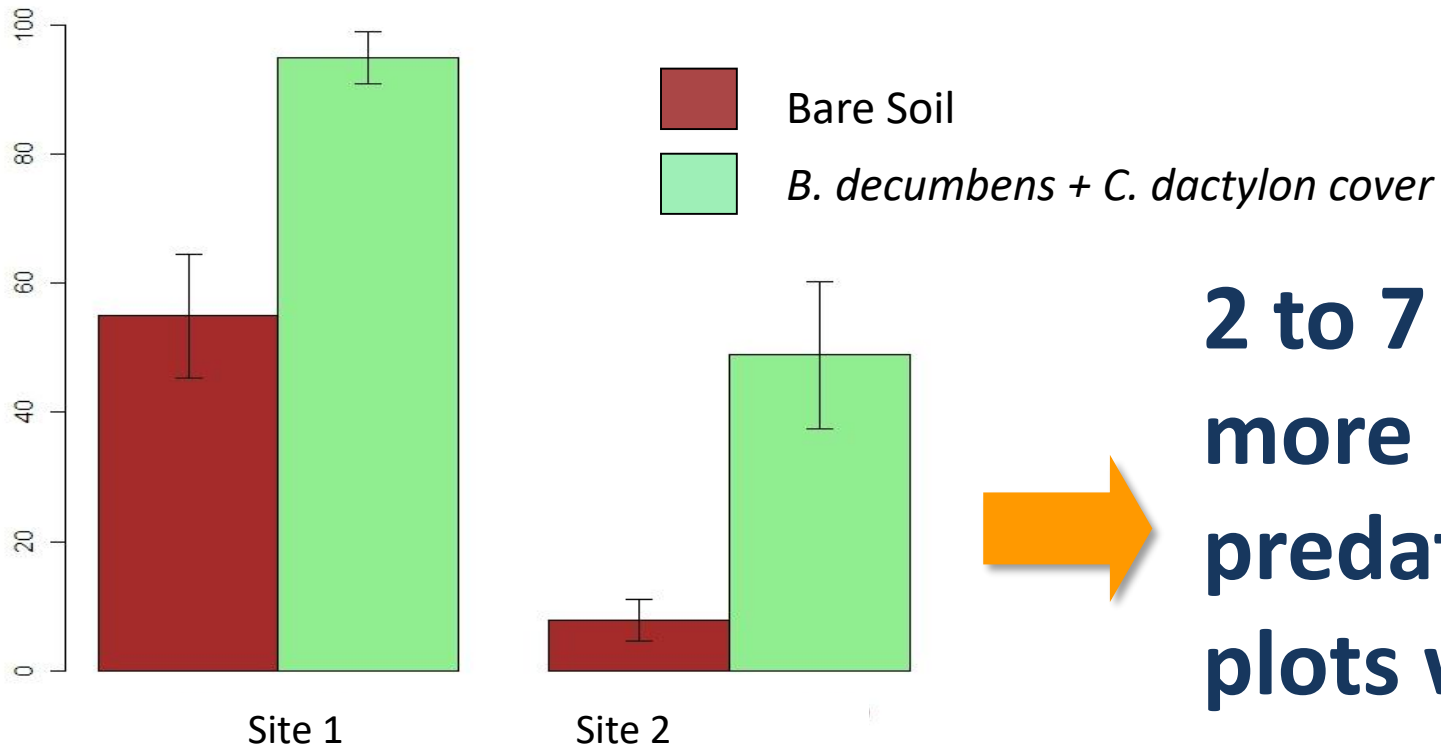
Solenopsis geminata



**5 times more
ants in plots
with cover
crops**

Cover crops increase predators abundance

Predation rate of weevil borer eggs by ants

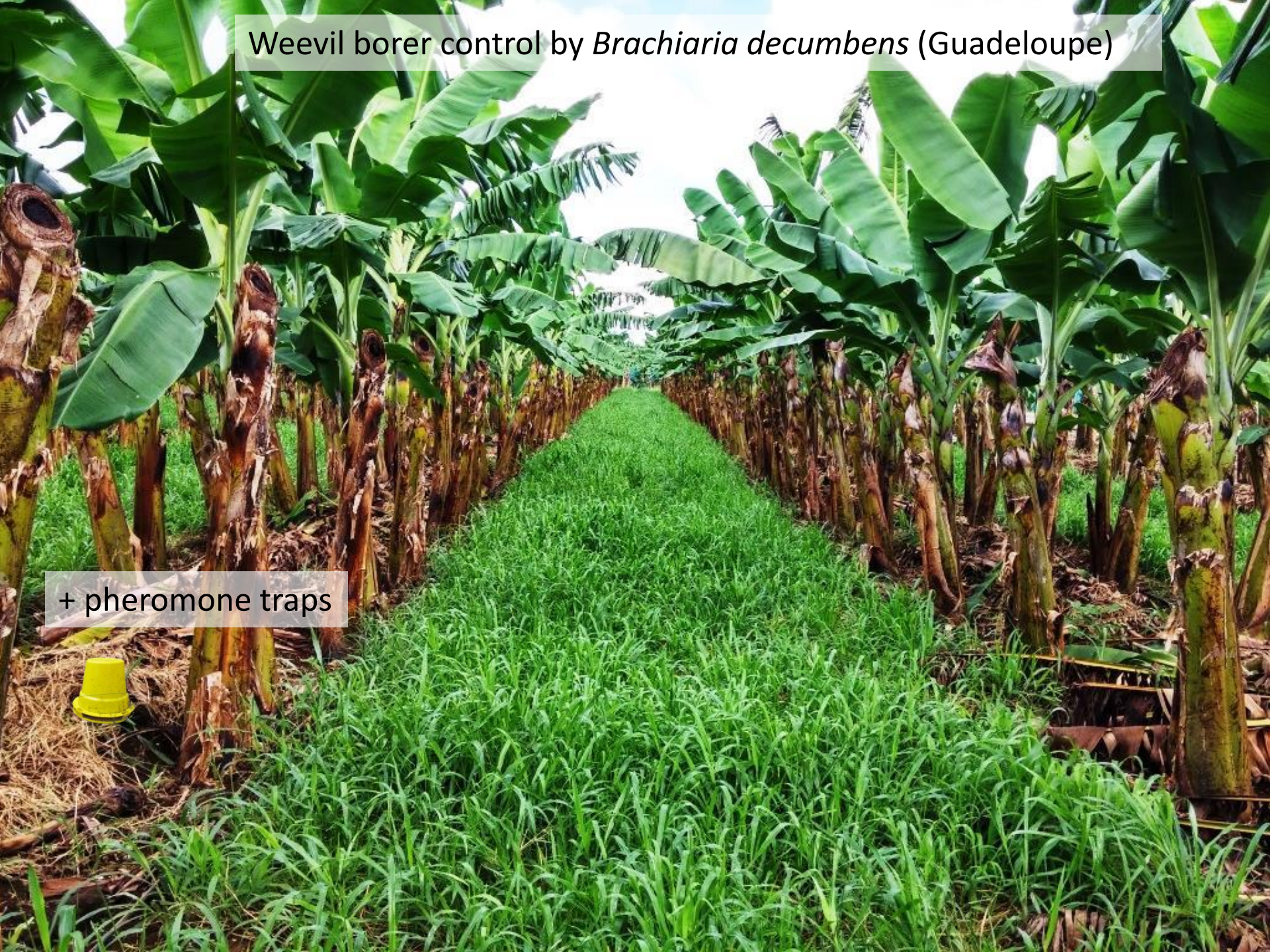


**2 to 7 times
more
predation in
plots with
cover crops**

**Predators increase the predation rate
of weevil borer eggs**

Weevil borer control by *Brachiaria decumbens* (Guadeloupe)

+ pheromone traps



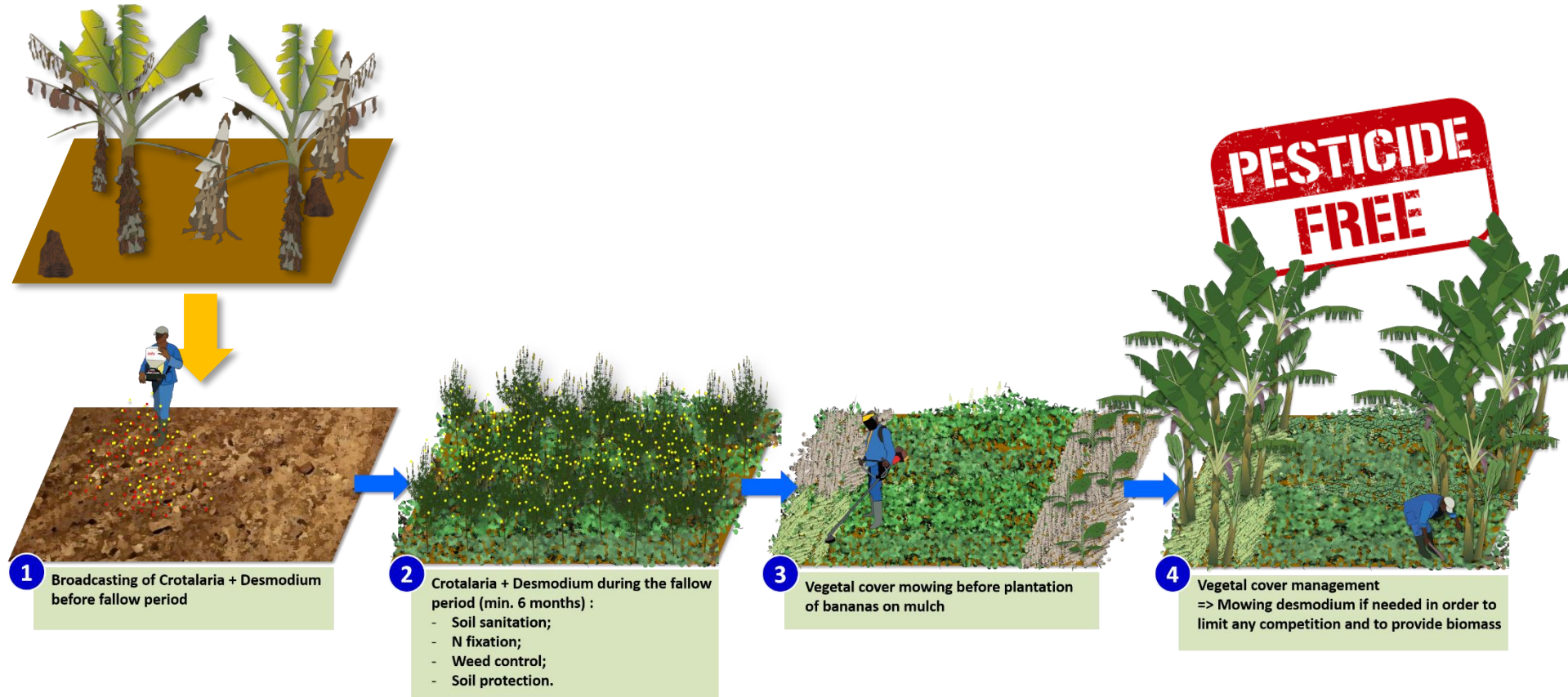
**MIX SPECIES ACCORDING TO
THEIR COMPLEMENTARITY**



**INCREASE THE
FUNCTIONAL BIODIVERSITY**



Example of an innovative banana system



- Soils are permanently covered (before and after banana plantation)
- Efficient pests control (nematodes, weeds...), continuous soil fertility improvement

- High technicity and Know-How required
- Mechanization is required to sow and manage cover crops

***Crotalaria juncea* + *Desmodium ovalifolium* + Bananas (Guadeloupe)**



***Crotalaria juncea* + *Desmodium ovalifolium* + Bananas (Guadeloupe)**



***Arachis repens* + *Desmodium ovalifolium* + Bananas (Guadeloupe)**



Bananas + *Gmelina arborea* + *Brachiaria D.* (Martinique)



Bananas + *Gliricidia* S. + Cocoa + *Brachiaria* D. (Martinique)



Bananas and *Desmodium ovalifolium* (Martinique)

With the support of:



Or Kun Chroearn!
Thank You!