



The **BarCo** project: for the promotion of barrier crops to curb the expansion of the Cocoa swollen shoot virus in Côte d'Ivoire
(June 2018 – December 2020)

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Côte d'Ivoire, France

BarCo CSSV, an expanding disease in Côte d'Ivoire

300 000 Ha infected in 2018



Survey 2008-2016 (Aka et al., 2020)



Government program for cutting and replanting: 100 000 Ha by 2022



Insect vectors: mealybugs, omnipresent in cocoa plantations

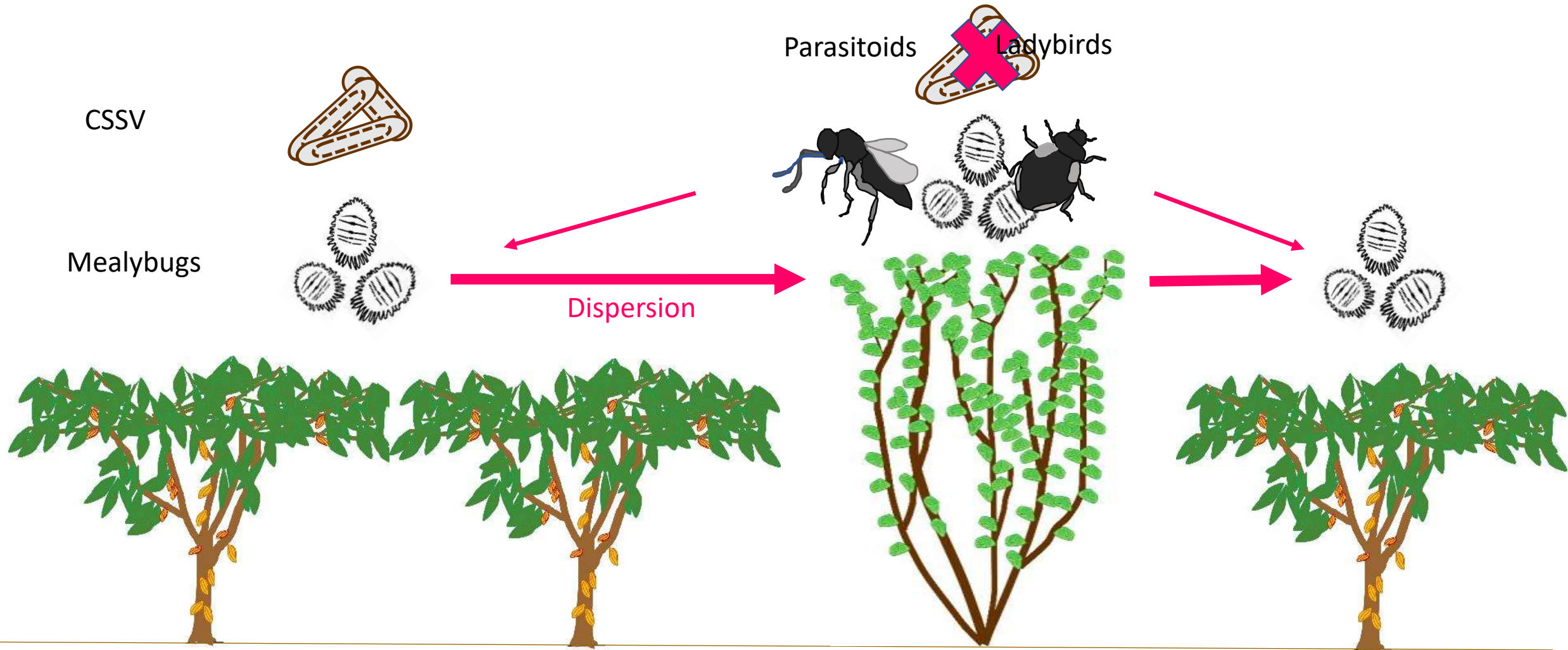
Implement a set of cocoa plantations surrounded by barrier crops for **experimentation** and **demonstration**

Optimize innovation adoption by beneficiaries through a "**Living Labs**" **approach** including trainings

Improve and promote the use of barrier crops when replanting in CSSV infested areas

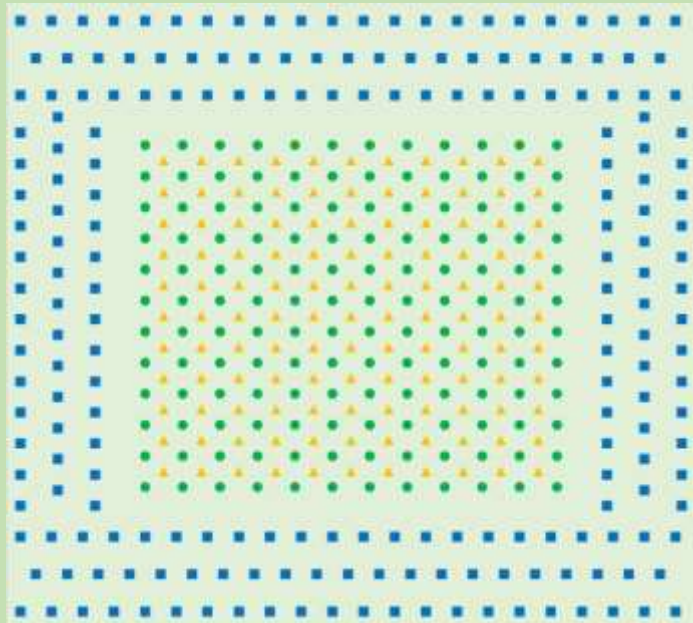
Characterize **barrier effect** on virus propagation and mealybug dispersion

Inventory of mealybug **natural enemies**



Ex: *Acacia*

BarCo 14 plots (4 ha) implemented in June 2019

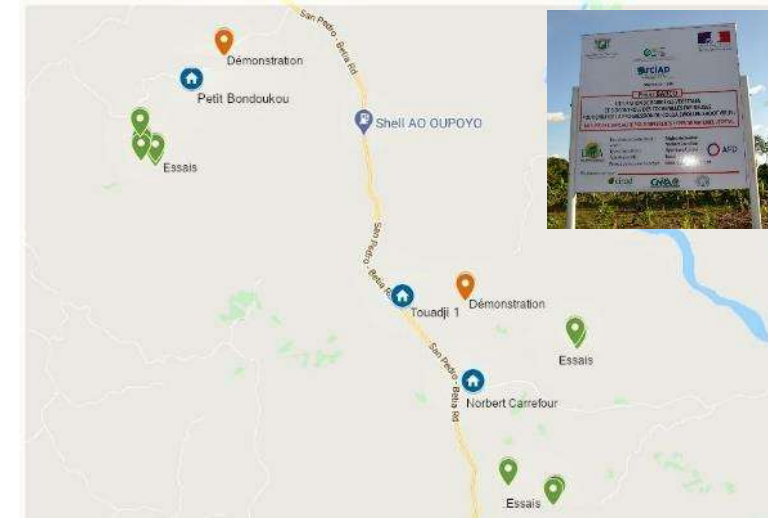


-  Cocoa infected by CSSV
-  Cocoa
-  Barriers
-  Plantains



Coffee - Cocoa

$S = 50\text{m} \times 50\text{m} = 0,25 \text{ ha}$
Barrier = 10m wide



Cocoa - *Acacia mangium*

2 demonstration plots, 4 plots with coffee barriers, 4 plots with *Acacia mangium* barriers, 4 control plots with barrier crops replaced by cocoa

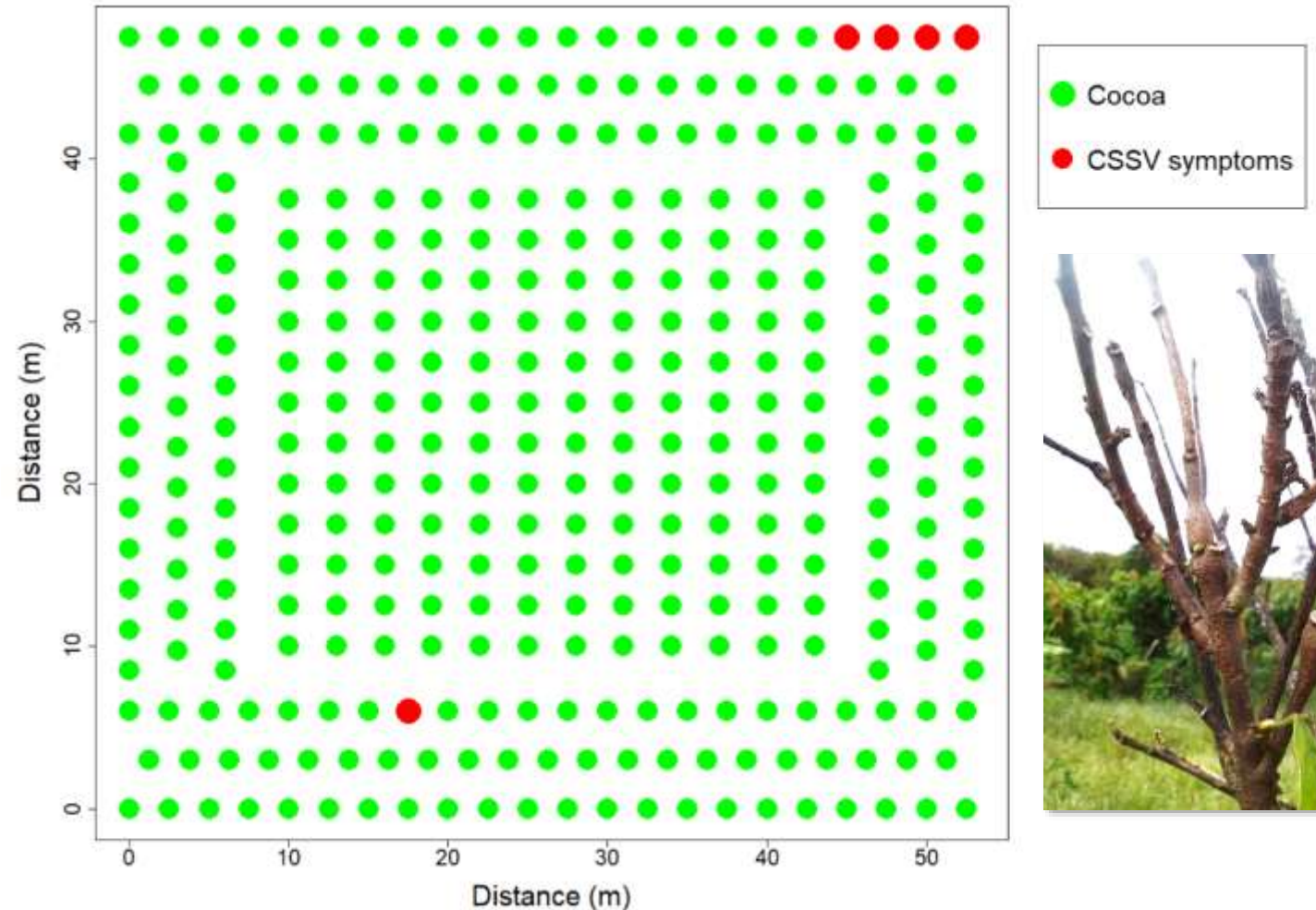
BarCo A “Living Labs” approach

- ✓ A functional collaboration platform with the farmer cooperatives SCAPB and SOCANC (≈ 700 cocoa farmers)
- ✓ Cooperatives, as partners of the project, in charge of most of field activities
- ✓ Involvement of farmers in plot implementation and maintenance



BarCo A 2 year database for CSSV/mealybugs (1) —

- ✓ CSSV symptoms appeared in 1 plot in June 2022 (2 years after planting)
- ✓ A control plot (barrier crop replaced by cocoa)
- ✓ Symptoms appeared mainly on cocoa in contact with old infected plantations



BarCo A 2 year database for CSSV/mealybugs (2)

Results from the most infested plot

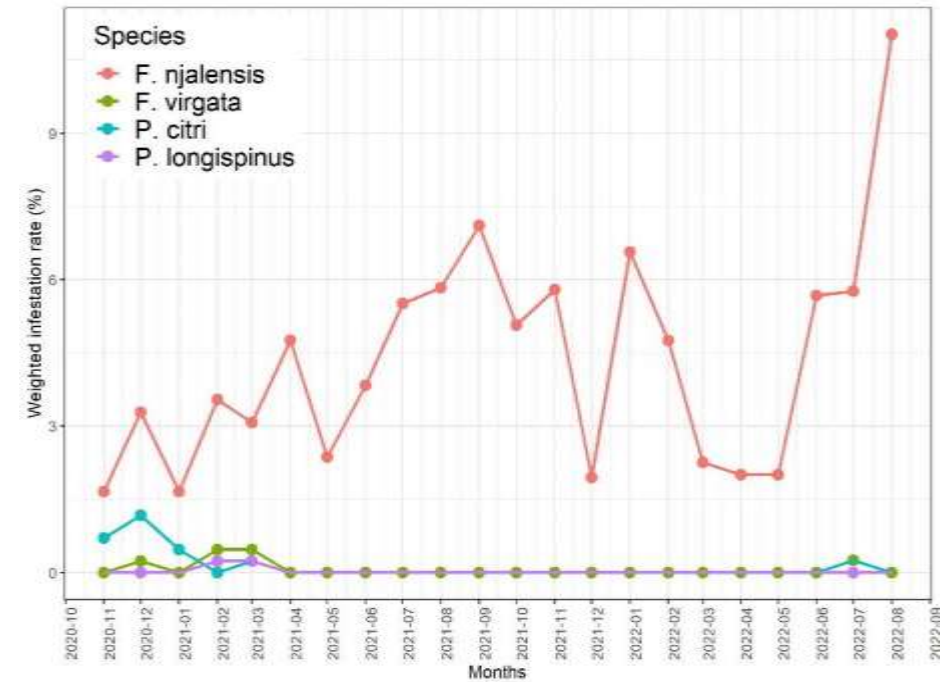
- ✓ Mealybugs *Pseudococcus longispinus* and *Ferrisia virgata*, early present on cocoa, but in small populations
- ✓ *Formicococcus njalensis*, first recorded in November 2020 and dominant from then



P. longispinus

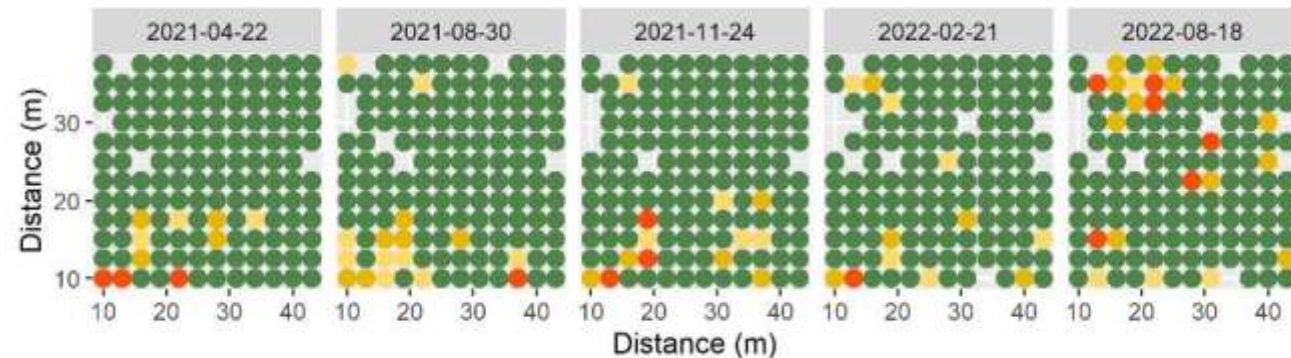


F. virgata

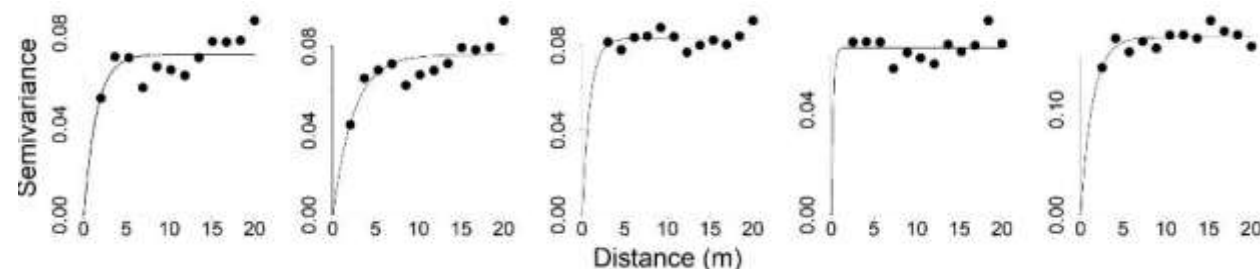


- ✓ *F. njalensis* populations first aggregated in a restricted area on the border of the plot

- ✓ Progressive invasion of the plot from an area in contact with the coffee barrier



F. njalensis



BarCo Diversity of mealybug natural enemies

Results from BarCo & Cocoa4Future projects, in different cocoa production areas of Côte d'Ivoire

- ✓ More than 30 morphospecies collected in Côte d'Ivoire (identification in progress)
- ✓ Parasitism rate > 10% in some sites
- ✓ Genera *Aenasius* sp. and *Anagyrus* sp. dominant among parasitoids and of interest for biological control



Parasitoid (*Aenasius* sp.)



Gall midges (*Coccodiplosis* sp.)



Parasitoid (*Anagyrus* sp.)



Ladybirds (*Hyperaspis* sp.)

BarCo 300 farmers trained



A wide acceptance of the innovation by farmers

FICHE DE FORMATION

Itinéraire technique

Replantation d'une cacaoyère détruite par la maladie du swollen shoot

Qu'est-ce que le swollen shoot ?

Le swollen shoot est une maladie grave du cacaoyer due à un virus. Elle détruit les feuilles et les branches des cacaoyers entraînant le dessèchement et la mort des arbres au bout de 5 ans.

Comment reconnaître la maladie ?

Il est important de détecter très tôt les premiers symptômes afin d'organiser la lutte. Ils apparaissent sur les jeunes feuilles, les branches, les cabosses et les racines.



Cacaoyers atteints de la maladie du swollen shoot



A : Rougeurs le long des nervures des jeunes feuilles



B : Décoloration des feuilles jeunes et adultes



C : Gonflement des jeunes tiges



D : Rabougrissement des cabosses et fèves ratatinées

Comment se propage la maladie du swollen shoot ?

La maladie est transmise par de petits insectes appelés cochenilles farineuses. On les trouve sur les cabosses, les tiges et les feuilles. Les cochenilles transmettent le virus en se nourrissant sur un cacaoyer infecté puis sur un cacaoyer sain. Elles sont très souvent « élevées » par les fourmis qui les dispersent et les protègent.

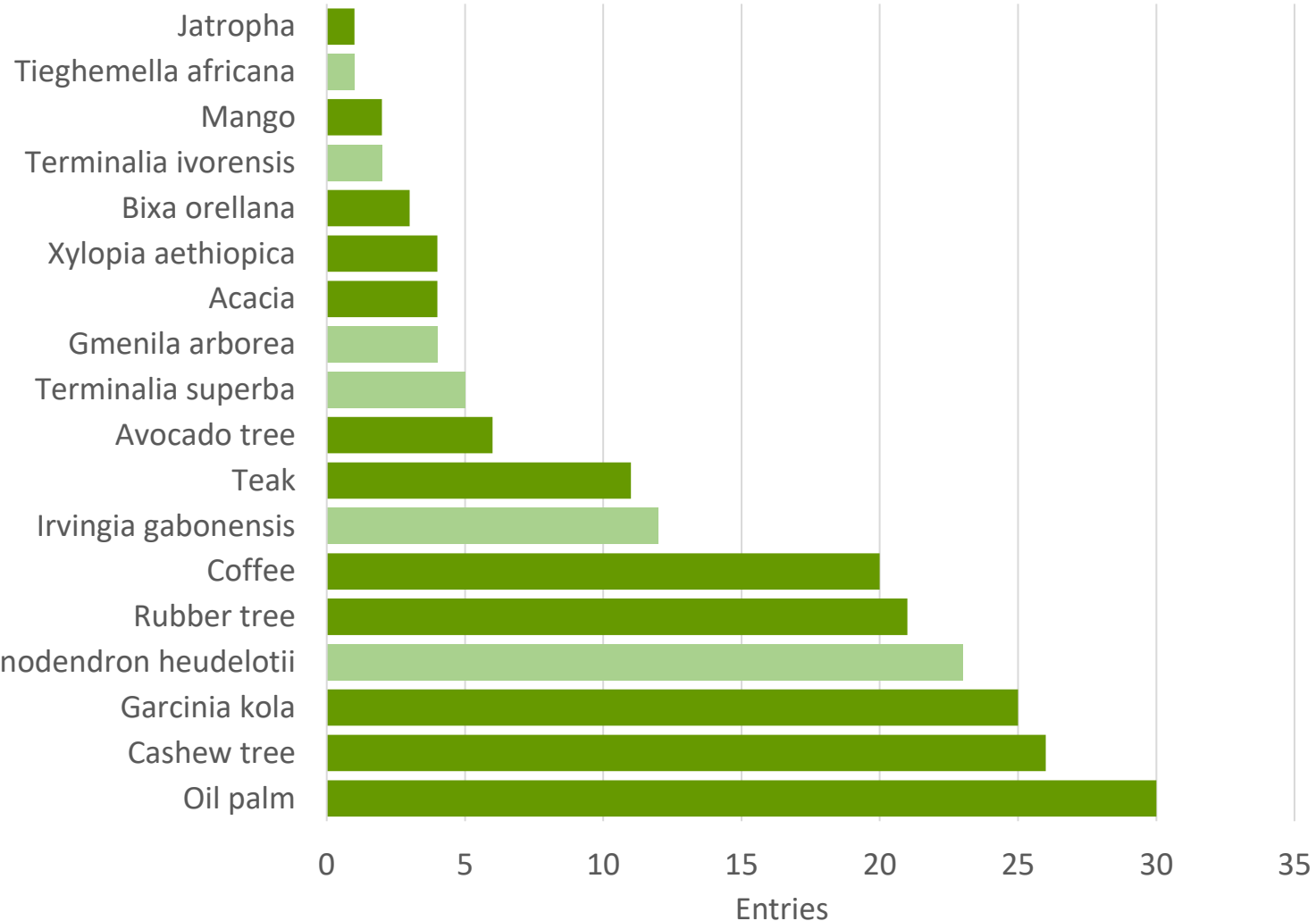


Différentes espèces de cochenilles vectrices de la maladie du swollen shoot

Fiche produite dans le cadre du projet BarCo
« Utilisation de barrières végétales et biocontrôle des cochenilles farineuses pour enrayer la progression du Cocoa Swollen Shoot Virus : Mesure de l'efficacité pour différents types de matériel végétal » Contrat FCIAD n° 1688

BarCo A survey of farmers to improve innovation

What barrier crops would you use?



<https://forestcenter.iita.org/>



Sanial Elsa, 2017

BarCo What next?

✓ **For a better characterization of barrier effects:**

Since January 2021, the Cocoa4Future EU project (2020-2025) ensures plot maintenance and observation continuity, for 4 years more

✓ **For a better inclusion of cocoa farmer expectations:**

Cocoa4Future project includes activities on co-conception of innovations with farmers



Production system sustainability and new dynamics of cocoa industry

- February 2020 - January 2025
- Funded by EU (DeSIRA) and AFD
- Total budget = 7 000 000 €
- ≈ 700 000 € for activities on CSSV





Many thanks!



<https://barco.cirad.fr/>

