RUSTICA

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

Deliverable D3.13: Outlook on future legislative aspects for RUSTICA nutrient cycles

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Table of Contents

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

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

Summary

Owing to the scale of RUSTICA embracing five test cases situated in the EU and in Colombia and introducing a revolutionary valorisation concept for redundant and neglected leavings from fruit and vegetable production, processing and distribution, the legal and political environment of the project concept and its value chains is among the important factors - during the lifetime of the project and beyond of this period.

Conventions established at the global level, serving as overarching legal frameworks and providing valuable international rules, e.g., on waste, soil and climate change, affect the circular nutrient cycles of the project proposed in EU Member States and in the South American country. More specific, political relations and agreements between the EU and Colombia enable collaborations, e.g., in RUSTICA research.

Feedstocks are critical elements in order to create "bio-based[1]" fertilisers. RUSTICA uses a range of organic[2] substrates coming from the primary sector up to food retail and not appropriate for food and feed purposes. It is crucial if a substrate is legally defined as "waste"[3] or can reach the preconditions of a "by-product."

Terms of the amended REACH Regulation EC No 1907/2006 need to be thoroughly studied if microbial biomass and NPK-concentrate shall be generated via processing trough carboxylic-acid-platform, cultivation of microbiota and electrodialysis in the EU as it takes place in RUSTICA. REACH is also relevant for biochar and its production by pyrolysis, whereas certain exemptions are laid down for compost. Rearing of insects in the EU is coupled to fulfillment of legislation on feeding of farmed animals. Marketing of insect biomass and frass in the EU directly leads to the stipulations of the amended Animal by-product Regulations. Rules in Colombia are different to those in Europe which is reflected, for instance, by compost and its defined input materials.

RUSTICA results in an assortment of blends for providing nutrients to plants and enhancing quality of soil. In the EU, two main options can be evaluated for placing blends onto the market: either the harmonised route via the new EU Fertilising Products Regulation 2019/1009 or, alternatively, non-harmonised national and regional frameworks in the Member States. For Colombia, it is reported that the term "blend" can also be interpreted as an organo-mineral fertiliser.

Fertilising products for organic production in the EU are imposed with additional rules, such as restrictions on mineral nitrogen, chemical preparations for treatments and final application (e.g., biochar just for soil improvement). Products from organic farming in Colombia need to pass a certification, the "*certificación ecológica*", and permitted fertiliser inputs are defined in Resolution 199/2016.

The EU Common Agricultural Policy enables and fosters the application of sustainable nutrient application and management. Specific details as regards protection of water are prescribed, for example, by the Nitrate Directive, and the new proposal on a *Soil Monitoring Law* advocates circular and tailored fertiliser solutions for plants. The uplifted targets of the LULUCF regulation are of particular relevance and represent important criteria for RUSTICA since the project involves biochar and deals with a new plant nutrition approach.

Apart from legally binding sources, policies in the EU and in Colombia[4] indicate the gateways of the future. Under the umbrella of the European Green Deal, *the First Priority* of the European Commission at the moment, recycling of nutrients and waste, opportunities for bio-based products and biofertilisers, as well as abatement of pollution, overexploitation and nutrient losses are promoted - which is entirely addressed by sustainable nutrient concepts of RUSTICA.

[1] The term "bio-based" is defined by EN 16575:2014.
[2] Organic in the meaning of "organic chemistry", not "organic farming"
[3] and as such achieving "end-of-waste" is critical if the economic cycle is targeted in the EU
[4] Currently, Colombia is operating an agricultural reform.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Acronyms and abbreviations

ABP	Animal-by-Product
ANPEA	Association Nationale Professionnelle des Engrais et Amendements
ANSES	French Agency for Food, Environmental and Occupational Health & Safety
BAT	Best Available Technique
BATC	Best Available Technique Conclusions
BIPS	Biochar Initiatives Platform Spain
bn	billion
BQM	Biochar Quality Mandate
BREF	Best Available Techniques Reference Document
BRS	Basel-, Rotterdam-, and Stockholm Convention
CAN	Communidad Andina (Andean Community)
CA	Carboxylic Acid
CAP	Carboxylic Acid Platform
CAP	Common Agricultural Policy
CELAC	Community of Latin American and Caribbean States
CH	Switzerland
CLP	classification, labelling and packaging (of chemicals)
CMC(s)	Component Material Category(-ies)
COP	Conference of the Parties
C(org)	Content of Organic Carbon
CSP	(National/regional) Common Agricultural Policy Strategic Plan
EBC	European Biochar Certificate
EBI	European Biochar Industry Consortium
ECHA	European Chemicals Agency
ECN	European Compost Network
ECN-QAS	European Quality Assurance Scheme (ECN-QAS)
EEA	European Environment Agency
EFSA	European Food Safety Authority
EoW	End-of-waste
ESPP	European Sustainable Phosphorous Platform

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

ESR	Effort-Sharing-Regulation
ETS	Emission Trade Sector
FAO	Food and Agriculture Organization of the United Nations
FPR	Fertilising Products Regulation
GA	Grant Agreement
GAEC	Good agricultural and environmental condition standard for agricultural areas
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IBI-BS	International Biochar Initiative
ICA	Instituto Colombiano Agropecuario
ILVO	Instituut voor Landbouw-, Visserij- & Voedingsonderzoek
INAO	Institut National de l' Origine et de la Qualité (France)
IPCC	Intergovernmental Panel on Climate Change
IPIFF	International Platform of Insects for Food and Feed
ICHAR	L'Associazione Italiana Biochar
IUPAC	International Union of Pure and Applied Chemistry
JRC	Joint Research Centre (of the European Commission)
LAC	Countries of Latin America and the Caribbean
LULUCF	Landuse, landuse change, and forestry
mn	million
NATO	North Atlantic Treaty Organisation
NDC	Nationally Determined Contribution
NH_3	Ammonia
NMVOC	Non-methane volatile organic compounds
NO	Norway
NO_x	Nitrogen oxides
NPK	Nitrogen, phosporous, potassium
NTC	NORMA TÉCNICA COLOMBIANA (National Colombian Technical Norm)
NVZ	Nitrate Vulnerable Zone
OECD	Organisation for Economic Cooperation and Development
OVAM	Openbare Vlaamse Afvalstoffenmaatschappij
Pb	Lead
PFC(s)	Product Function Category(-ies)

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

PHA	Polyhydroxyalkanoates
PM	(Fine) particulate matter
POP(s)	Persistent Organic Pollutant(s)
QAS	Quality Assurance Scheme
RBBF	RUSTICA Bio-based Fertiliser
REACH	Regulation of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
RED	Renewable Energy Directive
SCIP	Database for information on substances of concern
SDG	Sustainable Development Goal
SIAC	Environmental Information System for Colombia (Sistema de Información Ambiental para Colombia)
SINAB	National Information System on Organic Agriculture (Sistema d'informazione Nazionale sull'Agricoltura Biologica)
SMR	Statutory management rules
SO	Strategic Objective
SO_2	Sulphur dioxide
UK	United Kingdom
UNCCD	United Nations Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
UVCB	Substances of Unknown or Variable composition complex reaction products or Biological materials
VFA	Volatile Fatty Acid
WFD	Waste Framework Directive

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

List of Figures

List of Tables

RUS TI CA
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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Introduction

RUSTICA responds to fundamental global and European challenges including but not limited to the rural, agricultural and environmental spheres by transforming valuable underexploited resources into tailored nutrition concepts for plants and enhancement of soil.

The project starts from side streams, leftovers and redundant materials entailed with farming activities, food processing and -distributing. It valorises these substrates into RUSTICA bio-based fertilisers (RBBF)[5] by using innovative, scientific methods, technologies and business models.

Considering the project and its expected impact, the legal and political environments providing options and constraints for the new developments are at the forefront. Therefore, already in the first phase of the RUSTICA project, European Union Law was examined and results are laid down in the ***Deliverable D3.2: RUSTICA valorisation concepts in the EU legislative framework (2021)***. National and regional legislation pertaining to RUSTICA is documented in the ***Deliverable D3.6: RUSTICA legislative aspects at national and regional level (2022).*** Taking into account the enormous relevance of the Common Agricultural Policy in the EU, an additional ***Report on strategic plans to be drawn by EU Member States under the common agricultural policy (CAP Strategic Plans) (2023)*** has been elaborated in the project and published on the project's website.

Progress in the legal landscape affecting RUSTICA is monitored and evaluated throughout the duration of the project. Towards the end of the project, updated results and future prospects are debated at the international, European and national/regional scale. They are recorded in this ***Deliverable D3.13: Outlook on future legislative aspects for RUSTICA nutrient cycles*** and an overview is given in **Figure 1.**

Figure 1 - Composition of D3.13 RUSTICA Outlook

Source: Own depiction based on the content of RUSTICA D.3.13

Emphasising the international character of the RUSTICA project, international Conventions and agreements are displayed in **chapter one** of this D3.13 study.

EU legislation, as well as national/regional legislative matters of the RUSTICA testcase regions in the EU and Colombia along the value chains of the project are subject to the elaborations in **chapter two**. The D3.13 report comprehensively analyses the issues of feedstocks, obligations on the processing routes, and rules for placing on the market of the output including basic products (building blocks) or final RUSTICA blends. A dedicated section is elaborated on the requirements of organic production in the EU and Colombia.

Since the project upscales its result to pilots and demonstration by application tests, a glimpse of the legal compendia affecting deployment of fertilising products in the EU is made in **chapter three**.

Albeit this setting majorly relates to legally binding sources, European policies, priorities and strategies and Colombian political activities indicating future directions to be recognised for the impact of RUSTICA are incorporated into this Deliverable D3.13. They are drawn up in **chapter four**.

[5] RBBF relies technologically on several RUSTICA technologies and composting and is made up of at least two of the RUSTICA building blocks. (Official definition of RUSTICA)

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

1. RUSTICA - a view on international conventions, agreements and policy

The RUSTICA project involves five test regions of which four are situated in the EU and one in Colombia. Hence, international policy, agreements, and relations of the EU, the *Countries of Latin America and the Caribbean* (LAC), the *Community of Latin American and Caribbean States* (CELAC) (GOV.CO, 2024a) (gov.br, 2023)[6], the *Andean Community*[7] (CAN, 2024), and the state Colombia itself are of particular interest and were extensively addressed in the legal analyses *of RUSTICA D3.*2 on EU legislation (RUSTICA, 2021) and *D3.6* dealing with national and regional legal commands (RUSTICA, 2022).

1.1 International Conventions and Agreements

At time of writing, from 74 agreements listed in section 15.10 Environment of the *Directory of international agreements* of EUR-Lex[8] (EUR-Lex, 2024), those considered as relevant for RUSTICA (RUSTICA, 2021) and apply to both the EU and Colombia are briefly indicated in this D3.13 section with view on more recent trends.

The **Basel Convention**, setting rules on transboundary movement of wastes, has 191 parties (UNEP, 2024b). It is known as the *"most comprehensive global environmental agreement on hazardous wastes and other wastes"* and includes also *wastes arising from agro-food industries provided it is not infectious* in its Annex IX[9]. Such wastes are covered by the scope[10] of the Basel Convention for "*hazardous wastes*" only if they are contaminated with *"wastes to be controlled"* as defined in Annex I[11] and have a characteristic as laid down in Annex III[12] (UNEP, 1992). Waste classification is different to commodity classification (RUSTICA, 2021), and, more recently, in the Meetings of the Conference of the Parties in 2022[13] and 2023[14] e.g., decisions[15] were made, on "*Cooperation with the World Customs Organization on the Harmonized Commodity Description and Coding System* (COP.15, 2022) (COP.16, 2023)". In case of international transports of wastes would become necessary for RUSTICA purposes, the **Basel Convention**, which promotes not only waste minimisation but also valorisation closest to the point of origin, comes into play. Please view also **section 2.1.1.**

As the RUSTICA project strives for environmentally friendly solutions for organic waste from the agri-food chain, the **Stockholm Convention** on Persistent Organic Pollutants (POPs)[16] encompassing "*open burning of waste, including burning of landfill sites"*[17] (UNEP, 2019) was already presented in more detail in the first RUSTICA study D3.2, is presented here since the project and its results stand for innovative alternatives to burning of agri-food waste by means of its valorisation into novel fertilisers.

Apart from the Basel Convention and the Stockholm Convention, the first round of RUSTICA legislative analysis covered also the **Rotterdam Convention** ruling trade of hazardous chemicals and pesticides (UNEP-FAO, 2019)[18]. Even though, RUSTICA does not strive for pesticide development, but optimal plant nutrition and soil

[6] CELAC includes 33 Member States (all states on the American continent except of USA and Canada) since Brazil rejoined in 2023.
[7] The Andean Community comprises Bolivia, Colombia, Ecuador and Peru.
[8] EUR-Lex is a legal database of the EU.
[9] Basel Convention, Annex IX, List B, Section B3 and Code B3060. An excerpt is provided in D3.2 *RUSTICA valorisation in the EU legislative frameworks. (2021)*
[10] Art. 1 paragraph 1(a)
[11] e.g., Y1 clinical waste
[12] e.g., UN Class 9, H11 Toxic or H12 Ecotoxic
[13] COP.15.
[14] COP.16.
[15] BC-15/12 and BC-16/8
[16] Comprising 186 parties at 12.02.2024 and the list of chemicals was amended at several times, latest in 2023.
[17] Annex C
[18] At time of writing (19.02.2024), 55 chemicals are listed in Annex III of which 36 are pesticides.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

fertility, which is often entailed with lower pesticide request (Dordas, 2008), the project is entirely in accordance with the Convention.

Nine values[19] are laid down in the preamble of the **Convention on Biological Diversity**, which was signed by 168 parties and entered into force in 1993. It embodies a strong progress in the conservation of biological diversity and its elements including rules on genetic resources. Furthermore, sharing profit from the use of genetic resources is addressed by the Convention (UNEP, 1993) (UNEP, 2024c) (RUSTICA, 2021). More specifically, the **Nagoya Protocol[20]** provides details on access to genetic resources[21] [22]as covered by the Convention and how to share the **"***benefits in a fair and equitable way"* (UNEP, 2024a). RUSTICA demonstrates circular bio-based products for plant nutrition and soil improvement at the international level while on the one hand, redundant leftovers serve as an input and on the other hand, protection of biodiversity is envisaged by tailored product compositions. The **Convention on Biological Diversity** and the aforementioned protocol build an international framework thereto. In the EU, Regulation (EU) No 511/2014 defines rules for compliance with the Nagoya Protocol ((EU)No511/2014).

Since 1996, the **United Nations Convention to Combat Desertification in those countries experiencing serious drought and/or desertification**, particularly in Africa **(UNCCD**) is in force. In particular, it aims for "*prevention and/or reduction of land degradation"*, "*rehabilitation of partly degraded land"* and "*reclamation of desertified land".* Concerning the regional implementation*,* in Latin America and the Caribbean (Annex III) and Northern Mediterranean (Annex IV), for example, measures on soil conservation may be included in National Action Programmes (UNCCD, 1994) (UNCCD, 2001) (RUSTICA, 2021). In its COP 13[23], the *UNCCD 2018–2030 Strategic Framework* was adopted. RUSTICA solutions aim for fertile soils and at the same time, for prevention of soil and land degradation and as such, is fully in line with the Convention.

Not only because of the decisions of the COP21 in Paris ("The Paris Agreement") (UNFCCC, 2015) (UNFCCC, 2021) from 2015 on limiting temperature increase on earth[24], the **United Nations Framework Convention on Climate Change (UNFCCC)** is a very popular supranational agreement (UNFCCC, 1992). The EU and Colombia, both are strongly committed to the Convention and contribute with aims to address climate change and measures relating thereto. In an *Update of Level Determined Contribution National of Colombia*[25] (NDC) from 2020, a maximum of almost 170 million tonnes of CO_2 eq p.a. by 2030 which equals a reduction target of 51% compared to 2015 (UNFCCC, 2024). *A legally binding target of a domestic[26] reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030* has been declared by the EU and its Member States at October 16th of 2023 (UNFCCC, 2023b). To limit global warming to 1.5° C, it was recognised at **COP 28** in Dubai at December 2023 that science indicates: global greenhouse gas emissions require *to be cut 43% by 2030*, in comparison to the amounts of 2019 (UNFCCC, 2023a).

The BRS Secretariat[27] participated at **COP 28** as well, and according to climate change, e.g., the crucial role of waste management and the circular economy were highlighted. Waste should be considered as a resource in the context of environmental advantages: reduction of waste disposal results in lower GHG emissions (e.g., methane) (BRS-Conventions, 2023).

[19] Nine values of biological diversity: ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic
[20] It serves as a supplementary agreement to the Convention of Biological Diversity and entered into force in 2014.
[21] in contrast to the Cartagena Protocol dealing specifically with living modified organisms resulting from modern biotechnology
[22] In the EU, Regulation (EU) No 511/2014 defines rules for compliance with the Nagoya Protocol ((EU)No511/2014).
[23] 13th Conference of the Parties in 2017
[24] e.g., *Art. 2a "Holding the increase in the global average temperature to well below 2° C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5° C above pre-industrial levels"*
[25] Actualización de la Contribución Determinada a Nivel Nacional de Colombia (NDC), p. 32
[26] "domestic" is defined: "by means without the use of international credits"
[27] Secretariat of the Basel-, Rotterdam-, and Stockholm Convention

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

1.2 Multi- and bilateral policy: EU and Colombia

Multi- and bilateral relations of the **EU and Colombia** occurring at various levels were broadly discussed in RUSTICA reports D3.2 (RUSTICA, 2021) and D3.6 (RUSTICA, 2022). An update is set in this section.

The EU and the countries of Latin America and the Caribbean (LAC) built up a strong bi-regional partnership including but not limited to agreements on trade,[28] policy and cooperation (EEAS, 2023). An important role in the development of the partnership process is given to Comunidad de Estados de América Latina y el Caribe[29] **(CELAC)**. **CELAC** was founded in 2010 (CELAC, 2024) and is constituted by all of the 33 LAC countries[30] **(Figure 2**) (agenciaBrasil, 2023). In July 2023, the **EU-CELAC Summit** as the third meeting of the heads of States and Government took place in Brussels. In the Declaration of the **EU-CELAC Summit** from 18th of July 2023 "*renewing and further strengthening our long-standing bi-regional partnership*" is documented among others the wish to continue *"the work of the **EU-CELAC** Joint Initiative on Research and Innovation"* (EU-LAC, 2023) (EU-COUNCIL, 2023). In this context and with view on RUSTICA, it is worth to mention that the number of projects with **CELAC** participation under Horizon 2020 and Horizon Europe exceeds 650 (EC, 2023a).

Figure 2 - CELAC Countries

Source: Maps on the Web, 2023 (MapsontheWeb, 2023)

Apart from, e.g., a new action plan on EU-Colombia Regional Policy Cooperation (2021-2025) including economic development (EC, 2021b), political relations involving Colombia are also defined in the agreements between the **EU and the Andean Community** (CAN - Communidad Andina) (EUR-Lex, 1998). To date, the **Andean Community**, originally established by the Cartagena Agreement in 1969, encompasses the four countries Bolivia, Colombia, Ecuador and Peru as its members. Furthermore, CAN lists associated[31] and observer[32] countries (CAN, 2024).

As fertilisers are at the core of the RUSTICA project, attention is paid to the **Trade Agreement** from 21.12.2012 between the EU and Colombia as a member of the CAN (EU, 2012) (EC, 2024e). It has been provisionally applied

[28] EU-LAC total trade exceeded €218 bn in 2021.
[29] Community of the Latin American and the Caribbean States
[30] Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Dominica, Ecuador, El Salvador, Grenada, Guatemala, Co-operative Republic of Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Santa Lucia, Federation of Saint Kitts and Nevis, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela. Brazil temporarily left CELAC in 2020 but returned in January 2023.
[31] Argentina, Brazil, Chile, Paraguay, and Uruguay
[32] Spain, Morocco, Turkey, Greece and Panama

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

to this country and Peru since 2013. Furthermore, Ecuador accessed the **Trade Agreement** at 24.12.2016 (EU, 2020) (RUSTICA, 2021).

The **Trade Agreement**, which was debated in detail in D3.2, rules reduction and elimination of custom duties and indicates sustainable development, labour rights and environmental issues in its Title IX (Bartels, 2013) (Schmieg, 2018) . It aims to, e.g.: *"The promotion of the conservation and sustainable use of biological diversity and of natural resources"* (EU, 2012). In chapter 31, five main categories of fertilisers are mentioned, which are put in **Table 1:**

Table 1 - EU Imports: Five main categories of fertilisers in the Trade Agreement EU-CO

Trade Agreement	Main fertiliser categories for imports to the EU from Colombia
Chapter 31 **Five main categories of fertilisers for imports to the EU from Colombia**	• Animal or vegetable fertilisers, whether or not mixed together or chemically treated; fertilisers produced by the mixing or chemical treatment of animal or vegetable products
	• Mineral or chemical fertilisers, nitrogenous
	• Mineral or chemical fertilisers, phosphatic
	• Mineral or chemical fertilisers, potassic
	• Mineral or chemical fertilisers containing two or three of the fertilising elements nitrogen, phosphorus and potassium; other fertilisers; goods of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg

Source: Own depiction based on Trade Agreement EU-Colombia (modified) (EU, 2012)

If imported into the EU and originated in Colombia, tariff line staging category "0" applies which means that customs duties shall be eliminated totally (EU, 2012) (EU, 2020). Reduction and elimination of customs duties are defined for fertiliser imports to Colombia as well (RUSTICA, 2021).

Considering the development of fertiliser imports into the EU from Colombia by value, they increased from 365,000 USD in 2012 to 2,17 million USD in 2022 while the peak (2,85 million USD) was in 2021 (TradeEconomics, 2024). Fertiliser imports into Colombia from the EU reached ~234,645 USD in 2022 (WITS, 2024).

Bearing in mind that RUSTICA aspires to build sustainable and circular regional value chains on fertiliser production in the EU and in Colombia, the terms of fertiliser export and import may become relevant for e.g., establishing business models and achieving a maximum impact.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

2. RUSTICA value chains - from feedstocks to blends

Starting from side streams and leftovers of the agri-food chain, the feedstocks of the circular bio-based value chains of the RUSTICA project are analysed with regard to their legal positions and implications.

2.1 Feedstock - decisive from the beginning

Depending not only on local availability but also on the targeted technology, RUSTICA tested a wide range of substrates derived from agriculture, food processing, and -distribution. Examples of the selected feedstocks are given in **Table 2:**

Table 2 - Examples of RUSTICA substrates

RUSTICA Technology and Examples of Substrates		
Carboxylic Acid Platform	**Insect Cultivation**	**Biochar**
25 different substrates, such as leek waste, grape pomace, gross market waste, vinasse	16 different substrates from agriculture (e.g., vegetable waste from greenhouses), CAP presscake	11 different substrates, such as coconut shells, pruning from grapes, olives, eggplant stems/leaves

Source: RUSTICA research of DRANCO, ENTOMO and TNO (Deman, 2024) (Kuiper, 2024)

From the legal perspective, it is pivotal if the substrate meets the definitions of a **waste** or those of a **by-product**. Moreover, the terms "**animal by-product**" and "**biomass**" will be debated in the context of input materials for the new RUSTICA blends.

2.1.1. Waste

Various definitions on waste exist worldwide of which a few are mentioned in this Deliverable D3.13. According to the aforementioned Basel Convention: ""*Wastes" are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law" (UNEP, 1992).* The Organisation for Economic Cooperation and Development (OECD) defines waste in a more recent publication on waste management being not a primary product and includes information on its generation from raw material to consumption, as well as reused and recycled residuals[33] (OECD, 2019).

Since RUSTICA research on valorisation of agri-food waste takes place in five regions situated in the EU and in Colombia, waste definitions in these areas are of particular interest. In the EU, the definition itself does not refer, e.g., to waste generation or valorisation and is laid down in the Waste Framework Directive (WFD) (2008/98/EC). In Colombia, definitions published by Environmental Information System for Colombia (Sistema de Información Ambiental para Colombia, SIAC) (SIAC, 2024) for the Ministry of Environment and Sustainable Development of Colombia (Ministerio de Ambiente y Desarrollo Sostenible de Colombia) gives much more details on the origin and further use. Both are reflected in **Table 3.**

[33] *"Waste refers to materials that are not prime products (i.e. products produced for the market) and for which the generator has no further use for his/her own purpose of production, transformation or consumption, and which he/she discards, intends to discard or is required to discard. Wastes may be generated during the extraction of raw materials during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. Waste does not include residuals directly recycled or reused at the place of generation (i.e. establishment) or waste materials that are directly discharged into ambient water or air."* (OECD, Definition of Waste)

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Table 3 - Definitions of waste in the EU and in Colombia

Region or country	Definition
EU	*'waste' means any substance or object which the holder discards or intends or is required to discard;*
Colombia	In the Colombian context, the terms "waste" and "waste" have been defined in different ways. According to Decree 4741 of 2005, a solid waste or waste is any object, material, substance, element or product that is in a solid or semi-solid state, or is a liquid or gas contained in containers or tanks, whose generator discards, rejects or delivers it because its properties do not allow it to be used again in the activity that generated it or because the legislation or regulations in force so stipulate. On the other hand, Decree 2981 of 2013, and in the context of the provision of the public sanitation service, defines solid waste as any object, material, substance or mainly solid element resulting from the consumption or use of a good in domestic, industrial, commercial, institutional or service activities, which the generator presents for collection by the public sanitation service provider. Solid waste is also considered to be waste from sweeping and cleaning of public areas and roads, grass cutting and tree pruning. Solid waste that does not have hazardous characteristics is divided into usable and non-usable. Translated with DeepL.com (free version)[34]

Source: EU WFD (2008/98/EC) (Art. 3) and SIAC (Sistema de Información Ambiental para Colombia) (SIAC, 2024)

Biodegradable waste

As already mentioned, RUSTICA involves a broad spectrum of substrates derived from different stages of the agri-food supply chain. Therefore, additional and more specific, waste types defined in EU legislation are briefly elucidated in this report in the context of this fact. **Biodegradable waste** which includes food waste and is defined in the Directive on Landfill (1999/31/EC)[35] shall be reduced to 35% in landfill[36] [37] (RUSTICA, 2021). As it is evaluated by the European Commission, 50% of the EU countries reached this target already in 2015 (COM(2018)656). RUSTICA conversion of waste into fertilising products offers new avenues for **biodegradable waste** and, as such, it is fully in line with the objective of the Directive (1999/31/EC) and its amendments ((EU)2018/850).

[34] Residuos - En el contexto colombiano se han utilizado diversas formas para definir los términos ¿residuo¿ y ¿desecho¿. De acuerdo al Decreto 4741 de 2005 un Residuo sólido o desecho es cualquier objeto, material, sustancia, elemento o producto que se encuentre en estado sólido o semisólido, o es un líquido o gas contenido en recipientes o depósitos, cuyo generador descarta, rechaza o entrega porque sus propiedades no permiten usarlo nuevamente en la actividad que lo generó o porque la legislación o la normatividad vigente así lo estipula.
Por otra parte, el decreto 2981 de 2013, y en el contexto de la prestación del servicio público de aseo, define a los residuos sólidos como cualquier objeto, material, sustancia o elemento principalmente sólido resultante del consumo o uso de un bien en actividades domésticas, industriales, comerciales, institucionales o de servicios, que el generador presenta para su recolección por parte de la persona prestadora del servicio público de aseo. Igualmente, se considera como residuo sólido, aquel proveniente del barrido y limpieza de áreas y vías públicas, corte de césped y poda de árboles. Los residuos sólidos que no tienen características de peligrosidad se dividen en aprovechables y no aprovechables. (Definition of waste by SIAC in Colombia – Original in Spanish language)

[35] '*biodegradable waste*' means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard; (1999/31/EC)

[36] depending on the amount in 1995 or the reference year

[37] The amendment (EU)2018/850 establishes a new reduction target for municipal waste (10%) in landfill by 2035 which will be reviewed by the European Commission at the end of 2024.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Biowaste

With regard to RUSTICA feedstock encompassing waste from food processing and distribution **(Table 2)**, **biowaste** as it is defined[38] in the amendment ((EU)2018/851) of the WFD (2008/98/EC) (RUSTICA, 2021) is subject to this Deliverable D3.13. Hitherto, composting and anaerobic digestion are reported as the main treatment options for **biowaste** in EU countries. However, capacities for these treatments lag behind (e.g., Belgium, Spain) and do not reach 100% in all of the EU countries. In addition, **biowaste** is requested "*as a source of higher value products in line with the principle of the circular economy*" (EEA, 2020) which is envisaged by treatments under research in the RUSTICA project.

Municipal waste

Municipal waste, as it is defined in the amendment ((EU)2018/851) as well, excludes certain types of waste **(Table 4)**, but it is of relevance for RUSTICA because e.g., **biowaste** from food trade and retailers (e.g., gross market waste - **Table 2**) either separately collected or not can be part of **municipal waste**.

Table 4 - Scope of municipal waste definition in the EU

Municipal Waste (EU 2018/851) includes	Municipal waste (EU2018/851) excludes
a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics**, bio-waste**, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture; b) mixed waste and **separately collected waste from other sources**, where such waste is **similar in nature and composition to waste from households**;	waste from **production, agriculture**, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste;

Source: Amendment, Art. 1 ((EU)2018/851) to the WFD

RUSTICA and its proposed solutions for organic waste from the agri-food sector are fully in accordance with re-use and recycling targets of **municipal waste** (e.g., at least 65% in 2025) and stipulated benefits to agriculture (Art. 11a) ((EU)2018/851).

Food waste

Following estimations, around one third (1.05 billion tonnes) of global food is wasted while food available to consumer at retail, food service and household level counted for about 19% in 2022 (UNEP, 2024d). In this respect, legal framework on **food waste** needs to be highlighted in the course of this D3.13 report. **Food waste** is defined in the amendment of the WFD ((EU)2018/851)[39], and the Sustainable Development Goal (SDG) 12.3 requiring that **food waste** is reduced by 50% by 2030[40] is laid down, too. In 2019, Decision EU 2019/1597 introduced rules on measurement of food waste ((EU)2019/1597). In contrast to the aforementioned specific terms on waste, **food waste** covers the primary sector and non-edible parts of food as well but excludes agricultural material as determined in Art. 2(2)(e) of the WFD (2008/98/EC) (RUSTICA, 2021).

[38] 'bio-waste' means biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants; (EU 2018/851)
[39] 'food waste' means all food as defined in Article 2 of Regulation (EC) No 178/2002 of the European Parliament and of the Council that has become waste; (EU 2018/851)
[40] per capita at the distribution and consumption level

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

As it is revealed by **the Proposal for a Directive amending Directive 2008/98/EC** featuring measures on textile- and **food waste**, the latter amounted to 5.5 million tonnes in the EU in 2020 (COM(2023)420). Concerning **food waste**, the proposed amendment advocates for **food waste** reduction targets based on the reference year 2020. In particular, the document calls for food waste prevention, and the following food waste reduction targets shall be reached by Member States at the national level by 2030 (COM(2023)420) **(Table 5)**:

Table 5 - Food waste reduction targets by proposed WFD amendment

Area in the food chain	Proposed Food Waste Reduction Targets (COM(2023)420)
Processing and manufacturing	Reduction of the generation of food waste by **10 %** in comparison to the amount generated in 2020;
per capita, jointly in retail and other distribution of food, in restaurants and food services and in households	Reduction of the generation of food waste by **30 %** in comparison to the amount generated in 2020.

Source: Proposal for a Directive amending Directive 2008/98/EC (COM(2023)420)

Prevention of **food waste** is at the forefront of the proposal in the ongoing lawmaking procedure, and among others, *"raise awareness about food waste prevention;"* and *"identifying and addressing inefficiencies in the functioning of the food supply chain and support cooperation amongst all actors",* are described (COM(2023)420). The RUSTICA project encompasses food waste valorisation at various stages of the supply chain helping to strengthen awareness on preventing food waste but at the same time to deliver solutions for unavoidable residues and leftovers.

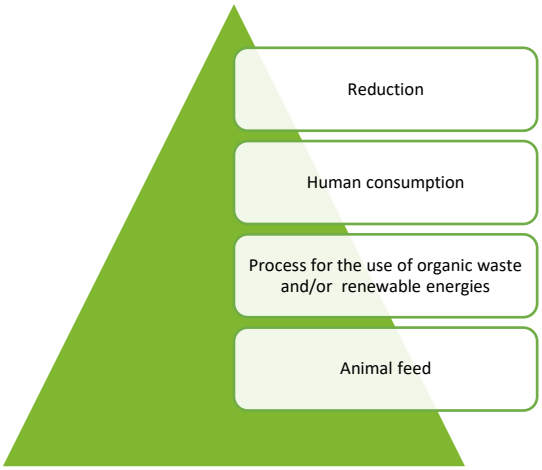

Figure 3 - Priority on actions against food losses and wastage in Colombia[41]

Source: Own depiction based on Gaceta del Congreso Republica de Colombia, Legislative Project No. 169 of 2016 (ProyectodeLeyNumero269, 2016)

In Colombia, a legislative project[42] (PROYECTO DE LEY NÚMERO 169 DE 2016 SENADO) on **food waste** acknowledges such waste for the use in processes and/or renewable energy (ProyectodeLeyNumero269, 2016). These developments in Colombian law on the use of waste in manifold directions are of specific interest for

[41] Original in Spanish language: a. Reducción. b. Consumo humano. c. Procesos de aprovechamiento de residuos orgánicos y/o energías renovables. d. Alimentación animal

[42] Ley antidesperdicios contra el hambre en Colombia (Anti-waste law against hunger in Colombia)

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

RUSTICA and its exploitation. In Art. 4, the legislative project contains a priority[43] on the use of food waste **(Figure 3).**

Four sectors are taken into account in Art. 2 of the legislative project in Colombia: agriculture, food manufacturing, food service and food consumption. With exception of food consumption, RUSTICA addresses these sectors, too. Unlike the EU WFD (2008/98/EC), the legislative project in Colombia refers to organic waste and prioritises its use in processes and energy (ProyectodeLeyNumero269, 2016).

RUSTICA focuses on regional circular value chains rather than international transport of feedstocks between regions within the EU and beyond. However, in case of transboundary movement, e.g., the EU Regulation on shipment of waste ((EU)2024/1157)[44], the OECD Decision (OECD, 2001) and the Basel Convention (UNEP, 1992) come into play (RUSTICA, 2021). **(Please view also section 1.1.)**

End-of-Waste

As previously mentioned in this D3.13 report, the definition of *waste* in the EU emphasises "discarding" (2008/98/EC) and does not include a specific indication on processes to transform it into a resource. Thus, to find a route for waste to be converted, e.g., into a product or material, **end-of-waste** (EoW) needs to be defined and achieved. General requirements for substances and objects are laid down in the WFD (2008/98/EC) (Art. 6) and its amendment and can be summarised as follows **(Figure 4):**

Figure 4 - General end-of-waste-criteria in the EU WFD

Source: Own depiction based on EU WFD (2008/98/EC) and amendment ((EU)2018/851)

At EU-level, **EoW** criteria are established for iron-, copper-, aluminum scrap and glass cullet (Johansson & Forsgren, 2020; Ragossnig & Schneider, 2019) (EC, 2021a). If no **EoW** criteria are available at EU or national level, they need to be determined "on a case-by-case" basis ((EU)2018/851).

EoW criteria for compost and digestate are elaborated by the Joint Research Centre (JRC) (Saveyn & Eder, 2014) (RUSTICA, 2021) of the European Commission, but at time of writing, these criteria are still not incorporated into EU legal sources with binding character. On the other hand, it needs to be stressed that the EU Fertilising Product Regulation (FPR) unveils **"end-of-waste"**[45] for fertilising products which have been achieved the CE-marked status by means of the Regulation ((EU)2019/1009). (Please view also **section 2.3.1.)**

A lack of **EoW** criteria for waste standardized at EU level affected also RUSTICA research. As it was pointed out in the project, waste-based output from the carboxylic acid platform needs specific authorization by the local authorities Openbare Vlaamse Afvalstoffenmaatschappij (OVAM) in Flanders in order to be transported and permitted for further use in RUSTICA field trials. Since the rules cover also sending and use of samples of fertiliser blends derived from waste e.g., in the Netherlands, more flexibility and harmonized rules in general and in particular for research purposes would be helpful to boost concepts of circular bio-based fertilisers as they are developed in RUSTICA (Deman, 2025) (Kuiper, 2025).

[43] In the EU, the general waste hierarchy is laid down in Art. 4 of the EU WFD and applies to food waste as well. (Please view also RUSTICA D3.2 (RUSTICA, 2021)).

[44] EU (2024/1157 repeals Regulation (EU)No 1013/2006.

[45] (EU) 2019/1009, Art. 19: "*This Regulation lays down criteria in accordance with which material that constitutes waste, as defined in Directive 2008/98/EC, can cease to be waste, if it is contained in a compliant EU fertilising product. In such cases, the recovery operation under this Regulation shall be performed before the material ceases to be waste, and the material shall be considered to comply with the conditions laid down in Article 6 of that Directive and therefore to have ceased to be waste from the moment that the EU declaration of conformity was drawn up.*"

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

2.1.2. By-products - new legislation

If a substance or object is neither the primary aim of a production process nor a waste, measures should be undertaken by Member States to assure that such substances or objects meet the legal requirements of by-products. According to the EU WFD (2008/98/EC), the use of the **by-product** must be certain and directly without other processes than commonly practiced in industry. The by-product needs to be an "*integral part"* of the production process and its use has to be lawful. No drawbacks concerning environment and human health may be related to the **by-product** (2008/98/EC).

As extensively verified in D3.2, there are options in the manufacturing process of foods resulting output (e.g., sunflower and its seeds and vinasse from sugarbeet) to be considered as **by-products** in the EU provided that they are not contaminated with animal **by-products**. If all requirements are fulfilled, such **by-products** may fall under the feed legislation instead of legislation on waste (RUSTICA, 2021) (C/2018/2035). With view on rearing of insects in the EU, the issue of food versus **by-product** versus feed versus waste is critical for the RUSTICA project and is comprehensively assessed in scientific literature (Van Raamsdonk, Meijer, Gerrits, & Appel, 2023) (Rao, Bast, & de Boer, 2021) (Papageorgiou & Skendi, 2018). Furthermore, **by-products** as residuals for the purpose of insect feeding have been evaluated by the European Food Safety Authority (EFSA) in 2015 (EFSAScientificCommittee, 2015). **(Please view also section 2.2.1.4.)**

In terms of fertilising products, the new EU FPR determines rules for six substrates **(Figure 5)** in its Component Material Category (CMC) 6 (Annex II) FOOD INDUSTRY BY-PRODUCTS ((EU)2019/1009), and as such, they may be directly used for plant nutrition purposes. As regards RUSTICA, vinasse is not directly foreseen as a fertiliser but serves e.g., as an input material for the CAP to be further processed into a fertilising product. **(Please view also section 2.1.1.)**

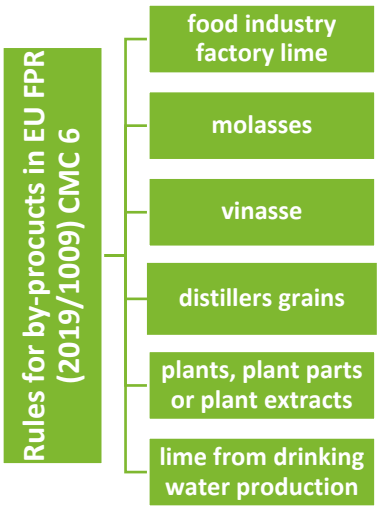

Figure 5 - Six substrates as by-products ruled in the EU FPR, Annex II, CMC 6

Source: Own depiction based on EU FPR ((EU)2019/1009)

Another reference to **by-products** is given in the amended EU FPR in Annex II, CMC 11 ((EU)2019/1009). The delegated act ((EU)2022/973) comprises two main categories of by-products in the context of the WFD (2008/98/EC):

1. "…*which provide nutrients to plants or mushrooms or improve their nutrition efficiency"*

2. "…*which are used as technical additives"* ((EU)2022/973)[46]

[46] RUSTICA does not focus on technical additives.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Since for the former 0.5% organic carbon (C_{org}) of the dry matter of the **by-product** at maximum is permitted ((EU)2022/973), these rules may hardly be applied to the agri-food chain derived feedstocks of RUSTICA. But they will be considered on their relevance in terms of the project output in **section 2.3.1.**

2.1.3. Animal by-products

Albeit the project does not primarily focus on **animal by-products**[47] as a feedstock for its processes, the subject is relevant with view on insect farming and its products insect biomass and frass as fundamental parts of the project and its research (RUSTICA, 2021). Thus, a more in-depth debate on **animal by-products** will take place in **sections 2.3.1.3. und 2.3.1.4.**

2.1.4. Biomass

Hitherto, the WFD excludes non-hazardous agricultural materials used for farming, forestry or renewable and environmentally friendly energy purposes (2008/98/EC). On the other hand, to the best knowledge of the author, the terms "**residue**" and "**biomass**" are not defined in the aforementioned legislation on waste (RUSTICA, 2021)[48], but definitions on these expressions can be found, e.g., in the *Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources*[49] ((EU)2018/2001) (RED II):

***'residue'** means a substance that is not the end product(s) that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it;* ((EU)2018/2001)

***'biomass'** means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin;* ((EU)2018/2001)

In its amendment (EU) 2023/2413 (RED III), the targets on guaranteed gross renewable energy consumption in the EU were uplifted from 32% to 42.5% by 2030 while the Member States shall take efforts to reach 45%. In addition, the transport sector needs to attain a share of 29% from renewable sources by 2030. The Directive clearly points out that the support schemes of EU countries ((EU)2023/2413) for "*biofuels, bioliquids and biomass fuels*" ((EU)2018/2001) (RUSTICA, 2021) shall be elaborated in a manner to "*avoid incentivising unsustainable pathways and distorting competition with the material sectors".* On the other hand, the amendment ((EU)2023/2413) presents conditions and targets for the use of feedstocks[50] in Annex IX ((EU)2018/2001) on their use in the transport sector ((EU)2023/2413). At present, the Annex IX amended by ((EU)2023/2413) includes e.g., grape marks and wine lees (Annex IX, Part A, (k)) ((EU)2018/2001), a feedstock which is also covered by research on fertiliser materials in RUSTICA.

2.1.5. Emissions

Reduction of **emissions** is at the forefront of the *Priorities* of European Commission and the Green Deal (COM(2019)640). As such, light is shed on legislative developments concerning GHG **emissions** in this Outlook D3.13. Moreover, with view on the complex technologies of the project, industrial emissions are incorporated into this work.

[47] Art. 3 (EC) No 1069/2009 (consolidated)
[48] Definitions on biomass could also **not** be found, e.g., in the novel FPR (EU)2019/1009 and REACH Regulation EC No 1907/2006.
[49] also called Renewable Energy Directive (RED)
[50] E.g., *"the combined share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX and of renewable fuels of non-biological origin in the energy supplied to the transport sector is at least 1 % in 2025 and 5,5 % in 2030, of which a share of at least 1 percentage point is from renewable fuels of non-biological origin in 2030.* (EU) 2023/2413 (Art. 25, 1. (b))

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

GHG Emissions

As already outlined in RUSTICA D3.2, the *"EU Climate Law"* ((EU)2021/1119) sets a reduction target for net **GHG** emissions of **55%** by 2030 in comparison to 1990 (RUSTICA, 2021) aimed at supporting the achievement of EU climate neutrality in 2050 ((EU)2021/1119). This legal act amends inter alia the Regulation (EU)2018/1999 on the Governance of the Energy Union and Climate Action which prescribes e.g., decarbonization objectives ((EU)2018/1999) (RUSTICA, 2021) related to the "Effort-Sharing-Regulation - ESR" (EU)2018/842 (as regards **GHG** emissions) and to Regulation (EU)2018/841 on landuse, landuse change and forestry, also called "LULUCF" (as regards **GHG** removals). **(Please view also section 3.5.)**

In 2023, the ESR encompassing the sectors domestic transports (without aviation), small industries, buildings, agriculture and waste (e.g., solid waste disposal)[51] was amended and an EU-wide legally binding reduction target of 40%[52] by 2030 below the level of **GHG** emissions in 2005 was set by (EU) 2023/857. The EU countries are committed to enhance their existing reduction targets[53] (reflected in Table 8 of RUSTICA D3.2) in the period from 2021 to 2030. The amendment ((EU)2023/857) requires the following **GHG** reduction targets for Member States where the RUSTICA testcases in the EU are located and reveals further options and constraints relating thereto **(Table 6)**:

Table 6 - New GHG reduction targets for the ESR sectors for RUSTICA EU testcase locations countries

EU Country	Targeted GHG Reduction by 2030 relating to 2005 (EU)2018/842	New Targeting GHG Reduction by 2030 relating to 2005 (EU)2023/857
Belgium	-35%	-47%
France	-37%	-47.5%
Italy	-33%	-43.7%
Spain	-26%	-37.7%

Source: European Commission (EC, 2023c); ((EU)2023/857)

To ensure fairness, the new Regulation ((EU)2023/857) differentiates targets along the economic capacities, e.g., by means of the Gross Domestic Product (GDP) per capita of each Member State, and adjustments were made in terms of expenditures for achievement of targets. In addition, limits for emissions per year are set and a trajectory system is introduced while the increase of the reduction limit for an EU country is 12% at maximum (EC, 2023c). The annual emission allocations for each Member State are legally defined by law (EC, 2023c).

RUSTICA deals with innovative alternatives to waste disposal pursuing to decrease GHG emissions and environmental burden.

[51] But in general: not the emission trading system (ETS)
[52] From formerly 30%
[53] Laid down in (EU) 2020/2126

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Industrial Emissions

Apart from legislation on GHG, **industrial emissions**[54] [55] are governed by a comprehensive legal framework while Directive 2010/75/EU[56] is at the core of this subject in the EU (2010/75/EU). The legal stipulations are discussed in detail in RUSTICA D3.2, especially those addressing incineration, pyrolysis, gasification in the context of waste management, chemicals industry and energy production (RUSTICA, 2021). To implement the aforementioned Directive, a range of legal sources on Best Available Techniques (BAT) Conclusions[57], and documents as Best Available Techniques Reference Documents (BREFs) are published. **BREF and BATC on *Waste Treatment*** including composting technologies and those on ***Waste Incineration*** as involving pyrolysis and gasification come particularly into play if the RUSTICA feedstock "waste" will be valorised at large scale in such facilities (EC, 2024h). Recently, the Directive 2010/75/EC was amended by Directive (EU) 2024/1785 on a better contribution to the European Green Deal and includes e.g., cattle farming ((EU)2024/1785).

2.2. Itineraries - from processing to basic products (building blocks)

In this section, the legal environment[58] will be explained along the avenues of converting RUSTICA feedstocks into products for nourishment of plants and supporting soils.

2.2.1. Main technologies

RUSTICA inputs are valorised by six main technologies: carboxylic acid platform (CAP), microbial cultivation, electrodialysis, insect breeding, pyrolysis and composting to accomplish microbial biomass, NPK concentrate, insect biomass, -frass, biochar and compost which represent the RUSTICA basic products to serve as a building block for blends, respectively **(Figure 6)** (RUSTICA, 2021)

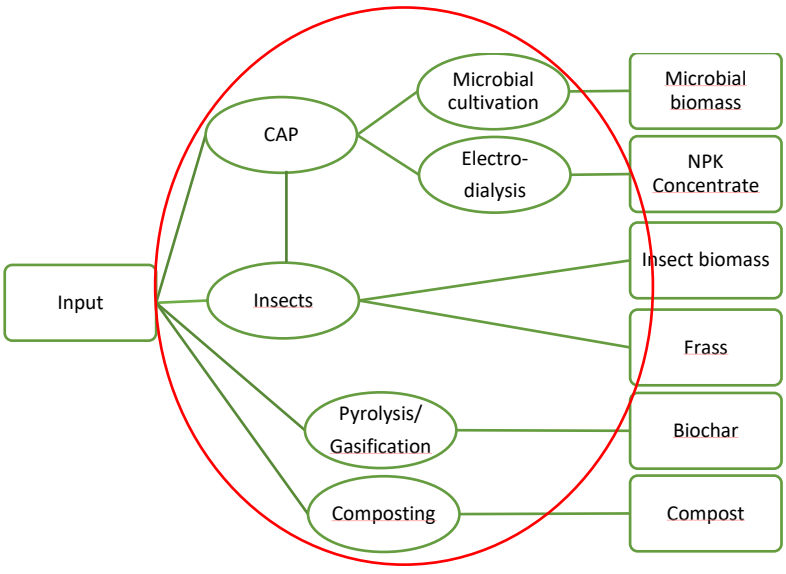

Figure 6 - RUSTICA - main valorisation technologies

Source: RUSTICA GA (modified)

[54] Including those generated by use of biomass for energy purposes, while **biomass** is defined in 2010/75/EC (Art. 3(31)(a)): products consisting of any vegetable matter from agriculture or forestry which can be used as a fuel for the purpose of recovering its energy content; Art. 3(31)(b) reveals definitions on waste including but not limited to waste from agriculture and food processing.
[55] List of polluting substances (Annex II) includes e.g., sulfur oxide, nitrogen oxides, dust.
[56] In its Annex II, the Directive 2010/76/EU lists 13 polluters each for air and water.
[57] Best Available Techniques Conclusions (BATC)
[58] Focusing on EU legislation

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

2.2.1.1. Carboxylic acid platform (CAP)

*"**CAP** is an anaerobic fermentation technology combined with dewatering technology, aiming at converting organic (side)streams into a carboxylic acid rich solution. The Carboxylic Acid (CA) spectrum varies depending on the input material and the process parameters, but ranges between C2 and C8. The solid fraction can be used for biogas production* (Deman, 2024)."

In RUSTICA, the **CAP** technology serves for valorisation of leftovers and side streams. Several feedstocks (e.g., waste and by-products) are debated in RUSTICA D3.2. The output comprising e.g., carboxylic acids and nutrients is delivered as a precursor to either production of microbial biomass or nutrient concentrate by means of electrodialysis towards supply of plants and maintaining healthy soils. Aside from constituting an input for the RUSTICA building blocks mentioned before, the **CAP** output was also tested for animal feeding. In addition, if integrated into a biogas plant, the **CAP** is legally affected by law determining such plants (RUSTICA, 2021).

To the best knowledge of the author, the **CAP** technology is not legally defined at the moment. Nevertheless, depending on the feedstocks, its use in context of various destinations is extensively discussed in RUSTICA D3.2 (RUSTICA, 2021). But, undoubtedly, if the **CAP** is deployed for certain purposes, the corresponding legal frameworks need to be considered. An excerpt is given in **Table 7**.

Table 7 - CAP purposes and examples of relevant law

CAP Purpose	Examples of relevant EU Legislation
Waste treatment and valorisation	WFD (2008/98/EC) and amendments
Production of chemicals	REACH (EC No 1907/2006) and amendments
Production of fertilisers (and precursors)	FPR ((EU) 2019/1009) and amendments
Production of feed (and additives)	"Feed marketing regulation" (EC) No 767/2009)[59] and amendments
Element of a biogas plant	RED III (EU)2018/2001 and (EU) 2024/2013

Source: Own depiction based on provisions of EU legislation and RUSTICA (RUSTICA, 2021)

Concerning **emissions**, legal requirements on **CAP** could not yet be identified. However, in terms of industrial emissions, e.g., production of biodegradable polymers (PHA) by converting organic waste is already captured by EU law ((EU)2018/1147).

2.2.1.2. Microbial cultivation

Multifarious cultivations and uses of **microorganisms** for direct or indirect plant nutrition and support, as well as soil effects are unfolded in literature (Sakarika et al., 2020). Among the most prominent examples are biostimulants ((EU)2019/1009)[60], living **microorganisms** (Stamenković, Beškoski, Karabegović, Lazić, & Nikolić, 2018)[61] indirectly affecting nutrient availability and **dried microbial biomass** to be delivered as a "direct fertiliser" to a plant (Spanoghe et al., 2020) (RUSTICA, 2021).

[59] Regulation on placing on the market and use of feed

[60] Legally defined in the FPR (EU) 2019/1009 by amending Regulation (EC) No 1107/2009: "plant biostimulant' means a product stimulating plant nutrition processes independently of the product's nutrient content with the sole aim of improving one or more of the following characteristics of the plant or the plant rhizosphere: (a) nutrient use efficiency; (b) tolerance to abiotic stress;(c) quality traits; (d) availability of confined nutrients in soil or rhizosphere." ((EU)2019/1009) (No1107/2009))

[61] Literature refers also to "microbial fertilizer" and "biofertilizer"

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

In the RUSTICA project, **microorganisms** convert the nutrient-rich effluent of the CAP into a *'protein-rich **microbial biomass**'* or *'microbial protein'* acting as a direct slow-release fertiliser. The **microbial biomass** is generated by a fermentation process (AVECOM, 2024a), and as it is pointed out in literature, depending on the quality of input, there are conversion rates far beyond of 90% (Spanoghe et al., 2020) (RUSTICA, 2021).

From the legal perspective, it needs to be stressed that the REACH Regulation includes **fermentation processes** and parameters to identify a substance are established in Annex VI, section 2 of the amended REACH Regulation ((EC)No1907/2006) and by CLP Regulation ((EC)No1272/2008). The parameters for each substance mentioned in REACH, Annex VI (version at 29.06.2024) can be summarised as follows **(Table 8).**

Table 8 - Identification of a substance (main parameters)

Main Parameters of substance identification	REACH Regulation (amended)
Name and any other identifier (e.g., IUPAC)	(Annex VI, section 2.1)
Molecular and structural formula or crystal structure	(Annex VI, section 2.2)
Composition (chemical)	(Annex VI, section 2.3)

Source: REACH Regulation (amended) ((EC)No1907/2006) ((EU)2022/477) ((EU)2018/1881)

According to the *Guidance for identification and naming of substances under REACH and CLP* published by ECHA: *"well-defined substances*" are appropriately identified by means of (Annex VI, section 2) while, on the other hand "*UVCB substances" (Substances of Unknown or Variable composition), complex reaction products or Biological materials* lack sufficient identification by the aforementioned criteria (ECHA, 2023).

Biological materials comprise fermentation products[62]. Following the Guidance of ECHA, products of fermentation may belong to **UVCB sub-type 1, where the source is biological and the process is a synthesis** (ECHA, 2023) (AVECOM, 2024b)**.** After purification, **"***substances may become identifiable"* concerning their chemical composition and then no longer fall into the category of UVCB (ECHA, 2023).

2.2.1.3. Electrodialysis

Another method to gain nutrients from the CAP solution in RUSTICA is **electrodialysis,** a technology already known since the first half of the 20th century. Desalination by means of disengaging ions is a very prominent use, and an increase of capacities up to commercial degree is reported from the 1950's to 1970's (LFLL Bazinet, Lamarche, & Ippersiel, 1998) (Wang, Zheng, Wang, Wang, & Wang, 2016) (Laurent Bazinet & Geoffroy, 2020) (RUSTICA, 2021).

In terms of RUSTICA, leftovers from food at different points of origin and various compositions are subject to the CAP leading to an output containing volatile fatty acids, nutrients, and other components[63] (RUSTICA, 2024). Subsequently, further treatment needs to take place (Kotoka, Gutierrez, Verliefde, & Cornelissen, 2024).

According to literature, several processes are considered for separating acids and nutrients, "*such as chemical precipitation, adsorption or ion exchange, membrane filtration (e.g., reverse osmosis and nanofiltration), chemical extraction, and membrane distillation have been applied to recover either nutrients or VFAs from various streams"*. However, **electrodialysis** presents properties, e.g., lower energy consumption, less quantities of chemical additives for post-treatment, no remarkable pretreatments and adsorbent surface blocking, and is as such superior to the aforementioned treatments. However, electrodialysis needs additional technology

[62] Includes also vinasse as a fermentation product of sugar fermentation.
[63] inorganic ions, alcohols, carbohydrates, and proteins (Kotoka et al., 2024)

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

(membrane contractor) to enable selective separation of nutrients from dissociative volatile fatty acids (Kotoka et al., 2024).

The legal positions of ionic mixtures and duties under the REACH legislation ((EC)No1907/2006) are widely described by ECHA (ECHA, 2012) and included in detail in the RUSTICA D3.2 report (RUSTICA, 2021). One criterion -among others- for an exemption[64] in the meaning of Annex V ((EC)No1907/2006) would be that no salts are isolated from a solution (ECHA, 2012 which will not be feasible for producing nutrient concentrates for plants by the technology (ECHA, 2012).

2.2.1.4. Insect farming and cultivation

In the EU, precise legal rules are established on the categorisation of insects for farming purposes ((EU)2017/893)[65] and a definition of ***"farmed animals"*** ((EC)No1069/2009)[66] applies. In RUSTICA, various insect species are under use for research on generating insect biomass and frass for fertiliser purposes (RUSTICA, 2021).

Table 9 - Examples of important legal sources affecting farmed insect feeding in the EU

Legal source	Main area	Examples of authorisations and restrictions
EC No 767/2009	Marketing and use of feed	It prescribes the use of safe feed and prohibits feeding of faeces and solid urban waste.
EC No 999/2001	Prevention, control and eradication of certain transmissible spongiform encephalopathies	It enables feeding of rendered fats but sets restrictions on the feeding of processed proteins from farmed insects.
EC No 68/2013	Catalogue of feed materials	It does not mean that a feed material listed in the catalogue may be automatically fed to farmed insects.
EC No 1069/2009	Animal by-products	It refers to former foodstuff containing products of animal origin.
EU No 142/2011	Animal by-products (implementing regulation)	It prohibits a range of products for insect feeding purposes, e.g., catering meals containing meat or fish.
2002/32/EC	Undesirable substances in feed	It lays down restrictions and maximum amounts of pesticides and other undesirable contents in feed.
EC No 1831/2003	EU Register on Feed Additives	It provides general rules for feed additives, no specific restrictions for insects are available at the moment.

Source: Own depiction based on (IPIFF, 2024a), (EUROGROUP, 2024), (Sogari et al., 2023), (Pinotti, Giromini, Ottoboni, Tretola, & Marchis, 2019)

[64] In the context of registration

[65] *""Farmed insects" means farmed animals, as defined in Article 3(6)(a) of Regulation (EC) No 1069/2009, of those insect species which are authorised for the production of processed animal protein in accordance with point 2 of Part A of Section 1 of Chapter II of Annex X to Regulation (EU) No 142/2011.""*

[66] The definition of farmed animals: *"…any animal that is kept, fattened or bred by humans and used for the production of food, wool, fur, feathers, hides and skins or any other product obtained from animals or for other farming purposes"* is laid down in the EC No 1069/2009.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Regardless of their final destination or utilisation, the *IPIFF*[67] *Guide on Good Hygiene Practices for European Union (EU) producers of insects for food and feed* confirms: *"Insects reared within the European Union fall within the category of '**farmed animals**" … "no matter the destination of the insect derived products, including if those are intended e.g., as feed for pet food, fur animal or for technical uses (e.g. biofuel production, cosmetic, biochemistry)..."* (IPIFF, 2024a).

Consequently, diets of **farmed insects** fall under the EU legislation governing rearing[68] of **farmed animals** (IPIFF, 2024a). As such, substrates delivered to the insect species have to meet quality requirements of feed and may not fall under the general definition of waste in the WFD (2008/98/EC).

The subject "feeding of farmed **insects** in the EU" is extensively depicted in scientific (Sogari et al., 2023) (Pinotti et al., 2019) (Rowe, 2020) and grey literature (EUROGROUP, 2024), as well as in RUSTICA D3.2 (RUSTICA, 2021). Hence, examples of important legal sources[69] affecting the use of feed for farmed insects in the EU are displayed in **Table 9.**

Aside from strict principles for feeding **insects** ensured by legal provisions, which include also medicated feed ((EU)2019/4), veterinary medicinal materials ((EU)2019/6) are covered by legislation in the EU. The amended Regulation on transmissible animal diseases ((EU)2016/429) applies to **insect farms**, too. Furthermore, EU law on invasive species ((EU)No1143/2014) ((EU)2016/1141) needs to be contemplated if one is active in cultivating **insects.** Conversely, the sector still lacks legally binding rules on animal welfare as designed in the dedicated Directive (98/58/EC) (EUROGROUP, 2024) (IPIFF, 2024c)

In RUSTICA, **insect** breeding occurs for plant nutrition purposes. Additional legislation is imposed if entomophagy is addressed (Pinotti et al., 2019). As described in literature, legal conditions for rearing **insects** vary considerably between the countries within and those outside the EU (Rowe, 2020). Moreover, it needs to be emphasised that in case of imports of **insect** material into the EU specific law is set (e.g., in the Animal by-products Regulation ((EU)No142/2011) and its amendments).

2.2.1.5. Pyrolysis and Gasification

In RUSTICA, biochar production takes place under both: pyrolysis (low and intermediate temperature (Mukherjee & Lal, 2013)) and gasification conditions following the Definition[70] and *Guidelines of European Biochar Certificate* (EBC), constituting a voluntary standard in Europe but a compulsory one in Switzerland (EBC, 2024a). The EBC includes a *Positive list* for feedstocks permitted to generate biochar. The new version of the list from 30th of June 2024 entails detailed provisions on the main categories (EBC, 2024b) as illustrated in **Table 10.**

Pertaining to the specific EBC standard, for example *EBC AgroOrganic,* the feedstocks depicted in the **Table 10** are subject to very detailed rules and restrictions (EBC, 2024b). In RUSTICA, the **biochar** production mainly relies on input materials from agriculture and food processing residues. In the report D3.2 specific legal conditions on resources and production in terms of industrial level are deliberated for **biochar** (RUSTICA, 2021) which is also designated as "charcoal" (Verheijen, Jeffery, Bastos, Van der Velde, & Diafas, 2010).

According to REACH ((EC)No1907/2006)[71] and ECHA Guidance on Annex V: *"Charcoal obtained by thermal decomposition of wood is not regarded as a substance which occurs in nature* (ECHA, 2012)". As published by the European Biochar Consortium Industry e.V. (EBI), registration for biochar under REACH took place under

[67] IPIFF means International Platform of Insects for Food and Feed.
[68] Rearing of insects belongs to the legal premises of primary sector. After killing them, it changes and Animal by-product law applies.
[69] and their amendments
[70] "Biochar is a porous, carbonaceous material that is produced by pyrolysis of plant biomasses and is applied in such a way that the contained carbon remains stored as a long-term C sink or replaces fossil carbon in industrial manufacturing. It is not made to be burnt for energy generation (EBC, 2024)."
[71] and its amendments

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

the “charcoal dossier” (EBI, 2020). At time of writing, searching in the ECHA SCIP database reveals 39 results for “charcoal” of which, for instance,

- *Charcoal - an amorphous form of carbon produced by partially burning or oxidizing wood or other organic matter (EC# 240-383-3)*
- *Charcoal, coconut shell (EC# 271-974-4)*

the related consumer uses include “fertilisers” (ECHA, 2024). Moreover, the amended REACH Regulation contains also information on other fractions resulting from pyrolysis processes, such as pyrolysis oils (EC)No1907/2006).

Table 10 - EBC - Main input origin categories and examples thereto

Input - Origin Category	Examples of feedstocks
Agriculture	Tree, vine and shrub pruning
Forestry and wood processing	Wood, wood residues from mechanical processing
Landscape management	Biomass from nature conservation
Recycling economy	Residues from industrial biomass processing
Kitchen and canteen waste	Kitchen, canteen and restaurant residues
Food processing residues on vegetable basis	Molasses residues
Water maintenance & vegetal marine biomass	Aquatic plants and algae
Textiles	Cellulose, cotton and plant fibers
Anaerobic Digestion	Plant-based digestate
Sludges from wastewater treatment	Sludge from municipal wastewater treatment ("biosolids")
Animal by-products	Manures

Source: EBC Positive list of permissible biomasses for the production of biochar (V10.3 20.06.2024) (EBC, 2024b)

2.2.1.6. Composting

In pursuing optimal results towards nourishment of plants and health of soils, the RUSTICA project includes also **compost** as a component for its products and blends under research. Thus, composting technologies, practices are of interest, and major regulatory aspects are concisely mentioned in this report D3.13.

The WFD (2008/98/EC) ((EU)2018/851) refers to **composting** at several times, particularly promoting it as an important instrument for biowaste recycling **(Please view also section 2.1.1.)**. The well-known aforementioned publication of the EC JRC (Saveyn & Eder, 2014) explains different composting categories and technologies:

- *“Open or closed composting*
- *With or without forced aeration*
- *different process techniques like windrow, container, box channel or tunnel composting (Saveyn & Eder, 2014)”*

At the EU level, certain exemptions from the obligation to register are laid down for compost in the amended REACH Regulation ((EC)No1907/2006) ((EU)2019/1691). Quality standards for **composting** (European Quality Assurance Scheme (ECN-QAS)) (ECN, 2024c) are developed by the European Compost Network (ECN) (ECN,

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

2024a). However, the schemes are voluntary, and in 2022, a share of 25% of the **compost** in EU-27, CH, NO and UK was certified according to ECN-QAS (ECN, 2024b).

Detailed legal provisions on **composting** can mainly be found at the national and regional scale in the EU. Therefore, insights to these positions were given about the RUSTICA testcase regions[72] in the report RUSTICA D3.6 (RUSTICA, 2022).

2.2.2. Emissions

Emissions are debated vibrantly at the global level, particularly with view on climate change (UNEP, 2023). RUSTICA research involves novel technologies, such as the CAP for generating a precursor for fertiliser production. At time of writing, less is known about the legal requirements on emissions for this process while those of renewable energy (biogas) production can be found e.g., in the RED ((EU)2018/2001) ((EU)2023/2413). As regards microbial cultivation and electrodialysis for fertiliser production, no legal stipulations on emissions directly imposed to these methods could be detected by the author at present. Emissions of the emerging insect farming sector are evaluated in literature and depend on various factors, such as feeding substrate, location of the farm and final destination of the insect (Oonincx et al., 2010) (Smetana, Spykman, & Heinz, 2021) (Paris et al., 2024). At the same time, IPCC highlighted the merits of biochar in terms of carbon storage, and it is pointed out that composting has certain advantages in terms of emissions against landfill (IPCC, 2024a) (IPCC, 2024b).

2.3. Basic products and blends - fertilising products in the EU and beyond

As previously mentioned in this D3.13, RUSTICA uses six basic products for building blocks to achieve ideal solutions for plants and soil by means of blends. Nonetheless, each single building block or precursor needs to be in compliance with legal frameworks while this section concentrates on

- harmonised rules enabled by the new EU FPR
- national and regional provisions in RUSTICA testcase in the EU[73] and in Colombia
- specific conditions of organic agriculture in the EU and worldwide.

2.3.1. EU FPR 2019/1009 and amendments (harmonised rules)

The new EU FPR 2019/1009 entered into force at 16th of July 2022 ((EU)2019/1009). In contrast to its predecessor (EC) No 2003/2003 mainly focusing on inorganic fertilisers ((EC)No2003/2003), the new Regulation comprises Product Function Categories (PFCs)[74] ruling e.g., organic and organo-mineral fertilisers and classifies materials into Component Material Categories (CMCs)[75] covering e.g., compost.

To be placed on the market as a CE-marked fertilising product by a manufacturer, a conformity assessment procedure permitted to the envisaged PFC and CMC needs to be passed ((EU)2019/1009) (RUSTICA, 2021).

By virtue of RUSTICA's activities, the EU FPR ((EU)2019/1009) is a crucial legal source paving the way via harmonised rules to the entire EU *single market*. Hence, light is shed in this study D3.13 on these legal premises relating to the building-blocks and blends of the project.

2.3.1.1. Compost

In its Annex II, the amended EU FPR ((EU)2019/1009) lists compost as a CMC 3 and determines the conditions and limitations for a CE-marked material enabled by this CMC. The Regulation explicitly opens the gate to

[72] in the EU and in Colombia
[73] With a focus on the RUSTICA test regions
[74] To date: 7 PFCs and subcategories thereto
[75] To date: 15 CMCs included in the amended EU FPR

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

compost for biowaste as defined by the WFD (2008/98/EC) separately collected at source whereas e.g., "*materials originating from mixed municipal waste," and "sewage sludge, industrial sludge or dredging sludge,…"* will not be accepted as a component material for this CMC 3. RUSTICA covers also the food distribution (retail) sector (e.g., gross market). That means, for example, if EU FPR CMC 3 is targeted: biowaste from the retail sector would need to be separately collected. In case, the biowaste originated from a mixed municipal waste collection, the aforementioned restrictions apply.

More recently, legal conditions were set for **compost** concerning "endpoints in the manufacturing chain" in the context of animal by-products and derived products[76] to be used for **compost** striving for a CE-label ((EU)2023/1605)). These conditions are of interest for RUSTICA and will be pondered here.

Specific equipment, such as one for monitoring temperature against time and hygiene measures are necessary for a **composting** plant processing Component Material 2[77] [78] and Component Material 3[79] as defined by the Regulation EC No 1069/2009 while both Component Material types have to be subject to a treatment by 70 degrees Celsius for a non-stop duration of one hour at minimum if supplied as a raw material to the plant. In addition, Component Material 3 may have a particle size of 12mm at maximum by entering the plant (EU No 142/2011, Annex V) ((EU)2023/1605)). **(Please view also sections 2.3.1.3. Insect biomass and 2.3.1.4. Insect frass.)**

Vibrant debates are triggered by the evolvements of novel legislation pertaining to plant nutrition in the course of harmonised rules in the EU. Various associations heavily discuss new legal designs on **compost**, especially if it comes to animal by-products, e.g.:

The European Sustainable Phosphorous Platform (ESPP) refers to animal-by products and sterilisation for **compost**: *"If ABPs (e.g. raw manure) are used as inputs for a compost/digestate process which achieves CMC3/5 criteria but does NOT achieve the ABP 'sterilisation' criteria (as specified in EU 2023/1605) then the output product (i.e. compost/digestate) cannot be 'post-sterilised' and then used in an EU fertilising product … because sterilisation is not a listed post-processing for compost/digestate under the FPR CMC3/5…"* (ESPP, 2024).

As regards compost, the ECN comments, for example, as follows: *"For all animal by-product input material, like catering waste, the EU Fertiliser Regulation recognises only the ABP transformation standard of 70° C for at least 1 hour at a maximum particle size 12 mm, which is not suitable for composting* (ECN, 2024d)*."*

Considering PFCs of the EU FPR, e.g., organic and organo-mineral fertilisers may be screened on suitability for compost of the project.

2.3.1.2. Biochar

The original version of the EU FPR ((EU)2019/1009) includes 11 CMCs. In the meantime, four CMCs **(Table 11)** were added by amendments of which *"CMC 14 Pyrolysis and Gasification Materials"* ((EU)2021/2088) addressing **biochar** is of particular relevance for the RUSTICA project.

Determining the input[80], the CMC 14 of the Regulation does not accept materials from mixed municipal waste and refuses sewage sludge but provides exceptions if treatments (e.g., composting) took place prior to the

[76] in accordance with the Animal by-product Regulations
[77] as defined in Art. 9 of Regulation (EC) No 1069/2009
[78] Rules of frass are aligned to those of "processed manure" [78] but its generic definition as a "manure" is not yet defined in EU law. But it must come from "*a plant for derived products for uses outside the feed chain or from a biogas or a composting plant* or from a plant for the manufacturing of organic fertilisers or soil improvement" (IPIFF, 2021).
[79] As defined in Art. 10 of Regulation (EC) No 1069/2009 and includes conditions for "terrestrial invertebrates".
[80] Certain options for vegetable waste, processing residues from renewable energy production, separately collected biowaste without animal by-products contents are listed.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

pyrolysis or gasification process. Furthermore, it is underlined that materials (Cat. 2[81] and Cat. 3[82] [83]) originally covered by the Animal by-product Regulation can be taken into account if the "*Endpoint of the Manufacturing chain*" is determined ((EU)2021/2088) in compliance with Art. 5(2) of the Regulation Animal by-product ((EC)No1069/2009). As it is pointed out by the European Sustainable Phosphorous Platform (ESPP), this applies just to raw manure and frass at the moment (ESPP, 2024). Other constraints are limits on pollutants and contaminants (e.g., 6 mg/kg dry matter of PAH_{16})[84] ((EU)2021/2088). As such, the stipulations of the EU FPR deviate from the EBC Standard (EBC, 2024b). **(Please view also section 2.2.1.5.)**

Table 11 - CMCs added by amendments to the EU FPR (EU)2019/1009 thus far (16.07.2024)

CMC	Designation	Legal source
12	PRECIPITATED PHOSPHATE SALTS AND DERIVATES[85]	((EU)2021/2086)
13	THERMAL OXIDATION MATERIALS OR DERIVATES[86]	((EU)2021/2087)
14	PYROLYSIS AND GASIFICATION MATERIALS	((EU)2021/2088)
15	RECOVERED HIGH PURITY MATERIALS[87]	((EU)2022/1171)

Source: Amended EU FPR (EU) 2019/1009 and legal sources as mentioned in this Table 11

To abide by the requirements of CMC 14 of the EU FPR, a temperature of at least 180° C for at least two seconds has to be reached in the reactor for the thermo-chemical process under oxygen-limited conditions towards the output "*pyrolysis and gasification materials*" ((EU)2021/2088).

As regards the amendment of the EU FPR, attention is drawn for manufacturers of CMC 14 materials ((EU)2021/2088) to the obligations under the amended REACH Regulation ((EC)No1907/2006) **(Please view also section 2.2.1.5.)** as laid down in CMC 1, point 2 ((EU)2019/1009) if it is intended to place **biochar** as a CE-marked fertilising product onto the market.

If it comes to selection of PFC for biochar, for example, PFC 3 Soil Improver ((EU)2019/1009) can be considered since literature attests excellent soil conditioner properties (Yadav et al., 2023) to biochar while PFC 3(A) Organic Soil Improver imposes limits on heavy metal content (e.g., Pb 120 mg/kg dry matter) ((EU)2019/1009).

Finally, it needs to be stressed that CE-marking for **biochar** also opens the avenue on enabling fulfillment of "end-of-waste criteria" if waste is the input ((EU)2019/1009).

2.3.1.3. Insect biomass

RUSTICA includes insect cultivation in order to achieve insect *biomass* and *frass* for fertiliser purposes. In this section, it is scrutinised how the former is reflected in the EU FPR ((EU)2019/1009) and legislation relating thereto. The term "***insect biomass***" could not be detected by the author in the sphere of legislation on animal by-products and fertilisers. However, as indicated before, "*terrestrial invertebrates*" are recognised in

[81] List of Category 2 Materials in Art. 9 (EC) No 1069/2009
[82] Material Category 3: *Art. 10 (l) aquatic and terrestrial invertebrates other than species pathogenic to humans or animals;*
[83] There are limits on the content defined in (EU 2023/1605) if used as a CE-marked fertiliser.
[84] Sum of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenzo[a,h]anthracene and benzo[ghi]perylene.
[85] addresses precipitated phosphate salts obtained through precipitation, e.g., from wastewater
[86] addresses thermal oxidation and thermochemical convention
[87] addresses *"recovered high purity material, which is ammonium salt, sulphate salt, phosphate salt, elemental sulphur, calcium carbonate or calcium oxide, or mixtures thereof..."*

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Regulation ((EC)No1069/2009). To be valorised as a "Fertilising Product" in accordance with the EU FPR ((EU)2019/1009), the *endpoint in the manufacturing chain* needs to be accomplished for a derived product ((EC)No1069/2009) ((EU)No142/2011) so that the rules governing animal by-products then do no more apply for this derived product or material.

Currently, the *Animal by-product Regulations* themselves do not include rules on the *"endpoint"* for **insect biomass**. But the delegated act ((EU)2023/1605) defines the treatments[88] in its *Art. 4 End point for certain organic fertilisers and soil improvers[89] conditional upon risk mitigation measures.* Provided that the **insect biomass** achieves the quality status of a *"Category 3 Material"* as defined in Art. 10 of the Animal by-product Regulation ((EC)No1069/2009), the stipulations on "*processed protein"* [90] (Art. 4, point 1.(c))[91] ((EU)2023/1605) or those for "hydrolysed protein" (Art. 4, point 1. (f))[92] ((EU)2023/1605) can be taken into account.

Table 12 - Summary of treatments for processed proteins from Category 3 Material in EU No 142/2011

Processing methods	Prescriptions for size and reduction of particles	Conditions (excerpt) in terms of temperature, duration and pressure
A. Processing method 1 (pressure sterilisation)	>50mm to <50mm	> 133° C for ≥20 min., 3 bar
B. Processing method 2	>150 mm to <150 mm	>100° C for ≥125 min. and >110° C for ≥120 min. and >120° C for ≥50 min.
C. Processing method 3	>30 mm to <30 mm	>100° C for ≥95 min. and >110° C for ≥55 min. and >120° C for ≥13 min.
D. Processing method 4	>30mm to <30 mm	ABP in a vessel with added fat: >100° C for ≥16 min. and >110° C for ≥13 min. and >120° C for ≥8 min and >130° C for ≥3 min.
E. Processing method 5	>20 mm to <20 mm	heating up coagulation "*and then pressed so that fat and water are removed from the proteinaceous material"* >80° C for ≥120 min. and >100° C for ≥60 min.
F. Processing method 6	Not applicable to RUSTICA products	
G. Processing method 7	*"Any processing method authorised by the competent authority where the following have been demonstrated by the operator to that authority*": e.g., identification of hazards and potential risks, capacity of the methods to reduce hazards, sampling of the final product to proof compliance with defined microbiological standards over 30 days.	

Source: Own depiction based on Animal by-products Regulation[93] (EU) No 142/2011, Annex IV, Chapter III.

[88] Production of such certain organic fertilisers and soil improvers may only take place in plants with a permission as laid down in the Animal by-product Regulation (EC No 1069/2009, Art. 24).
[89] There are different meanings of "organic fertiliser" and "soil improver" in the Animal by-product Regulation and in the EU FPR.
[90] Annex I (5.) of No 142/2011 (consolidated) (21.07.2024)
[91] "*processed animal protein of Category 3 materials which fulfils the specific requirements for processed animal protein set out in Chapter II, Section 1, point A, point B(1) and (2), point B(3)(a) and point C, of Annex X to Regulation (EU) No 142/2011;"*
[92] *"hydrolysed protein, including hydrolysed protein derived from residues coming from the leather or textile industry, which fulfils the specific requirements for hydrolysed protein set out in Chapter II, Section 5, point D, of Annex X to Regulation (EU) No 142/2011;"*
[93] Including its amendments

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

The derived products may reach 5% by volume at maximum if they are considered as "organic fertilisers or soil improvers" with an "*endpoint achieved*". Exceptions are made for the content of specific packages (e.g., 50 kg or one tonne) if merely the end-user is addressed (Art. 4, point 2.) ((EU)2023/1605).

Treatments for processed proteins can be summarised as depicted in the **Table 12**.

In addition, Art. 4 of Regulation ((EU)2023/1605) mentions **hydrolysed proteins** and describes the necessity to fulfill the legal imposition, notably in Annex X, Chapter II, section 5, point D, of the amended Regulation ((EU)No142/2011).

***"Hydrolysed protein** must be produced using a production process involving appropriate measures to minimise contamination.*" In addition, detailed requirements are revealed about hydrolysed proteins fully or partly derived from ruminants ((EU)No142/2011)). The Commission Expert Group on Fertilising Products indicates *"processes effectively used by manufacturers to minimise contamination:"* The list of processes comprises inter alia enzymatic hydrolysis, thermo-baric hydrolysis, heat treatment and hydrothermal hydrolysis (CIRCABC, 2024).

But even though the "endpoint" is defined by means of (EU)2023/1605): to be deployed as a "stand-alone product" in accordance with the EU FPR ((EU)2019/1009)), a "derived product" needs to be listed in Annex II, CMC 10 (EC, 2024i). At time of writing, only stipulations on "processed manure" are inserted into the dedicated Table in CMC 10 ((EU)2024/1682).

2.3.1.4. Insect frass

In 2021, insect **frass** has become legally defined in the EU by Regulation (EU)2021/1925 amending (EU) No 142/2011 as follows:

*"**frass**" means a mixture of excrements derived from farmed insects, the feeding substrate, parts of farmed insects, dead eggs and with a content of dead farmed insects of not more than 5 % in volume and not more than 3 % in weight"* ((EU)2021/1925) ((EU)No142/2011).

The Regulation (EU)2021/1925 also amends Annex XI of the Animal by-products Regulation EU No 142/2011 and requires inter alia for **frass**: *"a heat treatment process of at least 70° C for at least 60 minutes and they shall have been subjected to reduction in spore-forming bacteria and toxin formation, where they are identified as a relevant hazard"* ((EU)2021/1925) ((EU)No142/2011). *"Processed frass*" is reported by the Commmission Expert Group on Fertilising Products as well, and as it is emphasised, a new categorisation is foreseen by Article 9 of (EC)No 1069/2009 while these "by-products" belong to Category 2 Material and, thus, maybe not used for animal nutrition purposes (CIRCABC, 2024).

Regardless on the planned route to the markets in the EU - either harmonied or non-harmonised: the aforementioned rules apply to insect **frass**. More recently addressing the EU FPR, the delegated act (EU)2023/1605 refers to these treatments as well (Art. 3, d) if an endpoint needs to be defined for "organic fertilisers and soil improvers " ((EU)2023/1605). But at time of writing, "frass" is not inserted as a "standalone product" in CMC 10 of the EU FPR ((EU)2019/1009)).

2.3.1.5. NPK concentrate

The electrodialysis technology to separate contents of ionic mixtures (CAP solution) under use in the RUSTICA project leads to an **inorganic bio-based nutrient concentrate** available in a liquid form. Contingent to the substrate, the process has shown extremely high conversion rates of almost 100%. Considering the contents of nutrients in feedstocks, it is important that minimum contents of fertilising products as defined in legislation can be met.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Dealing with CMC of the new EU FPR, the first CMC in Annex II will catch one's eye if inorganic fertilisers shall be classified and aligned to such a category.

But looking at CMC 1: VIRGIN MATERIAL SUBSTANCES AND MIXTURES, the category does not encompass waste[94] as defined by the WFD (2008/98/EC). At the same time, substances or mixtures which have ceased to be waste under national measures transposing Art. 6 of the WFD either formed from a precursor[95] or not are excluded as well. Furthermore, CMC 1 does not cover animal by-products and derived products in the meaning of ((EC)No1069/2009). By-products[96] as defined by the WFD (2008/98/EC) even do not fall under CMC 1 ((EU)2019/1009). However, it could not be detected that CMC 1 completely refuses materials which are prepared from by-products (in the meaning of the WFD) serving as their precursors. Hence, the type of feedstock and the definition of the output (e.g., main product or by-product) will be decisive if CMC 1 will be verified on its suitability for RUSTICA **NPK concentrate** from electrodialysis.

In pursuing to find a PFC for **NPK concentrate**, e.g., PFC 1 including liquid inorganic fertilisers ((EU)2019/1009) can be examined on its provisions about nutrient contents and limits on pollutants.

2.3.1.6. Microbial biomass

As mentioned above, to exploit the full potential from the CAP solution for plant supply, RUSTICA promotes several valorisation routes. **Microbial protein** aimed to be deployed as a slow acting sustainable fertiliser directly supplying nutrients is one of these RUSTICA core basic products and building blocks (RUSTICA, 2021).

To date, the EU FPR incorporates micro-organisms which are subject to processing by drying or freeze-drying in CMC 7. The list comprises *Azotobacter* spp., *Mycorrhizal fungi, Rhizobium* spp. *and Azospirillum* spp. and these types are exclusively permitted to PFC 6(A): MICROBIAL PLANT BIOSTIMULANT at the moment ((EU)2019/1009).

In the preamble of the EU FPR, it is referred to micororganisms at several times, e.g., in Recitals 21, 22 and 59 while in the latter it is written down that the European Commission should get the permission to adopt Delegated Acts to design an exhaustive repository on microorganisms permitted for CE-marked fertilisers ((EU)2019/1009). To the best knowledge of the author, RUSTICA microbial protein, microbiota and processes relating thereto are not yet included in the scope of the EU FPR. Unlike the new EU FPR, regional/national rules are more favorable in this subject at the moment (AVECOM, 2024b). **(Please view also section 2.3.2.)**

If **microbial protein** will be further evaluated concerning an allocation to a PFC, organic fertilisers represented in PFC 1 would be of particular interest in the future (AVECOM, 2021).

2.3.1.7. Blends

Consequently, the RUSTICA research strives for combining the six basic products by means of building blocks to accomplish effective and sustainable supply to plants. These building blocks are mixed by a specific technology appropriate to generate materials to be applied for tests in posts, greenhouses and fields.

There are numerous **blends** developed in RUSTICA and for the purpose of this D3.13, a few examples of the list of the compositions (in % by weight) are presented in **Table 13.**

[94] In CMC 1, the amended EU FPR excludes also nutrient salts (e.g., ammonium salt) recovered from waste as defined in the Art. 3 WFD.
[95] which have ceased to be waste under national measures transposing Art. 6 of the WFD 2008/98/EC.
[96] In CMC 1, the amended EU FPR excludes also precipitated phosporous salts, thermal oxidation materials, and pyrolysis and gasification materials or their derivatives which are by-products or recovered from waste.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Table 13 - Examples of formulae for blending - compositions in w/w%

Building Block	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
Compost	75	75	70	0	30	50
Biochar	10	10	20	60	30	0
Microbial Protein	5	5	0	15	15	0
Insect frass	5	0	0	15	15	25
Insect protein	0	10	0	0	0	25
Mineral Concentrate	5	0	10	10	10	0

Source: RUSTICA, Daan Kuiper (Cropeye) (Kuiper, 2024)

If it is envisaged to commercialise them under the rules of the EU FPR, each of the building blocks needs to comply with the provisions laid down, e.g., for CMC and PFC. As such, in particular, Formula 3 involving compost, biochar and mineral concentrate and Formula 6 containing compost, insect frass and -protein may be further investigated on feedstocks under use, treatment methods, and properties of the product if one or more Component Material Categories[97] can be met ((EU)2019/1009) ((EU)2023/1605).

Depending on the specific description of the EU FPR, a PFC may encompass more than one CMC. Thus, for example, a PFC Organic Fertiliser may include more than one of the building blocks provided that all requirements of the EU FPR can be fulfilled ((EU)2019/1009).

But in case, more than one of the PFCs 1 to 7 shall be addressed by an EU Fertilising Product, PFC 7 FERTILISING PRODUCT **BLENDS** come into play. The blending "*shall not change the nature of each component EU fertilising product*" and a demonstrated accordance with conformity assessment rules needs to be evidenced for each Component Fertilising Product of the **blend.** There are no doubts that an EU declaration of conformity is needed for the **blend** ((EU)2019/1009).

2.3.2. National and regional rules in the RUSTICA test case regions (EU and Colombia)

Although the new EU FPR is a "Regulation" dictating rules directly applying to each Member State, and CE-marked fertilisers have to be fully in line with the Regulation: there is space for national and regional law under the premise of placing onto the market under "non-harmonised" rules in the EU ((EU)2019/1009) (RUSTICA, 2021). Therefore, national and regional regulatory aspects of RUSTICA building blocks and blends focused on testcase locations in the EU were comprehensively investigated in the RUSTICA D3.6 (RUSTICA, 2022) and will be further elucidated in this section of D3.13. Besides, legislation and policy governing RUSTICA results relating to the testcase region Valle del Cauca in Colombia will be discussed. The test regions are displayed in **Figure 7.**

[97] At time of writing, rules for compost, biochar of the amended EU FPR are of particular relevance for these Formulae and additional treatments may be requested before CE-marking can be achieved.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

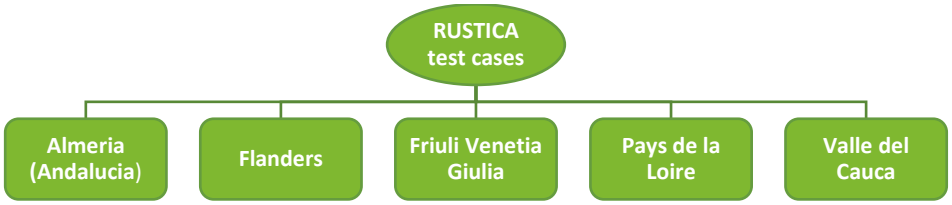

Figure 7 - RUSTICA test case locations for investigations on national and regional law

Source: Own depiction based on RUSTICA GA

As already indicated **(Please view also section 2.2.1.6.)**, **compost** plays a crucial role in **EU** waste management and fertiliser production (RUSTICA, 2021), while aside from the new EU FPR ((EU)2019/1009) quality schemes are determined at the very national or regional level. Moreover, voluntary schemes are established to bolster marketing of compost either under the rules of waste- or fertiliser legislation or a position between of both areas (Saveyn & Eder, 2014) (RUSTICA, 2022) in the **EU countries**. **Compost** is also well established in Colombian fertiliser legislation.

Aside from the new EU FPR ((EU)2019/1009) and voluntary certification schemes, such as EBC **(Please view also section 2.3.1.2.)**, Biochar Quality Mandate (BQM), and International Biochar Initiative (IBI-BS), some EU countries have already established national legal frameworks on **biochar** (Garcia, Alves, Rijo, Lourinho, & Nobre, 2022) (Meyer et al., 2017) (RUSTICA, 2022).

Albeit not marketed under the regime of a CE-mark: considering **insect biomass** for fertiliser purposes in the EU leads to the amended Animal by-products Regulation (EC) No 1069/2009 and (EU) No 142/2011. If the biomass falls under "Category 3 Material[98]", attention needs to be drawn to the treatments for processed protein and hydrolysed proteins **(Please view also section 2.3.1.3.)** if organic fertilisers and soil improvers[99] will be produced as derived products. On the other hand, the rules on "defined endpoints in the manufacturing chain" as required for derived products by the EU FPR ((EU)2019/1009) do not automatically apply to all of the national legal sources governing fertilisers under non-harmonised systems in EU countries ((EC)No1069/2009) ((EU)No142/2011).

As pointed out prior to this section, EU Regulation 2021/1925 amending the Regulation (EU) No 142/2011 introduces rules on treatments, such as one hour in 70 degree Celsius which are mandatory for **insect frass** in the EU countries. Regardless, if CE-marked or other fertilisers from derived products under a national/regional regime are manufactured, the rule has to be respected ((EU)2021/1925). **(Please view also section 2.3.1.4.)** Details on legal criteria guiding the use of **frass** for fertilisers are also published by IPIFF (IPIFF, 2024b).

The **NPK concentrate** as a bio-based inorganic fertiliser in RUSTICA is generated by including novel technologies on electrodialysis. Studying national legislation in the EU reveals that rules on inorganic fertilisers are very different and often strongly relate to certain manufacturing practices and processes, as it is explained below.

RUSTICA extensively studies **microbial protein** for fertiliser purposes. Thus, challenges and opportunities in national/regional legal compendia are briefly debated in this section.

The development of fertiliser **blends** and their demonstration by means of application tests are a crucial part of RUSTICA. A huge variety of such **blends** and mixtures are evolved in the course of the research of the project **(Excerpt in Table 13).** Each single building block and the blend itself needs to be legally authorised if the blend shall be marketed under the corresponding legal regime of a country or region.

[98] Defining rules including those for terrestrial and aquatic invertebrates
[99] Organic fertilisers and soil improver in the meaning of EC No 1069/2009 is different to the definitions in the new EU FPR 2019/1009.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

2.3.2.1. Spain and Almeria

In **Spain** and the testcase in **Almeria**, the National Royal Decree 506/2013 of 28th June presents, for instance, in Annex I/Group 2[100] an Organic nitrogen fertiliser of plant origin as a *"Solid product obtained by treatment, with or without mixture, of organic plant matter requiring an N-Content of at least 2% by mass."* The **Spanish** Decree further refers in Annex IV to biodegradable organic wastes[101] to be studied if waste is intended to be deployed in the context of fertilisers (RoyalDecree506/2013).

The new EU FPR ((EU)2019/1009) has been implemented into national law governing the RUSTICA test case **Almeria** as well. Whereas at the moment, a specific reference to **biochar** could not be detected in the amended Royal Decree 506/2013 (RoyalDecree506/2013), biochar is strongly promoted by associations (e.g., AVEBIOM, Biochar Initiatives Platform Spain (BIPS) (AVEBIOM, 2024) in **Spain.**

Screening the amended national Royal Decree 506/2013 in **Spain** results in some "animal-based" organic fertilisers, single or mixed in Annex I, Group 2 (RoyalDecree506/2013) which, as such, apply to the test region **Almeria**. The amended Real Decree 528/2012 (RealDecree1528/2012) implements the EU Animal by-products Regulations in **Spain** and includes treatment rules for **processed proteins** and **composting**, e.g., of Category 3 Material[102]. To the best knowledge of the author, no specific indications on the term "**insect biomass**" could be detected in both Decrees.

Concerning **Spain** and **Almeria**, unambiguously the aforementioned EU Regulation ((EU)2021/1925) applies if one has to treat and use **frass**. Annex I, Group 2 of the amended Royal Fertiliser Decree 506/2013 deals with a variety of organic fertilisers of animal origin, such as *„Solid product obtained by animals´ excrement treatment, without mineral acids".* With regard to **insect frass**, no explicit indications could be identified in the legal source (RoyalDecree506/2013) for **Spain** at present.

In **Spain and for Almeria**, Annex I of the Royal Decree includes a range of inorganic liquid fertilisers while Annex III encompasses organo-mineral ones. Aside from required contents of macro- or micronutrients, details on declaration and labelling need to be met (RoyalDecree506/2013).

A certain progress on listing stipulations as regards **microorganisms** can be noticed for the **Spanish** Royal Decree on fertilisers (RoyalDecree506/2013) and the test region **Almeria**. In Annex I, Group 4, the amended legal source contains "special products" including some amino acids (e.g., from algae) in section 4.1 and a dedicated list of amino acids (e.g., Arginin) in section 4.3. The amended Decree further presents a list with special products from **microorganisms** mainly involving mycorrhiza while the term "**microbial protein**" could not yet be inferred from the consolidated Decree (RoyalDecree506/2013) (RUSTICA, 2022).

Specific indications on "RUSTICA **blends**" could not be identified in the national law commanding fertilisers in **Spain** and **Almeria**. Depending on e.g., the individual components, the process and the compositions, stipulations on organic or organo-mineral fertilisers may be examined on their relevance for the **blend.**

2.3.2.2. Belgium and Flanders

With view on **Belgium**, for the Region **Flanders**, the National Royal Decree on trade of fertilisers and soil improvers classifies **compost** as a soil improver (RoyalDecree28January2013), and a derogation[103] is necessary for a **compost** which is not listed under *"permitted products"* (RUSTICA, 2022). In **Flanders**, Vlarema is an important legal source if waste is considered for fertilisers (Vlarema17thFebruary2012). But general **Flemish** rules on quality of **compost** are laid down at OVAM (OVAM, 2024).

[100] Organic Fertilisers, Section 2.1 Nitrogen
[101] Relating to the European List of Waste and including e.g., certain wastes from agriculture
[102] Category 3 Material is defined in the EC No 1069/2009 and includes rules for terrestrial invertebrates.
[103] To be decided by the regional authority enabling trade and use of the fertiliser

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

If in **Flanders** a placement on the market for a (fertiliser-)product is envisaged under national and regional conditions as long as the fertiliser is not listed in Annex I of the Royal Decree from 2013 (RoyalDecree28January2013) in **Belgium**, a derogation is needed. Concerning **biochar**, at time of writing, five authorisation numbers (EM 340.A to EM 340.E) and four valid authorisations could be identified under the key words "fertilisers" and "biochar" in PHYTOWEB (PHYTOWEB, 2024a).

In **Flanders**, the rules on the aforementioned EU stipulations for animal by-products ((EC)No1069/2009) have to be met if a derogation is requested for **insect biomass** targeting fertiliser purposes under the National Royal Decree (RoyalDecree28January2013) in **Belgium**. But no additional provisions to EU law are laid down for treatments of animal by-products as regards insect biomass in Flanders (DeNorre, 2022) (RUSTICA, 2022).

A website dedicated to insects, operated by the Agency for Agriculture and Fishery and ILVO is available in **Flanders.** Following the publication, a derogation can be obtained if **frass** shall be placed on the market and the requirements are fulfilled (Vlanderen, 2024). Currently, one type of frass could be discovered if the search term "insect" is inserted into the PHYTOWEB: TerraPlus®ReVital as a "*Mixed organo-mineral soil improver based on insect frass*" (PHYTOWEB, 2024b).

Dealing with inorganic liquid fertilisers in **Flanders** means, first of all, to have a look on the national **Belgium** Royal Decree (RoyalDecree28January2013) which includes e.g., information on such products and hydroponic agriculture. If the **NPK concentrate** is derived from waste, a derogation is needed in **Flanders** (DeNorre, 2022) (RUSTICA, 2022).

Due to the successful RUSTICA research in **Flanders**, **microbial protein** obtained a permission to be used in the **Belgium** region **Flanders** for test purposes and application to crops for fertiliser purposes. Furthermore, there is a certain optimism, that such an option could be extended to applications of **microbial protein** beyond of RUSTICA testing (AVECOM, 2024b).

Bearing in mind that **Flanders** already permitted products with microbial protein for test purposes, and derogations were given e.g., to insect frass, the future developments in **Flanders** and **Belgium** will influence the exploitation and impact for **blends** prepared from RUSTICA building blocks.

2.3.2.3. Italy and Friuli-Venezia Giulia

National legal sources on **compost** in **Italy** covering the region **Friuli-Venezia Giulia** are laid down in Legislative Decree 152/2006 (Decreto152, 2006) relevant if e.g., waste serves as an input material, Decree 75/2010 comprises detailed rules on types and properties for **compost**. The definitions include, for instance maximum contents of pollutants (Decreto75, 2010). Regional settings for **Friuli-Venezia Giulia** determine e.g., requirements of waste management and facilities (LeggeRegionale-n.34, 2017) (RUSTICA, 2022).

Among the EU Member States, **Italy** is at the forefront in introducing national legal options on **biochar** which apply to the RUSTICA business case in **Friuli-Venezia Giulia. Biochar** and its quality aspects as a soil conditioner are legally enshrined in the Decree 75/2010 (Decreto75, 2010) amended by Ministerial Decree 22 from 2015 (Min.Decreto22/2015). Before a charcoal may be designated as "**biochar**", it has to be certified. Besides, voluntary certification schemes are available for biochar which are awarded by ICHAR - L'Associazione Italiana Biochar (ICHAR, 2024) (ICHAR, 2020) (RUSTICA, 2022) **(Figure 8).**

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Figure 8 - Logo of the Italian Biochar Association (ICHAR)

Source: (ICHAR, 2024)

The implementation of the EU law on animal by-products ((EC)No1069/2009) ((EU)No142/2011) including those for processed proteins is laid down, e.g. in the amended Decree 75/2010 in **Italy** (Decreto75, 2010), and Guidelines on this EU legislation are officially established for Italian Regions including **Friuli-Venezia Giulia** (RUSTICA, 2022). Dedicated national or regional legal sources on the term "**insect biomass**" could not be identified thus far.

Apart from the EU legislation dictating rules on frass in **Italy** and **Friuli-Venezia Giulia** as an EU country or region respectively, the Decree 75/2010 has been updated (Decreto75, 2010). "**Frass**" is defined in Annex 2.11 and could be translated as follows: *"…organic soil improver obtained from excrements of worms (vermicompost) and insects, dried manure. Manure and dung, composted animal waste, including manure and composted manure.."* (ColtoreProtette, 2023).

Specific rules on **bio-based compound liquid fertiliser** could not be detected in **Italy** and the test regions **Friuli-Venezia Giulia** while certain minimum standards for inorganic fertilisers in a liquid form are determined in Decree 75/2010 (Decreto75, 2010).

Even though microorganisms are addressed in **Italian** law on fertilisers which applies to the case study **Friuli-Venezia Giulia**, hitherto no explicit rule on **microbial protein or microbial biomass** could be recognised in the legal source Decree 75 from 2010 (Decreto75, 2010).

In **Friuli-Venezia Giulia** and **Italy**, the amended legal act Decree 75/2010 comprises e.g., organic and organo-mineral fertilisers (Annex I). Nonetheless, the deployment of **RUSTICA blends** needs a thorough assessment of legal criteria relating to for example, input and its origin, processes, nutrient contents, destination (e.g., type of crop) and contaminants are crucial elements in such an assessment.

2.3.2.4. France and Pays de la Loire

As regards legislation on fertilisers in **France** and **Pays de la Loire**, Art. L.255-12 the Code rural et de la pêche maritime refers to waste-based fertilisers. The national legal act (CodeRural, 2024) indicates also conditions of an end-of-waste status of fertilisers as set in the Code de l'Environnement (Art. L.541-4-3) (CodeEnv, 2024). More recently, obligations on waste and composting, in particular for households and businesses were established in France (EURONEWS, 2024). To place **compost** on the market in **France,** a range of standards is available (e.g., NF-U42001 as a mandatory norm if used for fertilisers). Standards are elaborated and defined by ANPEA (Association Nationale Professionnelle des Engrais et Amendements) BN FERTI (ANPEA, 2024) and AFNOR (AFNOR, 2024) (RUSTICA, 2022). Mandatory fertiliser standards can be found on the list of LegiFrance (Legifrance, 2024).

For **Pays de la Loire** in **France**, the term "**biochar**" (biocharbon) is defined in LegiFrance for the energy-environment sector (Légifrance, 2024). Furthermore, as already stated, the EBC is an important instrument for marketing **biochar** under non-harmonised rules in the EU. Currently, five companies are listed from **France** in the EBC repository (EBC, 2024a). As it is published by Carbon Centric: **biochar** may be purchased just from organisations certified under the EBC in **France** (CarbonCentric, 2024).

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Like the other RUSTICA test regions in the EU, **Pays de la Loire** and **France** are subject to the EU Regulations on derived products stemming from animal by-products encompassing invertebrates as a Category 3 material. In **France**, Arrêté du 9 avril 2018 implements the EU legal settings e.g., for producing compost from such inputs. If just national markets are addressed, tailored rules are set. There could no special stipulations on **insect biomass** be disclosed in the legal compendium on animal by-products in France (Arreteédu9Avril2018).

As for each country in the EU, the hygiene standards for frass need to be abide by in **Pays de la Loire** and **France**. At time of writing, five entries could be identified in ANSES under the keyword "frass", and the most recent was "FRASSINOVA" at 26.06.2024 (ANSES, 2024).

The Code Rural, in particular chapter V, provides the essential base for fertiliser law in **France**. If an inorganic **liquid compound macronutrient fertiliser** (NPK-Concentrate) will be placed on the market under non-harmonised rules in **Pays de la Loire**, the Code Rural is at the forefront. On the other hand, marketing in accordance with a standard published by AFNOR (RUSTICA, 2022) can be verified for a bio-based inorganic RUSTICA **nutrient concentrate** as well.

In **France**, the amended Code Rural incorporates biostimulants and, thus, enables its use in test region **Pays de la Loire.** Conversely, fertiliser law in **France** does not explicitly refer to **microbial protein** at present (CodeRural, 2024).

With regard to the broad spectrum of RUSTICA **blends**, the availability of a market authorisation needs to be investigated for each composition in **Pays de la Loire** and **France** thus far. Considering standards, it pertains to the constituents of the blends if e.g., organic or organo-mineral fertilisers come into play.

2.3.2.5. Colombia and Valle del Cauca

As it is highlighted in the report RUSTICA D3.6 (RUSTICA, 2022), five main categories including organic fertilisers as one of them are defined in the National Technical Norm NTC 1927 (NTC1927(2001)) and specified in Norm NTC 5167 for **Colombia** and, as such, for **Valle del Cauca.** According to NTC 5167, requirements on quality are set for **compost** as an organic fertiliser including but not limited to organic carbon, total-N content, and limits for contaminants (e.g., heavy metals) which have to be ensured and declared (NTC5167(2004)). In **Colombia,** a registration process is necessary for manufacturers and products (RUSTICA, 2022).

Biochar is an emerging sector in **Colombia** and **Valle del Cauca.** A registration as a fertiliser and soil conditioner under NTC 1927/2001 (NTC1927(2001)) would become necessary if a marketing activity occurs (CIAT, 2024).

In **Colombia and Valle del Cauca**: if **insect biomass** will be marketed and used for fertiliser purposes, NTC 1927/2001 (NTC1927(2001)) would need to be considered (CIAT, 2024).

In case of application of **frass** as a fertiliser in **Colombia** and the RUSTICA test case location **Valle del Cauca**, a registration in ICA would be requested. In contrary, if used as a raw material input, a registration is not required (CIAT, 2024).

It is not planned to deploy **NPK concentrate** from RUSTICA in **Valle del Cauca, Colombia**, and hitherto, specific rules on bio-based NPK concentrate are not laid down. But, for example, contents of nutrients which have to be met by a fertiliser are defined in Res. 150/2003 (Res.ICA150(2003)) (CIAT, 2024).

Microorganisms are an important component of fertiliser products in **Colombia** and **Valle del Cauca**. With view on the types of microbiota, living organisms more indirectly influencing plant nutrition are at the forefront instead of those directly delivering nutrients to the plant (Res. 68370/2020). Whereas, regulatory provisions address biostimulants, biofertilisers and microbial fertilisers in Colombia, dedicated legal rules on **microbial protein** or **-biomass** could not be identified (Res.68370(2020)) (CIAT, 2024) (RUSTICA, 2022).

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

In **Colombia** and **Valle del Cauca blends** are also called organo-mineral fertilisers, and the same rules as for each ingredient apply for the final product-**blend** (CIAT, 2024). In NTC 1927, stipulations on organic-fertilisers as one of five main categories are written down as a national norm (NTC1927(2001)).

2.3.3. Organic agriculture in the EU and Colombia

According to the Food and Agriculture Organization of the United Nations (FAO), **organic** agriculture is practiced in 188 countries, the farmland under the premise of **organic** cultivation exceeds 96 million ha worldwide and involves more than 4.5 million farmers. In 2022, global revenues from **organic** food and beverages were nearly 135 billion EUR (FAO, 2024).

In the EU, 9.1% of the agriculture land were cultivated under the rules of **organic** farming which means 14.8 million ha in 2020. Strong efforts are made in the EU to reach a share of 25%. **(Please view also section 5.) Organic** production in the EU is subject to legally defined minimum standards which are scrutinised in this setting and debated below (EC, 2023b).

Alternatives to conventional agricultural methods are of high relevance in Colombia as well. Therefore, recent developments in this sector are pointed out in this D3.13 report as well.

2.3.3.1. Legal provisions in the EU and its Member States

Today, a set of legally binding sources dictates the scope of **organic** production in the EU, of which Regulation EU 2018/848 is commonly denoted as the "basic act"((EU)2018/848). If it comes to RUSTICA and its research, the "Implementing act" EU 2021/1165 reveals more details on materials for providing nutrients and soil improving purposes ((EU)2021/1165).

Table 14 - Important indications on RUSTICA building blocks in organic production

Building block and blends	Important indications derived from EU 2021/1165, Annex II
Compost	Mixture of vegetable material (composted or fermented)
Biochar	Biochar as a soil conditioner - pyrolysis product made from various plant materials[104]
Insect protein	Reference to "hydrolysed proteins" of animal origin, but no further details
Insect frass	Dejecta of worms (vermicompost) and insect frass-substrate mixture
NPK-Concentrate	Inorganic micronutrient fertilisers[105]
Microbial protein	Use of preparations of micro-organisms[106],
Blends	No explicit indications on the term "blends" and combinations of building blocks

Source: (EU) 2021/1165, Annex II (modified) ((EU)2021/1165)

[104] Treatments are limited to Annex I of (EU) 2021/1165, limits on contaminants according to (EU) FPR 2019/1009
[105] but no NPK concentrate since (EU) 2018/848 prohibits the use of mineral nitrogen; limits on contaminants as laid down in the (EU) FPR 2019/1009
[106] In accordance with point 1.9.6 of Part I of Annex II to Regulation (EU) 2018/848, which underpins the possibility of preparations of microorganisms for the purpose of soil improvement and nutrient availability; but no specific indications on microbial protein

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

As it is mentioned in RUSTICA D3.2 (RUSTICA, 2021), for fertilisers, soil conditioners and nutrients in organic production the requirements of the new and amended EU FPR ((EU)2019/1009) are also relevant. Furthermore, the rules of the EU Animal by-product Regulations have to be fulfilled by the products concerned ((EU)2021/1165). Regulation EU 2021/1165 is amended inter alia by Regulation (EU) 2023/2229 which introduces conditions on composted or fermented biowaste and refers to the WFR 2008/98/EC ((EU)2023/2229).

Some main indications on the RUSTICA building blocks are displayed in **Table 14**.

In the context of **organic** production, EU legislation enables certain applications and opportunities for almost all of the RUSTICA building blocks while at the same time restrictions and limitations are made to inputs, treatments and contaminants. Specific provisions on "**blends**" could not be identified, but can be verified for the individual case.

As the aforementioned EU law on **organic** agriculture is set by means of regulations, the contents are compulsory for countries throughout the EU. National legislation can supplement the EU law but it has to be at least at the level of the EU standard. An in-depth study on national regulatory measures in the EU countries including the test regions was conducted in RUSTICA Deliverable D3.6 (RUSTICA, 2022).

In **Spain**, the standard UNE 142500:2017 delivers the stipulations for inputs to **organics,** such as fertilisers, additives and growing substrates including e.g., rules on insect excreta and composting. To facilitate the implementation, guidelines are published by the Government of Andalusia applicable to **Almeria** as well (RUSTICA, 2022) (MinistryofAgriculture, 2024) (JuntadeAndalucia, 2024).

There is no official extra labelling on bioproducts from **organic** production in the **Belgium** region **Flanders**. EU rules are implemented. But in **Flanders,** additional rules are laid down, for example, on advertising. Such advertising may be not misleading and the term "bio" in the context of fertilisers does not automatically mean that it corresponds to **organic** production (RUSTICA, 2022) (Flanders-Dep.-of-Agriculture, 2024).

Organic production in **Italy** and **Friuli-Venezia Giulia** is legally incorporated into the Decree 75/2010 (Decreto75, 2010) (RUSTICA, 2022). A comprehensive platform serving details on **organics** is operated by SINAB (Sistema d'informazione Nazionale sull'Agricoltura Biologica) including EU and national legal settings and developments. The portal displays, for instance, the National Action Plan on Organic Production 2024-2026 in **Italy**. In addition, SINAB informs on regional legal activities in **Friuli-Venezia Giulia** (e.g., educational measures on **organic** production) (SINAB, 2024).

Unlike the EU countries and test locations mentioned above, **France** has established a national logo "AB AGRICULTURE BIOLOGIQUE" **(Figure 9)** representing **organic** farming and products. The logo may be just used together with the EU label on organic agriculture (Ministèredel'Agriculture, 2023) (RUSTICA, 2022).

Figure 9 - French and EU logo on organic agriculture

Source: Ministère de l'Agriculture et d'Alimentation (Ministèredel'Agriculture, 2023)

Aside from the Ministry of Agriculture, INAO, the **French** Institut National de l' Origine et de la Qualité gives extensive information on requirements of **organic** farming in **France** and **Pays de la Loire**. As it is outlined by

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

INAO, there is no exhaustive list of trade products available for the use in the categories fertilisers or soil improvers in **organic** production (INAO, 2024).

2.3.3.2. Alternatives and organic farming in Colombia

In **Colombia,** strong efforts are made on establishing agroecology. **Valle del Cauca** is recognised as a pioneer with Ordinance No. 656 of 11th June 2024. Especially small holders can benefit from these developments and as a target, it is envisaged to establish a number of 168 “Biofactories” for the next 10 years in this Colombian region (CIAT, 2024).

Organic production and its high-level environmental standards suit well into the new concept. To be marketed under the alternative organic agricultural scheme in **Colombia**, an ecological product certification “*certificación ecológica*” is necessary (RUSTICA, 2022). The **Colombian** Government promotes the merits of **organic** farming and precisely dictates the requirements of this certification (GOV.CO, 2024b). As it is reported in D3.6, Res. 199/2016 (Res.199(2016)) describes the materials permitted to be deployed as fertilisers for this type of farming, including but not limited to compost, solid and liquid manure, and treated (fermented or composted) organic household waste (RUSTICA, 2022).

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

3. RUSTICA - the legal environment on fertiliser application

Products developed in the RUSTICA project are not only tested at laboratory but also at pilot and field level. The tests on their efficacy and effect on plants take place across Europe and beyond. While in Europe a wide range of legally binding sources determines the **application** of products for fertiliser and soil enhancement purposes (RUSTICA, 2021), agronomic engineers are available to consult on deployment of plant nutrition materials in Colombia (RUSTICA, 2022).

3.1. Common Agricultural Policy

Since the **Common Agricultural Policy** is the overarching and pivotal legal instrument of the agricultural sector in the entire EU which has a significant impact on bio-based fertilisers and their use, a separate report on this important legally binding compendium including also national *CAP Strategic Plans* (CSPs) has been prepared in the RUSTICA project (RUSTICA, 2023).

At the EU level, the following Regulations build the current fundament of the **Common Agricultural Policy (Table 15)**:

Table 15 - Fundamental legal sources of the EU Common Agricultural Policy 2023-2027

Legal Source	Explanation
(EU) 2021/2115	providing the framework for national CAP strategic plans, and repealing Regulations (EU) 1305/2013 and (EU) 1307/2013;
(EU) 2021/2116	comprising the rules for the financing, management and monitoring of the CAP, and repealing Regulation (EU) 1306/2013
(EU) 2021/2117	amending the following Regulations: - (EU) 1308/2013 on the common organisation of the agricultural markets - (EU) No 1151/2012 on quality schemes for agricultural products - (EU) No 251/2014 on geographical indications for aromatised wine products - (EU) No 228/2013 laying down measures for agriculture in the outermost regions of the EU

Source: European Commission (EC, 2024a)

A number of 10 key objectives is formulated for the period 2023 to 2027 which are broadly addressed by the RUSTICA activities. For example, *Strategic Objective (SO) No 5 environmental care*[107] (EC, 2024b)*:*

RUSTICA and its research on soil improvement are dedicated to the protection of this important natural resource, and the development of fertilising products aims not only to optimal plant nutrition but also plant support which can be further evaluated on the requirements of the CAP (RUSTICA, 2023).

With view on application of fertilisers, environmental and climate sustainability are comprehensively addressed by the **Common Agricultural Policy**. Considering *"Conditionality"* serving as a mandatory instrument to be fulfilled if direct payments will be made to farms, nine GAECs (Good agricultural and environmental condition standard for agricultural areas) and 11 SMRs[108] (Statutory management rules) are established. GAEC 4, for example, sets limits on fertiliser application along water courses. SMR 1 calls to control diffuse sources of

[107] Short version of SO, the exact and long version is laid down in (EU) 2021/2115
[108] Including SMRs may be related to the national transposition of the EU Directives.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

pollution by phosphates in accordance with the Water Framework Directive while SMR 2 dictates the protection of waters against pollution caused by nitrates from agricultural sources in accordance with the Nitrate Directive. Conservation of wild birds falls under SMR 3. SMR 4 refers to the protection of natural habitats and of wild flora and fauna (RUSTICA, 2023).

As a voluntary scheme to meet environmental and climate standards, "*Ecoschemes"* and various areas of actions are part of the Regulation (EU) 2021/2115. Art. 31 includes a reference to nutrients and soil, for instance in 4.(d), *"prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management and soil biota;"* (RUSTICA, 2023) ((EU)2021/2115) which is an essential goal of RUSTICA.

The implementation of the aforementioned EU law by means of CSPs in EU countries and RUSTICA test case locations deviates clearly from one state/region to another. In **Spain**, an additional GAEC 10 on nutrient management is imposed, and *Ecoschemes* comprise measures on agroecology and carbon farming. **Flanders** put in place all of the 11 SMRs including prevention of pollution by phosporous and rules on "*slow-acting fertilisers*". The nine GAECs and four *Ecoschemes* are established in **Italy** while it is related to sustainable use and management of nutrients in the wider context of the Italian CSP as well. One broad E*coscheme* supporting inter alia transition to agroecology and the nine GAECs are decided in **France** (RUSTICA, 2023).

3.2. Law on water and related acts

Protection of **water** is also subject to the Common Agricultural Policy, as it is included, for example, in the *Enhanced Conditionality*[109] (RUSTICA, 2023). Nonetheless, protection of **water** is separately debated in this section.

As the primary and main law for **water** protection, the Water Framework Directive 2000/60/EC sets horizontal rules on the protection of surface- and groundwater (2000/60/EC). As it is already pointed out in RUSTICA D3.2 (RUSTICA, 2021) and D3.6 (RUSTICA, 2022), it is linked to a range of EU legal acts. In 2022, a proposal was adopted by the Commission (EC, 2022a) to revise the list of pollutants for 2000/60/EC and the Implementing Directive 2008/105/EC (2008/105/EC), respectively (EU, 2024a) .

From the RUSTICA and agricultural perspective, the Nitrates directive 91/676/EEC, also strongly related to the Water Framework Directive, is very critical since dictating precise instructions to fertiliser application (91/676/EEC). Main pillars of the Nitrates Directive can be described at a glance as follows:

- Designation of Nitrate Vulnerable Zones (NVZ)
- Introducing voluntary Codes of Good Agricultural Practice
- Prescribing mandatory Action Programmes within NVZs
- Limiting the amount of nitrogen from manure in NVZs (EC, 2024d)

EU countries need to define NVZs (e.g., areas of land that drain into polluted waters) or designate the entire country as a NVZ. Considering RUSTICA test cases in the EU and NVZ: Belgium and France are completely declared as a NVZ, while for those in Italy and Spain some areas are identified (RUSTICA, 2022).

Farmers are obligated to join Action Programmes if they are situated in an NVZ. All test regions and farmers falling into a NVZ have to follow Action Programmes including limited periods on nitrogen fertiliser application and may not exceed an annual application of livestock manure (corresponding to 170 kg nitrogen/ha) (91/676/EEC). No derogation on the RUSTICA test regions is currently in force (EC, 2024d) .

[109] e.g., Indications on Water Framework Directive and Nitrate Directive

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Currently, the Nitrates Directive (91/676/EEC) is under evaluation, and the European Commission has launched a public consultation on this legal source (EC, 2024d).

3.3. New rules on soil

Soil builds not only an important basis for manifold agricultural and food production activities, it represents also a vital resource for a multitude of economic and environmental matters. To this end, European Union takes strong efforts to maintain health and to accomplish high quality for its **soils**. In particular, policies are established in the EU which will be further deliberated in **section four** of this D3.13.

More recently, a proposal has been adopted by the European Commission and a lawmaking procedure (2023/0232(COD) is going on concerning a Directive on **Soil** Monitoring and Resilience (Soil Monitoring Law) in July 2023 (COM/2023/416). The proposal defines **soil** as follows:

"'soil' means the top layer of the Earth's crust situated between the bedrock and the land surface, which is composed of mineral particles, organic matter, water, air and living organisms;" (COM/2023/416) and formulates measures as illustrated in **Figure 10:**

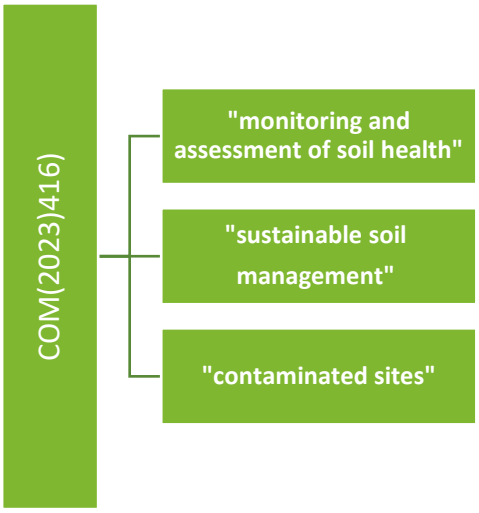

Figure 10 - Main measures of the Proposal of Soil Monitoring Law (COM(2023)416)

Source: Proposal of the Directive COM(2023)416) (Art. 1, point 2 a, b, c)

As it is laid down, Member States have to define **soil** districts and a monitoring framework thereto, as well as sustainable management practices. Subsequently, measures need to be implemented at the national level entirely on the managed **soils** with respect to the sustainable **soil** management principles defined in Annex III of the proposal considering types, use and condition of **soil**. From the RUSTICA perspective, point (e) is of specific interest:

"when fertilization is applied, ensure adaptation to the needs of the plant and trees at the given location and in the given period, and to the condition of soil and prioritize circular solutions that enrich the organic content" (COM/2023/416)

Undoubtedly, the proposal (COM/2023/416) promotes circular systems to unfold the organic content in **soils**. RUSTICA research develops and demonstrates a wide variety of solutions to serve this requirement and, as such, contributes predominantly to this principle of **soil** management.

Specific management will be also required to contaminated soils by the proposal (COM/2023/416).

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

3.4. Biodiversity and natural habitats

About one fifth of the EU land area and approximately 10% of the sea around EU countries are protected by the Natura Network covering 27,000 sites in the Union (EC, 2024g). Even though the legal foundations (92/43/EEC) and (2009/147/EC) do not explicitly impose direct commands on fertilisers (EC, 2024g), conservation of flora and fauna affects agricultural activities and has at least a more indirect impact on farming in these areas (RUSTICA, 2021). Following the EU interactive map, Natura 2000 sites are established in all of the four RUSTICA test regions in the EU, and as such are of particular relevance for the project. Moreover, protection of **biodiversity** is addressed in EU policies. **(Please view also section four.)**

3.5. Various emissions and agriculture

RUSTICA strives for environmentally friendly solution favorable to the climate and contributing to decline the volume of **emissions**, while emissions on air related to legal aspects on agriculture are examined in this section.

3.5.1. GHG emissions

As already highlighted in **section 2.1.5.**, enormous endeavors are undertaken to fight against **GHG emissions** and to mitigate climate change in the EU and worldwide. In terms of agriculture, the ESR (EU)2018/842 including provisions for certain output ((EU)2018/842) and the *Regulation* (EU) 2018/841 *on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework* (LULUCF) need to be predominantly assessed on their effects for applications targeting plant nourishment and soil improvement ((EU)2018/841).

In accordance with the publication of the European Commission, "*the management of cropland, grassland, wetlands, forests, settlements, as well as changes in land use including afforestation (i.e., planting trees), deforestation, or draining of peatlands*" are subject to the land use sector (EC, 2024c). Art. 2(c) of the LULUCF ((EU)2018/841) includes "*managed cropland"* which is relevant for RUSTICA research.

Table 16 - LULUCF - Targeted value of the greenhouse gas net removals by EU countries in 2030

EU country	Targeted value of the greenhouse gas net removals (CO_2 equivalent) in 2030, 2020 submission (LULUCF)
Belgium	-1,352 kt
France	-34,046 kt
Italy	-35,758 kt
Spain	-43,635 kt

Source: Regulation (EU) 2023/839 amending Regulation (EU) 2018/841 ((EU)2023/839)

The original version of the LULUCF from 2018 contains the so-called "no-debit" rule which means *that **emissions** do not exceed removals, calculated as the sum of total emissions and total removals"* in an EU country - valid from 2021-2025 ((EU)2018/841) (RUSTICA, 2021). Evaluating the amendment from 2023, the EU target *"for net greenhouse gas removals shall be 310 million tonnes of CO_2 equivalent as a sum of the values of the greenhouse*

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

gas net emissions and removals by Member States in 2030[110]*"* ((EU)2023/839). The targets for the Member States where the RUSTICA EU test case are located, are inserted in **Table 16.**

Comparing the entire amount of targeted reduction of the LULUCF sector in the EU with the figures in the **Table 16**, around one third of this target needs to be contributed by the countries where the RUSTICA test regions are set.

3.5.2. Emission and air quality

Aside from GHG **emissions,** orders on decrease of other **emissions** are legally prescribed, too. Obligations on anthropogenic atmospheric emissions[111] of sulphur dioxide (SO_2), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), ammonia (NH_3) and fine particulate matter ($PM_{2,5}$) are defined for the EU and its Member States by Directive ((EU)2016/2284).

The Directive ((EU)2016/2284) which was amended in 2023 commands that national **air** pollution control programmes are developed, adopted and implemented. It further requires monitoring and reporting of pollutants, emissions and their impacts ((EU)2016/2284).

Concerning ammonia **emissions,** the Directive encompasses details on farming practices and fertilisers (e.g., prohibition on ammonium carbonate and replacement of urea) ((EU)2016/2284) which are examined in detail in RUSTICA D3.2 (RUSTICA, 2021).

Reduction targets on the anthropogenic atmospheric **emissions** at the EU level are incorporated into the legal analysis of the RUSTICA D3.2 report as well (RUSTICA, 2021). National ammonia reduction targets also explored in scientific literature (Giannakis, Kushta, Bruggeman, & Lelieveld, 2019) (Jarosz & Faber, 2020) and compared with 2005, are laid down in Annex II of the Directive ((EU)2016/2284). Those targets relevant for the RUSTICA test case locations are shown in **Table 17.**

Table 17 - RUSTICA test case locations in the EU: national reduction targets for ammonia

Period	Reduction target for any year			
	Belgium	France	Italy	Spain
From 2020 to 2029	2%	4%	5%	3%
From 2030	13%	13%	16%	16%

Source: Directive (EU) 2016/2284, Annex II, Table B (Excerpt) ((EU)2016/2284)

RUSTICA research evolves and demonstrates fertiliser blends aimed to environmentally friendly crop nutrition and abatement of **emissions** from agriculture towards combating climate change and its drawbacks. To this end, the project conducts and evaluates comprehensive tests of the novel materials on their effect about plants and soil.

[110] "*set out in column D of Annex IIa, and shall be based on the average of its greenhouse gas inventory data for the years 2016, 2017 and 2018 as submitted in 2020*" ((EU) 2023/839)
[111] Of which some are also GHG emissions

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

4. RUSTICA - the context of EU priorities, strategies and other policies

Whereas this *D3.13 Outlook on future legislative aspects for RUSTICA nutrient cycles* primarily focuses on legally binding sources, to identify cornerstones and routes implying future legislative aspects, it is indispensable to ponder on current and actual policies in the EU and beyond.

4.1. EU - fundamental rules and political aspects

4.1.1. Priorities of the EU and the European Commission

Prior to a start of a new legislative five-year-period, the European Council (represented by the Governors of the Member States) designs and decides the official **priorities** as the *Strategic Agenda* of the EU (EU, 2024c). Based on these priorities and contributions from the European Parliament, the European Commission defines the priorities for the Mandate relating to the period mentioned here before (EU, 2024b).

4.1.1.1. Priorities in the period 2019-2024

Six **priorities** were defined by the European Commission for 2019-2024 of which the European Green Deal as the Growth Strategy (COM(2019)640; EU, 2024b) is the most prominent and at the same time paramount for the RUSTICA project. The efforts on achieving sustainable products for plant supply and soil enhancement by means of local circular business models are fully in accordance with the objectives of e.g., "*no net GHG emissions in 2050*" and "*decoupling economic growth from resource use"* (EC, 2021c).

To implement the Green Deal, a wide range of concrete measures, such as developing, supplementing and promoting *Strategies* and *Action Plans*, has been decided by the European Commission (EC, 2024f) (RUSTICA, 2021). With regard to RUSTICA, *Strategies*, *Action Plans and other policy instruments* on environment, agriculture and fertilisers are screened in this D3.13 Outlook in terms how they can be addressed by the project or affect it, respectively. **(Please view also section 4.1.2.)**

4.1.1.2. Priorities in the period 2024-2029

At time of writing, elections for the new EU legislative five-year-period 2024-2029 were just completed, and the European citizen await the appointment of the European Commissioners for the period of 2025-2029. Therefore, it is briefly referred to the new EU **Priorities** which are already put in place by the European Council. The three main headlines are illustrated in **Figure 11.**

Figure 11 - EU Priorities 2024-2029

Source: European Council (EuropeanCouncil, 2024)

Under the first Priority **"*A free and democratic Europe*"** it is encompassed, for instance, *"the Rule of Law*" and "*protecting free and pluralistic media*". "*Cooperation with transatlantic partners and the NATO*" and a "*merit-based enlargement process*" are included inter alia in the second Priority: ***"A strong and secure Europe"***. RUSTICA, its business models and impact, predominantly can align to the third Priority ***"A prosperous and competitive Europe"*** covering e.g., "*a sustainable and resilient agricultural sector"* and the promotion of

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

an *"environment conducive to innovation and business" (EuropeanCouncil, 2024)* of which the latter is of particular relevance for RUSTICA.

4.1.2. EU Strategies, Action Plans and further policies

By virtue of the scope and scale of the RUSTICA project, aside from the more international oriented policies (section 1), a set of EU policies related to environment, agriculture and fertilisers are reflected in this section.

4.1.2.1. Circular Economy Action Plan and nutrient management

Originally established in 2014, the **Circular Economy Strategy** (COM(2014)398), which was comprehensively examined in RUSTICA D3.2 (RUSTICA, 2021), opens new perspectives how Europe can benefit from a better and consequent use of its resources.

In 2020, the new **Circular Economy Action Plan** was adopted by the European Commission (COM/2020/98) (RUSTICA, 2021). From the seven "*key product value chains"* of the Plan, *"food, water and nutrients"* outlines that around 20% of food is wasted or lost in the EU and announces a target for food waste reduction in accordance with the *SDGs*[112]. An Integrated Nutrient Management Plan is prospected, striving for more sustainability in the application of nutrients and fostering the markets for nutrients gained from recovery (COM/2020/98).

RUSTICA does not only tackle the problem of food waste but also sustainable application of nutrients by offering valorisation routes for leftovers and side streams in order to develop novel innovative fertiliser blends.

4.1.2.2. Farm to Fork Strategy, biofertilisers and organic production

The **Farm to Fork Strategy** of the EU is one of the key strategies of the Green Deal and is, together with the Action Plan for the development of organic production, thoroughly investigated in the course of RUSTICA and its research (COM/2020/381; RUSTICA, 2021).

Taking into account sustainable food production, the strategy draws attention to advanced biorefineries for manufacturing of e.g., bio-fertilisers and implies new perspectives by means of a circular bio-based economy which are hitherto not fully exploited by the farming sector. But the strategy advocates also an abatement of 50% of nutrient losses and a general reduction of fertiliser application by 20% (COM/2020/381).

An **Organic Action Plan** has been developed to boost organic farming and uplift its share to 25% of agricultural area in the EU by means of promotion, financial support and concrete actions for organics to decrease environmental and climate impact (COM(2021)141).

By developing and advertising bio-based fertilisers, RUSTICA is in line with the strategy and, considering the great variety of the project output, the project even validates products to be verified in organic farming.

4.1.2.3. Biodiversity Strategy for 2030 and protection of land

Another key strategy of the Green Deal Action Plan is the **EU Biodiversity Strategy for 2030**, which was thoroughly studied in RUSTICA legal analysis (RUSTICA, 2021). It envisages a protection of at least 30% of the EU land area and ≥ 30% of the sea area by means of a legal framework by 2030. A share of 25% for organic farming is underpinned by this strategy (COM/2020/380).

From five "*main drivers of biodiversity loss*" described by the strategy, overexploitation and pollution are important points (COM/2020/380) (RUSTICA, 2021). RUSTICA adverts alternative solutions to mineral fertilisers

[112] (SDG) 12.3 requires that **food waste** is reduced by 50% by 2030. Please view also section 2.1.1 Food waste.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

and could help to accomplish applying "*balanced fertilisation and sustainable nutrient management*" as requested by the strategy.

4.1.2.4. Soil Strategy for 2030 and reduction of nutrient losses

In the vision for soil by 2050 of the **EU Soil Strategy for 2030**, *"all EU soil ecosystems are in healthy condition and are thus more resilient, which will require very decisive changes in this decade."* Among the medium-term objectives of the strategy, "*Reduce nutrient losses by at least 50%* (COM(2021)699)" directly relates to the activities of the RUSTICA project dealing with innovative fertiliser blends to decrease nutrient losses in soil.

Soil is seen as key solution for many challenges (Panagos et al., 2022), and the strategy encourages recycling of organic matter, for example, compost and agricultural residues. After suitable treatment it can be used as organic fertiliser, contributing to reconstruct depleted soil carbon pools, and enhance water retention capacity and soil structure. This way, closing of the nutrient and carbon cycle can be achieved (COM(2021)699).

RUSTICA recycling technologies provide an ideal solution to fulfill the requirements of transforming organic matter for uplifting soils quality. **(Please view also section 3.3 on the Proposal on a Soil Monitoring Law).**

4.1.2.5. Updated Bioeconomy Strategy and bio-based products

The **EU Bioeconomy Strategy**, established already in 2012 (COM(2012)60), was updated in 2018. It connects land and marine ecosystems and the services they deliver; "*all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce…* (COM(2018)673) (RUSTICA, 2021) (Wiedemann, Hiessl, & Rusu, 2020) **(Figure 12)**:

Figure 12 - Main outputs defined in the EU Bioeconomy Strategy

Source: Own depiction based on EU Bioeconomy Strategy Update (COM(2018)673)

In this respect, RUSTICA and its products "bio-based fertilisers" totally fit into the concept of the updated **Bioeconomy Strategy**.

In the Progress Report from 2022, three key messages explain the **Bioeconomy**. Especially "*Bioeconomy policies should be built on all sustainability dimensions: (1) management of land and biological resources within ecologic boundaries; (2) sustainable value chains and consumption; and (3) social fairness and just transition* (EC, 2022b)*"* can be seen as particularly relevant for the efforts of the RUSTICA project on sustainability and its impact.

4.1.2.6. Communication: Ensuring availability and affordability of fertilisers - recycling of wastestreams

In 2022, the European Commission launched a **Communication** dedicated to conditions and availability of **fertilisers**. As one of the measures on the promotion of **fertilisers**, an improved access to organic **fertilisers** and nutrients from recycled waste streams, particularly in regions with less deployment of such **fertilisers**, is set (COM(2020)590).

In addition, it is referred to the Common Agricultural Policy and the substitution of mineral **fertilisers** by organic **fertilisers** (Garske, Heyl, & Ekardt, 2024) from e.g., biological treatments provided that they do not trigger more nutrient losses than those products currently under use (COM(2020)590).

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Moreover, the Communication votes for the extension of nutrient recycling from organic waste to renewable bio-based **fertilising** products in line with the Farm to Fork Strategy. On the other hand, the legal source emphasises the facilitation of **fertiliser** trade (COM(2020)590).

RUSTICA and its circular bio-based products from regional value chains and business models suit well into the content of the Communication.

4.2 Colombia - recent policies on agriculture and the environment

According to recent publications, in Colombia a **reform on agriculture** (reforma agraria) has been decided and the government started the debate with the milk and rice sectors. Furthermore, international collaboration is decided and will occur at this occasion. The reform aims to aggregate regional needs and to match different economic and social requirements. At time of writing, the government (Ministry of Agriculture) compiles input for a national reform by visiting the departments while CAUCA was visited as the first region (GOV.CO, 2024c).

As it is underlined in previous sections **(Please view also section 2.3.3.) agroecology** is comprehensively investigated in Colombia and leads to new opportunities in the rural areas by developing biofactories and producing bio-based products and fertilisers for farming purposes including but not limited to organic production (CIAT, 2024).

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

5. Conclusions and Policy Recommendations

This *D3.13 Outlook on legal aspects for RUSTICA nutrient cycles* concentrates on legally binding sources and their alterations during the lifetime of the project, as well as results from monitoring, discussing and evaluating RUSTICA research activities relating thereto. A reference is also made to fundamental policies in the EU and in Colombia by including even latest signals and publications into this RUSTICA report.

To ramp up RUSTICA circular business models based on regional value chains in the EU and worldwide, solid and reliable legal frameworks favourable to novel systems on plant nutrition and soil fertility are necessary.

Supranational agreements, such as the Basel Convention and the UNFCCC, pave the way for equal global levels on protection of the environment, valorisation of waste and mitigation of climate change. In pursuing progress in these subjects, the RUSTICA project represented in the EU and in Colombia explores solutions through novel approaches on plant, and especially on crop supply.

The vital relationship between the EU and the Andean State leads inter alia to intensified collaborations in various areas, such as research and trade while long-term effects of the Trade Agreement covering also fertilisers would need a separate study and is not in the scope of this RUSTICA D3.13 work. However, it needs to be stressed that coherent and reliable rules on trade within the EU countries and between the EU and Third Countries can help to avoid adverse trade practices.

Dealing with circular nutrient cycles draws attention to the kind of feedstock, its origin and quality. If the substrate falls into the legal category of “waste”, the definitions are very different comparing the rules inside the EU and elsewhere on the planet. If a “waste status” is achieved for a subject in the EU, end-of-waste criteria need to be met before re-entering into the economic cycle and using as a resource or product can occur. As indicated in this report, missing end-of-waste criteria are also relevant for research activities in RUSTICA. Therefore, establishing harmonized rules for end-of-waste in the EU and specific instructions facilitating research and innovation including but not limited to sampling and transport for would represent an important step forward to closed and environmentally friendly valorisation of waste from the agri-food chain. In this respect, the policy makers are recommended to comprehensively define end-of-waste criteria at the EU-level.

The EU legislation prescribes also requirements for by-products to be fulfilled if a further use shall take place. To overwind these challenges, a thorough study of the legal frameworks on the individual situation of the intended feedstock is indispensable if novel value chains like those of RUSTICA shall be established. RUSTICA partners and stakeholders are willing to share their insights to accomplish the optimal uplift of by-products.

Converting leftovers from the agri-food sectors by fermentation processes, pyrolysis and electrodialysis in the EU automatically leads to the REACH Regulation and its comprehensive provisions on registration and other commitments. Insect farming and stipulations on feed in the EU is bound to rules on farmed animals while composting, particularly depending on the input, is accompanied by legislation, e.g., on waste, chemicals (REACH), and animal by-products. The RUSTICA Consortiums accumulates a strong expertise in these technologies and the project can support their application in terms of how to align with legal requirements. On the other hand, specific legal incentives in REACH favoring organic substances for fertilisers derived from circular processes could accelerate their launch onto the market.

Albeit the new EU FPR 2019/1009 does not yet cover the entire spectrum of bio-based fertilisers, end of waste criteria are established for certain circular materials by reaching the CE-mark and currently can benefit RUSTICA developments and combinations of compost, biochar, and nutrient concentrate. To date, legal dictates on insect-based products for plants and soils requiring an “endpoint of the manufacturing chain” are mainly set for composting if marketed under the harmonised legal scheme in the EU while discussions of experts reveal opinions favouring other (direct) uses. Deployment of microorganisms is already integrated into the EU FPR,

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

but with a focus on biostimulants at present. Moreover, with regard to “blends”: Depending on the component materials and its categories (CMCs), as well as envisaged product function(s) of the RUSTICA blends, the RBBF may either fall into the “PFC 7 Fertilising Product Blends“ or not. To expand the scope of the “endpoints of manufacturing chain” for insect materials as “standalone” component materials in the EU FPR would benefit placement onto the market of RUSTICA results on farmed insects. Collaboration among research consortia and sharing of best practices to policy makers are important instruments available to support this process.

National/regional law in the EU covers compost under a waste or a product regime or both. In Colombia, categories on fertilisers are precisely designed and inputs on compost including microorganisms are set. Legislation on the use of biochar is established in Italy, while in Flanders one can ask for a derogation. Using insect biomass and frass for organic fertilisers and soil improvers in the EU Member States has to be in compliance with the EU Animal by-product regulations. For example, five frass products are already listed in France. Spanish law defines inorganic fertilisers broadly, but indicates exact rules for waste-based products. Microbial protein has gotten a permission for RUSTICA test purposes in Flanders embodying a significant progress in these matters. Even though there was significant progress for circular fertilisers in national/regional legislation in the EU, more standardized rules between Member States could facilitate the acceptance of innovations like those of RUSTICA.

Law on organic production in the EU points out deployment and restrictions to compost, biochar, and frass. Conditions are laid down on the use of inorganic micronutrients while dedicated instructions on microbial protein and insect protein for fertilisers as expressed by RUSTICA could not be clearly detected in the legal acts determining organic farming in the EU. In Colombia, products yielded from organic farming can be just marketed if they are certified and additional rules apply to their trade. Although there is a clear advancement on the use of circular fertilisers in legislation on organic production in the EU, specific promotion of these products with proven safety by policy makers could help to boost their adoption in organic farming.

Since the project includes demonstration of its output, legislation affecting the application of the products resulting from RUSTICA value chains is analysed in this Deliverable D3.13 as well. First of all, the Common Agricultural Policy creates the framework encouraging the use of sustainable and bio-based fertilisers by coupling payments and subsidies to protection of the environment, such as conditionality and ecoschemes, in the EU. Law on decreasing emissions to water and air, e.g., Nitrate Directive and LULUCF, also significantly affects distributing fertilisers on farmland while areas protected for biodiversity impose additional duties. The results of RUSTICA are evaluated in terms of their sustainability and represent important databases for policy makers. In Colombia, agricultural experts advise farms on the application of products for plant nutrition which can also be used as an important channel for RUSTICA evolvements.

Undoubtedly, the European Green Deal as the first priority of the European Commission from 2019 to 2024, is the enabler for innovations towards protection of climate and environment as they are boosted by the RUSTICA project. Policies and strategies, such as *Farm-to-Fork*, *Circular Economy*, *Bioeconomy*, *Soil* and *Biodiversity,* are launched with an emphasis on reduction of food and nutrient losses, transposing useless residues into valuable resources by safeguarding biodiversity, while exploring and harnessing bio-based products and biofertilisers in the EU and beyond. RUSTICA pursues to align with the strategies, but there are still legal obstacles in more detail, e.g., for insect materials, as mentioned before.

At the same time, in Colombia an agricultural reform has been initiated and strong endeavors are made on investigations for agroecology aimed at benefitting farmers and rural areas. Since the reform also addresses the Cauca-Region, there is an opportunity for drawing attention to RUSTICA in this context.

More recently, the priorities of the EU are published for 2024 to 2029, and RUSTICA results offer, in particular, contributions to a *competitive and prosperous Europe* by strengthening a proper, sustainable and resilient agriculture.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

References

91/676/EEC. Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources; OJ L 375, 31.12.1991, p. 1–8. Retrieved from https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:31991L0676 at 16.08.2024

92/43/EEC. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora; OJ L 206, 22.7.1992, p. 7–50. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31992L0043 at 23.08.2024

98/58/EC. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes; OJ. L 221 from 8.8.1998, p. 23–27. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:31998L0058 at 10.07.2024

1999/31/EC. Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, OJ L 182, 16.7.1999, p. 1–19. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31999L0031 at 29.05.2024

2000/60/EC. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy; OJ L 327, 22.12.2000, p. 1–73. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060 at 16.08.2024

2008/98/EC. Directive on waste, 2008/98/EC; OJ L 312, 22.11.2008, p. 3–30. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32008L0098 at 02.05.2024

2008/105/EC. Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council; OJ L 348, 24.12.2008, p. 84–97. Retrieved from https://eur-lex.europa.eu/eli/dir/2008/105/oj at 16.08.2024

2009/147/EC. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds; OJ L 20, 26.1.2010, p. 7–25. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147 at 17.08.2024

2010/75/EU. Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control); OJ L 334, 17.12.2010, p. 17–119. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010L0075 at 31.05.2024

(EC)No1069/2009. Regulation (EC) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products

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Regulation); OJ L 300, 14.11.2009, p. 1–33 Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009R1069 at 23.06.2024

(EC)No1272/2008. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006; OJ L 353, 31.12.2008, p. 1–1355. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008R1272 at 08.06.2024

(EC)No1907/2006. Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC; OJ L 396, 30.12.2006, p. 1–854. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006R1907-20231201 at 06.07.2024

(EC)No2003/2003. Regulation (EC) No 2003/2003 of the European Parliament and of the Council of 13 October 2003 relating to fertilisers; OJ L 304, 21.11.2003, p. 1–194. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003R2003 at 01.07.2024

(EU)2016/429. Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Law'); ABl. L 84 vom 31.3.2016, S. 1–208. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016R0429 at 10.08.2024

(EU)2016/1141. Commission Implementing Regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of Union concern pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council; OJ L 189, 14.7.2016, p. 4–8. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R1141 at 10.08.2024

(EU)2016/2284. Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC; OJ L 344, 17.12.2016, p. 1–31. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016L2284 at 17.08.2024

(EU)2018/841. Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU; OJ L 156, 19.6.2018, p. 1–25 (LULUCF). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG at 17.08.2024

(EU)2018/842. Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527

Regulation (EU) No 525/2013; OJ L 156, 19.6.2018, p. 26–42 (ESR). Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32018R0842 at 28.05.2024

(EU)2018/848. Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007; OJ L 150, 14.6.2018, p. 1–92. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018R0848 at 16.08.2024

(EU)2018/850. Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste; OJ L 150, 14.6.2018, p. 100–108. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018L0850 at 20.05.2024

(EU)2018/851. Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste; OJ L 150, 14.6.2018, p. 109–140. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.150.01.0109.01.ENG at 29.04.2022

(EU)2018/1147. Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council (notified under document C(2018) 5070); OJ L 208, 17.8.2018, p. 38–90. Retrieved from https://eur-lex.europa.eu/eli/dec_impl/2018/1147/oj#PP2Contents at 23.06.2024

(EU)2018/1881. Commission Regulation (EU) 2018/1881 of 3 December 2018 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Annexes I, III,VI, VII, VIII, IX, X, XI, and XII to address nanoforms of substances; OJ L 308, 4.12.2018, p. 1–20. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32018R1881 at 29.06.2024

(EU)2018/1999. Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council; OJ L 328, 21.12.2018, p. 1–77. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R1999 at 21.05.2024

(EU)2018/2001. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources; OJ L 328, 21.12.2018, p. 82–209. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG at 25.05.2024

(EU)2019/4. Regulation (EU) 2019/4 of the European Parliament and of the Council of 11 December 2018 on the manufacture, placing on the market and use of medicated feed, amending Regulation (EC) No

183/2005 of the European Parliament and of the Council and repealing Council Directive 90/167/EEC; OJ L 4, 7.1.2019, p. 1–23. Retrieved from https://eur-lex.europa.eu/eli/reg/2019/4/oj at 08.07.2024

(EU)2019/6. Regulation (EU) 2019/6 of the European Parliament and of the Council of 11 December 2018 on veterinary medicinal products and repealing Directive 2001/82/EC; OJ L 4, 7.1.2019, p. 43–167. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32019R0006 at 08.07.2024

(EU)2019/1009. Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003; OJ L 170, 25.6.2019, p. 1–114. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32019R1009 at 21.05.2024

(EU)2019/1597. Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste, OJ L 248, 27.9.2019, p. 77–85. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32019D1597&qid=1620222269929 at 05.08.2024

(EU)2019/1691. Commission Regulation (EU) 2019/1691 of 9 October 2019 amending Annex V to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH); OJ L 259, 10.10.2019, p. 9–1. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R1691 at 15.07.2024

(EU)2021/1119. Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/199; OJ L 243, 9.7.2021, p. 1–17. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R1119 at 28.05.2024

(EU)2021/1165. Commission Implementing Regulation (EU) 2021/1165 of 15 July 2021 authorising certain products and substances for use in organic production and establishing their lists; OJ L 253, 16.7.2021, p. 13–48. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R1165 at 09.08.2024

(EU)2021/1925. Commission Regulation (EU) 2021/1925 of 5 November 2021 amending certain Annexes to Regulation (EU) No 142/2011 as regards the requirements for placing on the market of certain insect products and the adaptation of a containment method; OJ L 393, 8.11.2021, p. 4–8. Retrieved from https://eur-lex.europa.eu/eli/reg/2021/1925/oj at 20.06.2024

(EU)2021/2086. Commission Delegated Regulation (EU) 2021/2086 of 5 July 2021 amending Annexes II and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding precipitated phosphate salts and derivates as a component material category in EU fertilising products; OJ L 427, 30.11.2021, p. 120–129. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R2086 at 16.07.2024

(EU)2021/2087. Commission Delegated Regulation (EU) 2021/2087 of 6 July 2021 amending Annexes II, III and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding thermal oxidation materials and derivates as a component material category in EU fertilising products, OJ L 427, 30.11.2021, p. 130–139. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R2087 at 16.07.2024

(EU)2021/2088. Commission Delegated Regulation (EU) 2021/2088 of 7 July 2021 amending Annexes II, III and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding pyrolysis and gasification materials as a component material category in EU fertilising products; OJ L 427, 30.11.2021, p. 140–148 Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R2088 at 14.08.2024

(EU)2021/2115. Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013, ABl. L 435 vom 6.12.2021, S. 1–186. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R2115 at 15.08.2024

(EU)2022/477. COMMISSION REGULATION (EU) 2022/477 of 24 March 2022 amending Annexes VI to X to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH); OJ L 98, 25.3.2022, p. 38–53. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32022R0477 at 29.06.2024

(EU)2022/973. Commission Delegated Regulation (EU) 2022/973 of 14 March 2022 supplementing Regulation (EU) 2019/1009 of the European Parliament and of the Council by laying down criteria on agronomic efficiency and safety for the use of by-products in EU fertilising products, OJ L 167, 24.6.2022, p. 29–33. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022R0973 at 15.06.2024

(EU)2022/1171. Commission Delegated Regulation (EU) 2022/1171 of 22 March 2022 amending Annexes II, III and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding recovered high purity materials as a component material category in EU fertilising products; OJ L 183, 8.7.2022, p. 2–11. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32022R1171 at 16.07.2024

(EU)2023/839. Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review; OJ L 107, 21.4.2023, p. 1–28. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32023R0839 at 17.08.2024

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

(EU)2023/857. Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999; OJ L 111, 26.4.2023, p. 1–14. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0857 at 18.06.2024

(EU)2023/1605. Commission Delegated Regulation (EU) 2023/1605 of 22 May 2023 supplementing Regulation (EC) No 1069/2009 of the European Parliament and of the Council as regards the determination of end points in the manufacturing chain of certain organic fertilisers and soil improvers, OJ L 198, 8.8.2023, p. 1–5. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R1605 at 16.07.2024

(EU)2023/2229. Commission Implementing Regulation (EU) 2023/2229 of 25 October 2023 amending and correcting Implementing Regulation (EU) 2021/1165 authorising certain products and substances for use in organic production and establishing their lists; OJ L, 2023/2229, 26.10.2023,. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32023R2229 at 14.08.2024

(EU)2023/2413. Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652; OJ L, 2023/2413, 31.10.2023. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023L2413 at 16.06.2024

(EU)2024/1157. Regulation (EU) 2024/1157 of the European Parliament and of the Council of 11 April 2024 on shipments of waste, amending Regulations (EU) No 1257/2013 and (EU) 2020/1056 and repealing Regulation (EC) No 1013/2006; OJ L, 2024/1157, 30.4.2024. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R1157 at 13.06.2024

(EU)2024/1682. Commission Delegated Regulation (EU) 2024/1682 of 4 March 2024 amending Regulation (EU) 2019/1009 of the European Parliament and of the Council as regards adding processed manure as a component material in EU fertilising products; OJ L, 2024/1682, 13.6.2024. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32024R1682 at 18.07.2024

(EU)2024/1785. Directive (EU) 2024/1785 of the European Parliament and of the Council of 24 April 2024 amending Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC on the landfill of waste; OJ L, 2024/1785, 15.7.2024. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AL_202401785 at 22.08.2024

(EU)No142/2011. Commission Regulation (EU) No 142/2011 of 25 February 2011 implementing Regulation (EC) No 1069/2009 of the European Parliament and of the Council laying down health rules as regards animal by-products and derived products not intended for human consumption and implementing Council Directive 97/78/EC as regards certain samples and items exempt from veterinary checks at the border under that Directive; OJ L 54, 26.2.2011, p. 1–254. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011R0142 at 06.07.2024

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

(EU)No511/2014. Regulation (EU) No 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union; ABl. L 150 vom 20.5.2014, p. 59–71. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32014R0511 at 21.04.2024

(EU)No1143/2014. Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species; OJ L 317, 4.11.2014, p. 35–55 Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R1143 at 14.08.2024

AFNOR. (2024). Afnor Editions > Standards > NF U42-001-1; Fertilizers - Designations and specifications - Part 1 : inorganic fertilizers. Retrieved from https://www.boutique.afnor.org/en-gb/standard/nf-u420011/fertilizers-designations-and-specifications-part-1-inorganic-fertilizers/fa167576/37978#AreasStoreProductsSummaryView at 16.07.2024

agenciaBrasil. (2023). Brazil rejoins Community of Latin American and Caribbean States, 07/01/23. Retrieved from https://agenciabrasil.ebc.com.br/en/politica/noticia/2023-01/brazil-once-again-part-celac-understand-what-regional-block at 09.05.2024

ANPEA. (2024). Filière Fertilisation – ANPEA; Bureau de Normalisation Le BN FERTI; . Retrieved from https://anpea.com/bureau-de-normalisation/ at 27.07.2024

ANSES. (2024). Registre des AMM de produits phyto et MFSC; Nom de produit "frass". Retrieved from https://www.anses.fr/fr/decisions?combine=frass&field_amm_number_value=&field_product_type_tid_i18n=All&field_signature_date_value%5Bmin%5D%5Bdate%5D=&field_signature_date_value%5Bmax%5D%5Bdate%5D=&sort_by=field_publication_date_value&sort_order=DESC at 04.08.2024

Arreteédu9Avril2018. Arrêté du 9 avril 2018 fixant les dispositions techniques nationales relatives à l'utilisation de sous-produits animaux et de produits qui en sont dérivés, dans une usine de production de biogaz, une usine de compostage ou en « compostage de proximité », et à l'utilisation du lisier; NOR : AGRG1809743A; JORF n°0095 du 24 avril 2018; Text no 17. Retrieved from https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000036830969?page=1&pageSize=10&query=sous-produits+animaux&searchField=ALL&searchType=ALL&tab_selection=all&typePagination=DEFAULT at 01.08.2024

AVEBIOM. (2024). AVEBIOM COMIENZA 2024 REFORZANDO SU COMPROMISO CON LA EXPANSIÓN DE LA BIOENERGÍA Y LA BIOECONOMÍA EN ESPAÑA Y EUROPA. Retrieved from https://www.avebiom.org/biomasanews/avebiom/avebiom-comienza-2024-reforzando-compromiso-con-expansion-de-bioenergia-bioeconomia at 30.07.2024

AVECOM. (2021) *Information from AVECOM, personal email dated from 13.07.2021 and interview dated from 2021*.

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

AVECOM. (2024a). The Future of Plant Nutrition. Retrieved from https://avecom.be/biomass-fermentation/fertilizers/ at 29.06.2024

AVECOM. (2024b). Personal information from Avecom (Email Kim Windey 24.05.2024).

Bartels, L. (2013). Human rights and sustainable development obligations in EU free trade agreements. *Legal Issues of Economic Integration, 40*(4).

Bazinet, L., & Geoffroy, T. R. (2020). Electrodialytic processes: Market overview, membrane phenomena, recent developments and sustainable strategies. *Membranes, 10*(9), 221.

Bazinet, L., Lamarche, F., & Ippersiel, D. (1998). Bipolar-membrane electrodialysis: Applications of electrodialysis in the food industry. *Trends in food science & technology, 9*(3), 107-113.

BRS-Conventions. (2023). BRS at COP-28: How the sound management of chemicals and waste relates to climate action; BRS Conventions > Media Hub > News > News Features > BRS at COP-28. Retrieved from https://www.brsmeas.org/MediaHub/News/NewsFeatures/BRSatCOP28/tabid/9751/language/en-US/Default.aspx at 16.03.2024

C/2018/2035. European Commission; C/2018/2035; Commission Notice — Guidelines for the feed use of food no longer intended for human consumption C/2018/2035; OJ C 133, 16.4.2018, p. 2–18. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018XC0416(01) at 14.06.2024

CAN. (2024). La Communidad Andina; ¿Quiénes Somos? Retrieved from https://www.comunidadandina.org/quienes-somos/ at 05.02.2024

CarbonCentric. (2024). Biochar en agriculture : une solution polyvalente; Thomas Harcourt;. Retrieved from https://carbon-centric.fr/biochar-agriculture/ at 30.07.2024

CELAC. (2024). COMUNIDAD DE ESTADOS LATINO AMERICANOS Y CARIBENOS; CELAC International. Retrieved from https://celacinternational.org/ at 05.02.2024

CIAT. (2024) *Guillermo Pena Chipatecua, Myriam Sanchez, and Mirjam Pulleman - personal meeting (online) at 04.07.2024*.

CIRCABC. (2024). Commission Expert Group on Fertilising Products; TECHNICAL STUDY FOR CMC 10 MATERIALS-INTERIM REPORT.PDF; Autor: Themistoklis Sfetsas DRAFT 2024 Jul 18, 10:13;. Retrieved from https://circabc.europa.eu/ui/group/36ec94c7-575b-44dc-a6e9-4ace02907f2f/library/0581ca9d-fcda-4e4b-b688-bba848ebb941/details at 20.07.2024

CodeEnv. (2024). Code de l'environnement; Partie législative (Articles L110-1 à L713-9); ReplierLivre V : Prévention des pollutions, des risques et des nuisances (Articles L501-1 à L597-46); ReplierTitre IV :

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

Déchets (Articles L541-1 à L542-14); ReplierChapitre Ier : Prévention et gestion des déchets (Articles L541-1 à L541-50); ReplierSection 3 : Prévention et gestion des déchets (Articles L541-11 à L541-39); Sous-section 3 : Collecte des déchets (Articles L541-21 à L541-21-5); Version en vigueur depuis le 01 janvier 2021. Retrieved from https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000041627130 at 19.07.2024

CodeRural. (2024). Code rural et de la peche maritime; Partie législative (Articles L1 à L958-15); Livre II : Alimentation, santé publique vétérinaire et protection des végétaux (Articles L201-1 à L275-15); Titre V : La protection des végétaux (Articles L250-1 à L259-2); Chapitre V : Mise sur le marché et utilisation des matières fertilisantes, des adjuvants pour matières fertilisantes et des supports de culture (Articles L255-1 à L255-18); Version en vigueur au 28 juillet 2024. Retrieved from https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000006071367/LEGISCTA000006152218/#LEGISCTA000030678488 at 28.07.2024

ColtoreProtette. (2023). Il frass d'insetto: da sottoprodotto a valido fertilizzante organico; Di Giuseppe Di Cuia, Massimiliano D'Imperio, Maria Gonnella e Angelo Parente; 30 Giugno 2023. Retrieved from https://coltureprotette.edagricole.it/ricerca-scientifica/frass-insetto-fertilizzante-organico/ at 04.08.2024

COM(2012)60. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Innovating for Sustainable Growth: A Bioeconomy for Europe; COM/2012/060 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2012%3A0060%3AFIN at 18.08.2024

COM(2014)398. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Towards a circular economy: A zero waste programme for Europe; COM/2014/0398 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:52014DC0398 at 18.08.2024

COM(2018)656. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the implementation of EU waste legislation, including the early warning report for Member States at risk of missing the 2020 preparation for re-use/recycling target on municipal waste; 24.09.2018. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1537873850842&uri=COM:2018:656:FIN at 10.06.2024

COM(2018)673. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment; COM/2018/673 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0673 at 20.08.2024

COM(2019)640. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The European Green Deal; COM/2019/640 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52019DC0640 at 22.06.2024

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

COM(2020)590. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, Ensuring availability and affordability of fertilisers. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2022%3A590%3AFIN at 18.08.2024

COM(2021)141. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS ON AN ACTION PLAN FOR THE DEVELOPMENT OF ORGANIC PRODUCTION; COM/2021/141 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0141 at 18.08.2024

COM(2021)699. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS; EU Soil Strategy for 2030, Reaping the benefits of healthy soils for people, food, nature and climate. Retrieved from https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:699:FIN at 26.08.2024

COM(2023)420. European Commission; Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2008/98/EC on waste; Brussels, 5.7.2023; 2023/0234(COD). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023PC0420 accessed at 10.06.2024

COM/2020/98. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe; COM/2020/98 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A98%3AFIN at 15.08.2024

COM/2020/380. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Biodiversity Strategy for 2030 Bringing nature back into our lives; COM/2020/380 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0380 at 18.08.2024

COM/2020/381. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system; COM/2020/381 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381 at 18.08.2024

COM/2023/416. Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Soil Monitoring and Resilience (Soil Monitoring Law) (2023/0232(COD). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A0416%3AFIN at 17.08.2024

COP.15. (2022). Secretariat of the Basel Convention; Fifteenth Meeting of the Conference of the Parties to the Basel Convention, Online, 26 to 30 July 2021 (online segment) and Geneva, Switzerland, from 6 to 17 June 2022 (face-to-face segment). Retrieved from

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

https://www.basel.int/TheConvention/ConferenceoftheParties/Meetings/COP15/tabid/8392/Default.aspx at 05.02.2024

COP.16. (2023). Secretariat of the Basel Convention; Sixteenth meeting of the Conference of the Parties to the Basel Convention, Geneva, Switzerland, from 1-12 May 2023. Retrieved from https://www.basel.int/TheConvention/ConferenceoftheParties/Meetings/COP16/tabid/9311/Default.aspx at 05.08.2024

Decreto75. (2010). Decreto Legislativo 29 aprile 2010, n. 75. Riordino e revisione della disciplina in materia di fertilizzanti, a norma dell'articolo 13 della legge 7 luglio 2009, n. 88 (GU 121 26/05/2010). Version 31.01.2024. Retrieved from https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2010;075 at 01.08.2024

Decreto152. (2006). Decreto Legislativo 3 aprile 2006, n. 152. Norme in materia ambientale (GU 88 del 14/04/2006 - Suppl. Ordinario n. 96). Retrieved from https://web.camera.it/parlam/leggi/deleghe/06152dl6.htm at 30.07.2024

Deman, N. (2024). [RUSTICA - legal analysis on CAP technology and output, DRANCO - Personal Email dated from 22.05.2024].

Deman, N. (2025). Re: Personal Discussion at 18.03.2025

DeNorre (2022). [Personal communciation: Miss Heleen De Norre, from the Federal Public Service (FPS) Health, Food Chain Safety and Environment in Belgium to H. Cooreman (EV ILVO) 20.04.2022].

Dordas, C. (2008). Role of nutrients in controlling plant diseases in sustainable agriculture. A Review. *Agronomy for Sustainable Development, 2008, 28 (1), pp.33-46. ffhal-00886444f*. Retrieved from https://hal.science/hal-00886444/file/hal-00886444.pdf at 19.02.2024

EBC. (2024a). European Biochar Certificate - Guidelines for a Sustainable Production of Biochar. European Biochar Foundation (EBC), Arbaz, Switzerland, https://www.european-biochar.org/media/doc/2/version_en_10_3.pdf Version 10.3 from 5th April 2023. Retrieved from https://european-biochar.org/en/ct/2-EBC-guidelines-documents-for-the-certification at 12.07.2024

EBC. (2024b). Positive list of permissible biomasses for the production of biochar; European Biochar Certificate (last update 20th June 2024). Retrieved from https://www.european-biochar.org/media/doc/2/positivlist_en_v10_3_v4.pdf at 15.07.2024

EBI. (2020). European Biochar Industry - BioChar goes REACH; Harald Bier; 11.08.2020. Retrieved from https://www.biochar-industry.com/2020/biochar-goes-reach/ at 07.08.2024

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

EC. (2021a). European Commission; Environment; Home > Topics > Waste and recycling > Waste Framework Directive - End-of-waste criteria. Retrieved from https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en#ecl-inpage-632 at 18.06.2024

EC. (2021b). European Commission; EU Regional and Urban Development; New action plan on EU-Colombia Regional Policy Cooperation, 10 September 2021. Retrieved from https://ec.europa.eu/regional_policy/en/newsroom/news/2021/09/09-10-2021-new-action-plan-on-eu-colombia-regional-policy-cooperation at 07.06.2024

EC. (2021c). European Commission; Home > Strategy > Priorities 2019-2024 > A European Green Deal; Striving to be the first climate-neutral continent. Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#timeline at 18.08.2024

EC. (2022a). European Commission, Energy, Climate change, Environment, Proposal for a Directive amending the Water Framework Directive, the Groundwater Directive and the Environmental Quality Standards Directive. Retrieved from https://environment.ec.europa.eu/publications/proposal-amending-water-directives_en at 16.08.2024

EC. (2022b). European Commission, REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, EU Bioeconomy Strategy Progress Report, European Bioeconomy policy: stocktaking and future developments; COM(2022) 283 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A283%3AFIN at 19.08.2024

EC. (2023a). European Commission, Research and Innovation; European Commission hosts a bi-regional meeting with Latin America and the Caribbean, 1 December 2023. Retrieved from https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/european-commission-hosts-bi-regional-meeting-latin-america-and-caribbean-2023-12-01_en at 11.08.2024

EC. (2023b). European Commission; Agricultural Market Brief No. 20; Organic farming in the EU; A decade of organic growth; January 2023. Retrieved from https://agriculture.ec.europa.eu/document/download/df01a3c7-c0fb-48f1-8eca-ce452ea4b8c2_en?filename=agri-market-brief-20-organic-farming-eu_en.pdf at 11.08.2024

EC. (2023c). European Commission; Climate Action; Effort sharing 2021-2030: targets and flexibilities. Retrieved from https://climate.ec.europa.eu/eu-action/effort-sharing-member-states-emission-targets/effort-sharing-2021-2030-targets-and-flexibilities_en at 18.06.2024

EC. (2024a). The common agricultural policy at a glance, Legal Foundations. Retrieved from https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en#legal-foundations at 15.08.2024

EC. (2024b). The common agricultural policy: 2023-27; Ten specific objectives. Retrieved from https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27_en at 15.08.2024

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

EC. (2024c). European Commission, Energy, Climate change, Environment; Land use sector. Retrieved from https://climate.ec.europa.eu/eu-action/land-use-sector_en at 17.08.2024

EC. (2024d). European Commission, Energy, Climate change, Environment; Nitrates - Protecting waters against pollution caused by nitrates from agricultural sources. Retrieved from https://environment.ec.europa.eu/topics/water/nitrates_en at 16.08.2024

EC. (2024e). European Commission; Access2Markets; EU-Colombia-Peru-Ecuador Trade Agreement; . Retrieved from https://trade.ec.europa.eu/access-to-markets/en/content/eu-colombia-peru-ecuador-trade-agreement at 07.06.2024

EC. (2024f). European Commission; Energy, Climate change, Environment; European Green Deal; The EU's roadmap for a sustainable economy, striving to make Europe climate neutral in 2050. Retrieved from https://environment.ec.europa.eu/strategy_en at 18.08.2024

EC. (2024g). European Commission; Environment; Home > Nature and Biodiversity; Natura 2000. Retrieved from https://ec.europa.eu/environment/nature/natura2000/index_en.htm at 01.08.2024

EC. (2024h). European Commission; European IPCC Bureau; BAT Reference Documents. Retrieved from https://eippcb.jrc.ec.europa.eu/reference at 31.05.2024

EC. (2024i). European Commission>Docs Room>Document detail; FAQs related to Regulation (EU) 2019/1009 on fertilising products (the 'Fertilising Products Regulation') Document date: 21/03/2024 - Created by GROW.F.2 - Publication date: n/a - Last update: 21/03/2024. Retrieved from https://ec.europa.eu/docsroom/documents/58634?locale=en at 18.07.2024

ECHA. (2012). European Chemicals Agency; Guidance on REACH - Guidance for Annex V. Retrieved from https://echa.europa.eu/guidance-documents/guidance-on-reach at 25.06.2024

ECHA. (2023). Guidance for identification and naming of substances under REACH and CLP, Version 3.0 December 2023. Retrieved from https://echa.europa.eu/documents/10162/2324906/substance_id_en.pdf/ee696bad-49f6-4fec-b8b7-2c3706113c7d at 29.06.2024

ECHA. (2024). Retrieved from https://www.echa.europa.eu/web/guest/search-for-chemicals?p_p_id=disssimplesearch_WAR_disssearchportlet&p_p_lifecycle=0&_disssimplesearch_WAR_disssearchportlet_searchOccurred=true&_disssimplesearch_WAR_disssearchportlet_sessionCriteriaId=dissSimpleSearchSessionParam101401720812200020 at 12.07.2024

ECN. (2024a). European Compost Network; About ECN. Retrieved from https://www.compostnetwork.info/about-ecn/ at 12.07.2024

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

ECN. (2024b). European Compost Network; ECN-QAS NEWS;. Retrieved from https://www.compostnetwork.info/ecn-qas/ecn-qas-news/ at 13.07.2024

ECN. (2024c). European Compost Network; ECN-QAS; Targets of ECN-QAS; Contents of ECN-QAS. Retrieved from https://www.compostnetwork.info/ecn-qas/ at 15.07.2024

ECN. (2024d). Fertilising Product Regulation; IV. Process Requirements. Retrieved from https://www.compostnetwork.info/policy/from-waste/product-regulation/ at 20.07.2024

EEA. (2020). European Environment Agency (EEA); Bio-waste in Europe — turning challenges into opportunities; EEA Report No 04/2020. Retrieved from https://www.eea.europa.eu/publications/bio-waste-in-europe at 10.06.2024

EEAS. (2023). European External Action Service (EEAS); EU-LAC PARTNERSHIP, March 2023. Retrieved from https://www.eeas.europa.eu/sites/default/files/documents/2023/Factsheet%20EU_LAC_en_2022_2510-march.pdf at 09.05.2024

EFSAScientificCommittee. (2015). Risk profile related to production and consumption of insects as food and feed. *EFSA journal, 13*(10), 4257.

ESPP. (2024). European Sustainable Phosphorous Platform; Summary of EU Fertilisers Expert Group 15-16 April 2024 Animal by-products (ABPs) in EU fertilising products: ESPP eNews no. 86 - May 2024. Retrieved from https://www.phosphorusplatform.eu/scope-in-print/enews/2530-espp-enews-no-86-may-2024#_Toc164875154 at 18.07.2024

EU-COUNCIL. (2023). Council of theEuropean Union; Declaration of the EU-CELAC Summit 2023; 12000/23 COLAC 98; Brussels 18th July 2023. Retrieved from https://eulacfoundation.org/sites/default/files/attachments/2023-07/st12000.en23.pdf at 09.05.2024

EU-LAC. (2023). EU-LAC Foundation; III EU-CELAC Summit 2023. Retrieved from https://eulacfoundation.org/en/iii-eu-celac-summit-2023 at 09.05.2024

EU. (2012). Trade Agreement between the European Union and its Member States, of the one part, and Colombia and Peru, of the other part, OJ L 354, 21.12.2012, p. 3–2607. Retrieved from http://publications.europa.eu/resource/cellar/42e02e6c-1698-465e-923c-d2d12f91c728.0017.04/DOC_1 at 06.06.2024

EU. (2020). Trade Agreement between the European Union and its Member States, of the one part, and Colombia, Peru and Ecuador, of the other part - Informal Update: 02012A1221(01) — EN — 19.11.2020 — 002.001. Retrieved from http://publications.europa.eu/resource/cellar/899f51cb-8821-11eb-ac4c-01aa75ed71a1.0006.02/DOC_1 at 06.06.2024

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

EU. (2024a). European Commission, Energy, Climate change, Environment, Water Framework Directive. Retrieved from https://environment.ec.europa.eu/topics/water/water-framework-directive_en at 16.08.2024

EU. (2024b). European Union priorities 2019-2024 EU strategic agenda for 2019-2024. Retrieved from https://european-union.europa.eu/priorities-and-actions/eu-priorities/european-union-priorities-2024-2029/european-union-priorities-2019-2024_en at 18.08.2024

EU. (2024c). European Union; How EU priorities are set. Retrieved from https://european-union.europa.eu/priorities-and-actions/eu-priorities/how-eu-priorities-are-set_en at 18.08.2024

EUR-Lex. (1998). Framework Agreement on Cooperation between the European Economic Community and the Cartagena Agreement and its member countries, namely the Republic of Bolivia, the Republic of Colombia, the Republic of Ecuador, the Republic of Peru and the Republic of Venezuela - Exchange of Letters on shipping /* AGREEMENT EC - ANDEAN PACT */ OJ L 127, 29.4.1998, p. 11–25. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A21998A0429%2801%29 at 06.06.2024

EUR-Lex. (2024). Directory of international agreements, section 15.10 Environment. Retrieved from https://eur-lex.europa.eu/browse/directories/inter-agree.html at 03.02.2024

EUROGROUP. (2024). Enhancing insect welfare: assessing dietary practices for farmed Insects in the European Union; EUROGROUP FOR ANIMALS; Authorts: H. Lambert & A. Cornish. Retrieved from https://www.eurogroupforanimals.org/files/eurogroupforanimals/2024-01/15012023_report_efa_enhancing%20insect%20welfare%20assessing%20dietary%20practices%20in%20the%20European%20Union_FINAL.pdf at 08.07.2024

EURONEWS. (2024). France implements compulsory composting. Here's how it will help slash emissions; 04/01/2024 - Retrieved from https://www.euronews.com/green/2024/01/02/france-implements-compulsory-composting-heres-how-it-will-help-slash-emissions at 28.07.2024

EuropeanCouncil. (2024). European Council, Strategic agenda 2024-2029. Retrieved from https://www.consilium.europa.eu/en/european-council/strategic-agenda-2024-2029/ at 18.08.2024

FAO. (2024). Food an Agriculture Organisation of the United Nations; Family Farming Knowledge Platform; The World of Organic Agriculture 2024, Statistics and Emerging Trends. Retrieved from https://www.fao.org/family-farming/detail/en/c/1678159/ at 11.08.2024

Flanders-Dep.-of-Agriculture. (2024). Vlaanderen; Department Landbouw and Visserij; Wetgeving biologische productie. Retrieved from https://lv.vlaanderen.be/nl/bio/wetgeving-biologische-productie at 18.08.2024

Garcia, B., Alves, O., Rijo, B., Lourinho, G., & Nobre, C. (2022). Biochar: production, applications, and market prospects in Portugal. *Environments, 9*(8), 95.

Garske, B., Heyl, K., & Ekardt, F. (2024). The EU Communication on ensuring availability and affordability of fertilisers—a milestone for sustainable nutrient management or a missed opportunity? *Environmental Sciences Europe, 36*(1), 19.

Giannakis, E., Kushta, J., Bruggeman, A., & Lelieveld, J. (2019). Costs and benefits of agricultural ammonia emission abatement options for compliance with European air quality regulations. *Environmental Sciences Europe, 31*(1), 1-13.

gov.br. (2023). Ministério das Relações Exteriores Brazil; Return of Brazil to CELAC, Press release No 5; Published in Jan 05, 2023 07:10 PM Updated in Mar 08, 2023 11:05 AM. Retrieved from https://www.gov.br/mre/en/contact-us/press-area/press-releases/return-of-brazil-to-celac at 05.02.2024

GOV.CO. (2024a). Government of Colombia; Community of Latin American and Caribbean States (CELAC); Cancillería>Política Exterior>Mecanismos de Concertación e Integración Regionales>Comunidad de Estados Latinoamericanos y Caribeños (CELAC). Retrieved from https://www.cancilleria.gov.co/en/community-latin-american-and-caribbean-states-celac at 04.02.2024

GOV.CO. (2024b). Ministerio de Agricultura y Desarrollo Rural; Agricultura Orgánica Certificada; 25.03.2014. Retrieved from https://www.minagricultura.gov.co/tramites-servicios/Paginas/Sello-Ecologico.aspx at 15.08.2024

GOV.CO. (2024c). Ministry of Agriculture; Reforma Agraria. Retrieved from https://www.minagricultura.gov.co/paginas/default.aspx at 24.08.2024

ICHAR. (2020). ECOSCIENZA Numero 2 • Anno 2020; LA NORMATIVA SUL BIOCHAR E LE PROSPETTIVE D'USO. Retrieved from file:///C:/Users/Computer/Desktop/pozzi_et_al_ec-02-2020_per_web-14.pdf at 30.07.2024

ICHAR. (2024). CERTIFICAZIONI DELL'ASSOCIAZIONE ITALIANA BIOCHAR. Retrieved from https://ichar.org/index.php/marchi/ at 20.07.2024

INAO. (2024). INAO - Institut National de l' Origine et de la Qualité; Agriculture Biologique. Retrieved from https://www.inao.gouv.fr/Les-signes-officiels-de-la-qualite-et-de-l-origine-SIQO/Agriculture-biologique at 15.08.2024

IPCC. (2024a). Intergovernmental Panel on Climate Change; REPORTS ASSESSMENT REPORTS; Working Group III: Mitigation; 3. Technological and Economic Potential of Greenhouse Gases; 3.7 Waste. Retrieved from https://archive.ipcc.ch/ipccreports/tar/wg3/index.php?idp=120 at 30.06.2024

IPCC. (2024b). Intergovernmental Panel on Climate Change; Task Force on National Greenhouse Gas Inventories; 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 Agriculture, Forestry and Other Land Use, Appendix 4 Method for Estimating the Change in

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

Mineral Soil Organic Carbon Stocks from Biochar Amendments: Basis for Future Methodological Development. Retrieved from https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html at 28.06.2024

IPIFF. (2021). Fact sheet on insect frass. Retrieved from https://ipiff.org/wp-content/uploads/2021/11/Nov-29-2021-IPIFF-fact-sheet-on-insect-frass-final.pdf at 20.06.2024

IPIFF. (2024a). Guide on Good Hygiene Practices for European Union (EU) producers of insects for food and feed, February 2024 (p.17). Retrieved from https://ipiff.org/wp-content/uploads/2024/02/Folder-IPIFF_Guide_A4_19.02.2024_black-colour.pdf at 08.07.2024

IPIFF. (2024b). Insect Frass as Fertiliser; Valorisation of insect Frass as Fertiliser – an overview. Retrieved from https://ipiff.org/insects-frass/ at 02.08.2024

IPIFF. (2024c). International Platform of Insects for Food and Feed; EU Legislation. Retrieved from https://ipiff.org/insects-eu-legislation/ at 06.07.2024

Jarosz, Z., & Faber, A. (2020). Possibilities of reducing ammonia emissions from agriculture–Scenario for 2030. *Roczniki (Annals), 2020*(2).

Johansson, N., & Forsgren, C. (2020). Is this the end of end-of-waste? Uncovering the space between waste and products. *Resources, Conservation and Recycling, 155*, 104656.

JuntadeAndalucia. (2024). Junta de Andalucia; Productos fertilizantes, enmiendas y sustratos en producción ecológica. Retrieved from https://www.juntadeandalucia.es/organismos/agriculturaganaderiapescaydesarrollosostenible/areas/produccion-ecologica/asesoramiento-produccion-ecologica/paginas/guia-evaluacion-insumos-fertilizantes-pe.html at 16.08.2024

Kotoka, F., Gutierrez, L., Verliefde, A., & Cornelissen, E. (2024). Selective separation of nutrients and volatile fatty acids from food wastes using electrodialysis and membrane contactor for resource valorization. *Journal of Environmental Management, 354*, 120290.

Kuiper, D. (2024). Personal email Daan Kuiper, Cropeye, The Netherlands dated from 03.09.2024.

Kuiper, D. (2025). [Personal discussion at 18.03.2025].

LeggeRegionale-n.34. (2017). Legge Regionale 20 ottobre 2017, n. 34 (Supplemento ordinario N. 42 25/10/2017 al BUR N. 43 25/10/2017). Disciplina organica della gestione dei rifiuti e principi di economia circolare. Retrieved from https: https://lexview-int.regione.fvg.it/FontiNormative/xml/IndiceLex.aspx?anno=2017&legge=34&lista=0 at 22.07.2024

RUS TI CA

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

Legifrance. (2024). Republic Francaise; Legifrance; Normes AFNOR d'application obligatoire, Update 24.07.2023. Retrieved from https://www.legifrance.gouv.fr/contenu/menu/autour-de-la-loi/entreprises/normes-afnor-d-application-obligatoire at 29.07.2024

Légifrance. (2024). Vocabulaire de l'environnement (liste de termes, expressions et définitions adoptés), NOR : CTNR2221837K, JORF n°0179 du 4 août 2022, Texte n° 105 "biochar". Retrieved from https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000046139367?init=true&page=1&query=biocharbon&searchField=ALL&tab_selection=all at 30.07.2024

MapsontheWeb. (2023). CELAC (Comunidad de Estados Latino Americanos y Caribeños-Community of Latin American and Caribbean States) members. maps_by_an_argentine_ 04th of August 2023. Retrieved from https://mapsontheweb.zoom-maps.com/post/724720351397003264/celac-comunidad-de-estados-latinoamericanos-y at 20.08.2024

Meyer, S., Genesio, L., Vogel, I., Schmidt, H.-P., Soja, G., Someus, E., . . . Glaser, B. (2017). Biochar standardization and legislation harmonization. *Journal of Environmental Engineering and Landscape Management, 25*(2), 175-191.

Min.Decreto22/2015. GAZZETTA UFFICIALE; DECRETO 22 giugno 2015; Aggiornamento degli allegati 2, 6 e 7 al decreto legislativo n. 75 del 29 aprile 2010 «Riordino e revisione della disciplina in materia di fertilizzanti, a norma dell'articolo 13 della legge 7 luglio 2009, n. 88». (15A06176). Retrieved from https://www.gazzettaufficiale.it/gazzetta/serie_generale/caricaDettaglio?dataPubblicazioneGazzetta=2015-08-12&numeroGazzetta=186 at 30.07.2024

Ministèredel'Agriculture. (2023). Ministère de l'Agriculture et d'Alimentation; La certification en agriculture biologique 06 juin 2023. Retrieved from https://agriculture.gouv.fr/quest-ce-que-lagriculture-biologique at 15.08.2024

MinistryofAgriculture. (2024). Ministerio de Agricultura, Pesca y Alimentatión; La Producción Ecológica (Spain). Retrieved from https://www.mapa.gob.es/es/alimentacion/temas/produccion-eco/ at 15.08.2024

Mukherjee, A., & Lal, R. (2013). Biochar impacts on soil physical properties and greenhouse gas emissions. *Agronomy, 3*(2), 313-339.

NTC1927(2001). Norma Técnica Colombiana NTC 1927 (2001) Fertilizantes y Acondicionadores de Suelos. Definiciones, clasificación y fuentes de materias primas. Instituto Colombiano de Normas Técnicas y Certificación (ICONTEC).

NTC5167(2004). Norma Técnica Colombiana NTC 5167 (2004) Productos para la industria agrícola. Productos orgánicos usados como abonos o fertilizantes y enmiendas de suelo. Instituto Colombiano de Normas Técnicas y Certificación (ICONTEC).

RUS TI CA

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

OECD. (2001). Organisation for Economic Co-operation and Development; OECD - Glossary of Statistical Terms; HOUSEHOLD WASTE; November 19th, 2001. Retrieved from https://stats.oecd.org/glossary/detail.asp?ID=1261 at 01.07.2024

OECD. (2019). Organisation for Economic Cooperation and Development (OECD); iLibrary; Waste Management and the Circular Economy in Selected OECD Countries : Evidence from Environmental Performance Reviews; Glossary; Waste. Retrieved from https://www.oecd-ilibrary.org/sites/5ab8c6da-en/index.html?itemId=/content/component/5ab8c6da-en at 10.06.2024

Oonincx, D. G., Van Itterbeeck, J., Heetkamp, M. J., Van Den Brand, H., Van Loon, J. J., & Van Huis, A. (2010). An exploration on greenhouse gas and ammonia production by insect species suitable for animal or human consumption. *PloS one, 5*(12), e14445.

OVAM. (2024). Openbare Vlaamse Afvalstoffenmaatschappij (OVAM); groenafval: algemeen reglement van de certificering. Retrieved from https://ovam.vlaanderen.be/groenafval-algemeen-reglement-van-de-certificering?p_l_back_url=%2Fzoeken%3Fq%3Dcertificering at 28.07.2024

Panagos, P., Montanarella, L., Barbero, M., Schneegans, A., Aguglia, L., & Jones, A. (2022). Soil priorities in the European Union. *Geoderma Regional, 29*, e00510.

Papageorgiou, M., & Skendi, A. (2018). Introduction to cereal processing and by-products. In *Sustainable Recovery and Reutilization of Cereal Processing By-Products* (pp. 1-25): Elsevier.

Paris, N., Fortin, A., Hotte, N., Zadeh, A. R., Jain, S., & Hénault-Ethier, L. (2024). Developing an environmental assessment framework for an insect farm operating in circular economy: The case study of a Montréal (Canada) mealworm farm. *Journal of Cleaner Production, 460*, 142450.

PHYTOWEB. (2024a). Fertilisants; Liste des dérogations; Les dérogations délivrées peuvent être consultées iciHealth, Food Chain Safety, Environmet, Search fertiliser, soil improver, growing medium, related product or sludge; at 15.03.2024. Retrieved from https://apps.health.belgium.be/panamaPublicSearch/pages/public/fytoFertSearch.xhtml;jsessionid=PxXI8_sRlm8Poj3lUkR4zszsRNOdHdh05hE3e9zL.node5?dswid=-6831#b at 30.07.2024

PHYTOWEB. (2024b). Health, Food chain safety and Environment, Search fertiliser, soil improver, growing medium, related product or sludge; keyword "insects". Retrieved from https://apps.health.belgium.be/panamaPublicSearch/pages/public/fytoFertSearch.xhtml;jsessionid=bbRHwLOd4W1I1kqPyiABbGhmVlcB28CWLLRSQF3S.node5?dswid=289#b at 02.08.2024

Pinotti, L., Giromini, C., Ottoboni, M., Tretola, M., & Marchis, D. (2019). Insects and former foodstuffs for upgrading food waste biomasses/streams to feed ingredients for farm animals. *Animal, 13*(7), 1365-1375.

ProyectodeLeyNumero269. (2016). Gaceta del Congreso Republica de Colombia; PROYECTO DE LEY NÚMERO 169 DE 2016 SENADO; Ley antidesperdicios contra el hambre en Colombia. El Congreso de la

República de Colombia DECRETA; Viernes, 29 de Abril de 2016. Retrieved from https://leyes.senado.gov.co/proyectos/images/documentos/Textos%20Radicados/Ponencias/2016/gaceta_208.pdf at 13.06.2024

Ragossnig, A. M., & Schneider, D. R. (2019). Circular economy, recycling and end-of-waste. In (Vol. 37, pp. 109-111): SAGE Publications Sage UK: London, England.

Rao, M., Bast, A., & de Boer, A. (2021). Valorized Food Processing By-Products in the EU: Finding the Balance between Safety, Nutrition, and Sustainability. *Sustainability, 13*(8), 4428.

RealDecree1528/2012. Real Decreto 1528/2012, de 8 de noviembre, por el que se establecen las normas aplicables a los subproductos animales y los productos derivados no destinados al consumo humano, Version 17.05.2023. Retrieved from https://www.boe.es/buscar/doc.php?id=BOE-A-2012-14165 at 31.07.2024

Res.199(2016). Resolución 199 (2016) Por la cual se modifica parcialmente el Reglamento para la producción primaria, procesamiento, empacado, etiquetado, almacenamiento, certificación, importación y comercialización de Productos Agropecuarios Ecológicos. Ministerio de Agricultura y Desarrollo Rural.

Res.68370(2020). Resolución 68370 (2020) Por medio de la cual se establecen los requisitos para el registro de productor, productor por contrato, envasador, importador y departamentos técnicos de ensayos de eficacia agronómica de Bioinsumos para uso agrícola; así como los requisitos para el registro de Bioinsumos para uso agrícola". Instituto Colombiano Agropecuario (ICA). .

Res.ICA150(2003). Resolución 150 (2003) Por la cual se adopta el Reglamento Técnico de Fertilizantes y Acondicionadores de Suelos para Colombia. Instituto Colombiano Agropecuario (ICA).

Rowe, A. (2020). Insects farmed for food and feed—global scale, practices, and policy. Retrieved from https://doi.org/10.31219/osf.io/nh6k3 at 26.08.2024

RoyalDecree28January2013. Koninklijk Besluit van 28 januari 2013 m.b.t. de handel in meststoffen, bodemverbeterende middelen en teeltsubstraten) - 28 JANVIER 2013. - Arrêté royal relatif à la mise sur le marché et à l'utilisation des engrais, des amendements du sol et des substrats de culture. Retrieved from https://etaamb.openjustice.be/fr/arrete-royal-du-28-janvier-2013_n2013024068.html at 28.07.2024

RoyalDecree506/2013. National Royal Decree 506/2013 of 28th June, about fertiliser products, 164: 51119-51207 (consolidated) Version from 07.07.2023. Retrieved from https://www.boe.es/buscar/act.php?id=BOE-A-2013-7540 at 16.07.2024

RUSTICA. (2021). Deliverable D3.2: RUSTICA valorisation in the EU legislative frameworks. Author: Adelheid Wiedemann. RUSTICA - Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities. EU Horizon 2020 project grant agreement No 101000527. Retrieved from https://rusticaproject.eu/ at 25.07.2024

RUSTICA. (2022). Deliverable D3.6 RUSTICA legislative aspects at national and regional level, Authors: Adelheid Wiedemann (WIED), Carolina Martinez (TEC), Rebekka Ramos (TEC), Guadalupe Lopez (TEC), Hanne Cooreman (EV ILVO), Federica Cisilino (CREA), Claudio Mondini (CREA), Federico Mecchia (CREA) Céline Marjolet (CRAPDL), Guillermo Peña (CIAT); RUSTICA - Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities. EU Horizon 2020 project grant agreement No 101000527. . Retrieved from https://rusticaproject.eu/public-deliverables at 10.09.2024

RUSTICA. (2023). Report on strategic plans to be drawn by EU Member States under the Common Agricultural Policy (CAP Strategic Plans) Author: Adelheid Wiedemann (Wiedemann GmbH). (2023) RUSTICA - Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities. EU Horizon 2020 project grant agreement No 101000527. https://rusticaproject.eu/. Retrieved from https://rusticaproject.eu/wp-content/uploads/2023/10/RUSTICA_Report_on_CAP_Strategies_121023_final.pdf at 15.08.2024

RUSTICA. (2024). RUSTICA - a technical solution for the conversion of organic residues into novel bio-based fertiliser products. Retrieved from https://rusticaproject.eu/ at 30.06.2024

Sakarika, M., Spanoghe, J., Sui, Y., Wambacq, E., Grunert, O., Haesaert, G., . . . Vlaeminck, S. E. (2020). Purple non-sulphur bacteria and plant production: benefits for fertilization, stress resistance and the environment. *Microbial biotechnology, 13*(5), 1336-1365.

Saveyn, H., & Eder, P. (2014). End-of-waste criteria for biodegradable waste subjected to biological treatment (compost & digestate): Technical proposals. *IPTS: Sevilla, Spain.* Retrieved from https://asset-pdf.scinapse.io/prod/1589332136/1589332136.pdf at 14.06.2024

Schmieg, E. (2018). Labour clauses for sustainability? Colombian trade agreements exemplify potential and limits. Retrieved from https://www.ssoar.info/ssoar/handle/document/57011 at 26.08.2024

SIAC. (2024). Sistema de Información Ambiental para Colombia (SIAC) IDEMA -Residuos - Retrieved from www.ideam.gov.co › web › siac › residuos at 22.08.2024

SINAB. (2024). SINAB Sistema d'informazione Nazionale sull'Agricoltura Biologica. Retrieved from https://www.sinab.it/ at 15.08.2024

Smetana, S., Spykman, R., & Heinz, V. (2021). Environmental aspects of insect mass production. *Journal of Insects as Food and Feed*, 1-20.

Sogari, G., Amato, M., Palmieri, R., Saadoun, J. H., Formici, G., Verneau, F., & Mancini, S. (2023). The future is crawling: Evaluating the potential of insects for food and feed security. *Current research in food science, 6*, 100504.

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

Spanoghe, J., Grunert, O., Wambacq, E., Sakarika, M., Papini, G., Alloul, A., . . . Verstraete, H. (2020). Storage, fertilization and cost properties highlight the potential of dried microbial biomass as organic fertilizer. *Microbial biotechnology, 13*(5), 1377-1389.

Stamenković, S., Beškoski, V., Karabegović, I., Lazić, M., & Nikolić, N. (2018). Microbial fertilizers: A comprehensive review of current findings and future perspectives. *Spanish Journal of Agricultural Research, 16*(1).

TradeEconomics. (2024). European Union Imports of fertilizers from Colombia. Retrieved from https://tradingeconomics.com/european-union/imports/colombia/fertilizers at 07.06.2024

UNCCD. (1994). United Nations Convention to combat Desertification in those Countries experiencing serious drought and/or desertification, particular in Africa; about the Convention; Convention text. Retrieved from https://www.unccd.int/convention/about-convention at 28.06.2024

UNCCD. (2001). United Nations Convention to combat Desertification in those Countries experiencing serious Drought and/or Desertification, particularly in Africa; About the Convention - PDF version of Annex V as of September 2001. Retrieved from https://www.unccd.int/convention/about-convention at 18.03.2024

UNEP-FAO. (2019). United Nations Environment Programme and Food and Agriculture Organization of the United Nations; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. Retrieved from http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx at 12.02.2024

UNEP. (1992). BASEL CONVENTION - on the control of transboundary movements of hazardous wastes and their disposal - Text of the Convention (revised in 2019). Retrieved from http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx at 01.02.2024

UNEP. (1993). CONVENTION ON BIOLOGICAL DIVERSITY. Retrieved from https://www.cbd.int/convention/text/ at 26.02.2024

UNEP. (2019). STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS (POPS); Texts and Annexes revised 2019. Retrieved from https://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx at 12.02.2024

UNEP. (2023). UN Environement Programme (UNEP); Emissions Gap Report 2023; 20 NOVEMBER 2023;. Retrieved from https://www.unep.org/resources/emissions-gap-report-2023 at 12.07.2024

UNEP. (2024a). Convention on Biological Diversity, THE NAGOYA PROTOCOL ON ACCESS AND BENEFIT-SHARING, Text of the Nagoya Protocol. Retrieved from https://www.cbd.int/abs/text at 26.02.2024

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

UNEP. (2024b). United Nations Environment Programme; BASEL CONVENTION - Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Retrieved from http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx at 02.02.2024

UNEP. (2024c). United Nations Environment Programme; Convention on Biological Diversity - History of the Convention. Retrieved from https://www.cbd.int/history/ at 27.02.2024

UNEP. (2024d). United Nations Environment Programme; Food Waste Index Report 2024. Retrieved from https://www.unep.org/resources/publication/food-waste-index-report-2024 at 10.06.2024

UNFCCC. (1992). United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf at 16.03.2024

UNFCCC. (2015). United Nations Framework Convention on Climate Change; PARIS AGREEMENT. Retrieved from https://unfccc.int/sites/default/files/english_paris_agreement.pdf at 12.03.2024

UNFCCC. (2021). United Nations Framework Convention on Climate Change; What is the Paris Agreement? Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement at 15.03.2024

UNFCCC. (2023a). COP28 Agreement Signals “Beginning of the End” of the Fossil Fuel Era, 13 December 2023. Retrieved from https://unfccc.int/news/cop28-agreement-signals-beginning-of-the-end-of-the-fossil-fuel-era at 15.03.2024

UNFCCC. (2023b). Update of the NDC of the European Union and its Member States - SUBMISSION BY SPAIN AND THE EUROPEAN COMMISSION ON BEHALF OF THE EUROPEAN UNION AND ITS MEMBER STATES, Madrid 16th October 2023. Retrieved from https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf at 16.03.2024

UNFCCC. (2024). NDC Registry; Gobierno de Colombia (Government of Colombia); Actualización de la Contribución Determinada a Nivel Nacional de Colombia (NDC), 10th of December 2020. Retrieved from https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Colombia%20First/NDC%20actualizada%20de%20Colombia.pdf at 16.03.2024

Van Raamsdonk, L., Meijer, N., Gerrits, E., & Appel, M. (2023). New approaches for safe use of food by-products and biowaste in the feed production chain. *Journal of Cleaner Production, 388*, 135954.

Verheijen, F., Jeffery, S., Bastos, A., Van der Velde, M., & Diafas, I. (2010). Biochar application to soils. *A critical scientific review of effects on soil properties, processes, and functions. EUR, 24099*, 162.

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

Vlanderen. (2024). AGENTSCHAP LANDBOUW & ZEEVISSERIJ; Insecten kweken en verwerken. Retrieved from https://lv.vlaanderen.be/dier/insecten/insecten-kweken-en-verwerken at 02.08.2024

Vlarema17thFebruary2012. VLAREMA 17 FEBRUARY 2012. - Order of the Government of Flanders adopting the Flemish regulation on the sustainable management of material cycles and waste (consolidated version 15.07.2022). Retrieved from https://navigator.emis.vito.be/mijn-navigator?woId=8638 at 28.07.2024

Wang, J., Zheng, T., Wang, Q., Wang, C., & Wang, L. (2016). Global Trends of Electrodialysis Research during 1991-2014: a Bibliometric Analysis. *Journal of the Chemical Society of Pakistan, 38*(4).

Wiedemann, A., Hiessl, S., & Rusu, A. (2020). Bioeconomy - Stimuli and Barriers from the Legal and Market Perspective. In V. Consortium (Ed.), *Towards a Circular Bioeconomy - VOLATILE FATTY ACID PLATFORM FOR BIOWASTE RECYCLING*. Retrieved from http://hdl.handle.net/11556/1130 at 12.08.2024

WITS. (2024). World Integrated Trade Solution; European Union Fertilizers exports by country in 2022. Retrieved from https://wits.worldbank.org/trade/comtrade/en/country/EUN/year/2022/tradeflow/Exports/partner/ALL/product/31 at 07.06.2024

Yadav, S. P. S., Bhandari, S., Bhatta, D., Poudel, A., Bhattarai, S., Yadav, P., . . . Shrestha, J. (2023). Biochar application: A sustainable approach to improve soil health. *Journal of Agriculture and Food Research, 11*, 100498.

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101000527