Global Workshop

Roadmap for circular bio-based fertilisers: bridging innovation and market adoption

26 November 2024, Irish College, Leuven

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

1

Welcome & round table

Tessa Avermaete, KU Leuven

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

2

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Agenda

09:00	Welcome & round table *Tessa Avermaete*	13:30	RUSTICA policy briefs & recommendations *Tessa Avermaete*
09:30	Setting the scene & brief explanation of the RUSTICA project *Dominik Jasinski - Daan Kuiper*	13:45	Reflections from lunch seminar with DG AGRI *Tessa Avermaete*
10:30	Coffee break & visit exhibition pilot	14:10	Stakeholder reflection debate on opportunities *Lucia Piani, University of Udine* *Peter Paul van 't Veen, TNO* *Mohamed Eida, FAO* *José Mateo, BioSabor* *Moderator: Tessa Avermaete*
11:00	European versus Global south context *Mirjam Pulleman*	14:45	Q&A & discussion
11:30	Pitch *Dominique Helaine, Suez* *Katja Hora, SQM Europe* *Justine Brouns & Isolde De Beule, VCM* *Dominique Dejonckheere, Copa-Cogeca* *(tbc) Omar Zidarich, GITC* *Moderator: Liesbet Vranken*	15:00	Coffee break
12:30	Lunch	15:30	Focus on what's next: Where is support needed? What kind of support? What are the opportunities? How to bundle forces? *Tessa Avermaete*
		17:00	Closing

16:30 - 19:00

RUSTICA Demonstration of circular biofertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

3



RUSTICA in a nutshell

- foster the technical validation, demonstration and implementation
- focusing on waste from the fruit and vegetable agro-food system
- to close nutrient cycles on a regional level
- development of economically viable and environmentally sustainable alternatives

RUSTICA Demonstration of circular biofertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

4

RUSTICA´s key data

- 16 partners
- 8 countries
- 6 technologies
- 5 multi-actor networks
- 5 regions/case studies
- 2 pilot demonstrations

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

5

RUSTICA Consortium

- 16 partners
- 8 countries:
  - Belgium
  - France
  - Spain
  - Italy
  - Germany
  - The Netherlands
  - Croatia
  - Colombia

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

6

Bundling academic and non-academic expertise across Europe

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

RUSTICA Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

7

Rationale RUSTICA

- Nutrient pollution
- Soil degradation
- Food waste
- 70 million tonnes of dry matter of field crop residues

  -> Invest in recovery of nutrients from food waste

  -> Replace mineral fertilizer with bio-based alternative

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

8

Objectives RUSTICA

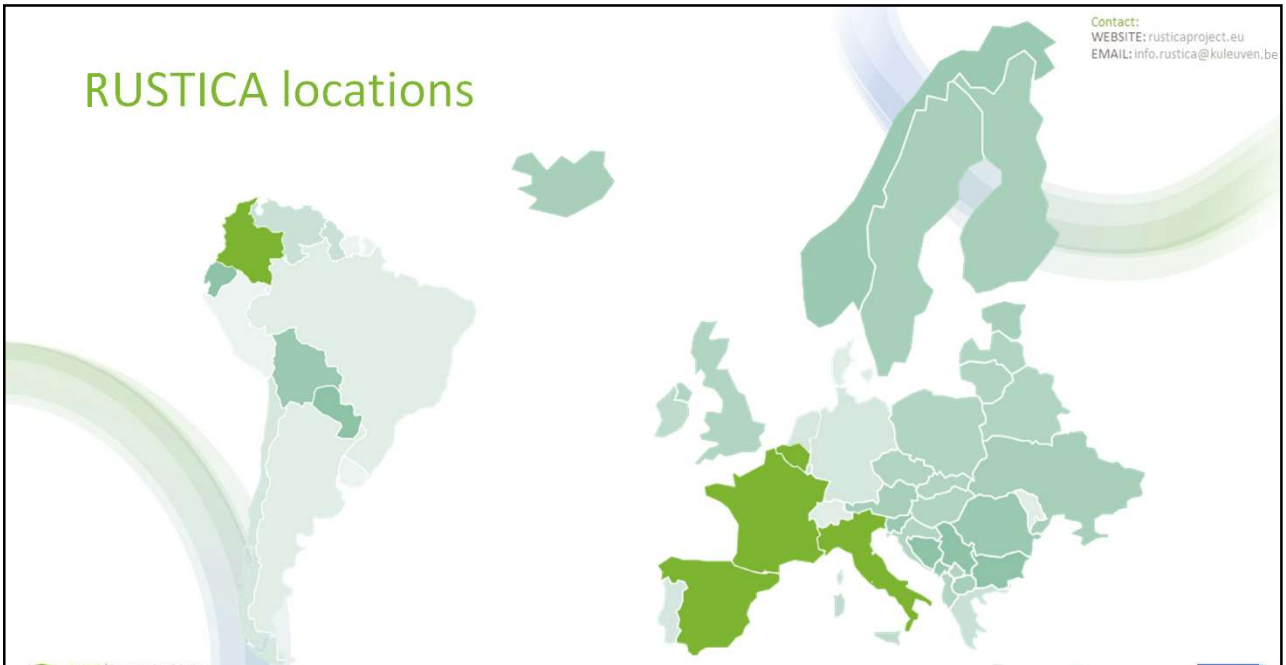
- Foster the validation, demonstration and implementation
- 6 technological options for mineral nutrient recovery
- Co-develop circular bio-based business models
- 4 regions across the EU + additional validation in Latin America

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

9

RUSTICA locations

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be



RUS TI CA Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

10

Work plan

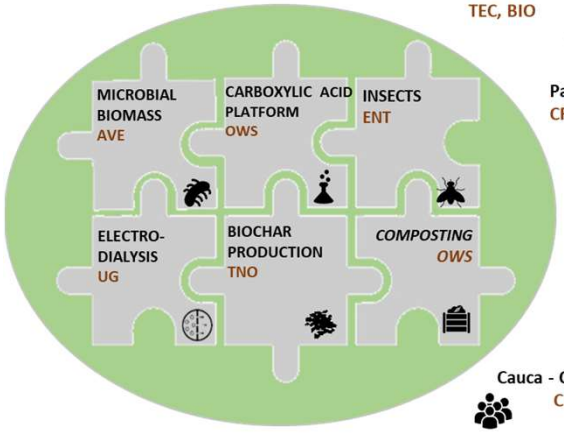
- Technology optimisation and integration
- Regional multi-actor approach and pilot demonstration
- Systemic feasibility assessment
- EU multi-actor approach & networking

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

11

Technological development

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be



Almeria - SP
TEC, BIO

Pays de la Loire - FR
CRAPDL

Flanders - BE
EVILVO

Friuli Venezia Giulia - IT
CREA

Cauca - CO
CIAT

RUSTICA Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

12

Market development

- Market analysis
- Techno-economic analysis
- Legal analysis
- Environmental and social LCA

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

13

EU level multi-actor approach

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

- Regional workshops
- EU and global workshops

RUSTICA Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

14

Setting the scene & brief explanation of the RUSTICA project

Dominik Jasinski, Particula & Daan Kuiper, CROPEYE

RUSTICA

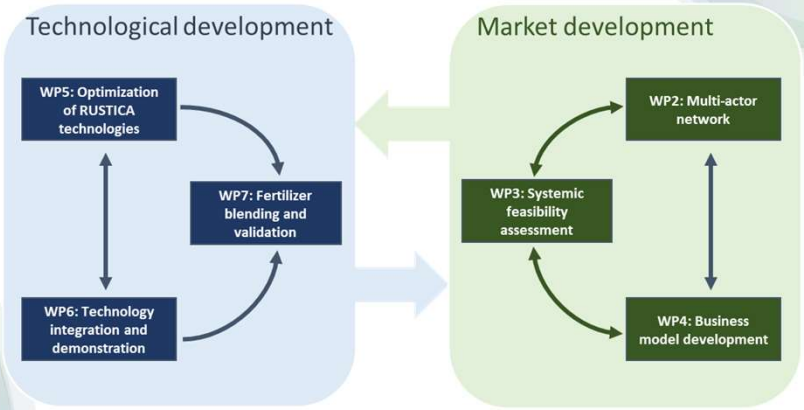
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

15

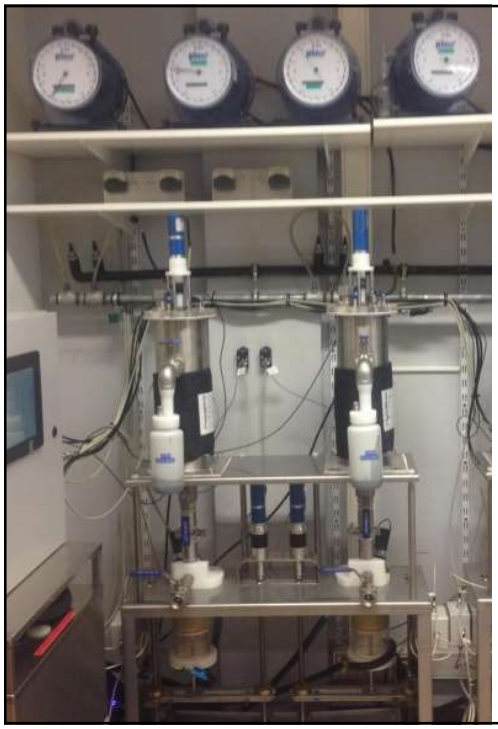
Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Overview of RUSTICA structure



THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

16



Technological development

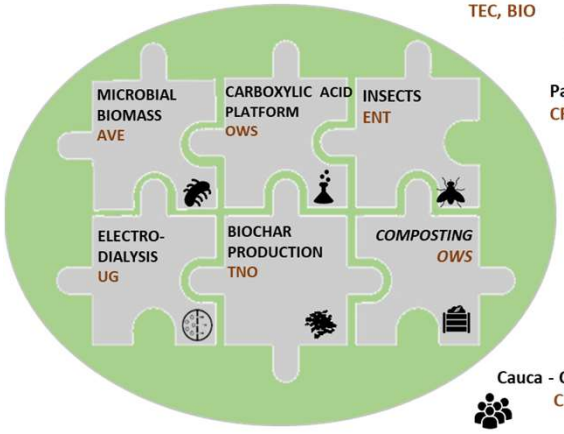
- Optimise and demonstrate technologies for nutrient recovery from F&V residues as bio-fertilizer
- Demonstrate the integration of technologies to reach a combined nutrient recovery of more than 90%
- Demonstrate the production of fertilizer blends adapted to local demand

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

17

Technological development

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be



Almeria - SP
TEC, BIO

Pays de la Loire - FR
CRAPDL

Flanders - BE
EVILVO

Friuli Venezia Giulia - IT
CREA

Cauca - CO
CIAT

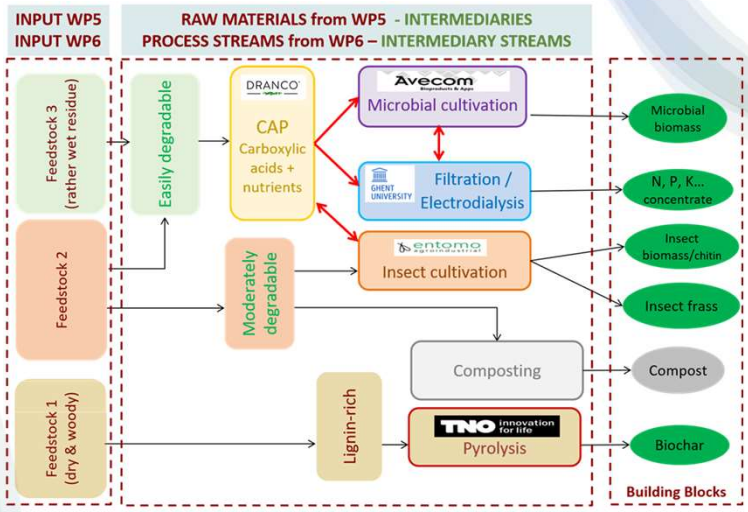
RUSTICA Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

18

RUSTICA technologies

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be



THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

19

Carboxylic Acid Platform (CAP)

TRL: 5

DRANCO

Substrate testing in the lab

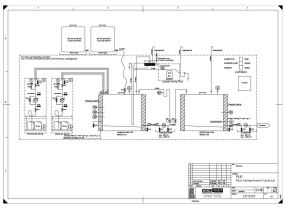
Technology: Anaerobic fermentation
Input: Easily degradable biomass
Fruit and vegetable cutting waste ALLGRO
End product: CAP-solution

Biomass → Shredder → CAP → Dewatering → CAP-solution

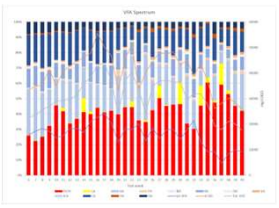
NPK and C-Rich Solution

Side Streams: Centrifuge Cake

Anaerobic digestion: Biogas
- Heat
- Electricity



CAP 3m³ pilot at ALLGRO



Pilot results

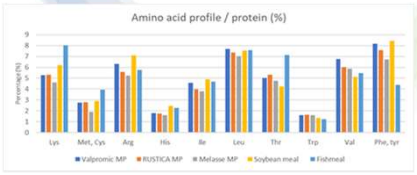
20

Microbial Protein Production (MP)

TRL: 5

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Technology: Aerobic fermentation
Input: CAP-solution
End product: Microbial Protein
Slow release N-source



CAP-solution → Aerobic Fermentation → MP biomass separation → MP biomass drying → MP powder

70% protein content

Side Streams: Process water

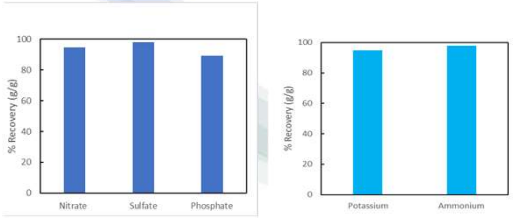
1/2 to 2/3 recycled
- Reduced COD content
- Easily treatable

Electrodialysis (ED)

TRL: 3-5

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

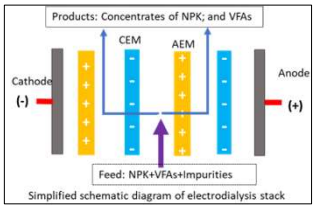
Technology: Electrodialysis
Input: CAP-solution
End product: NPK-solution



CAP-solution → Filtration → ED – bulk separation → ED – nutrient balancing → NPK-solution

Side Streams: VFA-solution

High value product



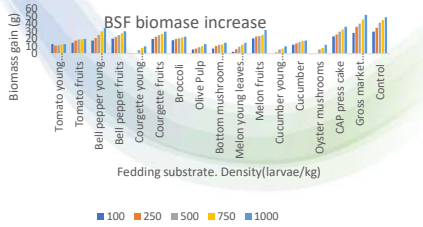
Simplified schematic diagram of electrodialysis stack

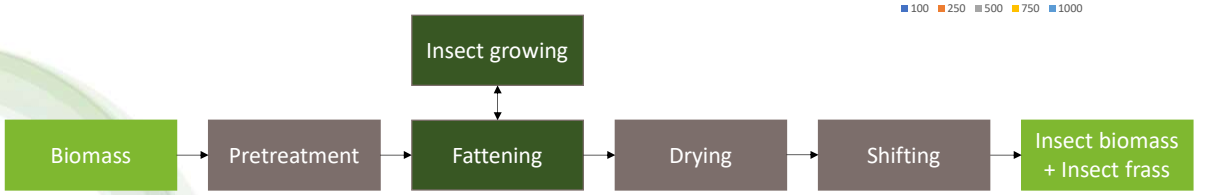
Insect cultivation (IC)

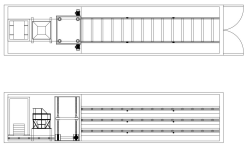
TRL: 5

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Technology:	Insect cultivation
Input:	Greenhouse side streams
End product:	Insect biomass (C- and N-source)
	Insect frass (soil structure improvement)







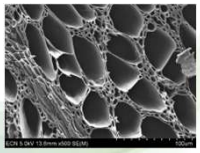
RUSTICA Demonstration of circular biofertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

23

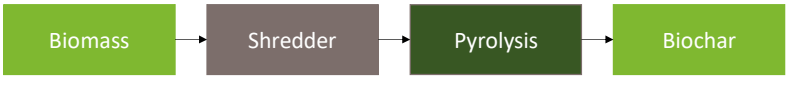
Biochar production (BP)

TRL: 5

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

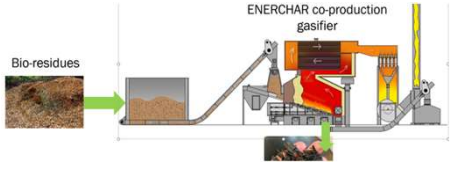


Technology:	Pyrolysis
Input:	Lignin rich substrates
End product:	Biochar
	- soil improvement
	- water retainment



Side Streams: Pyrolysis gas

- Heat
- Electricity



RUSTICA Demonstration of circular biofertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

24

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

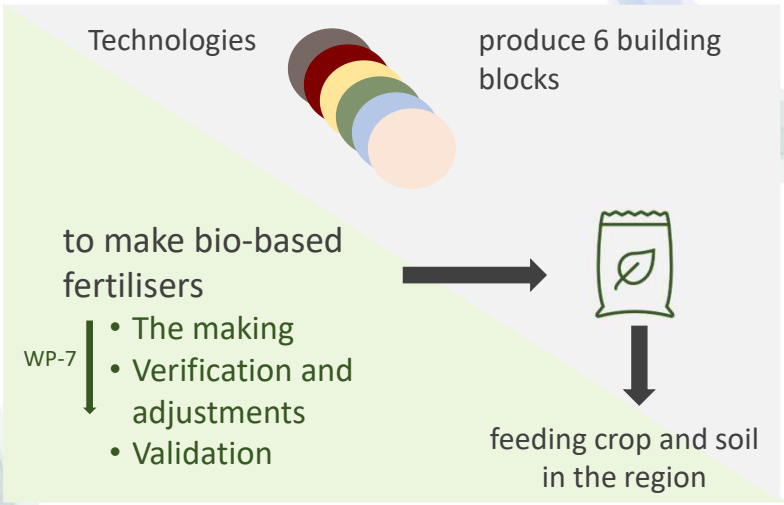
Conclusion

Multiple existing technologies could be used for the RUSTICA approach:

- Biomass properties
- Availability of the technology
- Regulatory instances of the region

25

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

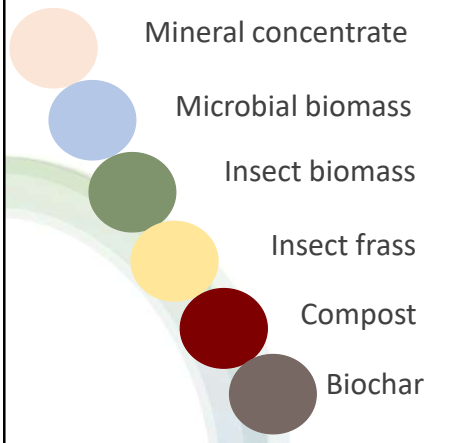


THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

26

Six building blocks for five main soil functionalities

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be



- Mineral concentrate
- Microbial biomass
- Insect biomass
- Insect frass
- Compost
- Biochar

Crop nutrition
Direct or via mineralisation

Soil life
Resilience, mineralisation, crop protection

Soil physics
Water retention, erosion, heavy metals

EcoSystem services
GHG-emission, Nitrate leakage, CO_2 capture, biodiversity

↓

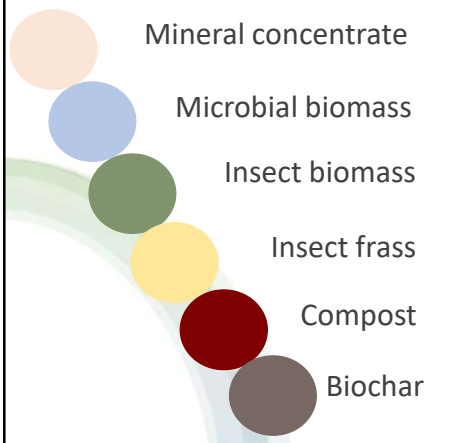
Nutrient management and organic matter management in the soil

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

27

Effects of RBBF depend on the composition and degree of bio-degradation

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be



- Mineral concentrate
- Microbial biomass
- Insect biomass
- Insect frass
- Compost
- Biochar

↑ Slow—biodegradation rate--Rapid

↑ Slow—micro life activity--Rapid

↑ Slow—mineralisation rate—Rapid = nutrient supply

↑ Slow—biologiocal activity—Rapid = soil resilience?

↓ positive-organic matter content-negeative

↓ positive-water retention-negeative

↓ positive-anti-erosion-negeative

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

28

RBBF in field trials

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

	Flanders	Pays de la Loire	Almeria	Friuli-Venezia Giulia
Crop	**Leek**	**Lettuce**	**Cucumber**	**Grapes**
Productivity	+	+	+	+
Product quality	+	+	+	+
Biological activity	+	+	+	+
Water retention	nd	nd	+	+
Anti erosion	nd	nd	nd	+
Crop	**Cauliflower**	**Grapes**	**Tomato**	
Productivity	+/-	?	+	
Product quality	+/-	+	+	
Biological activity	+	?	+	
Water retention	nd	nd	+	

+: similar or better than conventional

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

29

Conclusions

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

- RBBF composed of vegetable waste based building blocks can replace mineral fertilisers,
  - Promoting soil-born mineralisation (biological process)
  - Increasing biological activity leading to improved soil resilience
  - Promoting water retention and anti erosion
- Its composition determines the balance between mentioned effects
- Characteristics of acceptor-soil determine readiness to process RBBF
- High demanding crops like cauliflower could need some mineral support (also depending on the capabilities of the soil)

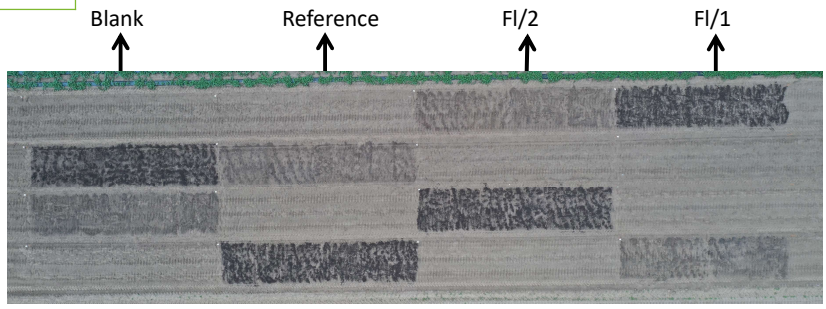
30

Field trials in Flanders (BE)

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Ton/ha	Fl/1	Fl/2
Compost	10	2
Biochar	1	2
Microbial biomass	1	1
Insect frass	1	1.5

Comparison with:
- Blank (no N fertiliser)
- Mineral fertiliser



31

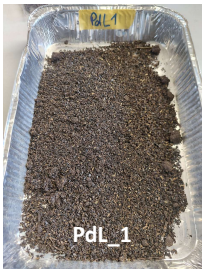
Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Field trials in Friuli-Venezia Giulia (IT)

BB type	Blend code		
	FVG_5	FVG_6	PdL_1
Compost	66.7	83.3	62.5
Biochar	16.7		18.75
Microbial biomass			6.25
Insect biomass	16.7	16.7	
Insect frass			
Total	100	100	100

Organo mineral fertiliser (OMF)

Manure



32

Market development

- Market analysis
- Business model development
- Techno-economic analysis
- Legal analysis
- Environmental and social LCA

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

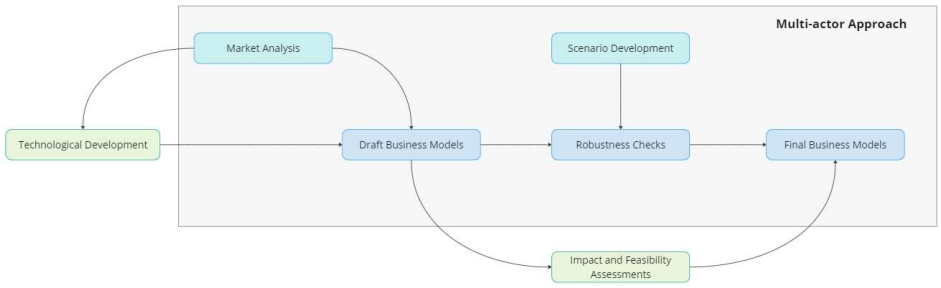
33

Methodological overview

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Multi-stakeholder input for market analyses and description of current and potential regional value chains and business models

Impact and feasibility assessments: Life Cycle Assessment (LCA), Life Cycle Costing (LCC), Techno-Economic Assessment (TEA), Agent-Based Modeling (ABM)



RUSTICA Demonstration of circular biofertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

34

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Regional Business Models

- Intermunicipal Collaboration
- Microbial Fertiliser Development

Flanders

- Multi-technology waste processing →

Almeria

- Multi-supplier building block production
- Compost and biochar integration
- NPK concentrate production

Pays de la Loire

- Intermunicipal alliance
- Coffee synergy

Friuli-Venezia Giulia

- Food market unit →

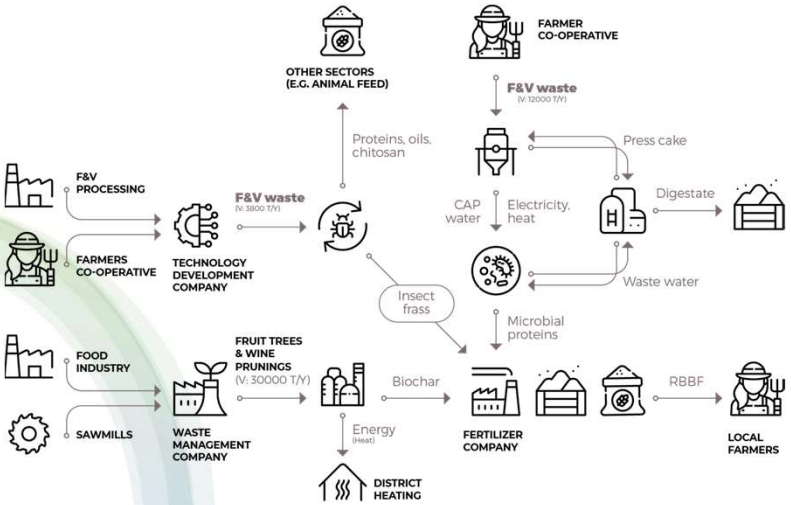
Valle del Cauca

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

35

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production



BUILDING BLOCKS	BLENDS Pdl/1 %
Compost	63
Biochar	19
Microbial biomass	6
Insect frass	13

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

36

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production

	Crop type: lettuce		
	PdL/1	Organo-mineral fertiliser	Mineral fertiliser
Fertiliser dose (kg/ha)	**6500**	**750**	**570**
Dry matter (kg/ha)	3906.5	750	570
N (kg N/ha)	79.3	82.5	79.8
P (kg P/ha)	27.0	37.5	28.5
K (kg K/ha)	47.3	105.0	114.0
TOC (kg C/ha)	1832.1	118.5	0.0
Irrigation water (l/ha)	-	-	-
Field experiment period (months)	-	-	-

	Crop type: vineyard	
	PdL/1	Organic fertiliser
Fertiliser dose (kg/ha)	**3300**	**570**
Dry matter (kg/ha)	1983.3	484.5
N (kg/ha)	40.3	39.9
P (kg/ha)	13.7	14.4
K (kg/ha)	24.0	18.9
TOC (kg/ha)	930.2	177.6
Irrigation water (l/ha)	-	-
Field experiment period (months)	-	-

BUILDING BLOCKS	BLENDS Pdl/1 %
Compost	63
Biochar	19
Microbial biomass	6
Insect frass	13

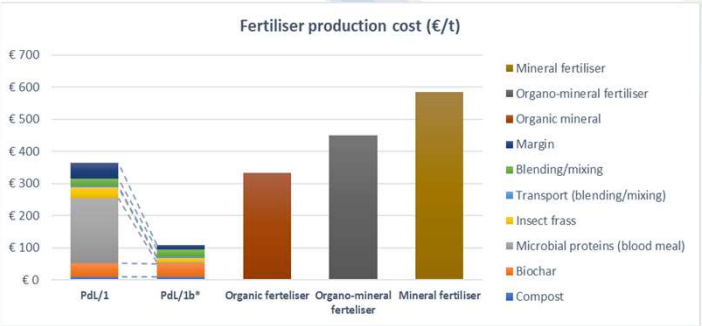
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

37

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production

Blend code	Target crop	Blend composition	Cost (€) per tonne of building block
PdL/1	Lettuce and vineyard	62.8% compost 18.6% biochar 5.8% microbial biomass 12.8% insect frass	**€16** **€226** **€3 499** **€266**



**use of blood meal (€50/t) instead of microbial biomass and frass cost reduced to €100/t*

Cost of microbial proteins could be also **reduced if scaled-up** (€1,120/t in Flanders), but only if used **in combination with other technologies** (e.g. AD or pyrolysis as a source of energy for electricity and heat)
Cost of frass very high due to **low volumes** (input waste 3,800 T/Y), it could be reduced at larger scale to **€100/t** (Flanders, Almeria and FVG)
Expensive building blocks could be **replaced** by **alternatives available in the regions**, e.g. **blood meal (€50/t)** is currently **considered** in **the Netherlands** to **replace microbial biomass**, which would help to reduce the cost of **PdI/1** from **€364/t** to **€108/t** (with frass at €100/t)

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

38

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production

	Unit	Lettuce (PdL/1)	Lettuce (organo-mineral)	Lettuce (mineral)	Vineyard (PdL/1)	Vineyard (organic)
Cost of fertiliser*	€/$t_{Product}$	€ 364 (€108)	€ 450	€ 585	€ 364 (€108)	€ 332
Fertiliser dose	t/ha	6.5	0.75	0.57	3.3	0.57
Fertilisation cost	€/ha	€ 2,429	€ 345	€ 339	€ 1,234	€ 195
Crop production yield (T/ha)	t/ha	43	43	43	2.25	2.25
Fertilisation cost per 1 ton of crop per ha*	€/t/ha	€56.5 (€17.8)	€8.0	€7.9	€548.6 (€173)	€86.6

- ***Fertilisation cost with Pdl/1b in bracket***

Cost-wise **RBBF not competitive** with commercial **mineral fertiliser, OMF and OF (poultry manure)** considering **current market conditions**. **Carbon Removal Credits** through biochar (and other BBs) **not considered** in the economic analysis (approx. €140/tCO2 according to CORC index Puro Earth), which would reduce the cost of Pdl/1 fertilisation by another €5 (for lettuce) to €50 (vineyard) per ton of crop/ha
Despite recent short-term market imperfections and price variations, the **long-term trend** for **mineral fertiliser prices** is **upward,** while **RBBFs** should **go down** in the long run

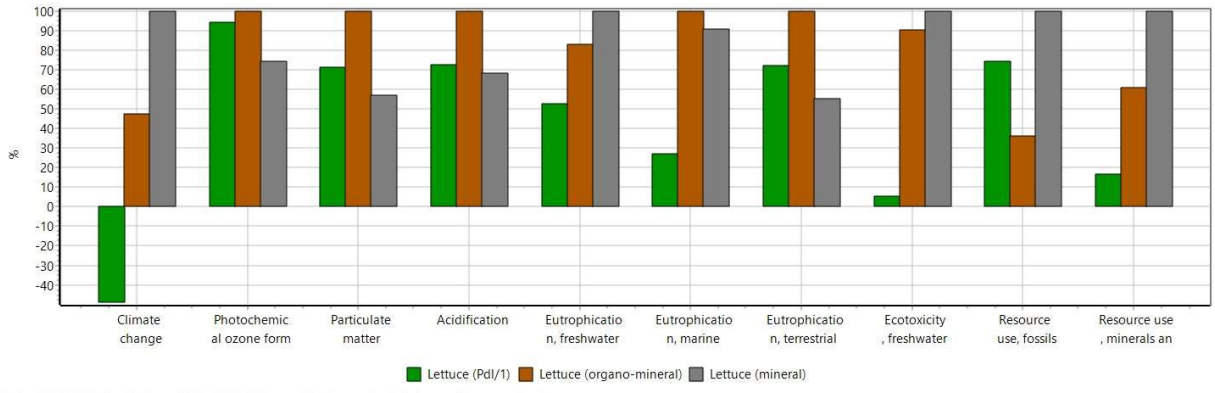
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

39

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production

LCA results – RBBF vs reference (FU=1 ton of crop/ha)



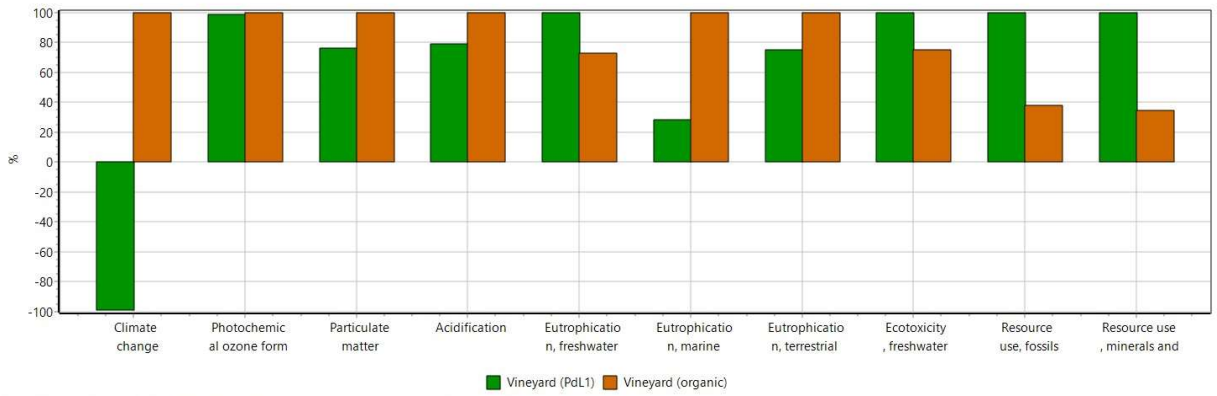
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

40

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production

LCA results – RBBF vs reference (FU=1 ton of crop/ha)



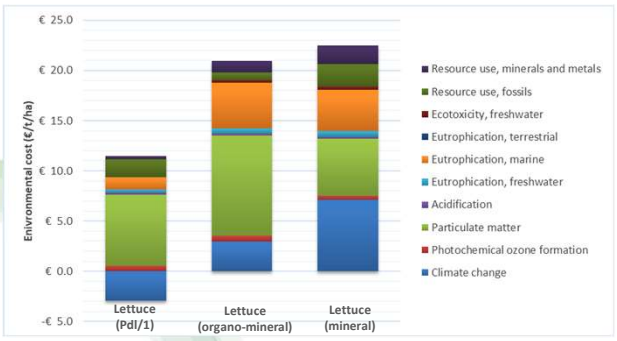
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

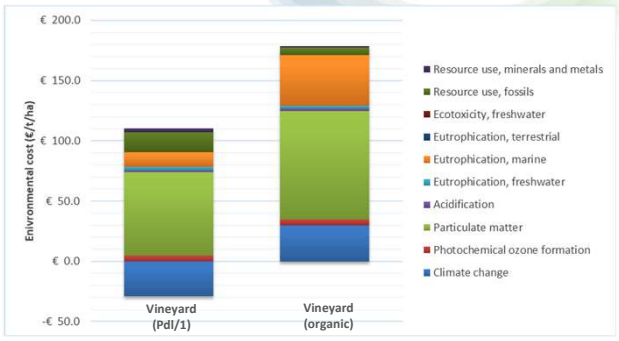
41

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Example BM: Multi-supplier building block production

Weighted LCA results – Environmental cost (1 ton of crop/ha)





Environmental improvements can further **compensate**, at least to some extend, the **current higher production cost for RBBFs** than the **reference fertilisers, €12-€14** (lettuce) to **€80** (vineyard) **in favour of RBBFs** per ton of crop per ha

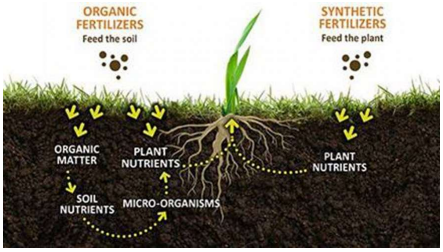
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

42

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Other potential agronomic advantages of RBBFs

- **Increased soil organic matter content** - recorded in the field trials of Flanders, FVG and Almeria
- **Improved soil health and quality** – anti erosion effect recorded in FVG
- **Improved water holding capacity** – recorded in Almeria
- **Increased soil biodiversity** – increase of biological activity in all regions
- **Improved crop resilience** - recorded in Almeria, and for the grapevine test in France
- **Improved crop quality** – recorded in FVG and Almeria and partly in Flanders (leek)



The **time constraints** (maximum 2 years of trials) allowed to **provide** only **partial evidence** supporting all these **claims**!!! Also, there is a **necessity of coupling LCA** and **agronomic models** to gain a more **precise picture** of **BBFs performance**.

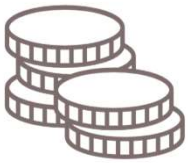
THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

43

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

General conclusions

- The cost of RBBFs depends on many factors, but in general, some building blocks of RBBFs are more expensive than the other (e.g. microbial proteins and insect biomass)
- As a substitute for mineral fertilisers (OMFs and OFs), RBBFs are currently more expensive (per ton of crop per hectare) but there is still plenty of room for further optimisation and improvement
- Possible strategies to lower costs
  - Combining drying processes (e.g. microbial biomass) with energy production processes such as anaerobic digestion or pyrolysis
  - Upscaling of technologies (e.g. insect production in PdL)
  - Looking for cheap source of biomass (especially for biochar production)
  - Factoring in carbon credits
  - Maximising value from selling by-products (where applicable)
  - Looking for alternative building blocks available in the region (e.g. manure or blood meal)



THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

44

Contact:
WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

General conclusions

- An extensive value proposition of RBBFs (far beyond of mineral fertilisers) should reduce the effect of price in the buying decision by farmers:
  - Improved soil organic matter content
  - Improved soil health and quality
  - Improved water holding capacity
  - Improved biodiversity
  - Improved crop resilience and quality
- Also, higher production costs can be compensated, to some extent, by environmental cost (value), which is better for RBBFs than the reference fertilisers
- The are also social benefits of introducing RBBFs (e.g. improved employment, regional closed-loop nutrient cycles and waste valorisation, technology development, by-products like renewable energy)
- Tailored business development approaches are needed per region
  - Based on regional waste streams, crop and soil needs
  - Based on regional technological expertise and partnerships

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

45

Coffee break & Visit exhibition pilot

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

46

European versus Global South context

Mirjam Pulleman, CIAT

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

47

Pitch

Dominique Helaine, Suez (FR)
Katja Hora, SQM Europe (BE)
Justine Brouns & Isolde De Beule, VCM (BE)
Omar Zidarich, GITC (IT)

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

48

RUSTICA policy briefs & recommendations

Tessa Avermaete, KU Leuven

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

49

POLICY BRIEF 1

Policy and legislation on circular bio-based fertilisers

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

Key challenges

- Transition from current regulations to the new Fertilising Products Regulation.
- Uncertainties hinder the development of new bio-based fertiliser products.
- Need for a level playing field in the development of bio-based fertilisers.

CURRENT CONTEXT

Farm to Fork strategy	EU funding	New FPR regulation
✓Europe promotes bio-based fertilisers as crucial for enhancing soil quality, resilience, and advancing circular food systems	✓Europe supports projects advancing bio-based fertilisers through diverse technologies, including those derived from animal and plant waste sources.	✓EU Regulation 2019/1009 establishes harmonized standards for fertiliser feedstocks and Component Material Categories for fertilisers and plant bio-stimulants.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

50

POLICY BRIEF 1

Policy and legislation on circular bio-based fertilisers

PROBLEMS ENCOUNTERED

LEGISLATIVE LEG - Regulations are not keeping pace with technological innovations in bio-based fertilisers.

OUTDATED FOCUS - EU Regulation 2003/2003 prioritized inorganic fertilisers, leaving bio-based producers reliant on fragmented national legislation.

UNFULFILLED OBJECTIVES - The new EU FPR 2019/1009, meant to harmonize rules and incentivize production, still leaves key principles unaddressed.

REGULATORY BOTTLENECKS - Strict regulations create barriers to market introduction of bio-based fertilisers from organic feedstocks and innovative technologies.

LEGAL RESTRICTIONS ON CIRCULAR MODELS - Waste, animal by-products, and microorganisms face legal restrictions that need clearer alignment with current technologies.

GLOBAL MARKET CONSISTENCY - The EU must ensure a level playing field for bio-based fertilisers within its member states and in global markets.

LACK OF DIALOGUE - Insufficient communication between policymakers and stakeholders is hindering market-aligned policies and sustainable practices.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

51

POLICY BRIEF 1

Policy and legislation on circular bio-based fertilisers

RECOMMENDATIONS TO POLICY MAKERS

Align legislation with Green Deal and Farm2Fork strategy to support innovation in bio-based fertilisers, promoting **sustainability and circular economy**.

Establish clear **guidelines on accepted feedstocks and valorisation pathways** for bio-based fertiliser production to reduce uncertainty.

Foster open **communication between stakeholders and policymakers** to share insights and develop policies that align with market needs.

Provide **support for project consortia** to navigate complex regulations, minimizing wasted time and resources due to legal uncertainties.

Encourage **collaboration between project consortia, backed by the EU Commission**, to overcome legislative barriers and streamline bio-based fertiliser development.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

52

POLICY BRIEF 2

Reality check on the feasibility of circularity in the food system

Key challenges

- Bio-based fertilisers have high production and transportation costs.
- Bio-based fertilisers may contain impurities and contaminants.
- Sustainable solutions in the bioeconomy are region-specific.

CURRENT CONTEXT

Farm to Fork strategy	Ambitious targets	Demonstrated potential
✓Europe emphasises the role of circular bio-based fertilisers in achieving sustainable food systems by reducing nutrient losses and promoting bioeconomy potential.	✓Europe aims to reduce mineral fertiliser use by 2030, highlighting the need for effective alternatives like bio-based fertilisers.	✓EU projects, including RUSTICA, show that circular bio-based fertilisers can effectively replace mineral fertilisers, supporting the EU's environmental and agricultural goals.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

53

POLICY BRIEF 2

Reality check on the feasibility of circularity in the food system

PROBLEMS ENCOUNTERED

HIGH PRODUCTION COSTS - Bio-based fertilisers have higher production costs than mineral fertilisers, requiring economic support to compete in the market.

TRANSPORTATION CHALLENGES - Transporting large volumes of feedstocks for bio-based fertilisers increases costs and limits profitable business opportunities.

IMPURITIES AND CONTAMINANTS - Bio-based fertilisers may contain impurities; clear guidelines and safety standards are needed to manage potential risks.

CULTURAL RESISTENCE - Concerns about using residues in food production require transparent communication to overcome cultural aversions.

REGIONAL VARIABILITY - Circularity depends on regional feedstock availability, technical resources, and local policy support, affecting scalability across different areas.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

54

POLICY BRIEF 2

Reality check on the feasibility of circularity in the food system

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

RECOMMENDATIONS TO POLICY MAKERS

- Align investment, regulation, and support mechanisms with the Farm to Fork Strategy and Green Deal to foster **circular food systems**.
- Overcome **economic and legislative barriers** that hinder circular innovation and provide **incentives** to make bio-based fertilisers competitive in the market.
- Develop consistent, **EU-wide guidelines and standards** for bio-based fertilisers to ensure safety, support market integration, and simplify compliance.
- Increase **stakeholder understanding and acceptance** of circular bio-based fertilisers through effective communication and awareness initiatives.
- Recognise and account for **regional differences** by supporting locally adapted policies and hybrid solutions, acknowledging that circularity's feasibility varies by location.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

55

POLICY BRIEF 3

Bio-based fertilisers as a piece of the puzzle in the transition towards more sustainable food systems

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

Key challenges

- Sustainable farming requires the integration of diverse agricultural practices.
- Profitable business models are essential to support sustainable farming systems.
- Research on BBFs should be conducted through inter- and transdisciplinary collaboration.

CURRENT CONTEXT

Farm to Fork strategy	Reducing synthetic fertilisers	Untapped potential
✓Europe aims for a comprehensive shift toward sustainability across the entire food chain to minimise environmental impact.	✓Europe's key goal is to reduce synthetic fertiliser use by advancing bio-based alternatives and valorising residual streams.	✓EC highlights bio-based fertilisers as a largely untapped resource for enhancing sustainability in European agriculture.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

56

POLICY BRIEF 3

Bio-based fertilisers as a piece of the puzzle in the transition towards more sustainable food systems

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

PROBLEMS ENCOUNTERED

DIVERSE SUSTAINABLE APPROACHES - Sustainable farming includes various practices like organic, regenerative, and agroecological farming, which must coexist and adapt to different constraints.

COMBINED FERTILISER USE - Combining mineral and bio-based fertilisers often enhances soil biodiversity and resilience.

NEED FOR BUSINESS MODELS - Viable business models are essential to support sustainable investments, considering both environmental and socio-economic diversity across regions.

INTERDISCIPLINARY RESEARCH - Interdisciplinary collaboration is crucial for addressing the broad impacts of sustainability, from agronomic to socio-economic factors.

STAKEHOLDER COOPERATION - Early cross-sector cooperation is key to developing marketable bio-based fertilisers to maximise product viability and impact.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

57

POLICY BRIEF 3

Bio-based fertilisers as a piece of the puzzle in the transition towards more sustainable food systems

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

RECOMMENDATIONS TO POLICY MAKERS

Encourage international recognition and **coexistence of diverse sustainable farming practices**, allowing bio-based and conventional methods to complement each other.

Promote **bio-based fertilisers as a sustainable option** across all farming systems, recognising their contribution to overall agricultural resilience.

Develop **market-aligned policies** that consider the economic realities of the global food system and regional differences in agricultural practices.

Foster **stakeholder dialogue** to ensure that policy goals are realistic, regionally adaptable, and support both sustainability and economic viability.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

58

POLICY BRIEF 4

Circular bio-based fertilisers in a global context

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

Key challenges

- EU sustainable food strategies impact global agriculture through policy, regulation, and cooperation.
- Locally adapted bio-based fertiliser technologies are essential for food security in the Global South.
- International cooperation should prioritise contextual research, innovation, and supportive policies.
- Global regulatory differences complicate International BBF trade, hindering efforts to balance nutrient demand and supply.

CURRENT CONTEXT

EU strategies	Global cooperation	Trade and standards
✓EU green Deal and F2F strategies aim to make the EU's food systems sustainable, focusing on reducing synthetic fertiliser use and encouraging bio-based alternatives.	✓The EU promotes sustainable food production globally through international partnerships and funding R&I to drive climate mitigation and sustainable practices.	✓EU trade agreements help extend environmental standards abroad. ✓The 2022 EU FPR sets standards and strict guidelines for BBF in the EU market.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

59

POLICY BRIEF 4

Circular bio-based fertilisers in a global context

RUSTICA
Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

PROBLEMS ENCOUNTERED

REGIONAL VARIABILITY - Production and use of circular bio-based fertilisers vary significantly across regions due to differences in fertiliser needs and availability of residue feedstock.

COOPERATION POTENTIAL - Geographic mismatches between nutrient-rich residue hotspots and nutrient-poor regions create opportunities for international cooperation to balance resources.

TRADE CHALLENGES - Discrepancies in global fertiliser regulations complicate international trade of bio-based fertilisers.

NUTRIENT RECOVERY GAPS - Insufficient nutrient recovery from residues and waste limits human nutrition, farmer incomes, and the availability of affordable agricultural inputs.

LOCAL ADAPTATION BARRIERS - Limited development of locally adapted technologies, business models, and supportive policies hinders effective BBF use and local value chain development.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

60

POLICY BRIEF 4

Circular bio-based fertilisers in a global context

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

RECOMMENDATIONS TO POLICY MAKERS

- Adapt bio-based fertiliser **technologies and value chains to local contexts**, ensuring solutions fit regional resources, capacities, and market needs.
- Develop cost-effective solutions for **specific residue streams and target crops**, addressing challenges such as limited residue availability and infrastructure gaps.
- Establish a regulatory framework that ensures a **level playing field** to facilitate international cooperation and trade in bio-based fertiliser components and blends.
- Balance support for **international trade and local supply chains**, facilitating cooperation through material and knowledge transfer and streamlined regulation.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101000527

61

Reflections from lunch seminar with DG AGRI

Tessa Avermaete, KU Leuven

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

62

Stakeholder reflection debate on opportunities

Lucia Piani, University of Udine (IT)
Peter Paul van 't Veen, TNO (NL)
Mohamed Eida, FOA (IT)
José Mateo, BioSabor (ES)

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

63

Q&A - discussion

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

64

What's next? Where is support needed? What kind of support? Opportunities? How to bundle forces?

Tessa Avermaete, KU Leuven

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

65

Closing

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

© 2024 RUSTICA all rights reserved
Grant Agreement No. 101000527

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH ANDINNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

66

RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

Contact:

WEBSITE: rusticaproject.eu
EMAIL: info.rustica@kuleuven.be

Rustica Project Consortium

(KU LEUVEN) University of Leuven
(DRA) Dranco
(CRAPDL) Chambre Régionale d'Agricultures des Pays de la Loire
(BIO) BioSabor, S.A.T.
(CREA) Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria
(TEC) Fundacion para las Tecnologias Auxiliares de la Agricultura
(AVE) Avecom NV
(ENT) Entomo Consulting S.L.
(PAR) Particula Group d.o.o.
(WIED) Wiedemann GmbH
(IDC) IDConsortium SL
(CROP) Stichting CropEye
(EVILVO) Eigen Vermogen van het Instituut voor Landbouw, Visserij en Voedingsonderzoek
(TNO) The Netherland's Organisation of Applied Scientific Research
(UGENT) Universiteit Gent
(CIAT) Centro Internacional de Agricultura Tropical

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

67