CONFERENCE:

Innovations to reduce and remediate farm soil pollution. A contribution to the EU Soil Strategy

EU supporting Innovation in agriculture to protect soil





Miguel de Cara Dr. Ingeniero agrónomo 21/11/2022 franciscom.cara@juntadeandalucia.es



European Committee of the Regions. Room JDE 51

IFAPA Centro La Mojonera



Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica Conseierá de Agricultura

Consejería de Agricultura, Pesca, Agua y Desarrollo Rura

| Origin of Bets4Soil

Focus Group IPM practices for soil-borne diseases

April 23 – 24, 2015 – Haarlem, The Netherlands December 1 – 3, 2014 – Alicante, Spain





Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



Instituto de Investigación y Formación Agraria y Pesquera



FOCUS GROUP Conclusions:

- Intensive production systems and soil borne diseases are a major factor with a negative impact on soil health.
- Soil health strategy is crucial to prevent soil-borne diseases.
- Best practices and sound crop rotations permit to maintain, improve or re-establish soil health.
- There is a need for reliable, truthful knowledge about soil-borne issues.





BEST4SOIL proposes three approaches for optimal soil health:

Optimal crop rotations



Tailor made crop rotations to prevent for soil health problems



Prevention for soil health problems



Best Practices: use of compost or other organic amendments, cover crops & green manure crops



Best practices: anaerobic soil disinfestation (ASD) and (bio)solarisation to control nematodes and fungi

Restore soil

health







BEST4SOIL proposes three approaches for optimal soil health:





Based in the use of organic matter

and the stimulation of life in the soils







Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



stituto de vestigación y rmación Agraria lesquera

Bets4Soil Products

BEST4SOIL products:

- Compilation of knowledge ready for practice
 - 23 Videos, 23 factsheets,
 - 2 Decision Support Tools



00

Cover crops and green manures have multiple positive effects on the soil health. But like all methods, this best practice has also some disadvantages. In this video, both sides are presented to allow practitioners to make their decisions based on a sound basi

SOIL

In this video you will see

And you will learn how to use them

This video informs you about the Best4Soil database and explain

how you can use this information to plan the crop rotation in you

to improve your crop rotation.

kind of information is a

in the Best4soil database



Biofumization is the use of special green manure crops to reduce the level of funcal pathocens and parasitic nematodes in the soil. How this works, what are the advantages and also the disadvantages of this natural method are presented in this

Splarisation, alone or in combination with organic matter

efficacy and application is shown in this video

amendments, known as biosolarisation, is a soil disinfection practice

used in Southern European countries. Practical information about its

00



A cron rotation is the basis for a healthy soil with minimized pressure of diseases and pests. Designing a good crop rotation can be other requirements. Why and how to design a good crop rotation is



08

Solarisation and biosolarisation are efficient soil disinfection methods. Advantages and disadvantages of both techniques are shown in this

All available in 22 EU oficial languages at www.best4soil.eu BEST4 🥽 SOIL







Investigación y Formación Agraria

Bets4Soil Products

BEST4SOIL products:

- Compilation of knowledge ready for practice
 - 23 Videos, 23 factsheets,
 - 2 Decision Support Tools

=				
SOIL			Home	Nematode scher
Χώρα	Αυστρία	•		
Τύπος εδάφους	Αργιλώδες	•		
Περιγραφή	Όνομα περιγραφής		ΔΗΜΙΟΥΡΓΊ, ΣΧΕΔΊΟΥ	A

	Root-knot n	ematodes	Root lesion nematodes	
	Meloidogyne chitwoodi Columbia root-knot nematode	Meloidogyne hapla Northern root-knot nematode	Pratylenchus penetrans Northern root lesion nematode	
	12345	12345	12345	
Potato	•••	•••	•••	Potato
Wheat	••		••	Wheat
Onion	•	•	•••	Onion
Carrot	••	••	••	Carrot
Marigold	-	-	-	Marigold
Radish	- R	••	•••	Radish

©2022. This nematode scheme is a product of Wageningen University & Research | Field Crops, Lelystad

Καλλιέργειες Από-επιλογή όλων όλα σε σμ	ίκρυνση	Νηματώδεις Από-επιλογή όλων όλ
Ξ επιλογή των καλλιεργειών	0	⊞ Κυστονηματώδεις
⊞ Καλλιέργειες	0/20	
Η Λαχανικά	0/29	Root lesion nematodes
⊞ Καλλιέργειες χλωρής λίπανσης	0/21	⊞ Νηματώδεις στελέχους
		⊞ Νηματώδεις φύλλων

Νηματώδεις	Από-επιλογή όλων	όλα σε σμίκρυνση
Η Κυστονηματ	τώδεις	0/9
🕀 Root-knot n	ematodes	0/7
Root lesion	nematodes	0/4
⊞ Νηματώδεις	στελέχους	0/2
Η Νηματώδεις	φύλλων	0/3
Ξ Ελεύθεροι ν	ηματώδεις	0/11
🗄 loi		0/2
🕀 LX group		0/2

Le	gend damage
	unknown
	none
	little (0-15%)
	medium (16-35%)
	serious (36-100%)

	Legend propagation
	active population decline
?	host plant susceptibility unknown
-	non host
•	poor
••	moderate
•••	strong
R	variety dependent
S	serotype dependent
i	some information

	Le	gend soil type
	1	sandy soil
[2	reclamed peat soil
	3	sandy clay loam
	4	clay soil
1	5	silty soil (loess)

All available in 22 EU oficial languages at <u>www.best4soil.eu</u>



Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696 APA Instituto de Investigació Formación A y Pesquera



BEST4SOIL promotes the Best Practices for Soil Health.

- Subnetworks in 4 EPPO Climatic regions, with facilitators in 20 countries.
- Participating and organizing meetings with professionals.
- Publishing informative articles in local languages.
- Organizing Training Workshops to train on the application of any of the best practices.
- Boosting the creation of Communities of Practice.
- Organizing mutilingual Regional workshops









to de gación y lón Agraria era A total of 175 meetings organised or collaborated / >11,000 people attended (62% farmers or crop advisors)

A total of 83 training workshops performed / 2,443 attendants (67% farmers or crop advisors)







Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



tuto de stigación y lación Agraria lquera



Some Results

A total of 52 Communities of practice started / 553 members

A total of 287 informative publications released







Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



tuto de stigación y nación Agraria squera



Followers in Social Media (Facebook, twitter, Linkedin): > 1,900 in total

Subscribers to Best4Soil Newsletter: > 5,300

Factsheets download: > 60,000 downloads from our website

Website visitors: > 70,000

Geographical origin of website visitors: 176 countries

Visualisations of the videos of 'Best4Soil Network' YouTube channel: > 530,000







Impact of Best4Soil on soil health

- Do (current and future) farmers and advisors increased their awareness on soil health?
- Do they know new practices and tools to prevent and restore soil health?
- Do they feel more confident to apply the practices proposed?







The case of Biosolarisation

It is a practice prior to planting, that consist on burying fresh organic matter into the soil, followed by watering over field capacity and covering with transparent film for more tan 45 days.

If this practice is carried out in Summer, the results controlling soil-borne diseases are equal to use chemical fumigants.





Type of organic matter used





Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



Instituto de Investigación y Formación Agraria y Pesquera



| Biosolarisation

Type of organic matter used

Agroindustrial By-products

AMMOUNT: Do not overpass limits established for nitrates.







Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696 FAPA Instituto de Investigación y Formación Agra y Pesquera



Smashing and burying





Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696 FAPA Instituto de Investigación y Formación Agrari y Pesquera



Biosolarisation

Film deployment





SEAELING CORRECTLY THE FILM IS CRUCIAL TO AVOID GAS LOSSES.



Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



o de vación y ón Agraria era



Wait, remove the film and ready to plant/sown









Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696







Basis of the Biosolarisation

Sun function:

- Heating the humid soil to inactivate unwanted pathogens/parasites/herbs due to their poor tolerance to relatively high temperatures.

Organic matter functions:

- Benefits thermotolerant saprophytic microbial species that feed on decomposed organic matter (recycling nutrients and organic molecules).
- Reduction of fertilizer and water consumption

Combination of functions:

- Results equal than chemical fumigants, with the advantage that soil functional microbiota recovers quickly with the presence of organic matter.







Classical literature about Biosolarisation

Arriaga H, Núñez-Zofío M, Larregla S, Merino P, 2011. Gaseous emissions from soil biodisinfestation by animal manure on a greenhouse pepper crop. Crop Prot 30: 412-419.

Bonanomi G, Antignani V, Capodilupo M, Scala F (2010). Identifying characterisitics of organic soil amendments. J Plant Pathol 89(3):311-324

Butler DM, Kokalis-Burelle N, Muramoto J, Shennan C, McCollum TG, Rosskopf EN (2012). Impact of anaerobic soil disinfestation combined with soil solarization on plant-parasitic nematodes and introduced inoculum of soilborne plant pathogensin raised-bed vegetable production. Crop Prot 39:33-40

García-Ruíz A, Palmero D, Valera DL, de Cara-García M, Ruíz C, Boix A, Camacho F (2012). Control de la Fusariosis vascular en clavel en el suroeste de España mediante la biodesinfección del suelo. ITEA 109(1):13-24Klein, E., Katan, J., and Gamliel, A.

2011. Soil suppressiveness to Fusarium disease following organic amendments and solarization. Plant Dis. 95:1116-1123.

López-Aranda JM, Miranda L, Domínguez P, Soria C, Pérez-Jiménez RM, Zea T, Talavera M, Velasco L, Romero F, De Los Santos B, and Medina-Mínguez J (2012). Soil Biosolarization for Strawberry Cultivation. Acta Hort, 926:407-414 Martín-Expósito E, Fernández-Fernández MM, Talavera M, Cánovas G (2013). Solarización y biosolarización, alternativas a la desinfección química de suelos en cultivos enarenados. Vida Rural 363:42-48

Martínez MA, Martínez MC, Bielza P, Tello J, Lacasa A (2011). Effect of biofumigation with manure amendments and repeated biosolarization on Fusarium densities in pepper crops. J Ind Microbiol Biotecnol 38:3-11

Martínez MA, Lacasa A, Guerrero MM, Ros C, Martínez MC, Bielza P, Tello JC (2006). Effects of soil disinfestation on fungi in greenhouses planted with sweet peppers. IOBC Bull 29(4):301-306

Melero-Vara JM, López-Herrera CJ, Basallote-Ureba MJ, Prados AM, Vela MD, Macias FJ, Flor-Peregrín E, and Talavera M (2012). Use of poultry manure combined with soil solarization as a control method for Meloidogyne incognita in carnation. Plant Dis. 96:990-996

Núñez-Zofio M, Larregla S, Garbisu C (2012). Repeated biodisinfection controls the incidence of Phytophthora root and crown rot of pepper while improving soil quality. Spanish J Agr Res 10(3):794-805

Ros M, García C, Hernández MT, Lacasa A, Fernández P, Pascual JA (2008). Effects of biosolarization as methyl bromide alternative for Meloidogyne incognita control on quality of soil under pepper. Biol Fertil Soils 45:37-44.







Effect of greenhouse soil bio-disinfection on soil nitrate

I. I. Marín-Guirao^{A,B}, I. C. Tello^A, M. Díaz^A, A. Boix^A, C. A. Ruiz^A, and F. Camacho^A

MDPI

content and tomato fruit yield and guality

Recent Literature about Biosolarisation



MDPI

Article Greenhouse Soil Biosolarization with Tomato Plant Debris as a Unique Fertilizer for Tomato Crops

Pablo García-Raya 1,*0, César Ruiz-Olmos 1, José Ignacio Marín-Guirao 1, Carlos Asensio-Grima¹, Julio César Tello-Marquina¹ and Miguel de Cara-García²

- 1 CIAIMBITAL, Campus de Excelencia Internacional Agroalimentario, Universidad de Almería. Carretera Sacramento s/n, 04120 Almería, Spain; ceroan22@hotmail.com (C.R.-O.); jignaciomarin@gmail.com (J.I.M.-G.); casensio@ual.es (C.A.-G.); jtello@ual.es (J.C.T.-M.)
- IFAPA-La Mojonera, Camino San Nicolás n.1, 04745 La Mojonera, Spain; franciscom.cara@juntadeandalucia.es
- * Correspondence: pgr335@ual.es; Tel.: +34-950-015-527



Article

Biodisinfection as a Profitable Fertilization Method for Horticultural Crops in the Framework of the Circular Economy

Francisco José Castillo-Díaz ¹, Luis Jesús Belmonte-Ureña ^{2,*}, Francisco Camacho-Ferre ¹ and Julio César Tello Marquina¹

Meloidogyne-infested tomato crop residues are a suitable material for biodisinfestation to manage Meloidogynesp. in greenhouses in Almería (south-east Spain)

M.A. Gómez-Tenorio¹, B. Lupión-Rodríguez¹, A. Boix-Ruiz¹, C. Ruiz-Olmos¹, J.I. Marín-Guirao¹, I.C. Tello-Marquina¹, F. Camacho-Ferre^{1,a} and M. de Cara-García²



Acta Hortic. 1207. ISHS 2018. DOI 10.17660/ActaHortic.2018.1207.29 Proc. V Int. Symp. on Tomato Diseases: Perspectives and Future Directions in Tomato Protection Ed.: E. Moriones, R. Fernández-Muñoz and C.R. Beuzón



CSIRO PUBLISHING

Soil Research, 2016, 54, 200-206

http://dx.doi.org/10.1071/SR15106



MDPI

Article Effect of Repeated Plant Debris Reutilization as Organic Amendment on Greenhouse Soil Fertility

Francisco José Castillo-Díaz 100, José Ignacio Marín-Guirao 200, Luis Jesús Belmonte-Ureña 3,*10 and Julio César Tello-Marquina¹





Best4Soil has received funding from the European Union's Horizon 2020 Programme as Coordination and Support Action, under GA n° 817696



Investigación y



Biosolarisation is ONE of the BEST4SOIL practices approached for optimal soil health:

Optimal crop rotations



Tailor made crop rotations to prevent for soil health problems



Prevention for soil health problems



Best Practices: use of compost or other organic amendments, cover crops & green manure crops





Best practices: anaerobic soil disinfestation (ASD) and (bio)solarisation to control nematodes and fungi





CONFERENCE:

Innovations to reduce and remediate farm soil pollution. A contribution to the EU Soil Strategy

EU supporting Innovation in agriculture to protect soil

Thanks for your attention





Miguel de Carafranciscom.cara@juntadeandalucia.esDr. Ingeniero agrónomo21/11/2022

European Committee of the Regions. Room JDE 51

IFAPA Centro La Mojonera



Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica Conseiería de Agricultura.