ORGANIC PLUS

Pathways to phase-out contentious inputs from organic agriculture in Europe

4.5 years Organic-PLUS: Conclusions and Next Steps

CDG (Civil Dialog Group) Organic Farming
12th May 2023, Brussels

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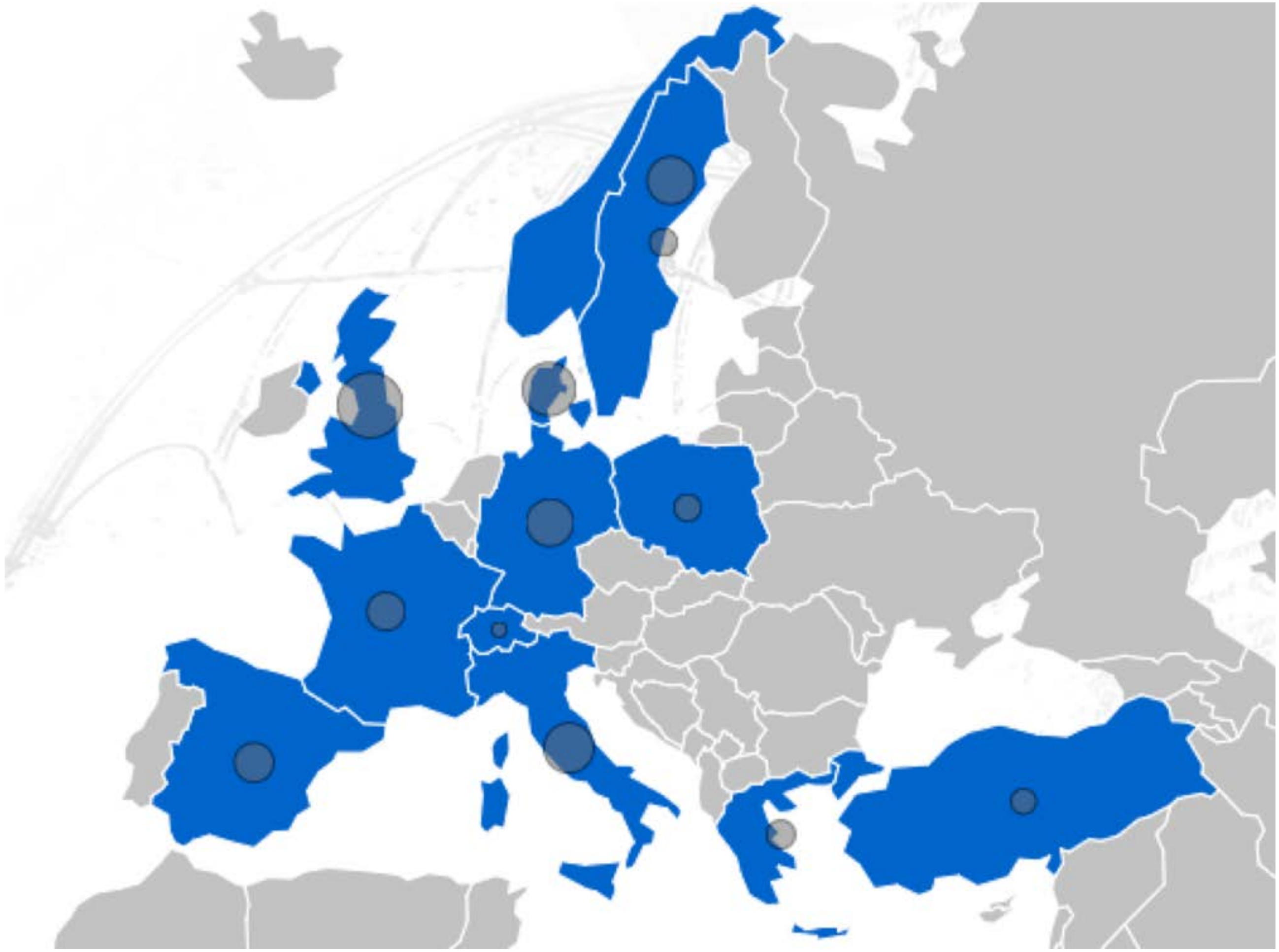
(Coventry University, England, UK)
Coordinator O+ & workpackage leader Impact/Social science

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Organic-PLUS



Numbers:

4.5 years, 4.1m Euro, 10 Universities, 15 other research & NGOs,
8 EU, 4 non-EU associated countries, > 50 supporting SMEs, NGOs

Organic-PLUS

WP2 - IMPACT
Public view of contentious inputs, dissemination, hybrid farmer-citizen juries, standards & policies

WP3
PLANT

Copper fungicides

Mineral oils and sulphur

WP4
LIVESTOCK

Antibiotics
Anthelmintics

Non-organic straw bedding

WP5
SOIL

Peat

Plastic mulches

Fertilisers
(RESID, VEGAN, URBAN)

WP6 - MODEL
Socio-economic models, life-cycle analyses and phase-out scenarios

WP1 - LEAD
Coordination
International and Industry Advisory Boards

1st Padova, Italy June 2018

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2nd Aarhus, Denmark June 2019

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4th Hohenheim and Biofach Nuremberg, Germany July 2022

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Contentious inputs course

4. Documentation of the international course

The International course **"Contentious inputs in organic agriculture"** can be found on the RuralCat website, in [Transferència Tecnològica.]()

The video link for each session with date and title is given below.

	*Alternatives to **copper** in organic agriculture.*	*Thursday June 2nd*	https://youtu.be/K4TkfX71IH0
	*Alternatives to **mineral oils** and sulphur in organic agriculture*	*Tuesday June 7th*	https://youtu.be/W1DWO1HLiv8
	*Alternatives to **fertilisers** from non-organic sources in organic agriculture*	*Thursday June 9th*	https://youtu.be/wym_MjDgVtU
	*Alternatives to **peat** in organic agriculture*	*Tuesday June 14th*	https://youtu.be/K-4RbheIbKE
	*Visit to the Farm Aurora del Camp: alternatives to **plastics, fertilisers, and copper***	*Thursday June 16th*	https://youtu.be/moye0SXrxP0
	*Visit to Farm Claret de Cavallers: alternatives to **antibiotics and antihelmintics**. Workshop: Preparation of phytotherapeutic products.*	*Friday June 17th*	https://youtu.be/zs6rGB-_RA8
	*Visit to Agroviver: alternatives to **peat**.*	*Friday June 17th*	https://youtu.be/eKEiYKPXPr4

Course Attendance

Course event (numbered online and field visits in-person)	Date	Registered	Attendees	Percent attendance
1. Alternatives to copper in organic agriculture.	02/06/2022	262	**101**	39%
2. Alternatives to mineral oils and sulphurs in organic agriculture.	07/06/2022	229	**52**	23%
3. Alternatives to fertilisers from non-organic sources in organic agriculture.	09/06/2022	219	**43**	20%
4. Alternatives to peat in organic agriculture.	14/06/2022	127	**27**	21%
Visits to innovative farms that phase-out contentious inputs 1	16/06/2022	29	**9**	31%
Visits to innovative farms that phase-out contentious inputs 2	17/06/2022	12	**2**	17%
5. Alternatives to plastic mulch and other plastics from fossil fuels in organic agriculture.	21/06/2022	127	**19**	15%
6. Alternatives to antibiotics and synthetic vitamins in organic livestock.	28/06/2022	58	**30**	52%
7. Alternatives to anthelmintics in organic livestock.	30/06/2022	59	**21**	36%
Total		**1122**	**304**	**27%**

Stakeholder interaction and dissemination

Results

2 Data analysis of stakeholder interaction

2.1 Headline figures

178 events

One event every working week for 4.5 years

>20,000 stakeholders engaged

39% events online mainly in 2020 and 2021 (COVID-19 pandemic)

61% events physical or *on-farm*

Average (mean) participation per event **165**

Median participation per event **50**

74% events with farmers & growers (organic and non-organic) or academic and students

Events with supply chain industry and retailers: **61%**

Dissemination - examples

Figure 1: Screenshot of CORDIS website https://cordis.europa.eu/article/id/442663?WT.mc_id=exp

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Organic Industry (Biofach)

Raising the bar for Organic: Input-substitution or system redesign? A tale of peat and copper Forum Science

Jul 27, 2022, 14:30 - 15:30 GMT+2
Raum Istanbul (NCC Ost)

Figure 3: BIOFACH Forum Science, science on peat and copper phase-outs, with a discussion of input substitution versus system redesign

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Farmers

Discussion and shared learning with bio-dynamic dairy farmers (on-farm, DE)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Growers

Discussion and shared learning with bio-dynamic compost and hops orchard, DE

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Scientists

Soon in Türkiye? - Organic, bio-dynamic, zero-copper, hops orchard

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

International

50th years IFOAM Goesan, Korea October 2022

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Impact example Farmers ‘Field Labs’

- **farmer-led** research where participants with a common problem/concern come together to trial alternative materials/methods
- open to organic and non-organic farmers

INNOVATIVE FARMERS
PART OF THE DUCHY FUTURE FARMING PROGRAMME

CSA (Community Supported Agriculture) farm on Coventry University land at Ryton Organic Gardens

Grower examining mulch materials and recording her observations

Pathways to phase-out contentious inputs from organic agriculture in Europe

Results & Conclusions

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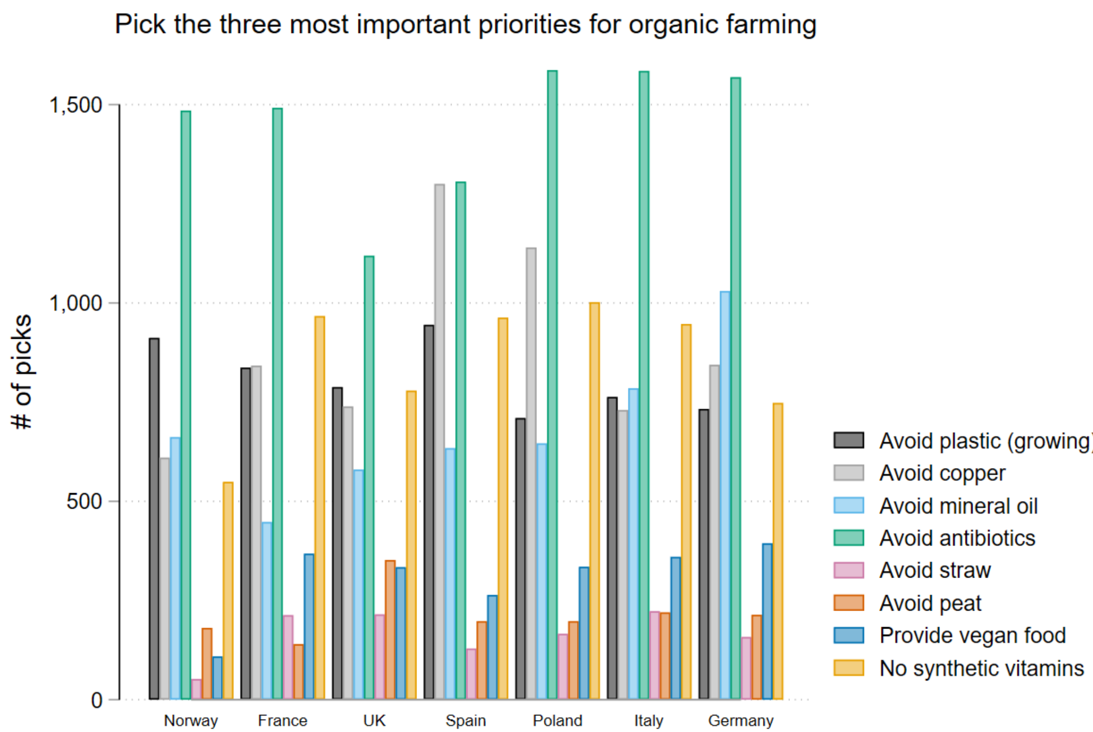
Representative survey of public opinion on contentious inputs

- **The largest ever survey of public opinion about contentious inputs in organic agriculture, with over 15 000 respondents.**
- Carried out in 7 European countries: France, Germany, Italy, Norway, Poland, Spain, UK
- The research aims to generate knowledge about the public understanding of sustainable and organic food and to understand public concerns about contentious inputs in organic farming
- Full survey report available online at **https://organic-plus.net/resources/deliverables**



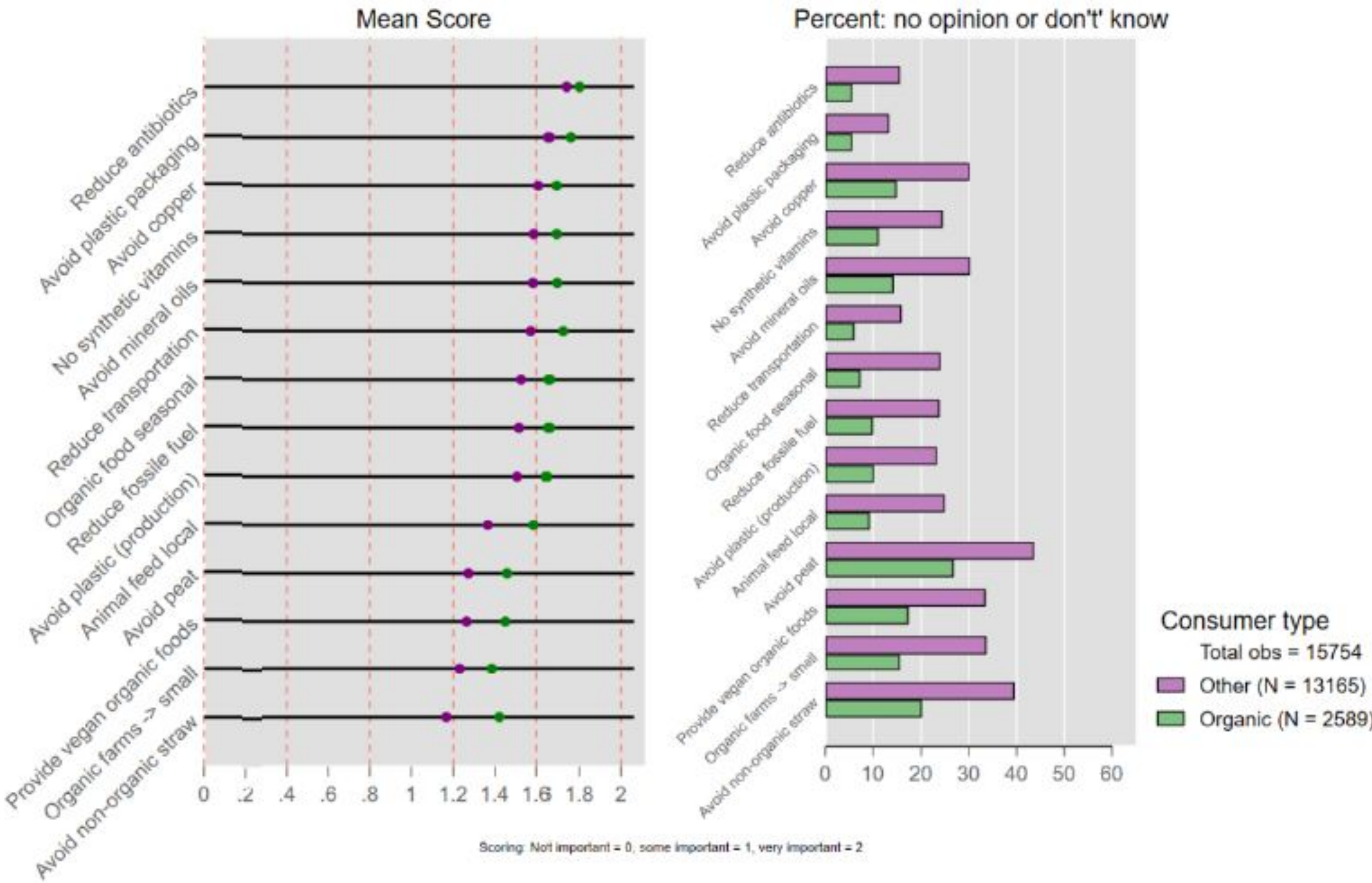
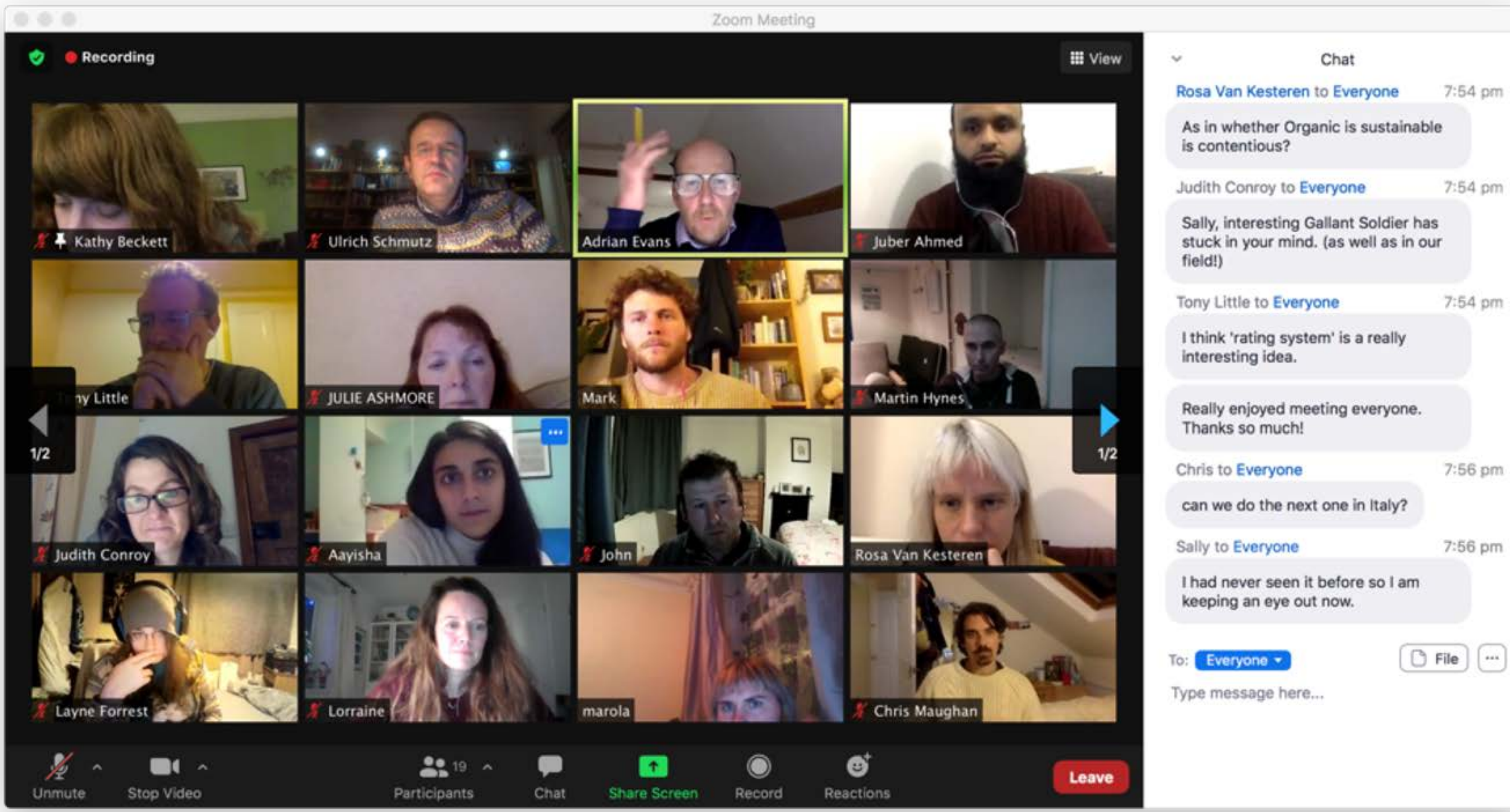


Figure 57: Improve organic food production - all countries

Hybrid Citizen & Farmer Forums



D2.3 Hybrid Citizen & Farmer Forum recommendations

1. Organic certifying bodies should be **open and transparent about the contentious issues** that they face and the measures that they are taking to continually improve standards. This will help to improve public debate more generally about sustainable agriculture.

2. Efforts to improve standards in Organic agriculture should go beyond the farm to **consider the importance of the whole Organic food supply chain** and to address issues such as local and seasonal food provisioning, sustainable packaging and farmer well-being.

3. Ensuring the **wellbeing of Organic farmers**, especially small-scale Organic farmers, should be central to efforts to support and expand Organic agriculture in Europe

4. Policy makers should further **recognise Organic farming as a key route to sustainability** and adopt appropriate measures to promote and financially subsidise Organic farming.

5. Models that aim to measure on-farm sustainability or LCA analyses that compare the sustainability of different agricultural inputs should **include measures of biodiversity**.

6. Encourage greater **dialogue and collaboration between Organic and Conventional farmers**. Many of the findings of Organic-PLUS research and the Hybrid citizen & farmer dialogues also of high to the conventional and regenerative sector, working towards higher sustainability in their system.

Policy briefing & phase-out reflections

Input substitution and system re-design

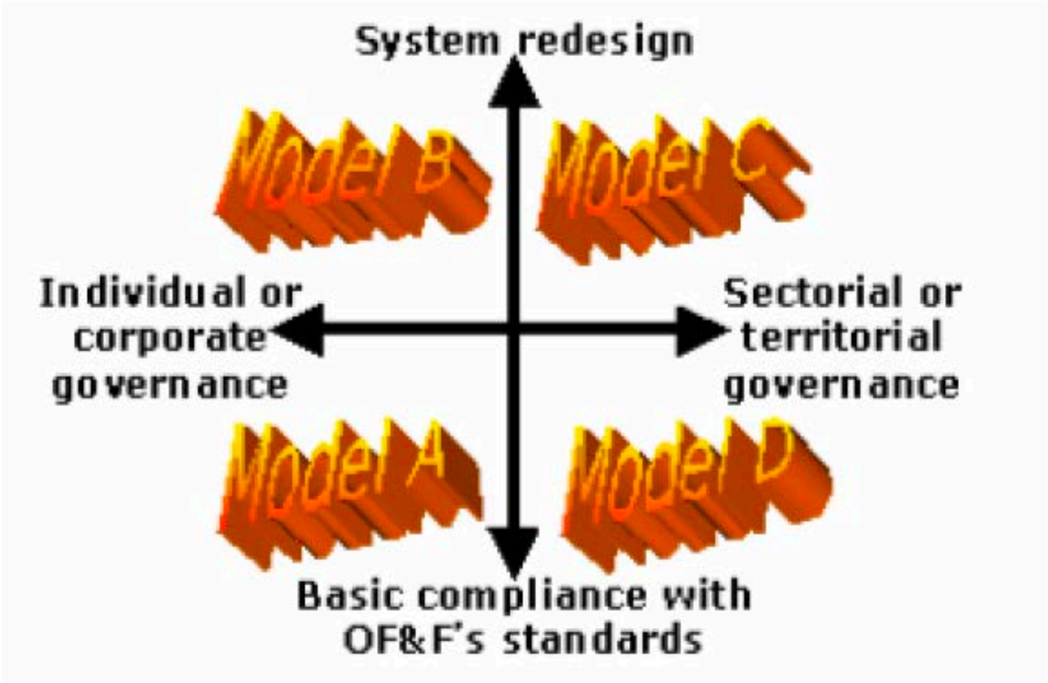


Figure. 1: A representation of the diversity of development models in organics.

Organic-PLUS - grant agreement No [774340]

ORGANIC PLUS

Pathways to phase-out contentious inputs from organic agriculture in Europe

Deliverable 2.10:

Policy briefing and phase-out reflections on contentious inputs from organic (and conventional) agricultural production

Version 1, 30 April 2022
Version 2, 31 October 2022

Funding
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Phase-outs (1/5) fertilisers

- Non-organic straw can be phased out immediately as alternative bedding is available. 25% organic land use will help with availability of straw. The same can be concluded for non-organic manure this can be phased-out immediately, (if organic farms need manure they can increase livestock).
- Non-organic fertilisers can also be phased-out soon, but currently there is limited availability e.g. Vinasse from sugar-beet and leguminous fertilisers like bean powder are not (yet) exclusively from organic farming systems.
  A legally accepted path for pesticide contamination in organic!
- Further research is needed to explore other nutrient inputs including Struvite (a phosphor fertiliser base on human waste) and 'Humanure'.

• = input substitution sufficient
= system re-design necessary

Phase-outs (2/5) mineral oil, copper

- Mineral oils for plant protection can be phase-out immediately, alternatives are available.
- Same is the case for mineral oils as machinery lubricants?

For copper as a fungicide the use in all crops they can be reduced from 4 kg/ha per year to 2 kg/ha per year after the current 7-year long regulation runs out in 2027.

- However, copper is a micro-nutrient and copper fertiliser and fungicide use below 2 kg/ha per year should be allowed, if there are copper deficiencies in the soil.
  In locations with ‘historic’ copper pollution build-up, and here a ‘drawdown’ to retain a healthy soil for carbon storage is needed.

• = input substitution sufficient
= system re-design necessary

Phase-outs (3/5) peat

- Peat as a soil conditioner is already phased-out, remaining phase-outs are needed for as growing media in plant and tree nurseries, for blocking and as casing for mushrooms.
- Peat restoration and peat lands are among the key drawdown options, and it is useful to re-wet peatland also where currently organic farming is practised, alternative crops like wet rice, water cress are possible to establish organic paludiculture (wetland agriculture) and agroforestry can be added around the new *'paddy fields'* of Northern Europe.

- = input substitution sufficient

= system re-design necessary

Phase-outs (4/5) plastic

- Fossil fuel derived plastic mulch can be phased-out until 2030. Alternative biodegradable bio-plastics are available, or mulching system re-design - further research needed.
- Fossil fuel plastic in all other uses will require more time. Research is ongoing for tree-guards, clips and many horticultural inputs to be 100% bio-based and bio-degradable. The bio-based materials should be from organic crops (potato starch, maize).
- Plastic in tools, tractors, solar batteries will be more difficult to remove and this is often recycled and does not degrade the soil with pollution, therefore this is currently not a priority.

• = input substitution sufficient
= system re-design necessary

Phase-outs (5a/5) antibiotics

- For synthetic vitamins alternative are available, they might be slightly more expensive. By providing more free-range and herbal additions synthetic vitamins are not needed.
- The use of antibiotics requires system re-design in some intensive organic systems in Europe e.g. Northern Italy. These are near ‘conventional’ with high yielding dairy breeds and limited grazing. Those systems, without re-design and re-creating a mixed grazing landscape with agroforestry, will have little chance to remain organic until 2050.
- In all other organic system, including 365 days free-range pigs and poultry antibiotics are not needed and should only be reserved for accidental damage in single animal (as per the organic welfare and care principles).

- = input substitution sufficient
= system re-design necessary

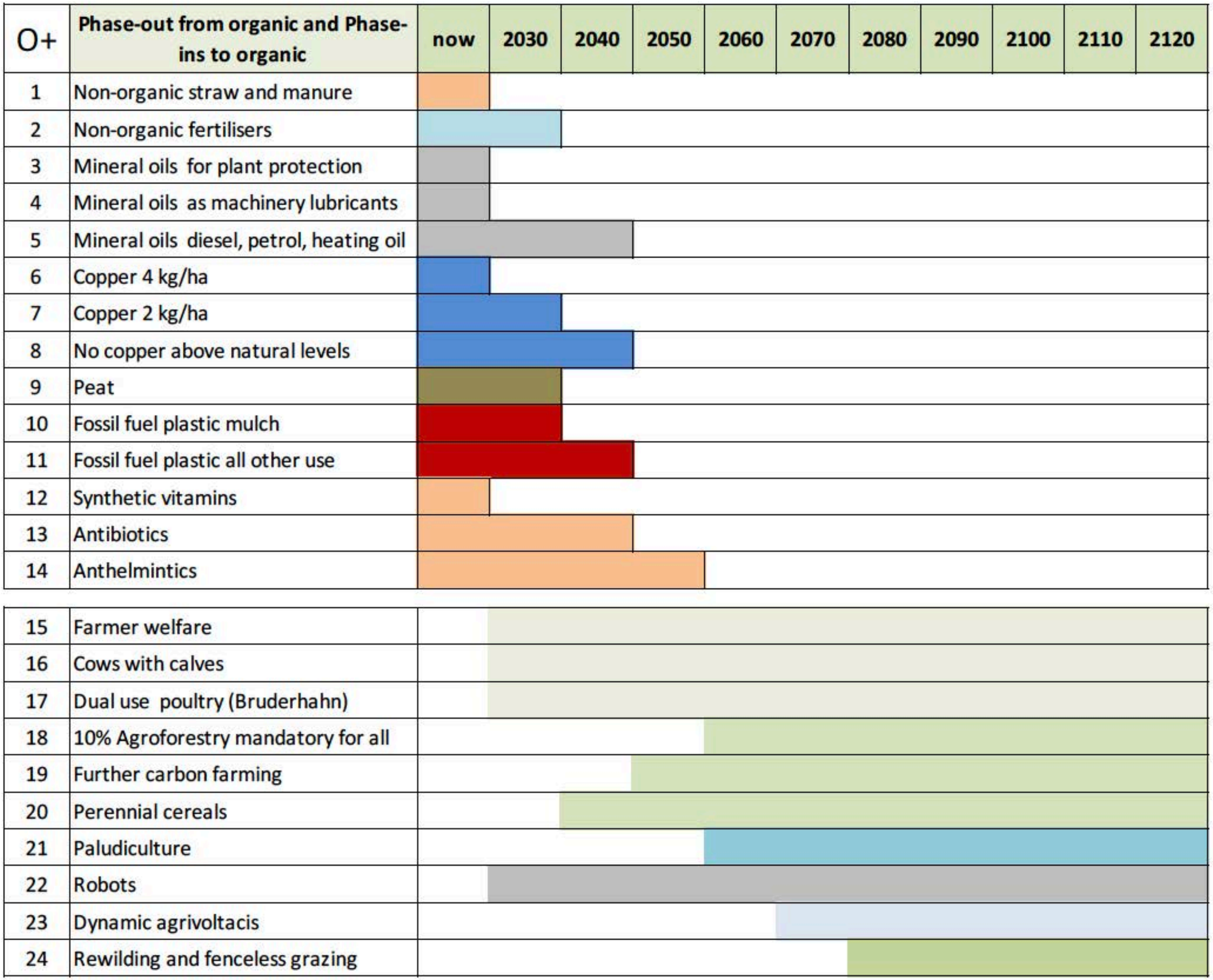
Phase-outs (5b/5) anthelmintics

- The full phasing out of anthelmintics is difficult as grazing is still too confined in organic. Mixed grazing and healthy use of pasture is often not possible and here system re-design is required to 'rewild' organic grazing patterns, introduce more agroforestry with beneficial anthelmintic properties and generally reduce the input-intensity further while equally increasing quality and input efficiency.

Mandatory Agroforestry (>10% of land) in organic, additional carbon farming methods like further reduced tillage, perennial cropping of cereals and vegetables, will be able to store much more carbon in the soil as organic can currently offer.

- = input substitution sufficient

= system re-design necessary



ORGANIC PLUS

Figure 1. Phase-out vision (1-14) of contentious inputs and phase-in (15-24) vison of other practices until 2120 in Europe and worldwide.

Conclusions

- With this vision organic agriculture can phase-out contentious inputs. This will still take at least 10 more years to achieve, but it could be 'easier' as combined with the growth of organic sector.
- European Partnership on Agroecology Living Labs and Research Infrastructures will help with phase-out.
- The phase-out covers all fossil fuel inputs, all peat, all plastic.

- *It opens up organic to carbon 'drawdown' back to 350 ppm CO_2, by rewetting peatland, making agroforestry mandatory and improving perennial cereals and vegetables with the integration of trees.*
- *Dynamic agrivoltacis (solar PV) could make organic energy independent, charging batteries, robots and heating greenhouses.*

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Next Steps

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Next steps – Phase-out Missions

Strategic Research and Innovation Agenda (SRIA) for a European Partnership on **Agroecology Living Labs and Research Infrastructures**

IA+ Innovation Actions plus = **Phase-out Missions (PoM)**
longer 7 years with adding of new partners
(micro-enterprises = farmers) each year (up to €10m for each topic)

1. **Copper** phase-out/minimise in perennial crops (esp. Mediterranean)
2. **Copper** phase-out in annual corps (potatoes, greenhouses)
3. **Peat,** phase-out, esp. peat in mushrooms
4. **Fossil-fuel plastic (mulch and other inputs)**, phase-out
5. Organic **plant based fertilisers,** (vegan organic)
6. **Antibiotics,** phase-out and livestock system re-design
7. **Anthelmintics,** phase-out and livestock system re-design
8. **Novel livestock bedding materials**, pesticide-free, healthy

Sum €80m

Contentious inputs - Mark II

HORIZON-CL6-2024-FARM2FORK-02-1-two-stage
“Increasing the availability and use of non-contentious inputs in organic farming.
Innovation Action, IA
6.5 million, 2 funded 4 years (total budget 13 million)
activities are expected to achieve **TRL 7-8** by the end of the project”

4-5 years running 2025-2030,

Consumer research, plant protection, fertiliser, livestock (including fish) with zero antibiotics and system-re-design. (Not Peat and Plastic).

Deadlines
Stage 1 is 22 February 2024 17:00:00 Brussels time
Stage 2 is 17 September 2024 17:00:00 Brussels time

Link
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl6-2024-farm2fork-02-1-two-stage

Pathways to phase-out contentious inputs from organic agriculture in Europe

Thank you

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Pathways to phase-out contentious inputs from organic agriculture in Europe

Bonus Material and WP details

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Pathways to phase-out contentious inputs from organic agriculture in Europe

Policy and Consumer Research

(WP1 LEAD and WP2 IMPACT)

highlights already shown before

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Other policy recommendations

IFOAM EU/TP Organic/RELACS/O+

- Authorisation in one Member State = valid for all
- Promote nutrient recovery and reuse of N and P from waste streams (IFOAM World Congress debate Rennes 9/2021)
- Stop 'greenwashing' misleading use of word 'organic' on fertiliser, bio-yoghurt, 100% natural
- Transparency: labelling of inputs (organic and conventional) on all products including feed e.g. GM not labelled in feed, wine no inputs required on label, peat

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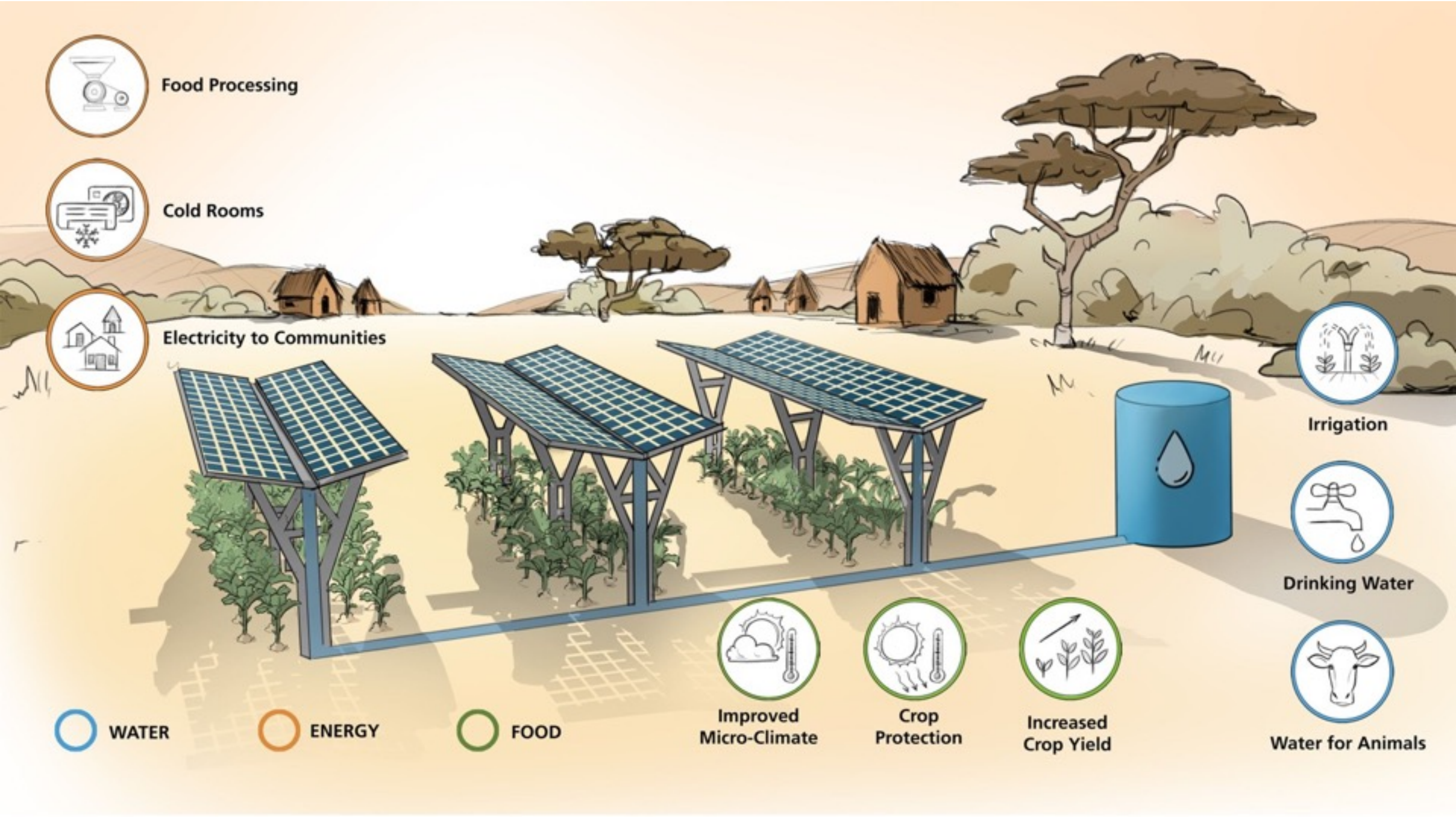
Fraunhofer Institute for Solar Energy Systems

Source:
www.ise.fraunhofer.de/en/press-media/press-releases/2021/dual-yield-on-arable-land-guideline-for-agrivoltaics-published.html

Source: Agroecology MSc Coventry University Professor Dr Ulrich Schmutz, 2022

www.ise.fraunhofer.de/en/research-projects/apv-maga.html
in Mali and the Gambia



Source: Agroecology MSc Coventry University Professor Dr Ulrich Schmutz, 2022

Pathways to phase-out contentious inputs from organic agriculture in Europe

Copper and Mineral Oils

(WP3 PLANT)

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Pathways to phase-out contentious inputs from organic agriculture in Europe

Project final (54 M) review meeting
online, 06-02-2023

WP3-Plant

Leader: UTH, Nikolaos Katsoulas

Co-Leader: INRAe, Didier Andrivon

Participants: CU, UTH, INRA, AU, CUT, L&F, IFAPA, MFAL, NORSØK, WSL, SLU, SA, FORI, UNICT

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Task 3.1: Current use of contentious inputs in organic production (M1-6, #1 D)

Participants:CU, UTH(lead), INRAe, AU, CUT, L&F, IFAPA, MFAL, NORSØK, WSL, SLU, SA, FORI, UNICT

- Deliverable 3.1

-Use of Copper, Sulphur and Mineral oils in org. farming

-Regulations related to inputs

-Survey in 10 countries for 14 crops (common questionnaire with T5.1).

-Interview of 1-3 experienced advisors per crop.

Crops/ Countries	Apple	Broccoli	Cabbage	Carrot	Cereals	Citrus	Cucumber	Eggplant	Lettuce	Olive	Potato	Pepper	Straw-berry	Tomato	SUM
Denmark	1	1			1						1		1	1	6
France				1				1	1	1	1			4	9
Germany			1		2						1			1	5
Greece	1	1				1				1	1			1	6
Italy						3				2	2			2	7
Norway	1			1							1		1	1	5
Po[illegible]nd							1				1		1	1	4
Sp[illegible]						[illegible]	[illegible]			3				3	9
Tur[illegible]					[illegible]	[illegible]	[illegible]	1		1	1	1	1	1	7
SUM	**3**	**2**	**1**	**2**	**3**	[illegible]	[illegible]	**2**	**1**	**8**	**9**	**1**	**4**	**15**	**60**
UK	*2*	*2*	*2*	*2*	[illegible]	[illegible]	[illegible]	[illegible]	*1*				*1*		*8*

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Org. Agr.
https://doi.org/10.1007/s13165-020-00330-2

SI: ORGANIC WORLD CONGRESS 2020

Current use of copper, mineral oils and sulphur for plant protection in organic horticultural crops across 10 European countries

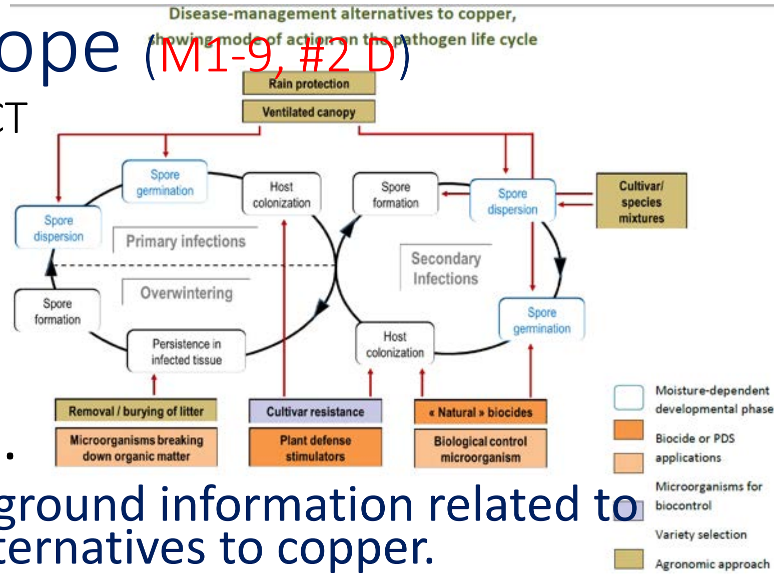
N. Katsoulas · A.-K. Løes · D. Andrivon · G. Cirvilleri · M. de Cara · A. Kir · L. Knebl · K. Malińska · F. W. Oudshoorn · H. Willer · U. Schmutz

Received: 30 April 2020 / Accepted: 1 October 2020

Abstract The use of several plant protection inputs of mineral origin, such as copper, sulphur or mineral oils is seen as contentious by many consumers and stakeholders within the organic sector. Although the use of these inputs is legal in organic systems and also applied in non-organic agriculture, their use by organic growers raises questions for organic practice, which aspires to be free from toxic, non-renewable chemicals. Data on the current use of permitted plant protection inputs is currently scarce, especially in horticulture where chemical inputs deserve special attention since horticultural products are often readily edible. A mapping of the use of copper, sulphur and mineral oils was conducted by collecting expert knowledge across 10 European countries during May–October 2018, i.e. before the limitation of copper use to 4 kg ha^{-1} year^{-1} from February 1, 2019. Results show that copper is widely used by Mediterranean organic growers in citrus, olive, tomato and

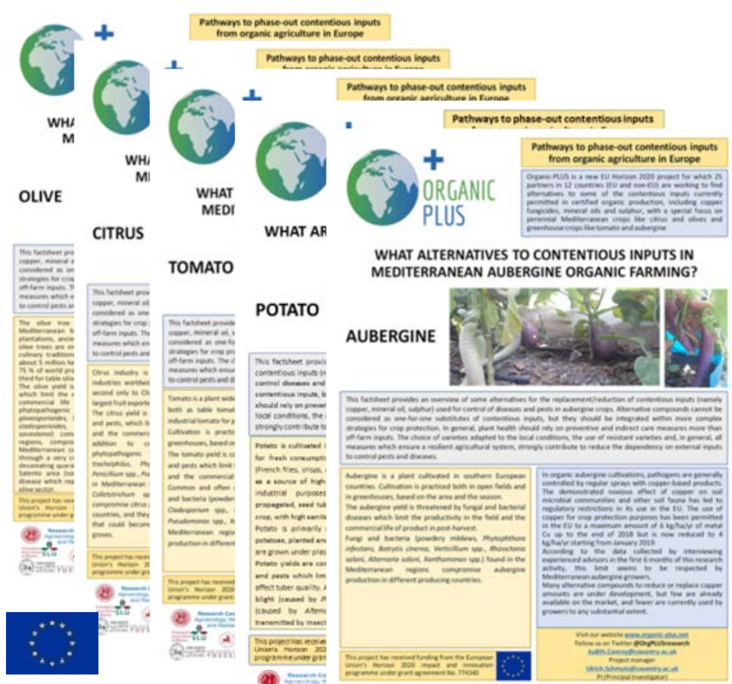
Task 3.2: Identification of available alternatives to copper and mineral oils for plant protection in organic crop production in Europe (M1-9, #2 D)

Participants: UTH, INRAe (lead), AU, IFAPA, SLU, FORI, UNICT



- Deliverable 3.3

5 Factsheets in 5 languages: Alternatives available for olives and citrus, tomato, potato and aubergine crops



- Deliverable 3.2.
  - Provides background information related to copper and alternatives to copper.
  - Describes the various technical means (available or proposed) to control pathogens.
  - Focuses on agronomic strategies designed to limit plant health risks
  - Considers information available at the level of the cropping systems, as well as the impediments that exist with respect to the development and adoption of innovations within these systems.
  - Summarises the lessons that may be drawn from this analysis, the possibilities for further implementation, and continuing research needs.

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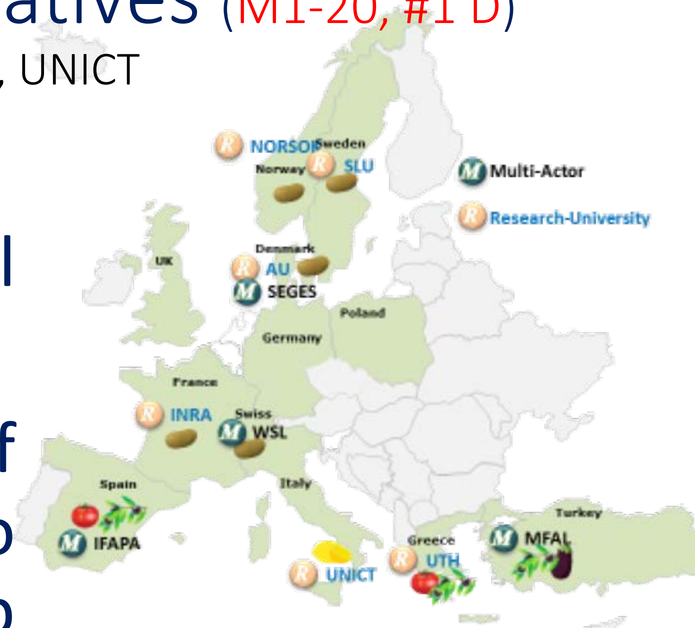
Task 3.3. Generation of additional knowledge required for optimal use of alternatives (M1-20, #1 D)

Participants: UTH, INRAe (lead), IFAPA, MFAL, NORSØK, SLU, UNICT

Deliverable 3.4. Lab and field trial evaluation:

- Lab experiments for investigation of modes of action of alternatives to facilitate the transfer of their lab efficacy to field conditions;
- In vitro assessment of the performance of alternatives;
- Field assessments of alternatives (copper substitutes or alternative strategies).



Field and lab trials

- early & late blight (INRA, SLU): BCAs & PDSs
- *Botrytis c. & Fulvia f.* (IFAPA): Alternatives from T3.2.
- *Alternaria s.* (MFAL): evaluation of landraces
- *Cycloconium o./Spilocaea o.* (MFAL-UTH), *Mycocent. cladosp*. (UTH) and *Colletotrichum sp* (IFAPA): BCAs & PDSs and alternatives from T3.2.
- *Colletotrichum sp* (UNICT): BCAs & PDSs, fertilisers, vegetable extracts, GRAS

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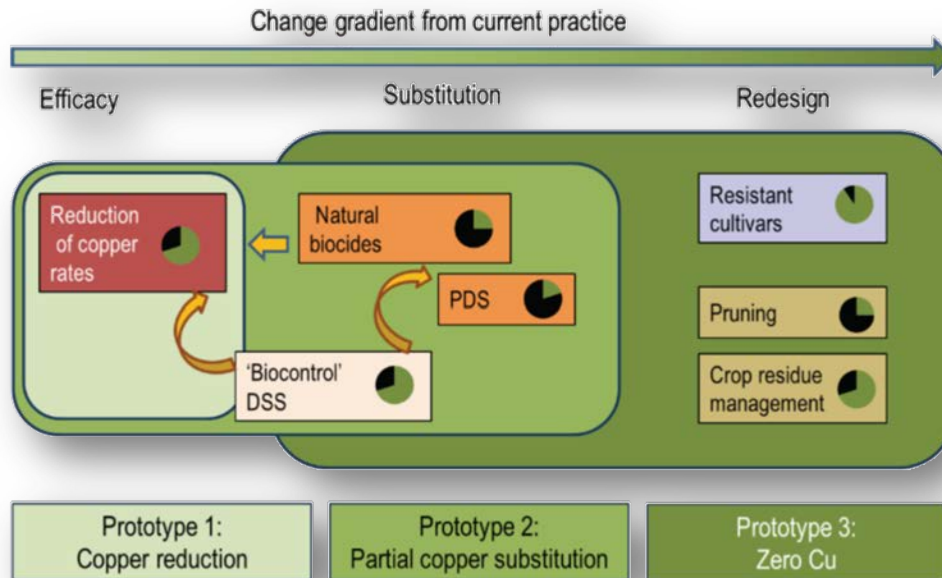
Task 3.4: Design of phase-out scenarios through substitution, combination or plant protection system redesign (M1-20, #3 D)

Participants: UTH, INRAe (lead), AU, IFAPA, WSL, SLU, UNICT

The scenarios designed relied on either a single control means, usually host resistance or a combination of up to 6 control means.

In addition to host resistance, such control means can include different types of biocontrol applications, sanitation, infection scouting and monitoring, population typing for pathogenicity, and the use of DSSs.



Scenario 1	Scenario 2	Scenario 3
• Replace susceptible cultivars with more resistant cultivars • No spraying • Lower tech- suitable for smaller areas	• Replace susceptible cultivars with more resistant cultivars • Good sanitation and prevention • Spraying of alternative products that are allowed • Suitable for larger areas	• Replace susceptible cultivars with more resistant cultivars • Good sanitation and prevention • Spraying of alternative products that are allowed • Use of a DSS for timing and choice of product • Use of variety mixtures and strip cultivation • High tech - suitable for larger areas: Use of precision agriculture tools, e.g. phenotyping with drones, robots and on-farm weather stations

Deliverable 3.5. Design of strategie avoiding copper use for protection potato, aubergine, tomato, olives a citrus against fungal and bacterial d

This project has received funding from the European Union's Horizon 202

Task 3.4: Design of phase-out scenarios through substitution, combination or plant protection system redesign (M1-20, #3 D)

Participants: UTH, INRAe (lead), AU, IFAPA, WSL, SLU, UNICT

Deliverable 3.6. Modelling Disease Dynamics. Two different kinds of models developed to understand and control potato diseases:

- Mechanistic model, applicable to pathogens with expanding lesions. For *Phytophthora infestans*, it shows that the dynamics of spore production differ between susceptible and partially resistant cultivars.

- A DSS for early and late blight. A fully operational DSS tested under D3.5 scenarios. Trials in Denmark in 2019-2020-2021 to test some alternatives to copper under field conditions.

DSS for early and late blight

Deliverable 3.7. DSS for prediction of diseases in tomato crops.

DSS for prediction of diseases in tomato crops

- A warning system forecasting the occurrence and intensity of Botrytis in a greenhouse, based on past and future climate conditions. Can be included in disease management systems to assist growers to disease control.

- Two identical systems for evaluation in Greece and Spain under D3.5 scenarios.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Original papers

A web-based system for fungus disease risk assessment in greenhouses: System development

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ARTICLE INFO

Keywords:
Decision support system
Organic farming
Botrytis

ABSTRACT

Nowadays, there is a great need and public concern for reduced use of hazardous pesticides in horticulture and implementation of alternative approaches for rational pests and diseases suppression. This goal is approached by integrating crop protection measures and non-chemical measures or applying crop protection products only

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Task 3.5: Field evaluation of system solution scenarios to foster the application of available alternatives based on best practice examples (M7-49, #1D)

Participants: UTH (lead), INRAe, AU, IFAPA, MFAL, WSL, SLU, UNICT

Alternative products and management practices identified in T3.2, evaluated in T3.3 (D 3.4) and considered in T3.4 (D3.5, 3.6 and 3.7), were tested in scientific and demonstration trials (with the growers ensuring that they were conducted in a commercially realistic manner, to maximise uptake of the findings) in the field for more than 2 years.

-INRA (France), AU (Denmark), WSL (Switzerland), SLU (Sweden)

-UTH (Greece), IFAPA (Spain), MFAL (Turkey)

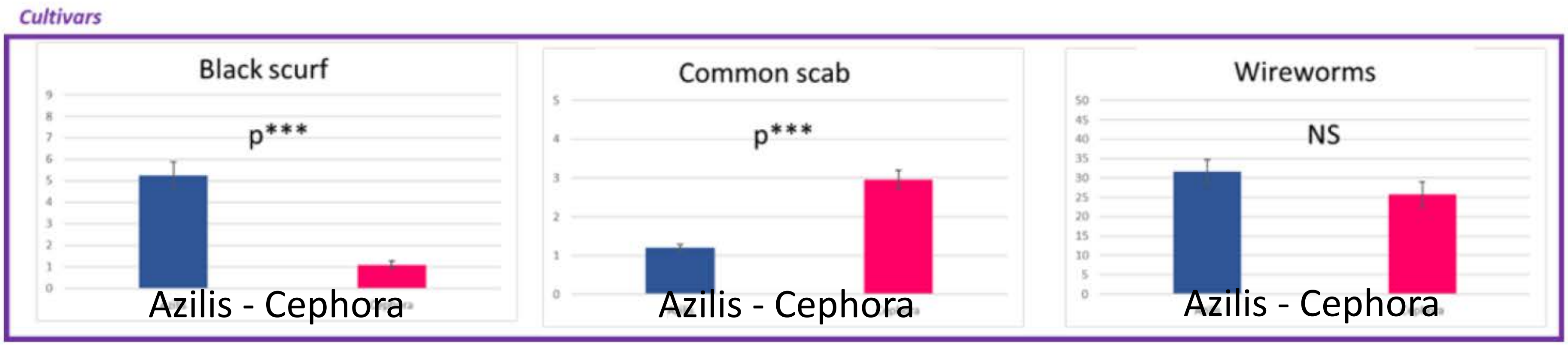
-UTH (Greece), IFAPA (Spain)

-UNICT (Italy)

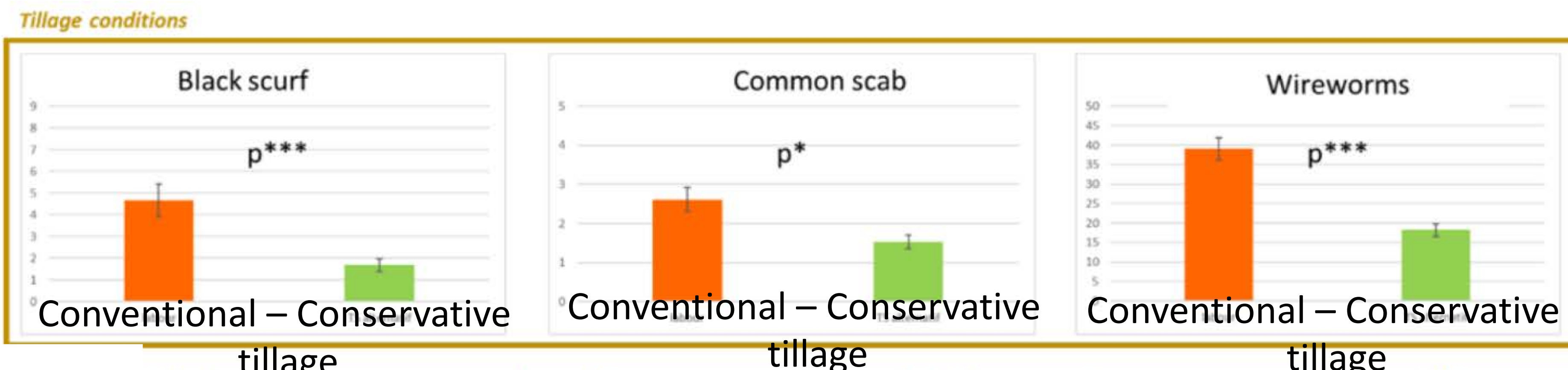
Deliverable 3.8: Field evaluation of system solution scenarios (M49)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Potato
IRNAe - Disease and pest incidence and severity on harvested tubers



Black scurf, common scab and wireworm severity/incidence at harvest, according to potato cultivars, in Le Rheu, 2021.



Black scurf, common scab and wireworm severity/incidence at harvest, according to tillage management, in Le Rheu, 2021. Orange bars: conventional tillage; green bars: soil conservation tillage.

Potato-key messages

- Host resistance is key for successful management of late and early blight in potatoes.
- The tested biologicals supposed to replace copper are more effective at low disease pressure and at the same time low weather-based infection pressure.
- A robust and integrated system to cover pathogen early warning, monitoring, and forecasting of the infection risk is essential for effective use of biologicals.
- Inclusion of all possible prevention actions e.g., healthy seed, variety mixture, strip cultivation, good crop rotation, use of precision agriculture can help to optimise the effect of biologicals to control late blight and early blight.

Tomato Field trials

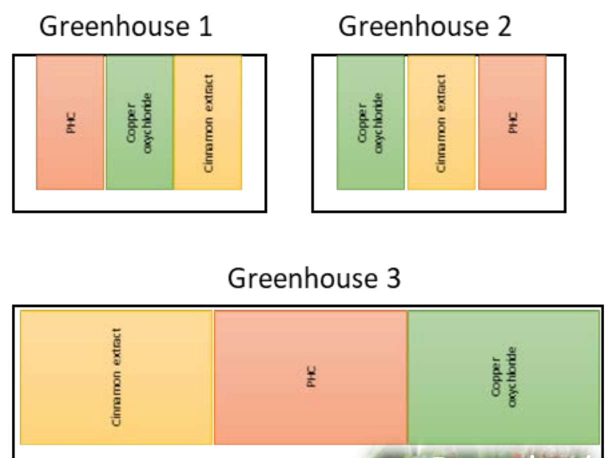
Field evaluation of system solution scenarios based on best practice examples

MODEL: TOMATO - *Botrytis*

Substitution by EFFICIENT and ACCEPTABLE products:

Cinnamom extract, Potassium H. Carbonate.

Experiments at IFAPA facilities: Two years



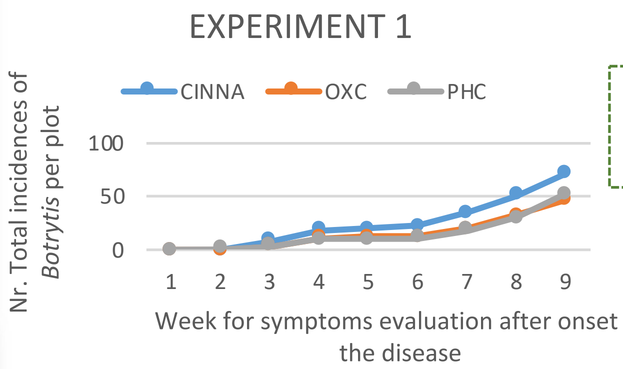
Two tomato cultivars

Exp. 1: 'Tasty tomato' (Greenhouses 1 & 2) **Organic Certified**

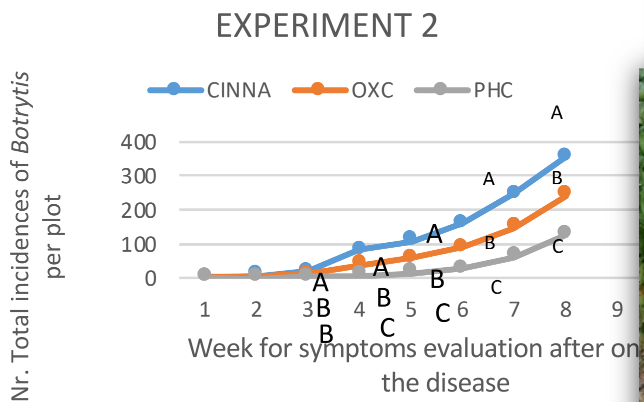
Exp. 2: 'Branched tomato' (Greenhouse 3) **Global GAP**

Tomato Field trials

Results: COMPARISON Nr. OF TOTAL INFECTION SITES DETECTED IN WHOLE TRIAL PLOTS



For the experimental conditions, once the first signs of *Botrytis* appeared, it was necessary to apply the products to stop the progression of the pathogen.



Regarding the effectiveness of the products, the less effective was the cinnamon extract (CINNA).
In 'Experiment 2' there were significant differences between treatments, being the incidence of *Botrytis* increasing in the order: PHC < OxC < CINNA

Copper oxychloride 50%

Cinnamon extracts

PHC (Potassium bicarbonate) + Chytosan

agronomy

MDPI

Article

Evaluation of Copper-Free Alternatives to Control Grey Mould in Organic Mediterranean Greenhouse Tomato Production

Jose Ignacio Marín-Guirao [1], Francisco César Páez-Cano [2], María del Carmen García-García [1], Nikolaos Katsoulas [3] and Miguel de Cara-García [1,*]

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2 Andalusian Institute of Agricultural and Fisheries Research Training (IFAPA), Centre Cabra, Antigua Ctra, Cabra-Doña Mencía, km. 2.5, 14940 Cabra, Spain
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Abstract: Grey mould caused by *Botrytis cinerea* is an endemic disease in greenhouse tomato crops in the Mediterranean Basin, where the scarcity of heating systems together with the winter weather conditions makes the use of fungicides necessary. The availability of fungicides for organic tomato production is limited, and traditionally, farmers have used copper-based formulations. In the present work, in vitro tests with twelve commercial formulations resulted in cinnamon extract and potassium hydrogen carbonate (PHC) showing high efficacy in the inhibition of *B. cinerea* growth. Both formulations were evaluated in on-farm greenhouse trials conducted for two seasons (2019/2020 and 2020/2021) in three greenhouses located in Almería, Spain. In terms of controlling *Botrytis*, PHC showed efficacy results comparable to or even better than those that have been obtained for copper oxychloride. Weather conditions outside and inside the greenhouse were conducive to the onset and development of the disease. Tomato variet
main factors that reduced the use of copp
grey mould infection. Smart and integrate
substitution of copper to control *Botrytis* ir

Keywords: *Botrytis cinerea*; cinnamon extra
bonate

check for updates

Citation: Marín-Guirao, J.I.; Páez-Cano, F.C.; García-García, M.d.C.; Katsoulas, N.; de Cara-García, M. Evaluation of Copper-Free Alternatives to Control Grey Mould in Organic Mediterranean Greenhouse Tomato Production. *Agronomy* **2023**, *13*, 137. https://doi.org/10.3390/agronomy13010137

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A web-based system for fungus disease risk assessment in greenhouses: System development

Check for updates

Nikolaos Katsoulas *, Dimitrios Antoniadis, Andreas Nikitas

Laboratory of Agricultural Constructions and Environmental Control, Department of Agriculture Crop Production and Rural Environment, University of Thessaly, Fytokou Street, 38446 Volos, Greece

A R T I C L E I N F O

Keywords:
Decision support system
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Botrytis

A B S T R A C T

Nowadays, there is a great need and public concern for reduced use of hazardous pesticides in horticulture and implementation of alternative approaches for rational pests and diseases suppression. This goal is approached by integrating crop protection measures and non-chemical measures or applying crop protection products only when needed, thus eliminating unnecessary applications. In addition, preventive farm management methods

8.27 x 11.02 in

Citrus-Disease incidence and severity in the field

Farm 2) Lentini

Oranges cultivar “Tarocco Scirè”

***Penicillium* digitatum**

Task 3.5: Field evaluation of system solution scenarios to foster the application of available alternatives based on best practice examples

Alternatives tested:

- substitution products used as such including biocontrol agents, plant defence stimulators, bio-stimulants and natural biocides,
- complex strategies combining resistant cultivars, decision support systems and crop management measures.

The experiments showed:

- with few exceptions, substituting copper for an alternative product without any further action was generally less efficient than the copper control; in some cases, the promises of substitutes could not be transferred to field conditions.
- cultivar resistance should serve as one of the pillars of IPM (Integrated Pest Management) strategies devoid of copper. These strategies are often more complex to implement on farm, and sometimes too expensive to be profitable without supporting policies.

Substantial reduction or even complete protection of the target crops without copper applications is within reach. Some are not economically competitive with the low cost of copper applications. Additional support from political and economic actors is required

Task 3.6: Evaluation of the acceptance of alternative solutions and barriers to further reduction of contentious inputs (M13-52, #2 D)

Participants: UTH, INRAe, IFAPA, MFAL (lead), UNICT

- -Stakeholders/farmers evaluation and participation in the development process in actual farm conditions.

- -Development and validation of actions to overcome the barriers towards large-scale implementation.

- -Economic, technical and sociological analysis of the scenarios to evaluate and suggest alternative scenario solutions that will not compromise the competitiveness of the organic sector.

Deliverable 3.9: Evaluation of alternatives and design of complete systems. Multi-criteria assessment and cost/benefit analysis (M52)

Deliverable 3.10: Barriers to reduction of contentious inputs: Technical, Social, Economic. Measures to foster the acceptance and performance of alternative scenarios in actual farm conditions (M52)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Task 3.6: Evaluation of the acceptance of alternative solutions and barriers to further reduction of contentious inputs

Growers are interested in feasible (technically and economically) alternative products to copper. They are willing to use them mainly when the use of copper fungicides is prohibited.

Barriers to adopt alternatives: higher price, low persistence, low effectiveness.

Although potato resistant variety use is important, it has to be combined with other strategies.

The characterised set of landraces can be a valuable resource for organic aubergine breeding programmes

No significant technical barriers were identified.

In order to foster the performance of alternatives to copper, a broader research will be needed, focusing the efficacy of the evaluated alternatives against other pathogens controlled by copper, not included in this project

Barriers to copper reduction: lack of awareness of possible innovative system solutions and products

Task 3.7: Stakeholder interaction and dissemination (M13-52, #1 D)

Participants: CU, UTH (lead), INRAe, CUT, L&F, IFAPA, MFAL, NORSØK, FORI, SA, UNICT

- several workshops with growers, advisors and policy makers (Greece, Italy, Spain, France, Turkey)
- open field days (Greece, Italy, Turkey)
- >8 publications in peer review journals
- >12 presentations in conferences

Deliverable 3.11: 4 Factsheets in 4 languages for stakeholder uptake. (M52)

Organic-PLUS workshop in Norway, October 28-29, 2019

Open day at University of Thessaly

Members of the public were able to see the ongoing work of Organic-PLUS and other projects in the greenhouse facilities of the University of Thessaly, Greece on 18th September 2019. The Open Access Day was part of the pan-European communication campaign Europe in My Region 2019 (#EUinMyRegion). Associate Professor, Nikolaos Katsoulas, (director of the Laboratory of Agricultural Constructions and Environmental Control) and his colleagues guided visitors through the facilities including a new pilot greenhouse.

Associate Professor Nikolaos Katsoulas (leader of O+ workpackage 3) de...

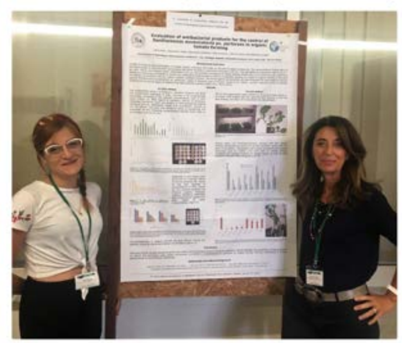
3rd European Conference on Copper in Plant Protection

The Organic-PLUS and RELACS projects participated to the 3rd European Conference on Copper in Plant Protection that was held in the Julius Kühn-Institut, Berlin, Germany, from 15-16 November 2018, organised by IFOAM EU-Group, BÖLW and the Julius Kühn-Institut.

University of Catania researchers present on Organic-PLUS

Researchers from Organic-PLUS partner the University of Catania have presented their work on the project at two recent conferences:

From 9th-11th July 2019, 'Biocontrol 2019' the 4th International Symposium on Biological Control of Bacterial Plant Diseases took place in Viterbo, Italy. The Italian Organic-PLUS team working on the PLANT workpackage presented early findings of their trials as a poster "Evaluation of antibacterial products for the control of *Xanthomonas euvesicatoria* pv. *perforans* in organic tomato farming".



Alice Anzalone and Gabriella Cirvilleri presenting their poster at Biocontrol 19

The Catania team presented again at the 5th International Conference on Microbial Diversity (MD2019) in Catania, Italy, from 25th-27th September 2019.

Field trials at NORSØK feature on Norwegian TV

At NORSØK (Norwegian Centre for Organic Agriculture) in Tingvoll, Norway, two Organic-PLUS field trials recently featured prominently on Norwegian television (www.tv.nrk.no):

Growing potatoes without copper fungicides

On 18th September Organic-PLUS partner the Soil Association ran a workshop to examine the future of growing potatoes in the UK following uncertainty around the reauthorisation of copper-based fungicide Cuprokylt. The sell-out event was attended by a wide range of stakeholders, indicative of significant interest in the topic. The first half of the workshop comprised a series of presentations examinin key areas. The Soil Association gave an overview of the legislative background,

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Pathways to phase-out contentious inputs from organic agriculture in Europe

Antibiotics
Anthelmintics

(WP4 LIVESTOCK)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

WP4 Livestock

Leader: Massimo De Marchi (UNIPD, Italy)

Co-leader: Federico Righi (UNIPR, Italy)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

T.4.1: Survey famers contentious inputs across Europe

(UNIPD)

- **Task Leader**: UNIPD
- **Partners involved**: CU, UTH, UNIPD, CUT, L&F, ETO, NORSØK, SLU, UNIPR, ABioDoc, SA, FORI, ORC; also non-partners: Birgit Fuerst-Waltl (Austria), Rannveig Guðleifsdóttir (Iceland), Luciana da Costa (The Ohio State University)
- **1 published scientific paper** in ITEA (only Spain data)
- Paper with the complete dataset: submitted to Animal (all countries)

T.4.2: Bibliographic research alternatives

(UNIPR)

- **Task Leader** : UNIPR
- **Partners involved**: UNIPD, SLU, ORC
- **5 scientific papers:** 1 in Animals and 4 in Antioxidants

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T.4.3: Development of alternative/new bedding materials from agroforestry (M1-24)

(ATB)

- **Task Leader**: ATB
- **Partners involved**: UNIPD, UNIPR
- Preparation of a scientific paper ongoing
- Bedding material provided to Parma (Italy) for the in vivo trial

T.4.4: Chemical analysis and in-vitro trials on alternative natural plant products (M1-24)

(SLU)

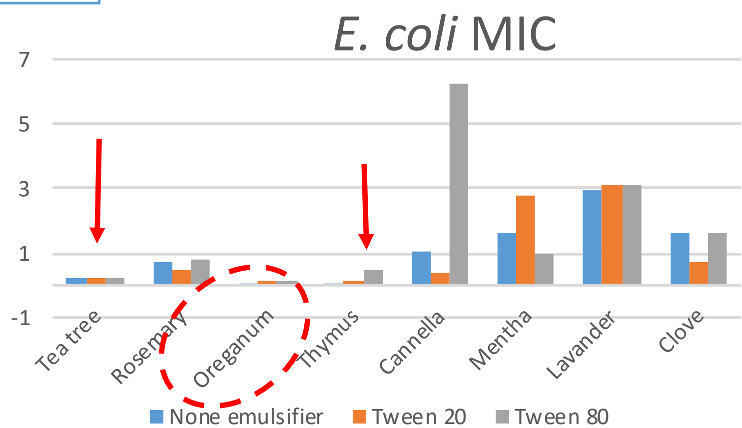
- **Task Leader**: SLU
- **Partners involved**: UNIPD, UNIPR
- **Produced** D4.5

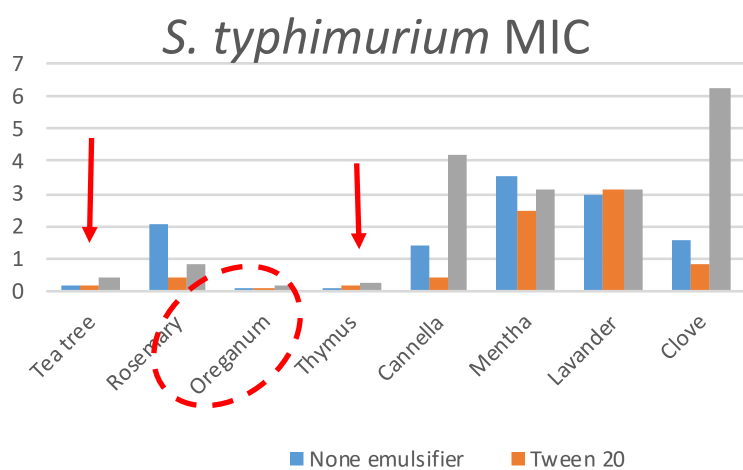
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

T.4.4: Chemical analysis and in-vitro trials on alternative natural plant products (M1-24)

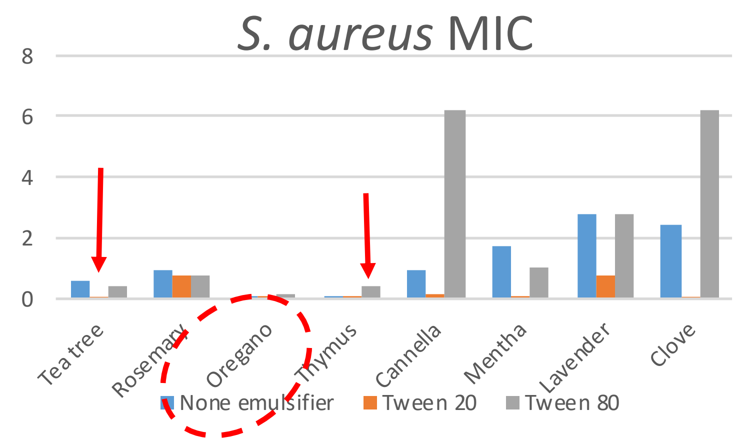
In-vitro studies with Essential Oils

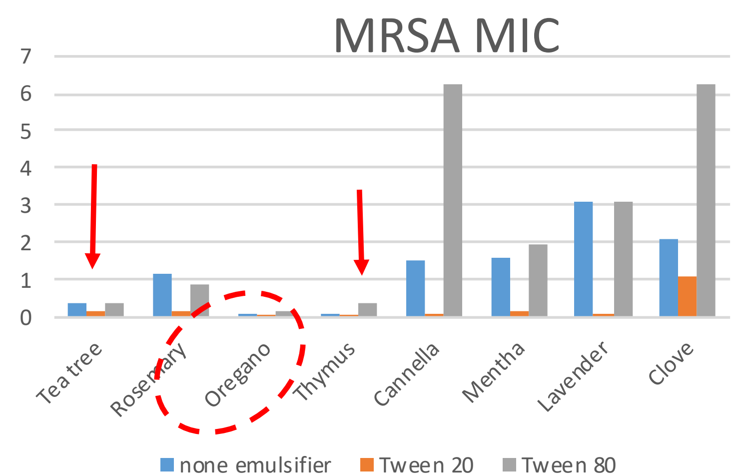
Gram -





Gram +

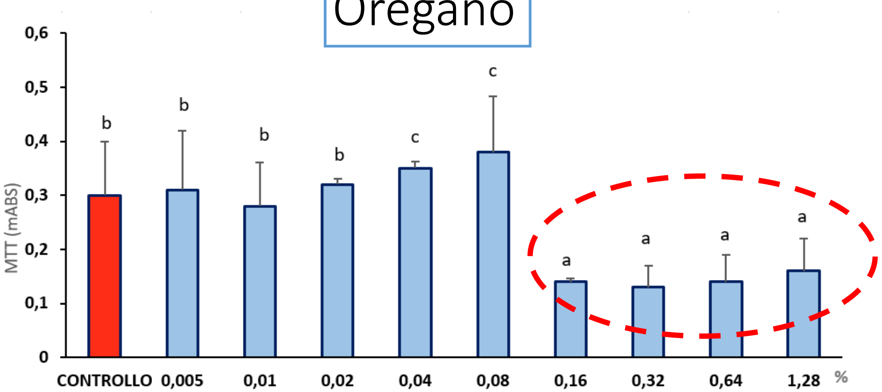




T.4.4: Chemical analysis and in-vitro trials on alternative natural plant products (M1-24)

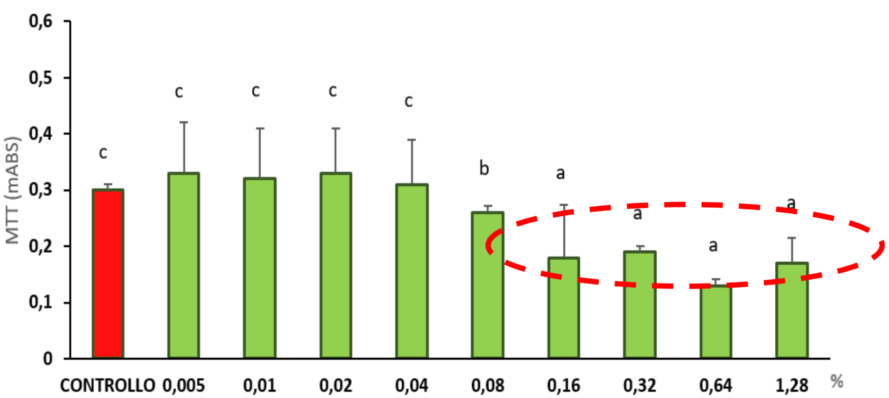
In-vitro cytotoxicity test Essential Oils

Oregano

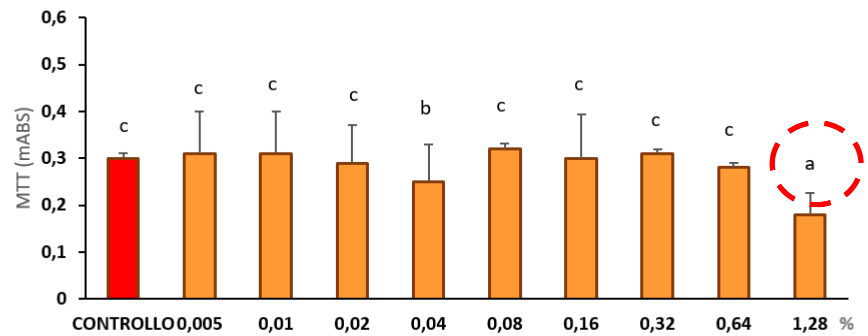


- Viability of the cells

Cinnamon



Rosemary



T.4.5: In-vivo trials on the use of alternative molecules from plant products and bedding materials from agroforestry in **animal production** (M7-43)

- **Task Leader**: UNIPR
- **Partners involved**: NORSØK, L&F, UNIPD, ORC
- **Produced:** D4.8 to D4.10 and D4.12 to D4.13: Mini papers for stakeholders
- **Produced** D4.6: Report on in vivo trials on the use of alternative molecules
- **Produced** D4.11: Protocol(s) for vitamins and bedding – poultry
- **2 scientific papers**
- **1 PhD thesis**
- **2 graduation thesis**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Alternatives to Zinc to prevent diarrhea in pigs

(L&F)

- **Trial 1**: Test p-phenol as a substitute for medical Zn to avoid diarrhea after weaning and management
- **Trial 2**: Test Artemisia against intestinal worms in pigs from 10 weeks old (30 kg) to 15 weeks old (60 kg)
- Results showed management is key

Bark extract to control coccidiosis in lambs

(NØRSOK)

- Condensed tannins reduce coccidian in the intestine
- Lower fecal score
- Affected lamb's appetite
- **1 scientific paper** in Acta Veterinaria Scandinavica
- **1 PhD thesis**

Plant feed additives as substitutes of Vitamin E in poultry

(UNIPD, UNIPR)

- Study lasted 82 days
- Substitution of VitE by: Bark Extract or Green tea + Grape Extract
- Better feed conversion with the plant extracts
- Protective effect on the kidneys by Green tea + Grape Extract
- Protective effect on the liver by Bark extract
- **1 graduation thesis**

Scutellaria baicalensis to improve health status in beef

(UNIPD, UNIPR)

- Dose: 20 g SB/animal and day, 4 months
- 144 Charolaise bulls (fattening - finishing period)
- **1 scientific paper** in AAB

Herbs mix to boost immune system in dairy cattle post-partum

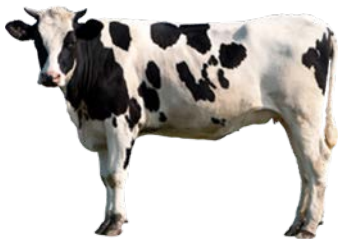
(UNIPD, UNIPR)

- Dose: 3 boluses/animal before 30 DIM
- Samples collected at T0, T30, T70, T100
- Not impact milk production and composition, metabolic profile, fertility traits
- **1 international conference** communication

Herbs mix to boost immune system in dairy cattle peri-partum

(ORC, UNIPD)

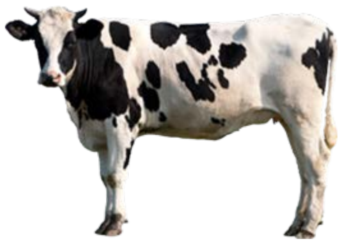
- Affected some biochemistry traits
- Did not affect colostrum and milk quality, calf’s weight, or BCS



Dairy cattle supplementation with linseed oil in transition cows

(UNIPR)

- Linseed oil did not improve animal performance and health status
- Reduced DMI during the lactting period
- Colostrum quality was not affected



Organic poplar woodchip bedding in dairy cows

(UNIPR, UNIPD)

- Study lasted 10 days in a commercial farm
- **1 paper in R1** in JDS

Poplar and vineyard pellets for poultry bedding

(UNIPR, UNIPD)

- Study lasted 82 days
- Tested 2 bedding sources
- **1 graduation thesis**

T.4.6: Impact of alternative molecules from plant products and bedding materials from agroforestry on **animal product quality** (M13-43)

- **Task Leader**: UNIPD
- **Partners involved**: UNIPR
- **Produced** D4.7 and submitted on time: Report on the impact on animal product quality
- **2 scientific papers**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Monitoring organic bulk milk

(UNIPR, UNIPD)

- Bulk milk samples from 24 dairy farms (12 CONV; 12 ORG) collected monthly during 1 year. Laboratory analysis recently finished.
- **2 scientific papers** published in TJAS and JDS

Monitoring cheese quality traits

(UNIPR, UNIPD)

- Cheese type: formaggio latteria, Caciotta, mozzarella STG and Asiago DOP
- **1 paper in R1** in JDS

Plant feed additives effect on meat quality of broilers

(UNIPR, UNIPD)

- Effective substitution of VitE with Green tea+Grape Extract or Hydrolyzed polyphenols
- Not impair post-mortem organ weight and meat quality

Bedding effect on meat quality of broilers

(UNIPR, UNIPD)

- Carcass weight was higher for poplar pellet than wood shaving bedding
- Meat of animals reared on pelleted bedding was softener and richer in protein content both for poplar and vineyard pellets.

T.4.7: Stakeholder interaction and dissemination (M13-46)

- Actively involved in O+ dissemination: O+ newsletters, news O+ website and twitter, translation factsheets and mini-report
- Webinar with producers and consumers in collaboration with WP IMPACT
- Dissemination articles and interviews
- Stakeholder meetings by different partners involved in WP4-Livestock
- Webinars and Seminars presenting the results
- **Produced** D4.14 farmer-facing workshops, which included workshops, webinars/seminars and wider dissemination

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Deliverables including extension new dates:

Year 1	Year 2	Year 3	Year 4
D4.1: Survey (M6) UNIPD ✓	**D4.4:** Alternatives for bedding, production technologies and processing **(M18) ATB** ✓	**D4.6**: Report on in-vivo trials on the use of alternative molecules (M49) **UNIPR** ✓	**D4.8**: Mini papers for stakeholders- enhance animal's immune system (M52) **ORC** ✓
D4.2: Vitamins, antiparasitics, and antimicrobials (M9) UNIPR ✓	**D4.5:** Reports on the chemical analysis and in-vitro trials **(M24) SLU** ✓	**D4.7**: Report on the impact on animal product quality (M49) **UNIPD** ✓	**D4.9**: Mini papers for stakeholders – dairy cows (M52) **UNIPR** ✓
D4.3: 4 Factsheets (M9) UNIPR ✓			**D4.10**: Mini papers for stakeholders – beef (M52) **UNIPD** ✓
			D4.11: Protocol for vitamins and bedding- poultry (M52) **UNIPR** ✓
			D4.12: Mini papers for stakeholders- pig production (M52) **L&F** ✓
			D4.13: Mini papers for stakeholders – poultry, meat and milk production alternative molecules and bedding (M52) **UNIPD** ✓
			D4.14: Farming-facing workshops (M52) UNIPD (n=4) ✓

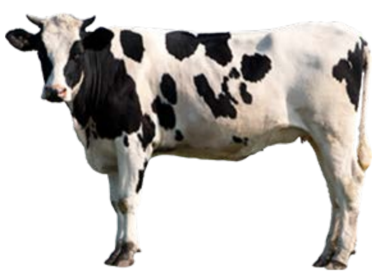
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

WP4 Livestock

thank you for your attention

Questions?

Massimo De Marchi/Federico Righi

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Pathways to phase-out contentious inputs from organic agriculture in Europe

Fertiliser, Peat, Plastic Mulch

(WP5 SOIL)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

FERTILISERS

PLASTIC

Organic-PLUS evaluation meeting (web), 6.2.2023

PEAT

WP 5: Soil research in Organic-PLUS

Anne-Kristin Løes, NORSØK

Organic-PLUS has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774340

Thanks to all for the excellent collaboration in WP5

5.1+2: Initial mapping and review of inputs - peat, plastic, fertilisers

Organic growers use a lot of fertilisers from conventional production, peat-based growing media, and non-degradable plastic foil for mulching

Crops/ Countries	Apple	Broccoli	Cabbage	Carrot	Cereals	Citrus	Cucumber	Eggplant	Lettuce	Olive	Potato	Pepper	Straw-berry	Tomato	SUM
Denmark	1	1			1						1		1	1	6
France				1				1	1	1	1			4	9
Germany			1		2						1			1	5
Greece	1	1				1				1	1			1	6
Italy						3				2	2			2	7
Norway	1			1							1		1	1	5
Poland							1				1		1	1	4
Spain						3				3				3	9
Turkey						1		1		1	1	1	1	1	7
SUM	3	2	1	2	3	8	1	2	1	8	9	1	4	15	60
UK	2	2	2	2					1				1		8

D 5.1 (report)

Current use of peat, plastic and fertiliser inputs in organic horticultural and arable crops across Europe. Løes et al, 2018

D 5.2 (report)

Report on alternatives to contentious inputs
Oudshoorn et al, 2019

5.3: Processing woody residual materials

D 5.3 (tech paper)
Twin screw extruder processing technology for fibres as raw material for peat substitution
Dittrich et al 2019

D 5.4 (tech paper)
Technical paper on organic materials as peat substitute: Experimental investigation of different extruded lignocellulosic materials to determine a suitable substitute for peat
Dittrich et al 2020

D 5.5 (peer-reviewed paper)
Extrusion of different plants into fibre for peat replacement in growing media: adjustment of parameters to achieve satisfactory fibre-characteristics
Dittrich et al 2021, Agronomy (MDPI)

5.4: Fertilisers   Why do we need alternative fertilisers?


- To decrease current dependency on contentious fertilisers from **conventional farming and food industries** (stockless farms; fruit and veg. production)
- Increasing number of organic farms **without animal husbandry**
- **Increasing political targets** for area under organic management 25%


Why are fertilisers considered contentious?

- Nutrients derived from **conventional animal husbandry**
- Fertilisers sourced from **distant countries**, often from the global South
- **Contamination risk:** veterinary drugs, pesticides (clopyralid in vinasse)


Structuring the alternatives: URBAN, VEGAN, RESIDUAL

- Closing the nutrient gap; recycling of nutrients from **URBAN** sources: composts, digestates
- Legume based and plant derived fertilisers for **VEGAN** growing
- **RESIDUAL**s from sustainable sources: organic food production and sustainably produced natural-derived (e.g., marine) materials

Country	Denmark	Germany	Norway	UK	Poland
URBAN	Source-separated organic household waste digestate	Source-separated organic household waste digestate			
VEGAN		Clover-grass silage; clover-grass digestate (with pig slurry); clover pellets		Comfrey extract, nettle extract, bean powder	
RESIDUAL		Tofu whey	Marine-derived residues (seaweed, wild fish)		Organic fish pond sediment
CONTROL	Pig slurry	Horn grit, solid cattle manure	Dried poultry manure	Liquid, plant based commercial fertiliser	

D 5.6 (summary paper)

Summary paper on alternative fertilisers
Zikeli et al, 2022

D 5.7 (tech report)

Technical report on alternative fertilisers (arable farming and vegetables)
Zikeli et al., 2022

Table 1: Nutrient concentrations and characteristics of biogas digestate used for the field vegetable trials (source-separated household waste used in trials in Germany).

	Dry matter (%)	N_{total} (g kg^{-1} FM)	NH_4^+-N (g kg^{-1} FM)	C (% DM)	N (% DM)	C:N ratio	P (g kg^{-1} DM)
Mean value	9.3	5.4	4.2	27.8	2.57	4.8	5.7
Range	(8.43-10.2)	(5.02-5.7)	(4.03-4.45)	(26.9-2.87)	(2.51-2.64)	(4.24-5.42)	(5.5-5.86)
No. of anal.	2	6	6	4	4	4	4

	K (g kg^{-1} DM)	S (g kg^{-1} DM)	Ca (g kg^{-1} DM)	Mg (g kg^{-1} DM)	Na (g kg^{-1} DM)	Cl (g kg^{-1} DM)	Zn (mg kg^{-1} DM)
Mean value	34.3	4.30	30.2	7.62	9.82	10.1	210
Range	(30.4-38.3)	(4.19-4.42)	(28.2-32.2)	(7.31-7.93)	(8.87-10.8)	(1.86-18.4)	(206-213)
No. of anal.	4	4	4	4	4	4	4

	As (mg kg^{-1} DM)	Cd (mg kg^{-1} DM)	Cr (mg kg^{-1} DM)	Cu (mg kg^{-1} DM)	Ni (mg kg^{-1} DM)	Pb (mg kg^{-1} DM)	Hg (mg kg^{-1} DM)
Mean value	4.47	0.45	54.7	58.9	19.1	24.7	0.11
Range	(4.11-4.99)	(0.43-0.47)	(49.6-59.6)	(58.5-59.3)	(17.9-20.1)	(23.9-25.6)	(0.10-1.2)
No. of anal.	4	4	4	4	4	4	4

	pH *
Mean value	7.9
Range	(7.4-8.2)
No. of anal.	64

No. of anal.: number of analyses.
*pH value is cited from Möller and Schulth
Methods: **C, N and S**: Dry combustion; **N_{total} and NH_4^+-N:** Kjeldahl; **P, K, Mg, Ca, Na, Zn:** Microwave digestion with HNO_3, measurement with Inductively Coupled Plasma- Optical Emission Spectrometry (ICP-EOS); **As, Cd, Cr, Cu, Ni, Pb and Hg:** Microwave digestion with HNO_3; measurement with ICP- Mass Spectrometry (MS); **Cl**: Hot water extraction and ion chromatography.

REPORT BITE
Nutrient concentrations and other characteristics

Evaluation

- **All tested fertiliser can be used,** but **no fertiliser is a „perfect" solution**
- **URBAN**: **often cheap; high fertilizer value** (NH_4); **contamination risks (plastic); need for treshold values**
- **VEGAN: made on farm, they may improve the internal N-cycle; made off farm they are very expensive due to high use of energy (legume pellets)**
- **RESIDUAL: more work required to develop practically feasible, well-balanced fertilisers (low DM, high pH, unbalanced)**

What is needed?

- All categories (URBAN, VEGAN, RESIDUAL) must be utilised to reach 25% organic land
- Regionalisation of fertiliser sourcing
- Increased interest/acceptance by farmers
- Adapted fertilisation strategies in organic growing
- More efficient acceptance procedures are require

Denmark: Application of digestate from source-separated organic household waste in large-scale field trial, 2019

UK: Comfrey plants grown next to a polytunnel with a fertilisation trial with tomatoes, enabling on-farm nutrient acquisition for intensive organic protected cropping

5.5 peat in growing media


7/6/2021 Sales of peat compost to gardeners to be banned from 2024 | Climate change | The Guardian

News Opinion Sport Culture Lifestyle

Climate change

Sales of peat compost to gardeners to be banned from 2024

Damian Carrington *Environment editor*

@dpcarrington

Tue 18 May 2021 06.00 BST

Sales of peat compost to gardeners will be banned from 2024, the government has said. Ministers will also give £50m to support the restoration of 35,000 hectares of peatland by 2025, about 1% of the UK's total.

The UK's peatlands store three times as much carbon as its forests. But the vast majority are in a degraded state, and are emitting CO_2, which drives the climate crisis.

Why do we need to phase out peat use?

- Peat are valuable areas, need protection
- Organic growing should be a front-runner
- Compost is a good alternative and composting is common in organic farming
- UK a leading country

[HTA | The Responsible Sourcing Calculator]

Horticultural Trades Association HTA

- energy use
- water use
- social compliance
- habitat and biodiversity
- pollution
- renewability
- resource use efficiency

To replace peat in growing media, O+ tested left-over plant materials for extrusion or composting

September 8, 2022:
Judith Conroy interviewed by BBC:

[Is there a good alternative to peated compost? - BBC Future]

Alternative growing media were tested for seedlings and transplants

Various extruded wood (poplar, cane, forest residue, vineyard) tested in different proportions mixed with compost, with tomato, lettuce and pepper seedlings in Catalonia.

(pure) woodchip compost from ash tree tested in lettuce, cabbage and leeks in UK; addition of vermiculite and extruded poplar

Composts of horse manure and leaves tested with lettuce and cauliflower in Norway

Cocoa shells with soil decomposed in Greece

Local compost (horse manure and forest residue woodchips) tested with lavender in Catalonia

Local compost (chopped olive prunings) tested with olive saplings in Turkey

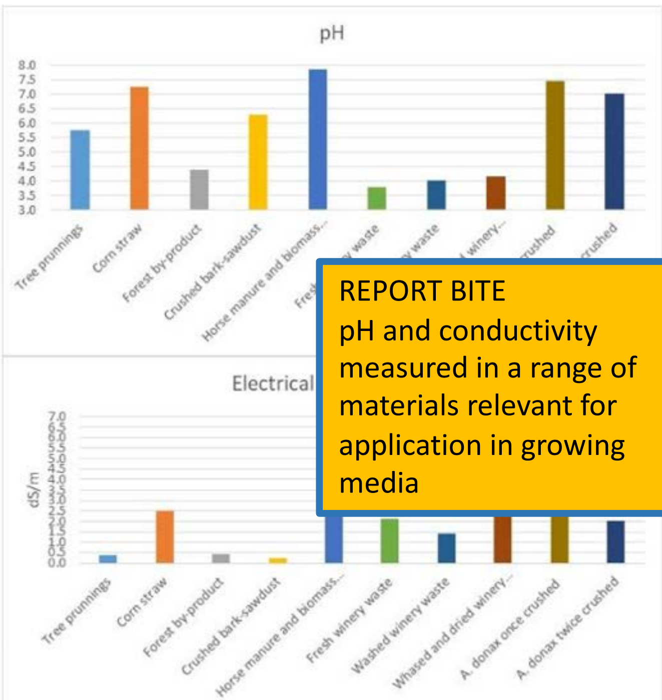
D 5.8 (report)

Report on trials with alternative growing media (replacement of contentious input peat)
Caceres et al., 2022

D 5.9 (report)

Report on farmer-focused open days – including bio-economy supply chain actors (growing media manufactures and plant nurseries)
Caceres et al., 2022

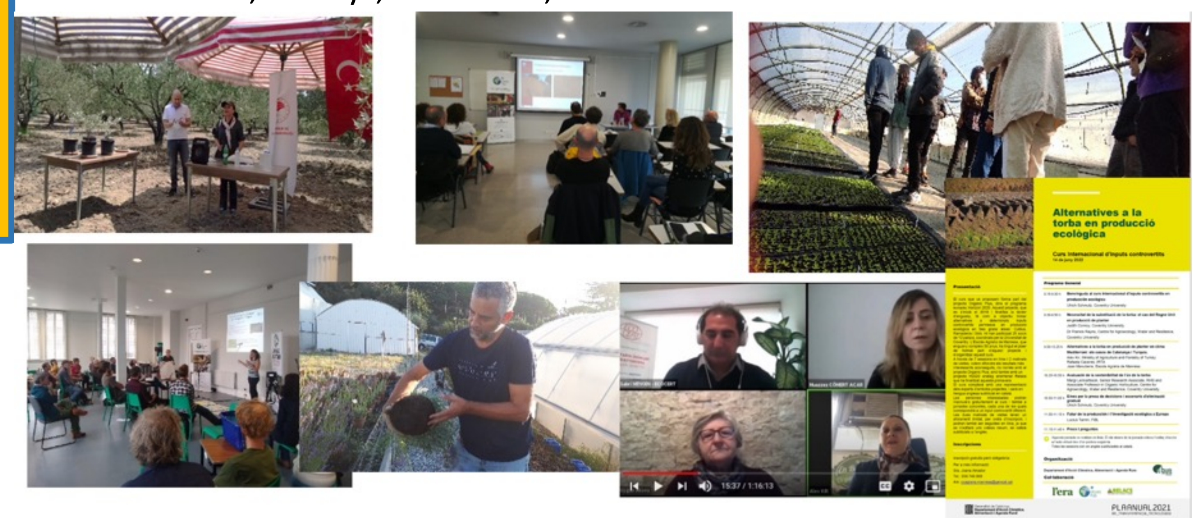
Figure 6. An interview with a leading organic farmer in Bostanlı, Karsiyaka (Izmir, Turkey) open organic market.



REPORT BITE
pH and conductivity measured in a range of materials relevant for application in growing media

Figure 7. pH (top) and electrical conductivity EC (bottom) measured in raw materials investigated by IRTA.

In Turkey, UK, Catalonia and Norway: visits to growers, workshops, fairs, surveys, interviews, conference sessions



Conclusions

- Different growing media for seedlings and larger plants
- Mature composts can replace peat
- Composted woody materials gave good results; N immobilisation needs monitoring
- We need better fertiliser strategies! Struvite? Soon permitted in organic growing
- Significant N+P leaching observed from peat-based growing media
- Soil blocks may fall apart
- More experiments are needed to confirm the results (with additional species and in commercial nurseries)

5.6: Plastic foil for mulching

Why do we need more bio-degradable plastic foils?

Typical view of PE mulch films collected after plant harvesting

Biodegradable mulch films after soil mixing

Biodegradable foils are available, but very expensive compared to polyethylene (PE)

Currently available films are monolayered; degradation in field dependent on thickness (and local conditions = VARIABLE)

Current films are often made from corn starch = risk of GMO

Can multilayer films be used to reduce cost, e.g. by making a cheaper inner layer?

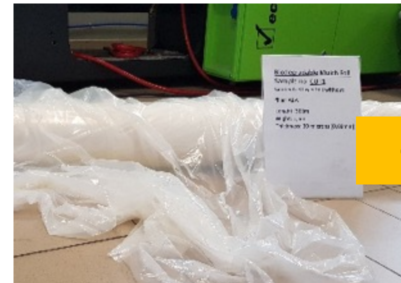
Can degradable plastic be made from potato starch instead of corn?

Topics studied in Organic-PLUS

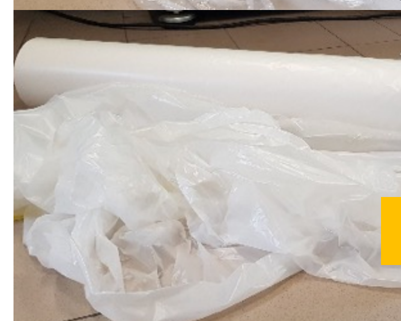
3-layered biodegradable mulching films tested in O+

ORGANIC PLUS

Structure	Characteristics
A B CUT 1 A	Thickness: 30 microns (0,03 mm) A - Bioplast 400 ELIT (longer degradation) B - Bioplast 400 D (fast degradation); no filler
A B CUT 2 A	Thickness: 35 microns (0,035 mm) A - Bioplast 400 ELIT B - Bioplast 400 D; 20% filler $CaCO_3$ from sea shells
A B CUT 3 A	Thickness: 40 microns (0,04 mm) A - Bioplast 400 ELIT B - Bioplast 400 D; 5% BLACK color, bio-based, biodegradable pigment FDM 85911 BK BIO1 MASTERBATCH – PolyONE



CUT 1

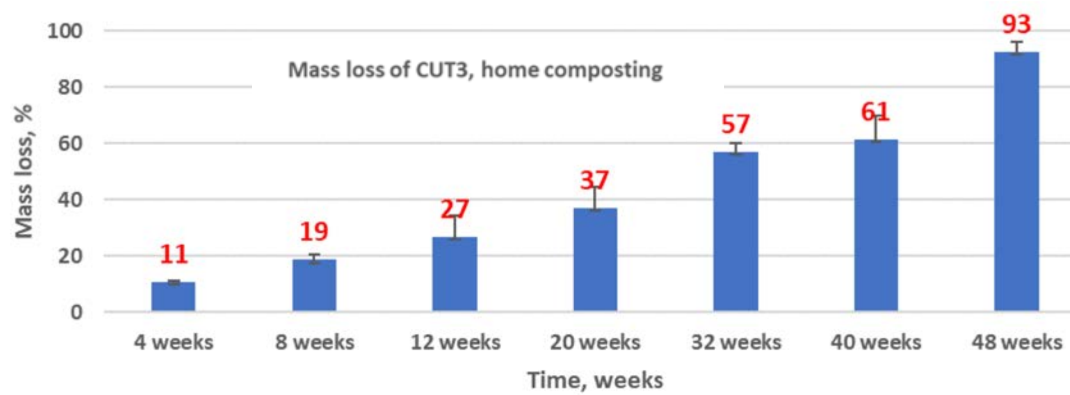


CUT 2

CUT 3

Biodegradation of CUT3 – industrial and home composting (58 vs. 30 °C)

Degradation very dependent on temperature



D5.10: Overview of biodegradable plastic mulches applied in horticulture and agriculture; prices, characteristics..

D 5.10 (summary paper)

Summary paper on alternative mulch materials
Malinska et al., 2022

D 5.11: Testing of 3-layer plastic foil with fillers and potato starch in Poland, UK and Turkey

- Much less weeding
- 15-30% higher yields
- Less irrigation
- Good mixing with soil (ploughing) required for complete degradation in field

D 5.11 (tech report)

Technical report on using alternative mulch materials
Malinska et al., 2022

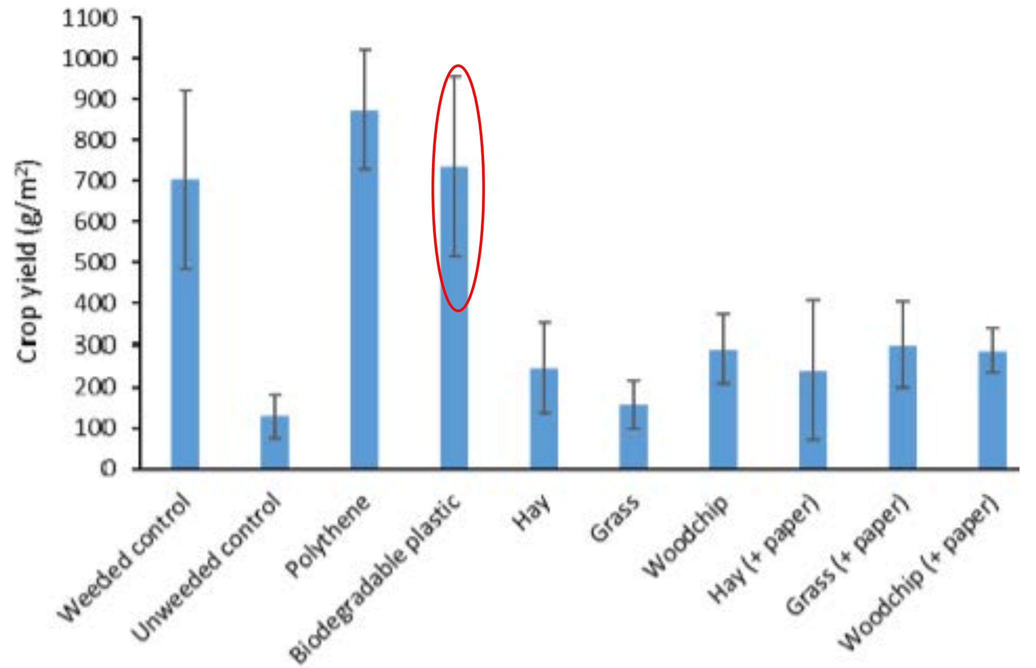


Figure 2. Yield of onions in the 2021 loose mulch trial. Values are the means of four plots +/- standard deviations.

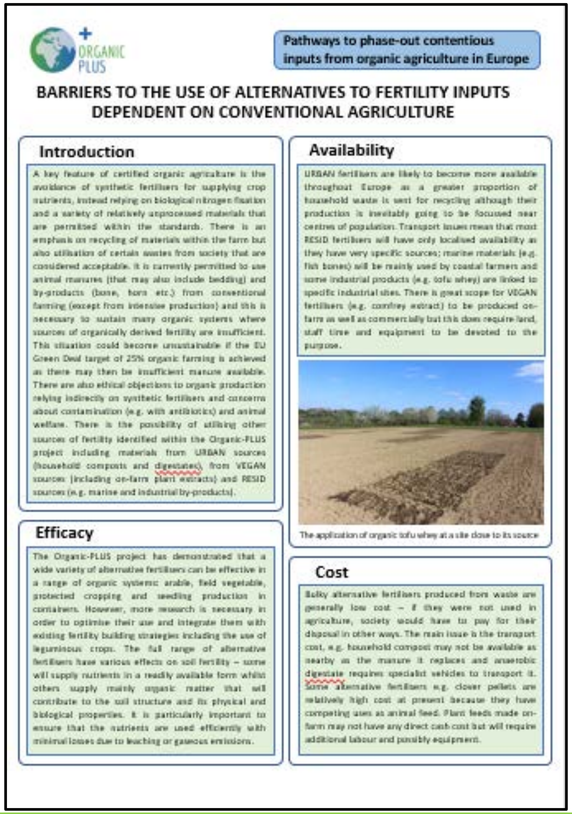
5.7 barriers to uptake of alternatives

..mapped via engagement with stakeholders

- **Efficacy**
- **Availability**
- **Cost** (economies of scale may reduce future prices; e.g. plastic mulch)
- **Knowledge** (training needed)
- **Practicality** (farmers “locked in” to current practices; e.g., transplant soil blocks demand peat for cohesion)
- **Regulatory restrictions** (acceptable limits for pollutants; e.g. digestate)
- **Consumer acceptance** (sustainable image of AO should not be compromised by use of contentious inputs)

O+ participants visiting Melcourt growing media, UK (above) and organic compost producer, Germany (below)

Findings summarised in factsheets (ferts, peat and plastic)



Barriers should be lifted by more research, development of regulations, and policy development

Pathways to phase-out contentious inputs from organic agriculture in Europe

Phase-out feasibility, RISE and LCA

(WP6 MODEL)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

WP6: MODEL

Model and assess the feasibility, environmental, and overall sustainability consequences for different pathways to phasing out contentious inputs in organic production systems

Multiple participants from other WPs contributing with information on specific cases

Claus Grøn Sørensen, Montse Nuñez, Frank Willem Oudshoorn

Participants: CU, UTH, INRA, UNIPD, UoH, AU, CUT, SEGES, IRTA, ETO, NORSOK, WSL, AberU, ABioDoc, RHS, SA, FORI

WP lead: Claus G. Sørensen (AU)
WP co-lead: Anton, Assumpció (IRTA)

Final review meeting 6th February, 2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

WP6 tasks

- Task 6.1: Design of phase-out scenarios (AU..)
- Task 6.2: Analysis and feasibility assessments (AU..)
- Task 6.3: Environmental assessment (IRTA..)
- Task 6.4: Sustainability assessment (ICOEL..
- Task 6.5: Validity of sustainability assessment (ICOEL..)
- Task 6.6: Stakeholder interaction and dissemination (CU..)

Task 6.2

Analysis and feasibility assessments

Participants: **AU (lead)**, CU, UTH, INRA, UNPD, L&F, IRTA, NORSØK

Feasibility study

- **Functional and operational capabilities** of specific processes and methods
- **Multi-actor** engagement
- **study farms** in Germany (GE), Denmark (DK) and Spain (ES)
- **7 production branches**: Pig, poultry, vegetables, cereals, potato, apple and wine
- **Farm interviews** about alternative methods without contentious inputs
- **Pros and cons** of alternative methods without contentious inputs

Contentious unputs in focus

- Peat
- Plastic folio
- Cu used in plant production
- S used in plant production
- Mineral oils used for pest control
- Anthelminthic and antibiotics
- Conventional straw and manure
- without contentious inputs

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Potato cultivation without Cu, Denmark

On the bases of the information gathered in and from the visit at Danish farm it may be seen that potato production in Denmark without copper is feasible. Blight can be a challenge and some year the blight result in reduced yields. With optimal strategy and good management reasonable outcome can be achieved. Extra labour and machine input are required but standard machinery and technique can be used.

Case study farm 1 (DK)

Potato

Q: Can **copper** be phased out?

A: **Yes**

How: Blight resistant varieties, management. Extra labour required and reduced yields some years with blight.

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Wine without Cu, Germany

In vegetable production phasing out copper 100 percent is difficult, but a significant reduction of 90 percent can achieved by a combination of management measures, chose of healthy varieties and use of potassium bicarbonate as alternative fungicide.

In grapes for wine significant reduction can be achieved. Fungus resistant varieties are available and advanced sprayer technique can improve efficiency and avoid losses to the environment.

Case study farm 2 (GE)

Wine

Q: Can **copper** be phased out?

A: **No**, not completely

How: Fungus resistant varieties have been introduced. Copper is only used for the old varieties, but introduction of an advanced sprayer has reduced the consumption.

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Apple production without sulphur, Denmark

Phasing out S is feasible but may result in increased occurrence of apple scab. However, there are alternative organic approved fungicides on the market. No significant increase in machine and energy input are seen. In general labour inputs on studied farms were high because much work was done by hand. Yield and sales prices were as for common organic apples although no spraying with S and Cu was used.

Case study farm 3 (DK)

Apple and Poultry

Q: Can **sulphur** and **copper** be phased out?

A: **Yes**

How: Cu and S is not used. Organic approved fungicides are applied for apple scab. Local manure from the laying hens is used.

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Plant production without conventional manure, Denmark

The feasibility for phasing out conventional manure in organic plant production strongly depends on the availability of alternative fertilizer. Digestates from e.g. biogas production, green waste compost and other organic bio fertilisers are withy used. The phasing out will require crop rotation with legumes and increased use og green manure. If alternative organic fertilizer are available yields can be maintained. Change in crop rotation and use of green manure may increase labour and machine input

Case study farm 4+5 (DK)

Cereals

Q: Can **conventional manure** be phased out?

A: **Yes**

How: Can be replaced by local chicken manure and digested slurry. Crop rotation with legumes and catch crops needed.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

Pig production without antibiotics and anthelminthic, Denmark

A complete phasing out antibiotic is not feasible in most countries due to animal welfare legislation. A sick animal must be treated. However, the studies have shown that pig production with very low input of antibiotics and anthelminthic are feasible, as the production figures can be in line with standard production figures. Key factors are late weaning of piglets, quality feed and management. No significant change in machine, energy and labour input were reported.

Case study farm 6 (DK)

Pig production

***Q*:** Can **antibiotic medicine** be phased out?

***A*:** **No**, not completely, since sick animals must be treated. Consumption can be **reduced** significantly with same production quantity and quality

***How*:** Outdoor hold, late weening, mixed feeding and attentive management.

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Vegetables without use of plasitic folio, Spain

Phasing out the fossil plastic folio for weed control is feasible when alternative products as non-fossil bioplastic and paper mulching are used. However, the alternative folies are more expensive. On the other hand the alternative folios are degradable and do not need to be recollected after use and thereby reduction in work is achieved.

Case study farm 7 (ES)

Vegetables

***Q*:** Can **plastic folio** be replaced?

***A*:** **Yes**

***How*:** Can be replaced by paper mulch and bioplastic. It is more expensive but saves labour.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

WP6 Environmental Assessment
Task 6.3

Participants: CU, UTH, INRAe, UNIPD, AU, **IRTA (lead),** NORSØK, ORC and in addition CUT, ICOEL, IFAPA, MAF, UNICT

Conducted the following Life Cycle Assessment methodology

It is the recommended tool by

It has a comprehensive perspective:

- ✓ **Whole production chain +consumption**
- ✓ **Multicriteria environmental impact**

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Case Study Scenarios

- Organic Tomato Production
- Organic Lemon Production
- Organic Aubergine Production
- Organic Olive Production
- Organic Sheep production
- Organic Pig production
- Organic Poultry Production

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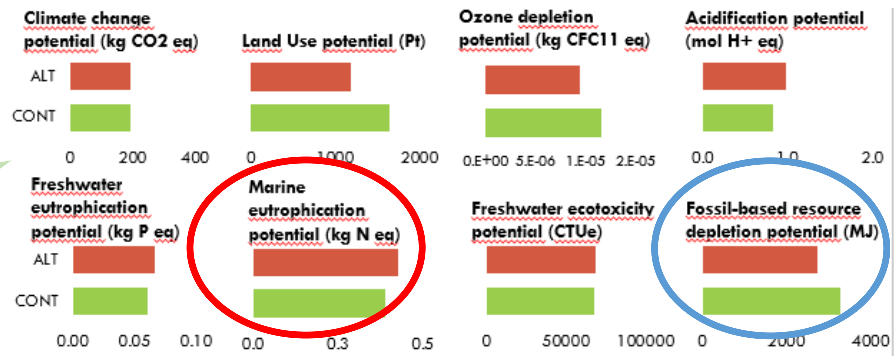
Results

+/- environmental impacts:

e.g. Bioplastic :

better for resource use, fossil

worse for eutrophication



Contentious inputs	Alternatives	Take care on
Copper	Low Cu Fertilizers	Less amount + ionised?
Mineral Oil	Essential oils	Plant origin
Peat growing media	Compost	Transport / emissions
Fossil plastic	Bioplastic	Origen of “Biomaterial”

Other environmental hotspost:

Some infrastructures

Greenhouse, photovoltaic panel, machinery

Fossil fuel-based energy consumption

Diesel for labour operations, Electricity consumption ,Transport.

Water consumption, in particular, for dry Mediterranean

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Results

LCA limitations!

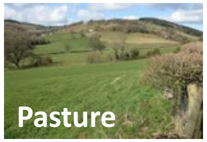
- Lack of background data for organic farming,
- Better adjustment of emission factors
- Lack of Characterization Factors for some products, mainly for Toxicity impact categories
- Impact methods not fully developed for organic production i.e Biodiversity impact category

FURTHER RESEARCH REQUIRED

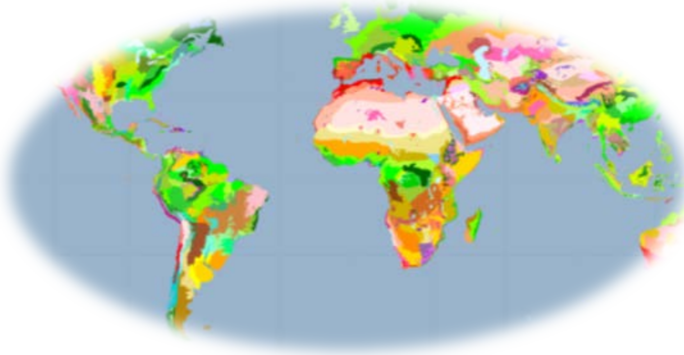
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 774340

LCA Biodiversity loss: Chaudhary& Brooks 2018

Estimates the Potential Species Loss (**PSL**) at regional (i.e. localized) and global (i.e. imported effects included) scale



804 terrestrial ecoregions



Low-intensity farms, typically with small fields, mixed crops, crop rotation, little or no inorganic fertiliser use, little or no pesticide use, little or no ploughing, little or no irrigation, little or no mechanisation.

Limitations:

Highly dependent total land use and yields

Quite general land uses

Minimal use = Organics?

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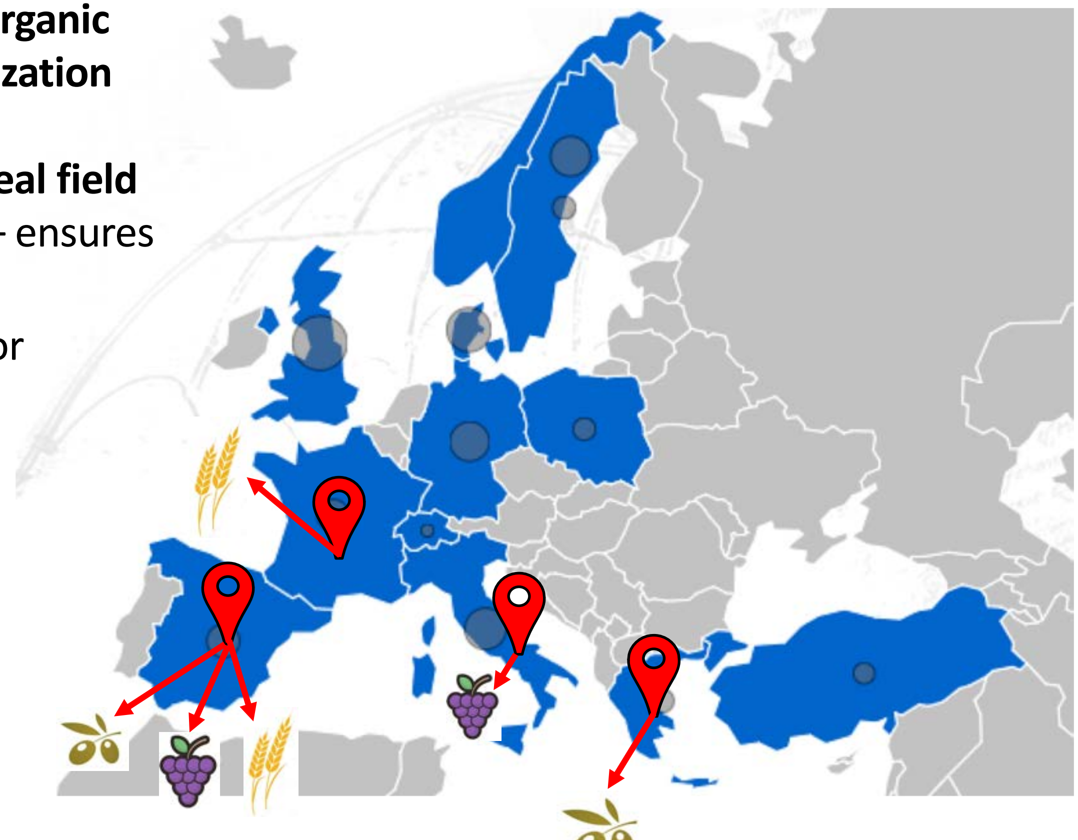
Biodiversity Damage Potential:

- Addresses **biodiversity impacts** in **Organic** Production where impact **characterization factors** (CFs) were derived.
- It is **bottom-up, data-driven**, from **real field measurements** of species richness – ensures **higher certainty**.
- **BUT None** of the models have CFs for the **Mediterranean** biome!



Knudsen et al Science of the Total Environment 580 (2017) 358–366

New CFs were derived for these **countries and crops:**

- **Grapes**
- **Olives**
- **Arable crops**

<u>Organic vs conventional</u>:

Can be differentiated in systems that require intense care, e.g. arable crops

Cannot be differentiated in permanent crops, rather it is highly dependent on intensity of management practices, despite if ORG or CONV

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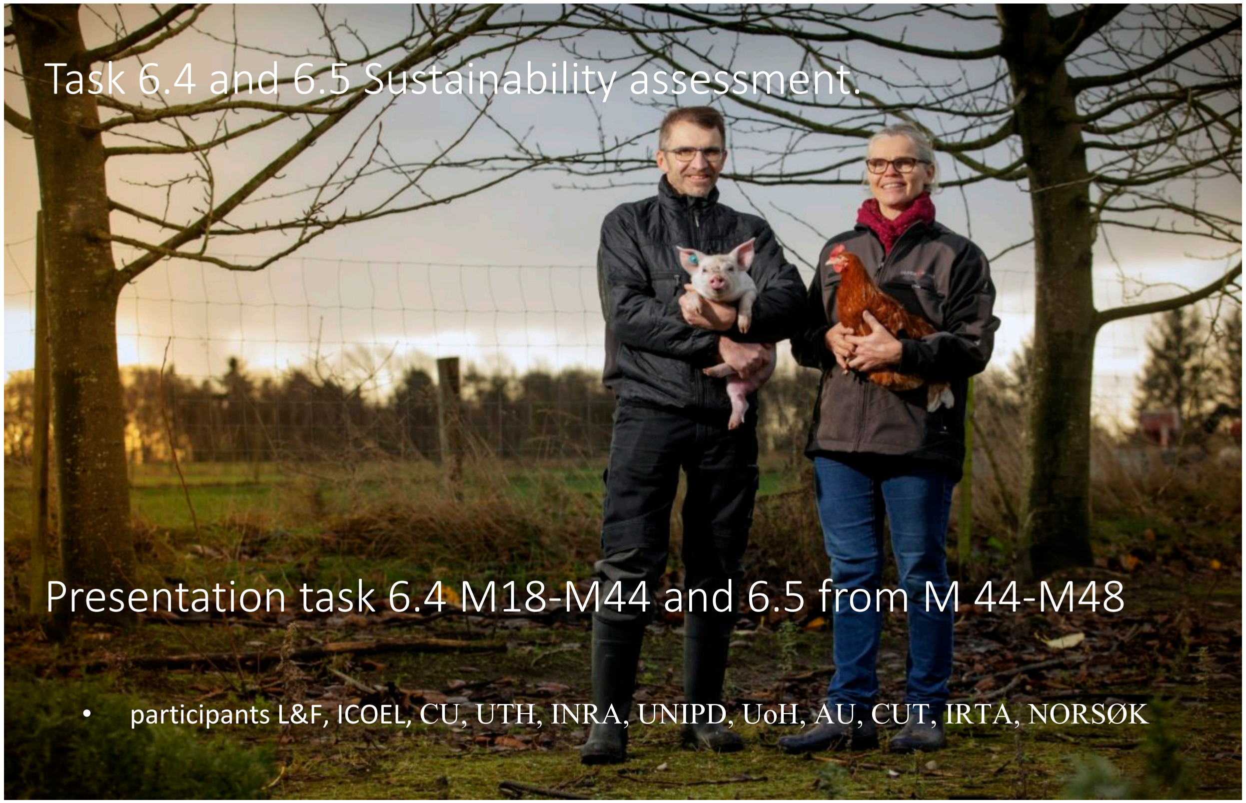

Task 6.4 and 6.5 Sustainability assessment.

Presentation task 6.4 M18-M44 and 6.5 from M 44-M48

- participants L&F, ICOEL, CU, UTH, INRA, UNIPD, UoH, AU, CUT, IRTA, NORSØK

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 774340

Objective

Assess farm sustainability for using alternatives to contentious inputs

Methodology

Farm sustainability is assessed using the RISE tool (Response Inducing Sustainability Evaluation).
Procedure: recruit evaluators, find case farms using alternatives, adapt reference values to country, visit and analyse farms, model, discuss with experts from WP's and stakeholders, conclude and report. (D6.4)

Validity

Sensitivity test for specific quantitative indicators (D6.5)

Farm type	Contentious input	WP
Olive production	Copper	3
Mediterranean vegetable	Copper, mineral oils	3
Vegetable	Conventional manure	5
Vegetable	Plastics	5
Vegetable	Farm peat	5
Dairy	Antibiotics	4
Fruit	Copper, sulphur	3
Arable	Conventional manure	5
Pig	Antibiotics, anthelmintics	4
Arable potatoes	Copper	3

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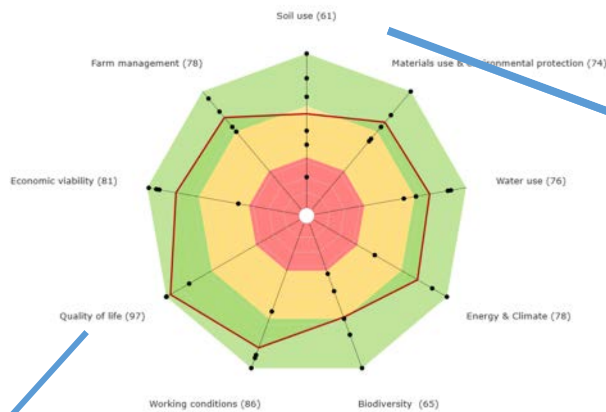
Example of Results for Farm

WP Plant
Copper in Potatoes



4 Crop production

Text	Unit	Barley	Oats (	Potato	Wheat	Rye (S	Clover	Barley	Græs	Eft.afg	Perma	Green
Crop productivity												
Crop area	ha	187.4	61.0	58.0	21.8	95.2	111.4	49.4	3.1	260.9	1.4	1.4
Score yield level per crop	points	47	44	51	29	36	26	50	32		67	
Yield per hectare	t/ha	3.8	3.6	25.0	3.0	4.1	4.5	3.5	4.5		2.5	
Regional standard yield (for crop)	t/ha	5.0	5.0	34.0	5.0	6.0	9.0	9.0	7.0	0.0	2.5	0.0
High yield	t/ha	6.5	6.5	50.0	6.5	8.0	11.0	7.0	10.0		3.5	0.0
Low yield	t/ha	3.0	3.0	15.0	3.5	4.0	6.0	10.5	4.8		1.5	0.0
Quality trends during the past 5 years		Stagnati	Stagnati	Stagnati	Stagnati	Stagnati	Stagnati	Stagnati	Stagnati	Not yet a	Stagnati	Not yet a
Production quality criteria		Market R	Market R	Market R	Market R	Market R	Market R	Fodder C	Fodder C	Fodder C	Market R	Market R
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Not yet a	Fulfilled	Not yet a
Soil organic matter												
Crop soil organic matter balance	points	75	55	64	100	89	33	100	100	79	100	64

8	Quality of life	97 points
8.1	Occupation & Training	100 points
8.2	Financial situation	100 points
8.3	Social relations	100 points
8.4	Personal freedom & values	83 points
8.5	Health	100 points

6	Biodiversity	65 points
6.1	Biodiversity management	35 points
6.2	Ecological infrastructures	100 points
6.3	Distribution of ecological infrastructures	66 points
6.4	Intensity of agricultural production	77 points
6.5	Diversity of agricultural production	47 points

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Conclusions

WP3 Plant

Sustainability has many aspects, and often the combination of values makes organic farming sustainable, maybe not always the separate issues.

Many complex alternatives are being used in practice: functional biodiversity, plant-based fungicides and insecticides, rotation, resistant strains, management, technology, marketing, or combinations of these.

WP4 Livestock

The Pig farmer in Denmark managed to greatly reduce antibiotic usage, mainly because of management. This inspite the productivity was high. Special attention, stalls for sick animals, free range, roughage to pigs. No alternative herbs of homeopathics were used. The co-workers were happy, and ready for extra effort.

The dairy farmer had many other challenges on the farm, and therefore the economy was problematic. The antibiotic usage was low, but also the productivity could be increased. Many predictive udder care was used, in addition to management issues e.g. grazing, straw supply

Management is the best preventive measure !

WP 5 Soil

The lack of nutrients is in general a challenge for the bulk production of food, as the availability of organic manure is still low (only few percent livestock are converted)

The combination of values makes organic farming sustainable, maybe not the separate issues.

The vegan systems were not challenged by lack of nutrients, as they received material from outside for compost, but registration of amount and source was poor.

Biodiversity score should be enhanced, maybe also by lower intensity of nitrogen, but who will pay.

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Validity, selected essential indicators

which were changed +/- 10%

- Theme: soil use
  - Indicator: crop productivity
  - Indicator: soil reaction
- Theme: animal husbandry
  - Indicator: livestock productivity
  - Indicator: animal health
- Theme: materials use and environmental protection
  - Indicator: material flows
- Theme: energy and climate
  - Indicator: energy intensity of agricultural production
  - Indicator: greenhouse gas balance
- Theme: biodiversity
  - Indicator: ecological infrastructures
  - Indicator: distribution of ecological infrastructures

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Conclusions (D6.5)

- The RISE tool has a **great level of detail** in the computation of the sustainability scores, -> a good **management tool**
- **Changing the farm data input** for some parameters used in the computation of the indicators by **10%,** affected the score of different indicators in distinct ways from **0->30%.**
- The differences make it **difficult to check** if the farm **improvements** have improved the sustainability of the farm, when relying on the scores.
- In some cases, it will be more appropriate to **communicate raw data or interim results**, when looking to improve on specific parameters

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