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Improving the nutrition and resilience of organic citrus trees against HLB and other diseases

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Frick - International webinar on citrus greening (HLB) February 28, 2024

This project is supported by the Coop Sustainability Fund.

Content

- Increasing the resistance of trees against citrus greening (concept)
  - Biochar and organic fertilizer
  - Micronutrients
  - Biochar and soil microorganisms
  - Leguminous to increase soil fertility
- Dissemination activities

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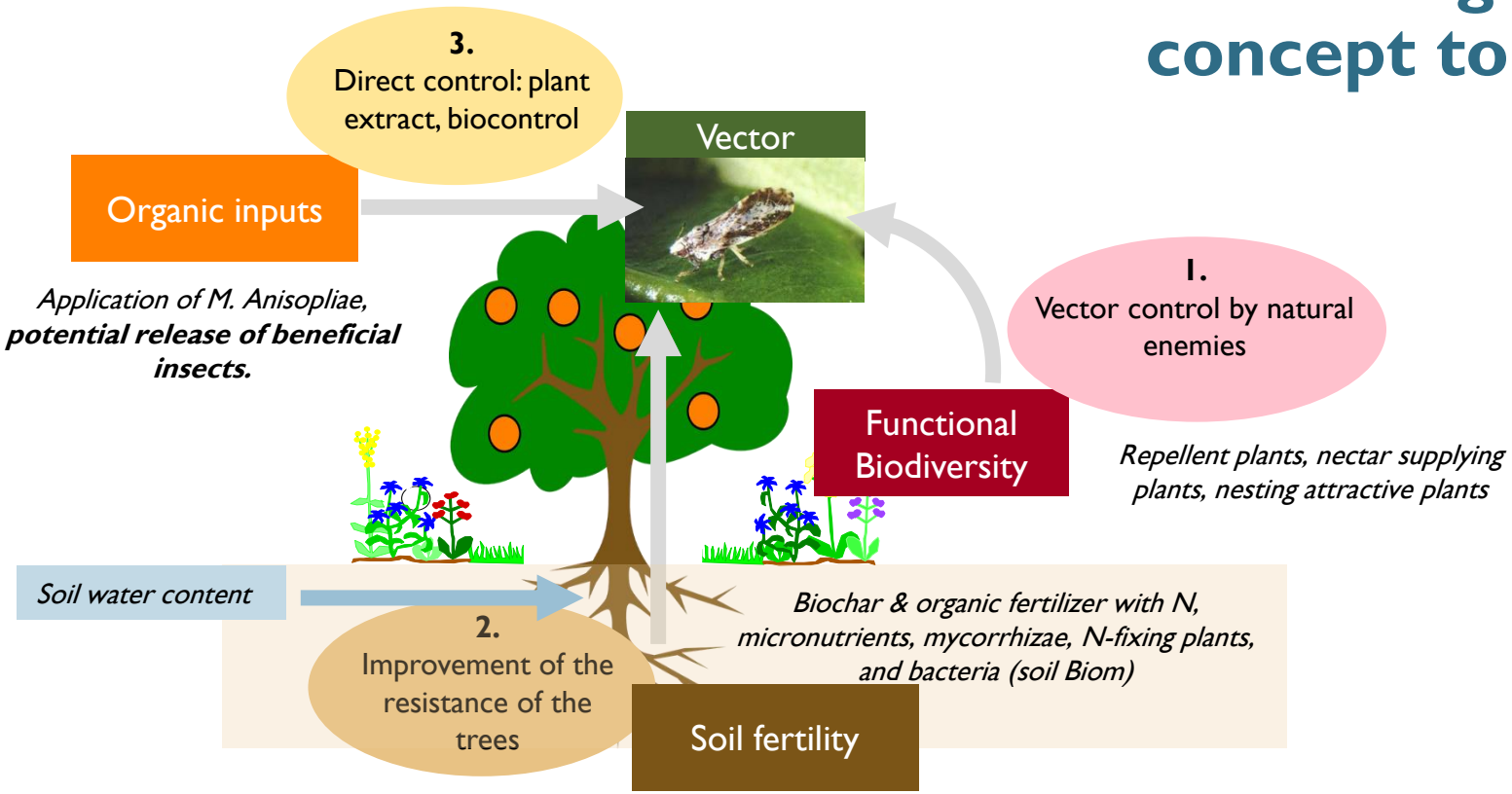
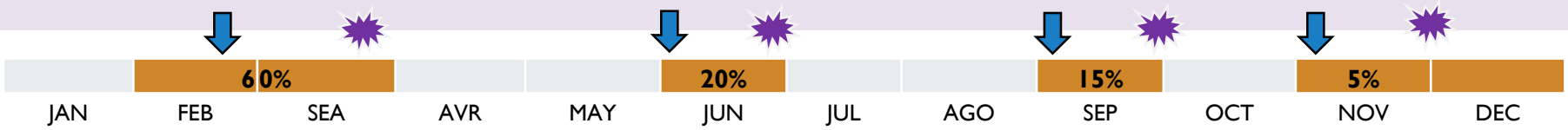
FiBL's integral organic concept to fight HLB



4. Continuos monitoring of the *D. citri* population when vegetative outbreaks develop and direct control with *plant extracts*, *M. Anisopliae* at specific thresholds, and possible release of beneficial insects. Monitoring of outbreaks and direct measures:



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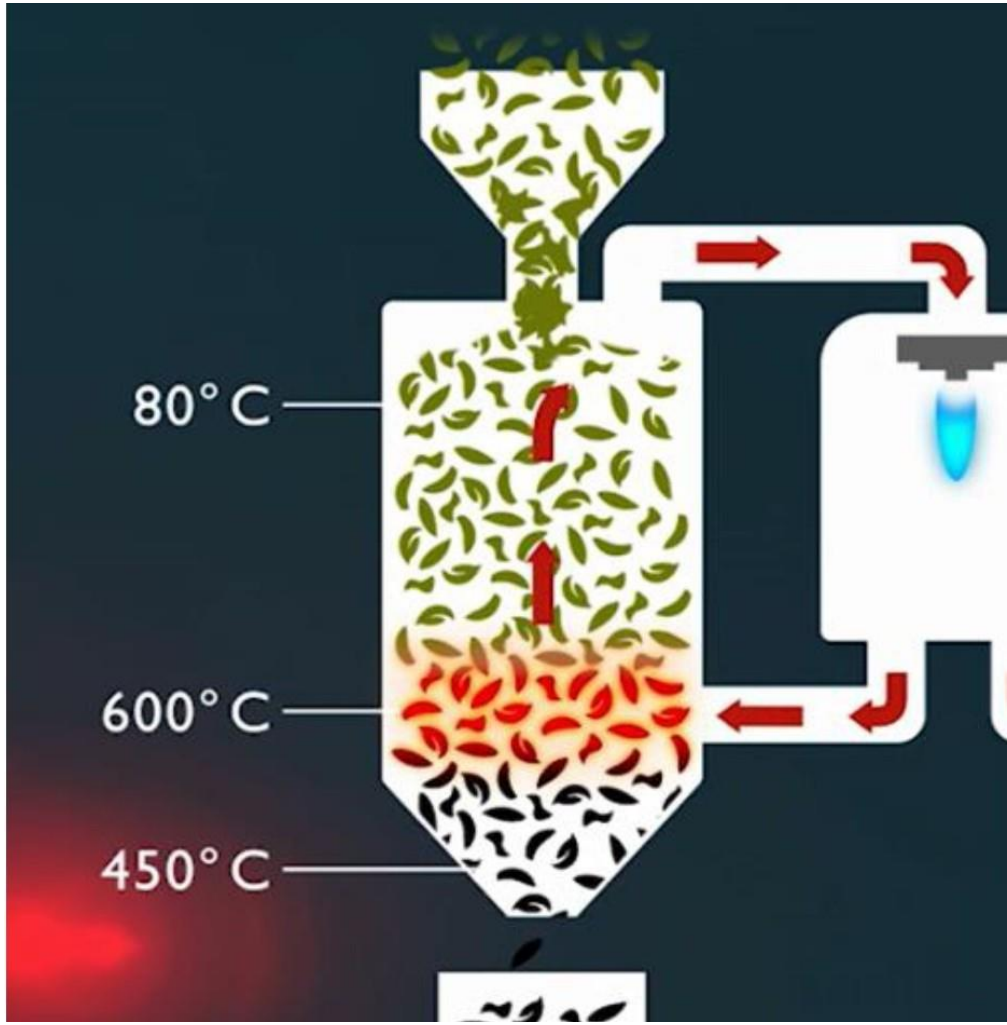
Biochar catalizing soil fertility (nutrients & water)

Trat	Description of treatments two applications per year		
T1	Control		Fossil 20 (1kg/tree)
T2	Biochar (2 kg/tree)		
T3	Biochar (0.5 kg/tree)		
T4	Organic fertilizer (11.2 Kg N/ha/year)		
T5	Organic fertilizer (36.6 Kg N /ha/year)		
T6	Biochar (2 kg/tree)	+	Organic fertilizer (11.2 Kg N/ha/year)
T7	Biochar (2 kg/tree)	+	Organic fertilizer (36.6 Kg N /ha/year)
T8	Biochar (0.5 kg/tree)	+	Organic fertilizer (11.2 Kg N/ha/year)
T9	Biochar (0.5 kg/tree)	+	Organic fertilizer (36.6 Kg N /ha/yr)
T10	Micro carbon (5l/ha)		
T11	Micro carbon (5l/ha)	+	Organic fertilizer (11.2 Kg N/ha/year)



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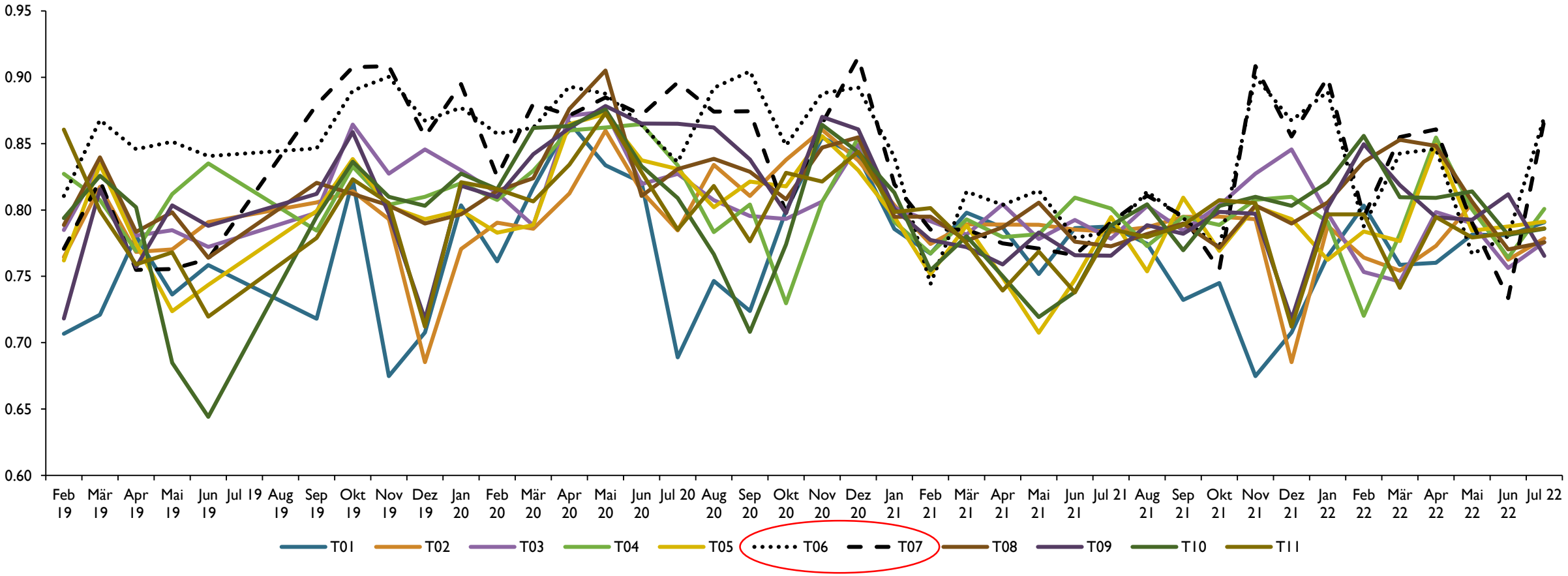
Relative chlorophyll content in different treatments



Monthly average of chlorophyll per treatment in different phenological stages of the Valencia orange

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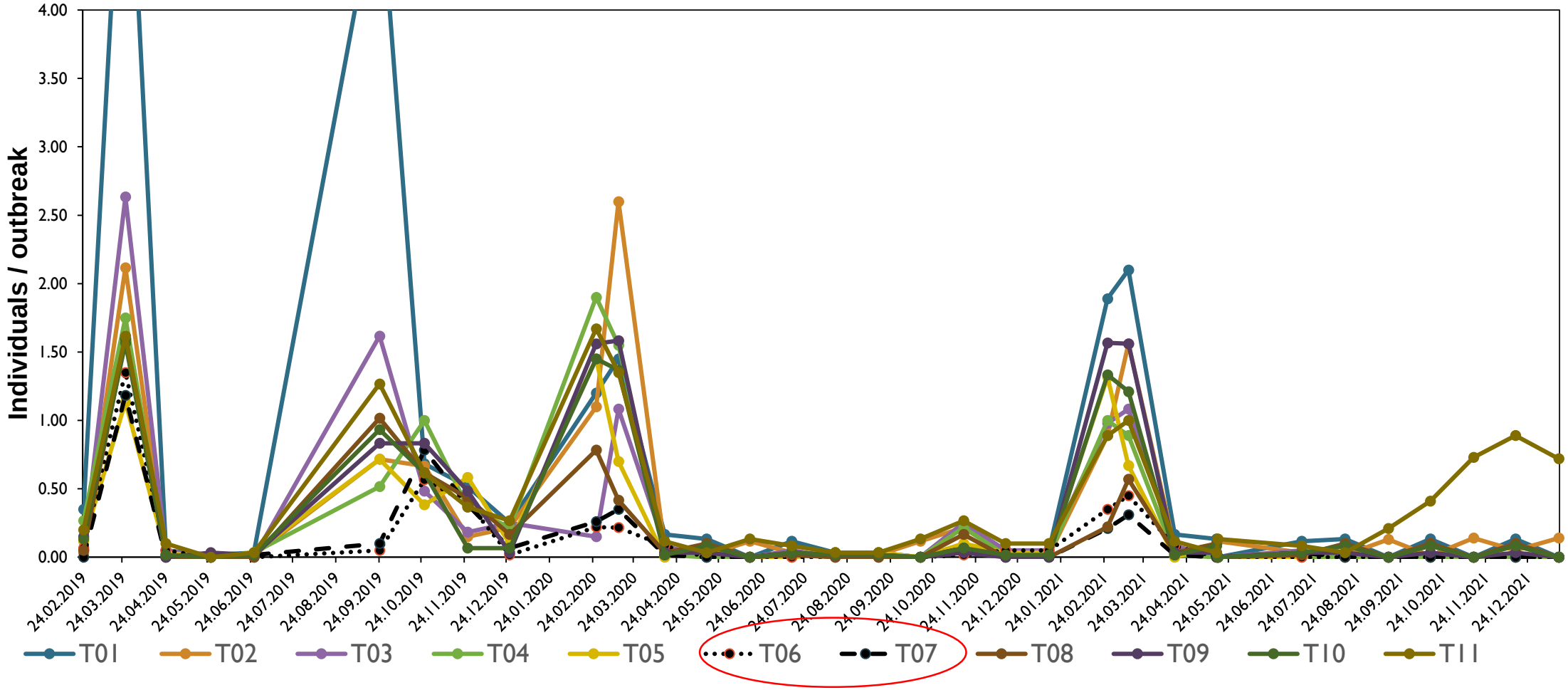
Effect of Biochar on *Diaphorina citri* abundance



Average number of eggs, nymphs and total adults per treatment in different phenological stages of the Valencia orange

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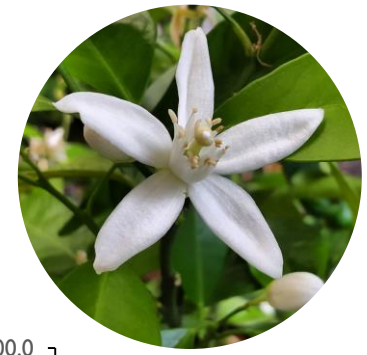
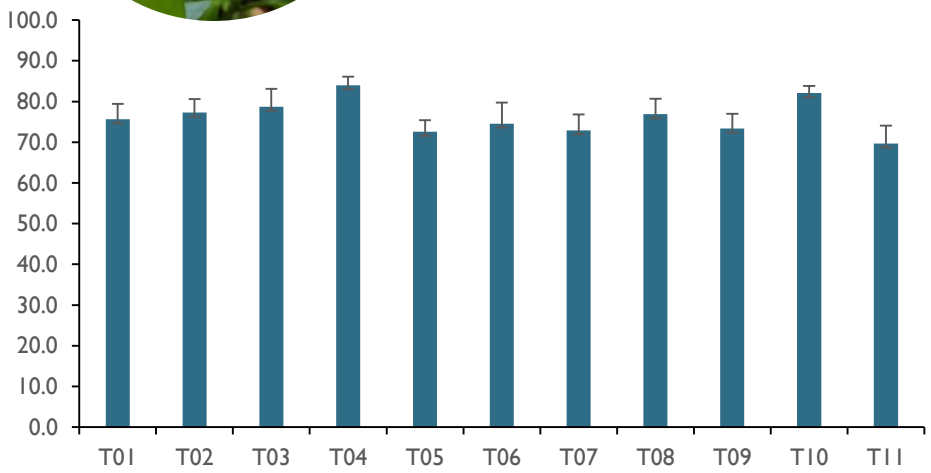
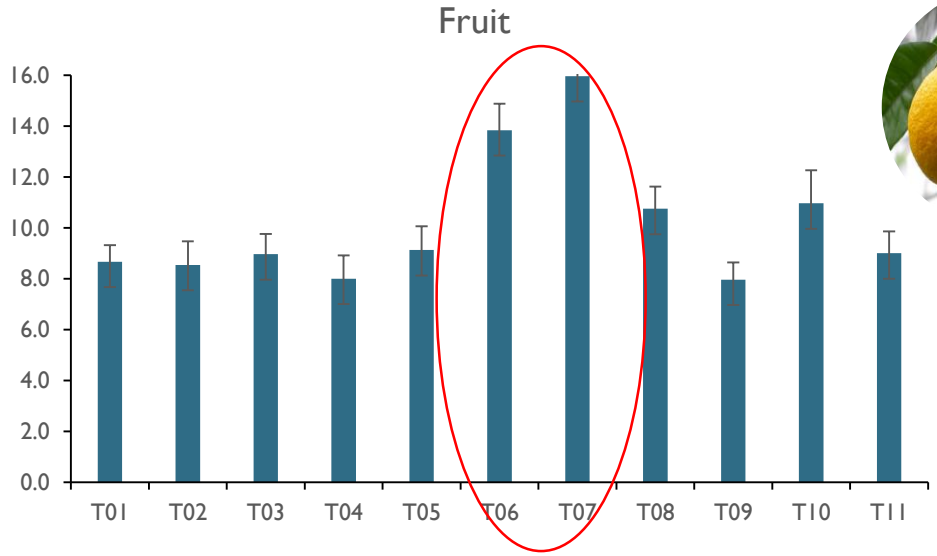
Relative abundance of flowers, fruits and tachuelas (Antrachnosis)







Average of flower, tachuela and fruit per treatment of the orange crop valencia variety

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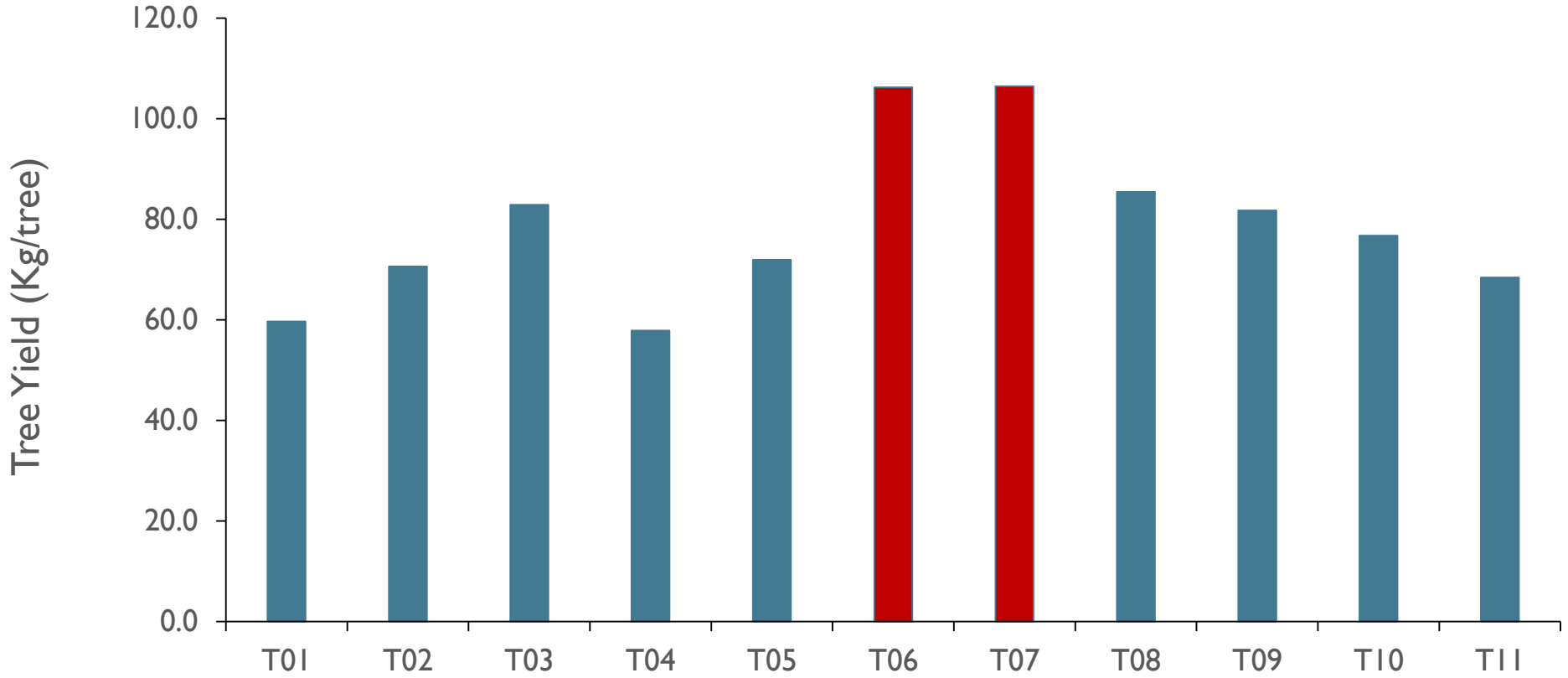
Performance of Biochar treatments



Average of treatments of the Cedro orchard in the Valencia orange

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Effect of micronutrients sprayed to the foliage vs HLB

Nutritional treatments with foliar microelements	
1.- Control	Water
2.- Boron	Fertigol B
3.- Copper	Fertigoll Cu
4.- Iron	Fertigol Fe
5.- Manganese	Fertigol Mn
6.- Molybdenum	Fertigol Mo
7.- Zinc	Fertigol Zn

No significant effect was detected in trees with advanced decay.

Only the lifespan of the branches in the treatments was different.

Effects of Biochar and biofertilizer to increase the resilience vs HLB

Trat	Description of soil nutrition treatments	N	P205	K20
1	Sick witness. Fert. A	22.5	10.5	42
2	Healthy control: Biochar 2 Kg + Fert A	22.5	10.5	42
3	Biochar 2 Kg			
4	Biochar 1 kg			
5	Biochar 2 Kg + N org	22.7		
6	Biochar 2Kg + Fert A	22.5	10.5	42
7	Biochar 2Kg + Fert B	45	21	84
8	Biochar 2 Kg + Fret A + Probac Mix (bactrias)	22.5	10.5	42
9	Biochar 2 Kg + Fret. A + Spectrum Micoradix (Bacts and mycorrhizae)	22.5	10.5	42
10	Biochar 2 Kg + Fert. A + Biofit (Bacts and Hong. P Solubilizers)	22.5	10.5	42
11	Biochar 2 Kg + Fert A + Nutrisorb G (Si)	22.5	10.5	42
12	Organic Producer + Fert A + Biochar 2 Kg	5	13	3
13	Porridge (2 Kg C) + Fert A	103	30	120
14	Porridge (1.2 Kg C) + Fert A	65	30	120
15	Conventional sick + fert average of the area			

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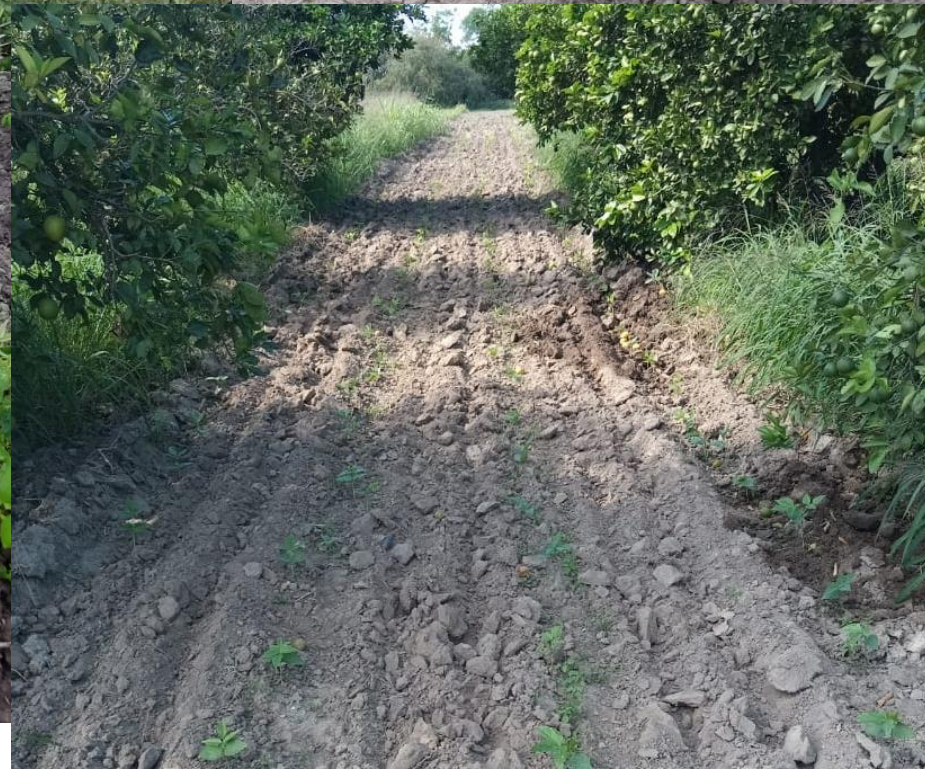
Experiment in process

Use of leguminous to increase soil fertility

- Experiments with legumes consist of planting under tree canopies and between tree lanes.

- Their objective is to improve soil fertility, produce mulch, compete against grasses, and be material for compost use.



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Implemented Dissemination Activities

- Development of the project website
- Production of two videos on citrus greening, two already published.
- Realization of Webinars for exchanging experiences (Mexico, Spain, Italy, and others).
- Training for technicians of the processing companies in the implementation of the measures obtained.
- Field visit with producers and technicians (Veracruz & Monterrey).

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Citrus Greening
FiBL Research Program

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https://citrus-greening.fibl.org/

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About the research program

Citrus Greening, also known as Huanglongbing (HLB), is the most important citrus plant disease worldwide. The core mandate of the Research Institute of Organic Agriculture FiBL is to conduct practice-oriented research to develop environmental-friendly innovations with and for farmers and the food industry. Concerning HLB, since 2011, FiBL, together with partners from Mexico, has been conducting different research activities to develop and test different interventions to mitigate and control Citrus Greening in the context of organic production. This involves both direct and indirect measures to reduce the level of disease infection and strategies to increase citrus plants' resistance to disease.

The research results obtained until now (see *Our research* and *Resources*) reveal that an optimal combination of the most promising technological innovations is the way forward to control HLB infections in organically managed citrus orchards. This involves alternate weed cutting (to promote

Program in brief

- Start 2011
- Project sites: Veracruz & Monterey, Mexico
- Implemented by: Research Institute of Organic Agriculture FiBL, Switzerland
- Research partners: Universidad Nacional Autónoma de México, Colegio de Postgraduados
- Industry partner: Ultraquimia
- Private sector partners
- Financig: Coop Sustainability Fund

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Der **Coop Fonds für Nachhaltigkeit** unterstützt dieses Projekt.

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