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Fer_Play final event

Jorge Senán-Salinas, PhD
University of Vic-BETA technological center (UVIC)

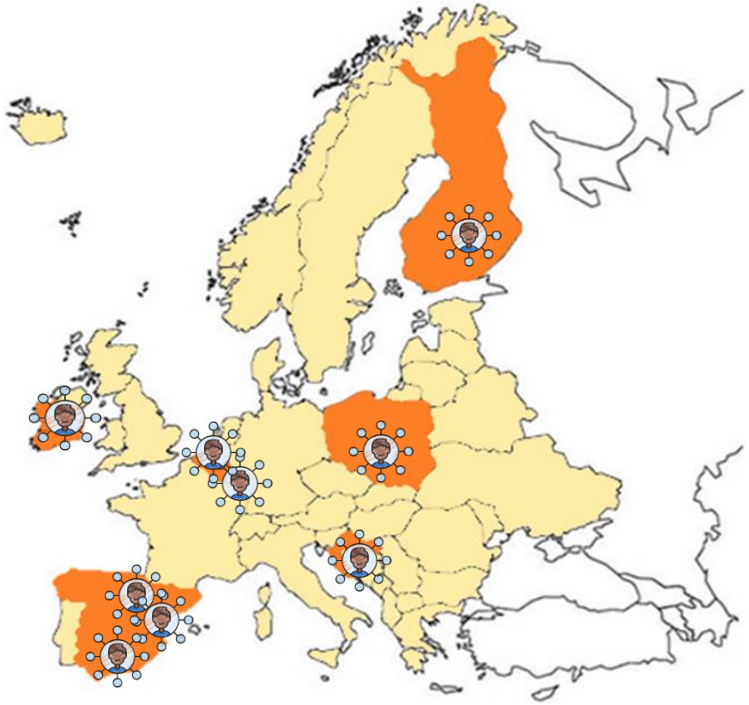
Environmental aspects of alternative fertilizing products. What is covered and not by LCA?

17th Feb 2025, Brusels

Funded by the European Union

NOVAFERT overview

- CSA-101060835
- 9 PARTNERS
- 6 COUNTRIES
- 2 Million €
- 36 Months



Project aims

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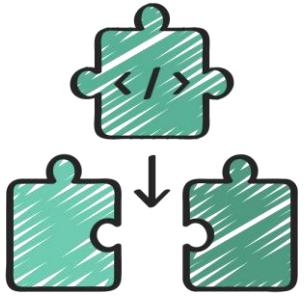
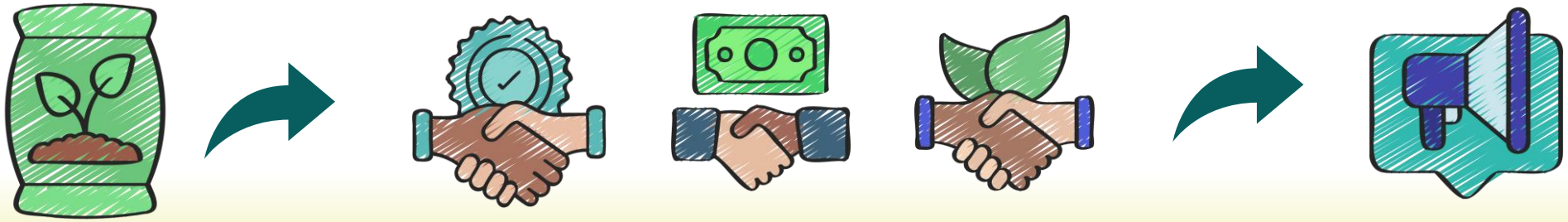
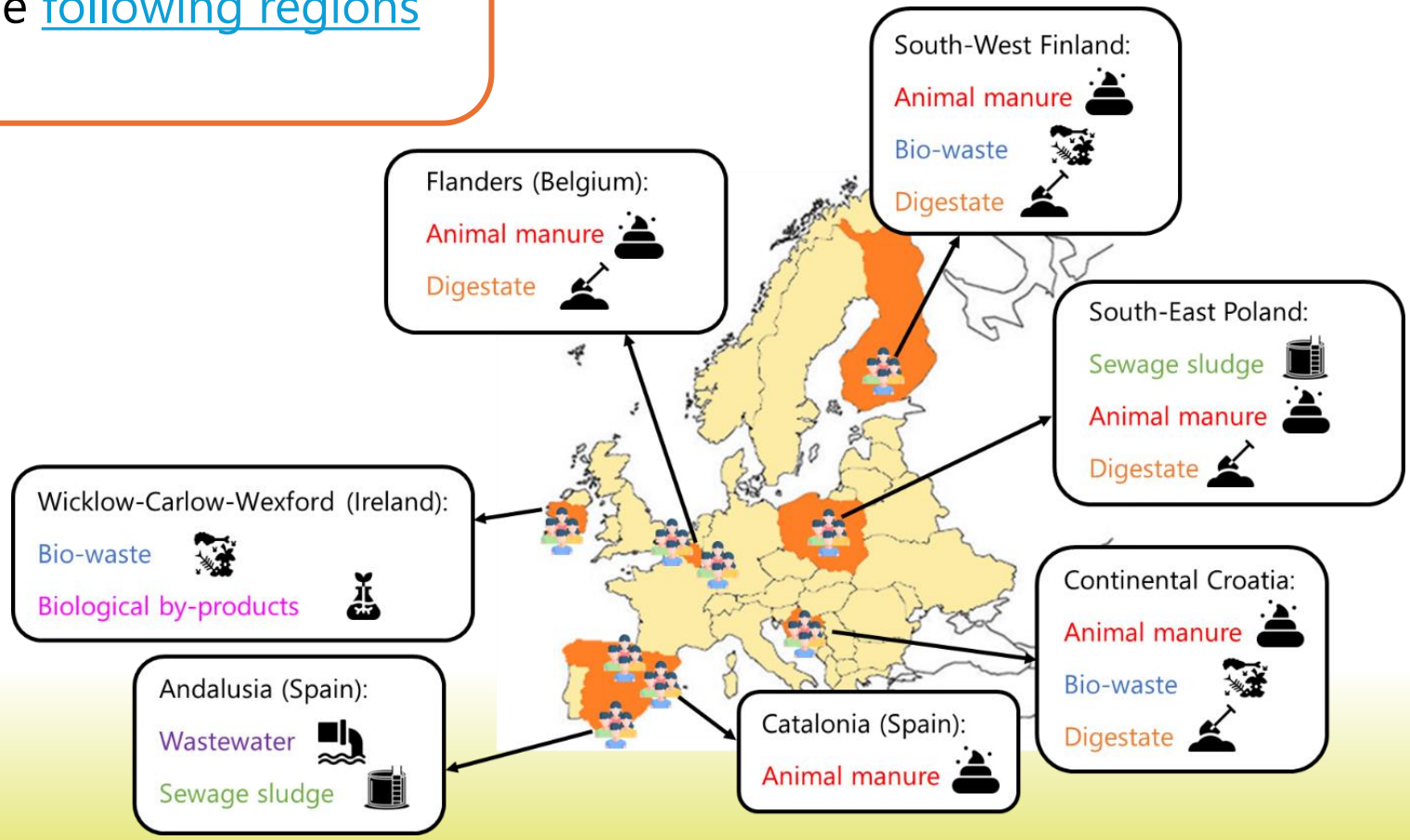


- To demonstrate the **technical, economic, and environmental** feasibility and safe use of a wide portfolio of alternative fertilising products from different waste streams
- To **promote their use** and increase the **awareness** of their benefits



NOVAFERT Overview

7 Regional Working Groups acting as Front Runners for knowledge sharing with the following regions



NOVAFERT regions and their associated waste streams

NOVAFERT methodology

WP 1

Products & technologies mapping

European Commission

BIOREFINE CLUSTER EUROPE

Living labs mapping

WP 2

Sustainability mapping

Sources:

PEF/OEF

ISO 14040 Approved Life Cycle Assessment

ILCD2011 IPCC2013 ReCiPe

Consensual sustainability methodology

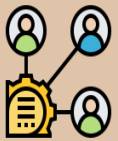
Sustainability assessment

Alternative fertilising products ILCD compliant database

WP 6

IMPACT

WP 5



Stakeholder engagement

Participatory workshops
Regional working groups
Stakeholders engagement
International workshops

WP 4

Acceleration of market awareness and adoption

WP 3

SWOT/PEST analysis

Address remaining legal hurdless

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eagasc
Agriculture and Food Development Authority

Beta
UVIC
Universitat de Vic
Universitat Central de Catalunya

Luke
Luonnonvarakeskus

BIOAZUL

eit Food

Universiteit Gent

WP2 Objectives

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Three main objectives of WP2 (M1-M32):

- Develop a **common method for environmental assessment** of alternative fertilising products' production, storage, distribution and application
- **Demonstration of the environmental performance of producing** and using alternative fertilising products by a common PEF compliant methodology
- Development of validated **ILCD compliant datasets**

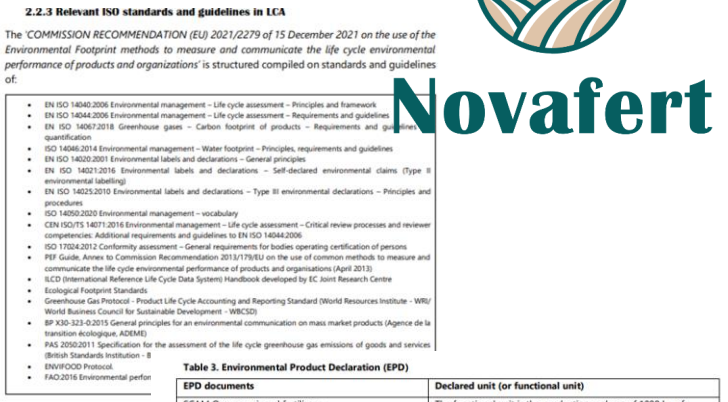
T2.1.-Mapping of available LCA guidelines and standards to environmentally assess the production and application of alternative fertilising products (LUKE, UVIC and MEERI)

- Compilation and comparative assessment of:
  - the normative framework: Product Environmental Footprint (PEF), Environmental product declarations (EPD), International Standardization Organization (ISO) and Other Standards for bio-based products
  - Development in specific category rules (PEFCRs, EPDs) of other similar sectors (beer, flowers production or fertilisers) ISOs)Product Category rules (beer, fertilisers)
  - Scientific literature: Reviews (Egas et al (2023) and Tanger et al (2022)) and papers

- Critical analysis oriented to specific methodological decisions such as the functional unit, system boundaries, allocation schemes, inventory, carbon modelling highlighted the most critical points of controverse and potential solutions for PEF integration as well

- Other activities to get feedback from LCA community :
  - Topical discussion at SETAC23 ***"Environmental assessment of Biobased fertilizers application from agronomics, ecotoxicology and life cycle assessment perspectives. The story of three worlds that should not be so far"***
  - ESNI 2023 Workshop ***"Towards a harmonized approach on sustainability assessment of nutrient recovery pathways: setting LCA methodological priorities"***

- Results in Deliverable 2.1



2.2.3 Relevant ISO standards and guidelines in LCA

The *'COMMISSION RECOMMENDATION (EU) 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organizations'* is structured compiled on standards and guidelines of:

- EN ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework
- EN ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- EN ISO 14067:2018 Greenhouse gases – Carbon footprint of products – Requirements and guidelines quantification
- ISO 14046:2014 Environmental management – Water footprint – Principles, requirements and guidelines
- EN ISO 14020:2001 Environmental labels and declarations – General principles
- EN ISO 14021:2016 Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)
- EN ISO 14025:2010 Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 14050:2020 Environmental management – vocabulary
- CEN ISO/TS 14071:2016 Environmental management – Life cycle assessment – Critical review processes and reviewer competencies: Additional requirements and guidelines to EN ISO 14044:2006
- ISO 17024:2012 Conformity assessment – General requirements for bodies operating certification of persons
- PEF Guide. Annex to Commission Recommendation 2013/179/EU on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (April 2013)
- ILCD (International Reference Life Cycle Data System) Handbook developed by EC Joint Research Centre
- Ecological Footprint Standards
- Greenhouse Gas Protocol - Product Life Cycle Accounting and Reporting Standard (World Resources Institute - WRI/ World Business Council for Sustainable Development - WBCSD)
- BP X30-323-0:2015 General principles for an environmental communication on mass market products (Agence de la transition écologique, ADEME)
- PAS 2050:2011 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (British Standards Institution - B
- ENVIFOOD Protocol.
- FAO:2016 Environmental perfor

The compiled basic guidelin
methodology outlined in the PE
and their product group, a PEF-c
several specific standards and c
standards and guidelines used t
for biobased fertilizer products,

- 16760:2015; Bio-based product
- CEN/TR 16957:2016; Bio-based
- Life Cycle Assessment (LCA) of a

Additional standards and guidel

Table 3. Environmental Product Declaration (EPD)

EPD documents	Declared unit (or functional unit)
SCAM Organo-mineral fertilizers	The functional unit is the production and use of 1000 kg of packaged fertilizer
PUSRI Prilled Urea Fertilizer	1000 kg of urea fertilizer and its packaging
Nitrea Prilled Urea Fertilizer	1 ton of urea fertilizer and its packaging
DURAMON 26 PLUS	The declared unit is 1000 kg of product and its packaging. The reference flow is defined at the customer gate, at the shelf or the retailer or at the market place.
Microquel Amin Cuaje	The declared unit is 1000 kg of product and its packaging. The reference flow is defined at the customer gate, at the shelf or the retailer or at the market place.
DICHIARAZIONE AMBIENTALE DI PRODOTTO DI BIOSTIMOLANTI, FERTILIZZANTI E MICRONUTRIENTI ORGANO MINERALI SOLIDI E LIQUIDI	For all solid products under study, the declared unit is 1000 kg with its packaging
Mineral Fertilisers from TIMAC AGRO	The declared unit is 1 ton of fertiliser, packaging included.

Beer	Packed water
Dairy	Pasta
Decorative paints	Pet Food
Household liquid laundry detergents	Photovoltaic electricity production
Hot and cold water supply pipe systems	Rechargeable batteries
Intermediate paper product	T-shirt
Feed for food producing animals	Thermal insulation
IT equipment	Uninterrupted Power Supply
Leather	Wine
Metal sheets	

T2.2 Mapping of other relevant environmental/sustainability (UVIC-LUKE)

- Main goal was to map out the available standards to assess the environmentally relevant aspects not well covered by LCA methodology.
  - Affections to soil
  - Carbon sequestration
  - Biodiversity
  - Pollutants (heavy metals, pathogens, emerging pollutants such as PFAS and microplastics)
  - Others such as the odour
- The mapping included the parameters and methods for measuring them since chemical analysis to earth observation systems.
- The main conclusions of the literature as well as the potential controversies were as well compiled.
- The analyses began with a bibliometric analysis to systematised the compilation of literature. Moreover, other standards and reports from the United nation (UN) or Food and Agriculture Organization of the United Nations (FAO) were consulted and integrated.

- Other activities to get feedback from LCA community :
  - ESNI 2023 Webinar ***"Biogenic Carbon accounting modelling in bio-based fertilisers: State of the art, limitations, and global trends towards the integration of realistic modelling in LCA"***

- Results in Deliverable 2.1

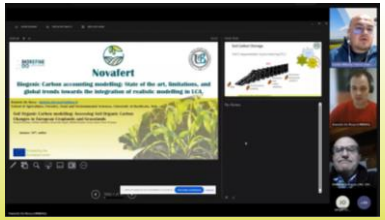


Table 5. Terms of queries for the main sentence. For crossing both queries the operator AND was used that is, a term each query had to be contained in the publication to be considered[18].

Terms of BBFs	Terms of environmental impacts
OR ("bio-based fertili*", "biobased fertili*", "recycling derived fertili*", "nutrient recovery", "waste-based fetili*" "alternative fertili*", "waste-to-fertili*", "nutrient recycling", "recycled fertili*", "recovered nutrient", "recover* nitrogen", "recover* phosphorous", "recover* carbon", "fertili* product", "fertili* products")	OR ("environmental impact*", "environmental assess*" "environmental indicator*", "environmental analys* "environmental metric*")

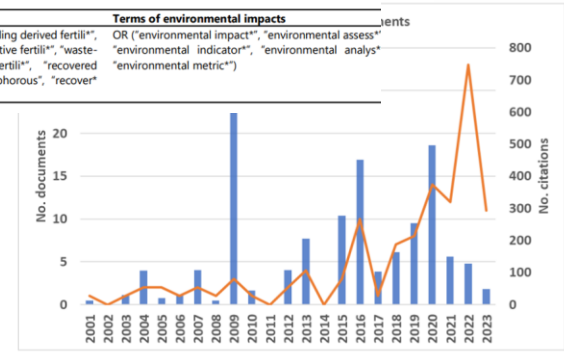


Figure 1. Overall production of scientific production about environmental concerns of BBFs.

Table 6. Selection of the most relevant references about the non-LCA environmental concern of BBFs.

Environmental concern		Importance	Trade-offs sign	Main references
Affections on soil properties (physical and chemical)		BBFs can induce modifications in soil properties. There are some evidence in favour: physical properties, and biological activity. However, there are also risks associated with decreasing efficiency of soil nutritional management.	Positive or negative	Adegbeye et al. 2020; Santos et al. 2018; Ren et al. 2020; Karim et al. 2022; Gillingham et al. 2022; Rizzioli et al. 2023; Kiani et al 2023; Martinez-Sabater et al. 2022; Ro et al. 2016; Bernstad et al. 2013; Hendriks et al. 2022; Hidalgo et al. 2021; Piash et al. 2023; Wester-Larsen et al. 2022; Zilio et al. 2022; Preisner et al. 2022; Raza et al. 2021; Collivignarelli et al. 2020; Maltais-Landry et al. 2019; Černe et al. 2019; Sigurnjak et al. 2016.
Heavy metals		The presence of toxic substances in livestock manure and sewage (the most common secondary raw material), can result in damage to ecosystems and human health. Thus, it is very important to develop specific frameworks and datasets to assess them to prevent environmental impacts and human risks.	Negative	Egle et al. 2015; Robles et al. 2020; Antonini et al. 2012; Wang et al. 2004; Kräheinbühl; Zou et al. 2021; Siwal et al. 2021; Karim et al. 2022; Gillingham et al. 2022; Rizzioli et al. 2023; Kiani et al 2023; Zabaleta and Rodic 2015; Álvarez-González et al. 2023; Zilio et al. 2022; Preisner et al. 2022; Collivignarelli et al. 2020; Černe et al. 2019; Sigurnjak et al. 2016.
Soil carbon sink and sequestration		Soil carbon dynamics are affected by BBF application as well as various land management measures (e.g. ploughing). Therefore, should be incorporated the measuring of the different Carbon stocks in the soil and their transformation.	Potentially positive- (under discussion)	Adegbeye et al. 2020; Anex et al. 2007; Ren et al. 2020; Karim et al. 2022; Martínez-Sabater et al. 2022; Galamini et al. 2023; Liu et al 2023; Egene et al. 2022.
Biodiversity		Assessing the impacts caused by BBFs on biodiversity is crucial due to the potential effects on ecosystem stability and functioning such as changes in soil microbial communities.	Positive or negative	Stacey et al. 2019; Chelinho et al. 2019; Ren et al. 2020; Suleiman et al. 2020; Zou et al. 2021; Karim et al. 2022; Gillingham et al. 2022; Kiani et al 2023.
Others	Organic emerging contaminants	Their presence is related to the secondary raw materials quality and the transformation processes. Their application may lead to bioaccumulated soil, uptaken by the crop or leached to the groundwater, causing potentially severe risks to human health and the environment.	Negative	Egle et al. 2015; Robles et al. 2020; Albihn et al. 2007; Suleiman et al. 2020; Karim et al. 2022; González et al. 2023; Zilio et al. 2022; Preisner et al. 2022.
	Microplastics	The use of BBFs can introduce microplastics into soil and water causing important damage to human health and affecting ecosystem services. Plastics included in organic fertilisers could be linked with soil alteration, accumulation on water reservoirs and impact on biota.	Negative	Santos et al. 2018; Johansen et al. 2023.
	Odour	Emissions of odours from organic fertilizers, rich in organic matter, may lead to the release of compounds like ammonia, impacting air quality and causing disturbances in the nearby community. Furthermore, the detection of odours may indicate the decomposition of organic matter and the potential release of substances that could be harmful.	Negative	Riva et al. 2016; Zabaleta and Rodic 2015.

First bibliometric and literature review

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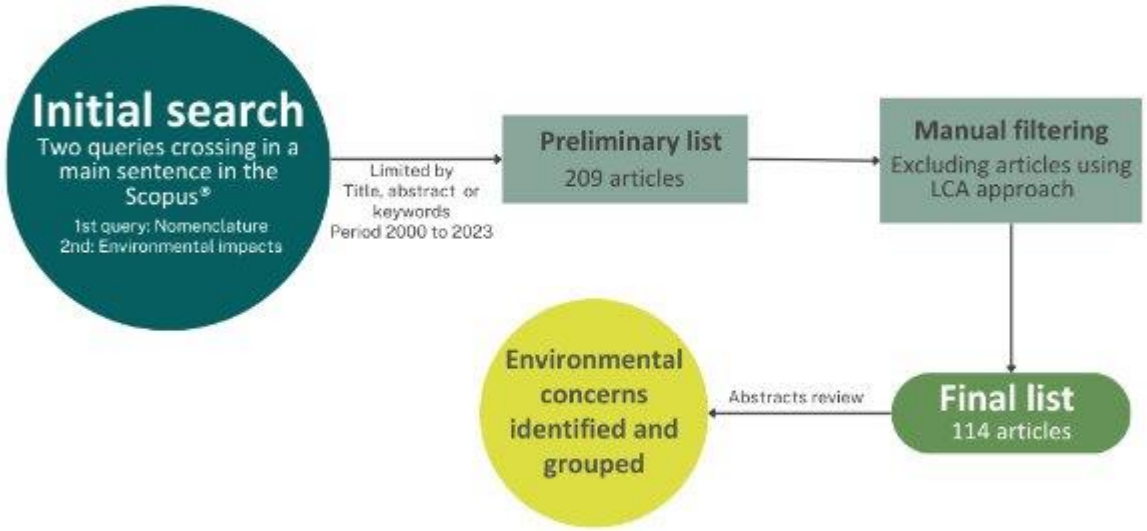

Terms of BBFs	Terms of environmental impacts
OR ("bio-based fertili*", "biobased fertili*", "recycling derived fertili*", "nutrient recovery", "waste-based fetili*" "alternative fertili*", "waste-to-fertili*", "nutrient recycling", "recycled fertili*", "recovered nutrient", "recover* nitrogen", "recover* phosphorous", "recover* carbon", "fertili* product", "fertili* products")	OR ("environmental impact*", "environmental assess*" "environmental indicator*", "environmental analys*", "environmental metric*")

First results

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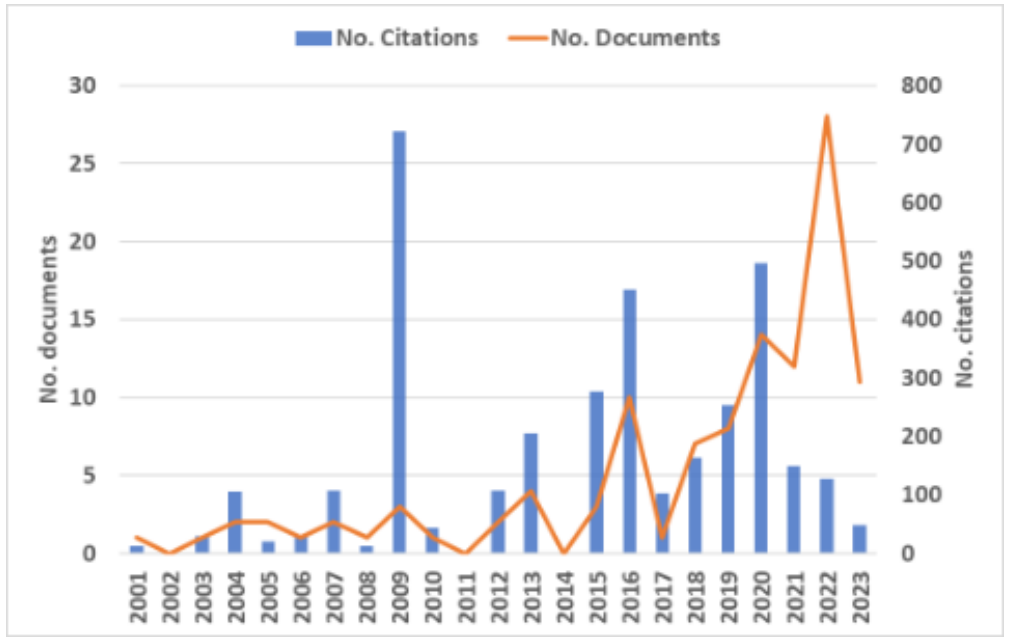

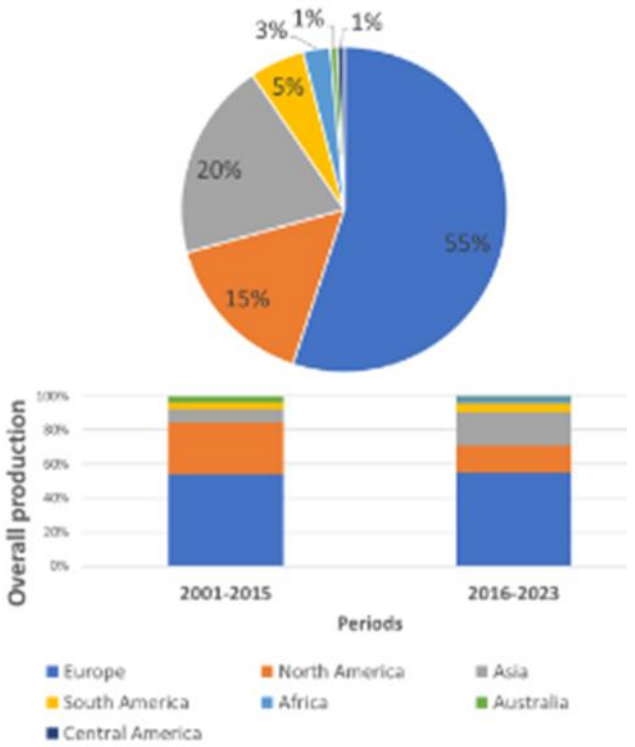

LCA states the first

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Non-LCA environmental concerns

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Environmental concern	Affections on soil properties	Heavy metals	Soil carbon sequestration	Biodiversity	Microplastics	Organic emerging contaminants	Odour
Nº of papers	28	18	8	8	2	2	2
Trade-off sign	**Positive** and **Negative** (controversial)	**Negative**	**Positive** (under discussion)	**Positive** and **Negative** (controversial)	**Negative** (magnitude under discussion)	**Negative**	**Negative**
Description	They can improve soil structure and biological activity. However, there are also risks associated with decreasing efficiency of soil nutritional management.	The presence of toxic substances secondary raw material can result in damage to ecosystems and human health.	Soil carbon dynamics are affected by BBFs application as well as various land management measures (e.g. ploughing).	Soil structure and xenobiotics could alter ecosystem stability and functioning such as changes in soil fauna or soil microbial communities.	MP into soil and water could potentially damage human health and ecosystem services They accumulate on water reservoirs and impact on biota.	Organic pollutants (bio)accumulates in the soil, can be uptaken by the crop or leached to the groundwater. They are a risk to human health and the environment.	The detection of odours may indicate the release of substances that could be harmful impacting the air quality and human health.
Main issues for LCA adaptability	-Soil complexity -Limited understanding of long-term effect -Limited standardization of methods and concepts -Limited impact assessment methods	-Spatio-temporal variability -Bioavailability consideration -limited fate and transport models -LCIA methods differ	-Non consensual methodologies -Uncertainties in the long-term stability -Variability of soils and pedoclimatic conditions	-Spatial dimension -Specific data needs -Issues in representing the biodiversity -Human-made impacts effects isolation	-Data availability and reliability -Analytical challenges -Uncertainty in environmental fate -Impact assessment limitations	-Analytical challenges -Spatio-temporal variability -Impact assessment limitations	-Subjectivity -No harmonised method -Data availability -Chemical heterogeneity -Spatio-temporal variability

T2.3 Definition of a unified compliant methodology to implement LCA for the environmental assessment of alternative fertilising products (LUKE and UVIC)

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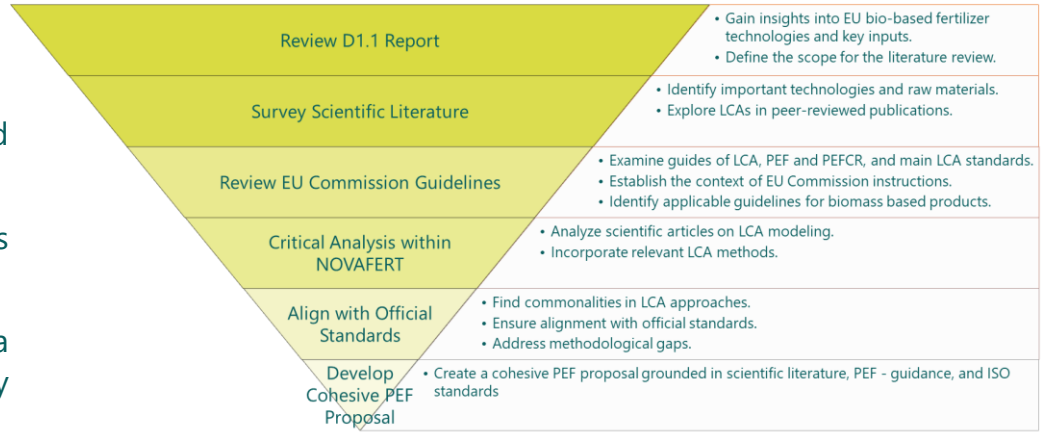
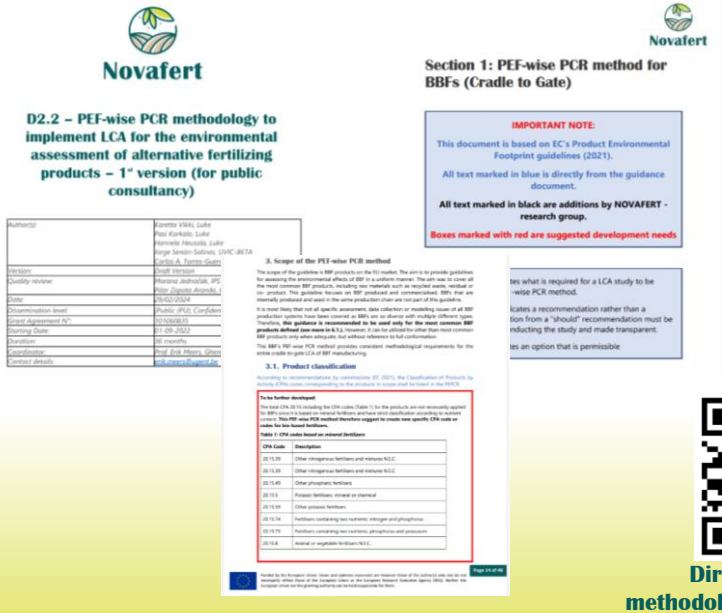
- Methodology was published in the NOVAFERT website (D2.2) survey created to address the 7 main issues found (Accomplishment of M3)

1. **Scope**. The products code: CPAs proposed are common with mineral/fossil-based fertilisers.
2. **The representative product:** the variability of products under the umbrella of BBF makes difficult to create one unique representative product for the sector
3. **The functional unit:** The kg of BB could be a default unit easy to operate with. However, a complementary unit to refer the main plant nutrient in the BBF will ease the comparability (i.e. 1 kg of N).
4. **The system boundaries:** For the present version, the system boundaries cover from the secondary raw materials until the retailer. Application/use phase modelling are variable and depend on the use-application methods (and several parameters such as the weather).Use phase modelling and emission factors are as well recommended for the inclusion in the PEF framework.
5. **Burdens allocated from the secondary raw materials**: waste and products dichotomy affects importantly in the allocation of upstream burdens.
6. An adaptation of **Circular Footprint formula** is proposed though under discussion. This point method has been highly criticised and incoherent with the ISO standards.
7. **The emission factors** for BBFs are proposed based on their chemical characteristics. Nonetheless, some of them lack robust field tests.





Direct link to the methodology and the survey!

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Thank you!
Keep posted to see the final results!

Jorge Senán-Salinas, PhD
Jorge.senan@uvic.cat

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Coffee break

See you at 15:25

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101060426.