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Nutrient recycling practices – new opportunities for agriculture

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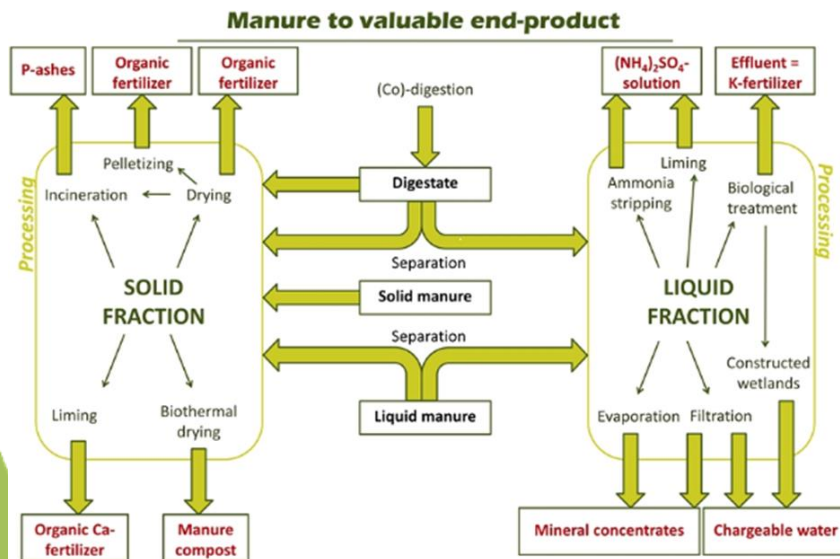
15.02.2024



Nutrient recycling (NR) – the overall process where biomass or other nutrient-rich matter is utilized and/or managed to end up back in the cycle for the use of plants.

Nutrient recycling practice (NRP) – the activity of recovering nutrients from organic waste and wastewater and returning them to agricultural land as **recycled nutrient fertilizers (RNFs)**.

- NRP is a sustainable practice that helps reduce waste and pollution while improving soil health and increasing crop yields.
- NRP reduces the use of non-renewable natural resources and can reduce nutrient emissions into the environment.



Challenges:

- Food production needs nutrients – mainly N, P, K
- The huge demand for food = a high need for fertilizers
- The production and transportation of mineral fertilizers require high amounts of energy from fossil fuels
- The resources of phosphorus **are limited ?**, and long-term renewable.

Treatment processes that allow the upcycling of organic waste streams to nutrients and organic products

Source: <https://www.vcm-mestverwerking.be/en/manureprocessing/10305/techniques-and-end-products>

The **European Green Deal** is a package of policy initiatives, which aims to set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050



2030 Targets for sustainable food production

PESTICIDES

Reduce the overall use and risk of chemical and hazardous pesticides



NUTRIENT LOSSES

Reduce nutrient losses by 50% whilst retaining soil fertility, resulting in 20% less fertilisers



ANTIMICROBIALS

Reduce sales of antimicrobials for farmed animals and aquaculture



ORGANIC FARMING

Increase the percentage of organically farmed land in the EU



The Commission's **farm to fork strategy** aims to help the EU achieve climate neutrality by 2050, by shifting the current EU food system towards a sustainable model

- develop an **Integrated Nutrient Management Plan** to ensure a more sustainable application of nutrients and stimulate the markets for recovered nutrients

The **Common Agricultural Policy** is a set of laws adopted by the EU to provide a unified policy on agriculture in EU countries

- fertilization plan & nutrient management

The EC **Circular Economy Action Plan**

- reducing waste
- reducing dependence on raw materials
- reduction of greenhouse gas emissions



#EUFarm2Fork #EUGreenDeal





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 – **Water Framework Directive (WFD)**

Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC) – **Nitrates Directive (ND)**

- **WFD & ND** preventing the pollution of groundwater and surface water by nitrates from agricultural sources and promoting the application of good agricultural practices

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 fertilizing products

- harmonizes standards for fertilizing products derived from organic or secondary raw materials, and creates new opportunities for their production and sale in line with the principles of the circular economy

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste – **Waste Framework Directive**

- Waste land use is recycling if it benefits agriculture or improves the environment

Helsinki Convention
Annex III – Criteria and measures concerning the prevention of pollution from terrestrial sources
Part II – Prevention of pollution from agriculture
Regulation 2 – Plant nutrients

12. Nutrient recycling

- current sub-national level information on biomass production, in particular manure and sewage sludge
- current sub-national level information on the state of soil fertility, in particular with regard to phosphorus
- enabling the development of markets for recycled organic fertilisers to promote nutrient reallocation, including replacement of mineral fertilisers
- developing actions to improve the production of recycled fertilisers (product safety, usability, production technologies, and logistics solutions)
- encouraging close cooperation between livestock and crop producers to use nutrients efficiently and secure soil fertility



Baltic Marine Environment Protection Commission

[HELCOM Recommendation 42-43/2](#)

Adopted 20 October 2021
having regard to Article 20, Paragraph 1 c)
of the Helsinki Convention

AMENDMENTS TO PART II ANNEX III "CRITERIA AND MEASURES CONCERNING THE PREVENTION OF POLLUTION FROM LAND-BASED SOURCES" OF THE 1992 HELSINKI CONVENTION

THE COMMISSION,

TAKING INTO CONSIDERATION the amendment procedure for the Annexes of the 1992 Helsinki Convention, as contained in Article 32 of that Convention,

RESOLVES:

- to amend part II Annex III of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992, in accordance with the Attachment to this Recommendation;
- to ask the Depositary Government to Communicate these amendments to the Contracting Parties with the Commission's Recommendation for acceptance; and
- to determine that the accepted amendments shall enter into force one year after the adoption of this HELCOM Recommendation,

REQUESTS the Governments of the Contracting Parties to report on the progress of implementation of the amendments to Annex III in accordance with the agreed deadlines and Article 16, Paragraph 1 of the 1992 Helsinki Convention.



Baltic Sea Action Plan Eutrophication Segment Topic: Nutrient recycling

E30 – Implement adequate measures, especially in agriculture and wastewater management, to achieve the objectives of the Baltic Sea Regional Nutrient Recycling Strategy by 2027

E31 – Create legal and institutional tools to advance towards introducing annual field-level fertilization planning and farm-gate nutrient balancing for nitrogen (N) and phosphorus (P) as a requirement for all farms in the Baltic Sea

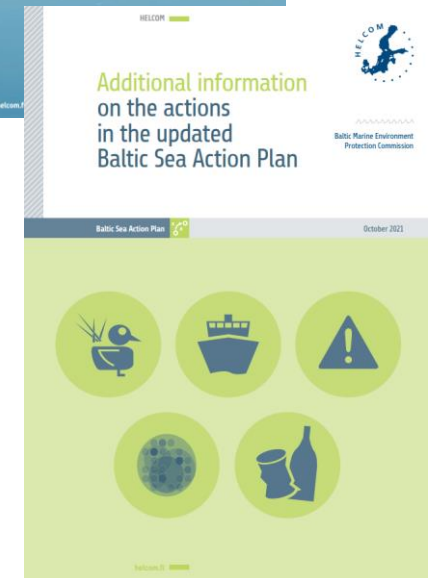
E32 – Enhance the use of recycled nutrients in agriculture using the best available technologies and fertilizers according to crop needs.

E33 – Develop safety requirements for recycled fertilising products by 2027 and minimise the occurrence of harmful compounds

E34 – Increase the knowledge and promote education and advisory services on nutrient recycling.

E35 – Improve the conditions for the development of the market for recycled fertilising products by incentivising the use of recycled fertilisers instead of mineral fertilisers.

E36 – Enhance cooperation and share experience between sectors and actors to create a holistic view on sustainable food systems, including nutrient recycling sectors



Baltic Sea Regional Nutrient Recycling Strategy

- increasing the efficiency of nutrient recycling in a closed loop, in regions with a high concentration of nutrients
- reducing the use of external sources of nutrients in the production of fertilizers
- reduction of nutrient losses to water and atmosphere, closing their cycles
- improving soil quality and carbon sequestration
- promotion and development of precision agriculture
- reducing risks to people and the environment
- research, technological development and consulting
- increasing the profitability of recovery, cooperation and new forms of entrepreneurship development
- strengthening cooperation between decision-makers
- new and/or updated legal solutions



RENURE fertilizers

RENURE – (REcovered Nitrogen from manURE) – any N containing substance fully or partially derived from livestock manure through processing that can be used in areas with water pollution by nitrogen, following otherwise identical provisions applied to nitrogen-containing chemical fertilizers as defined in the Nitrates Directive (91/676/EEC)

- replacing part of the current production of synthetic nitrogen fertilizers – reducing CO₂ emissions
- $N_{\min}/N_{\text{total}} \geq 90\%$, $C_{\text{total}}/N_{\text{total}} \leq 3$
- no limit of 170 kg N/ha
- extending Annex III ND and supplementing existing EU legislation that governs the use, handling, transport and placing on the market of manure-derived N fertilizers
- Scrubbing salts, struvites, mineral concentrate, liquid phase of digestate



JRC SCIENCE FOR POLICY REPORT

Technical proposals for the safe use of processed manure above the threshold established for Nitrate Vulnerable Zones by the Nitrates Directive (91/676/EEC)

Huygens D, Orveillon G, Lugato E, Tavazzi S, Comero S, Jones A, Gawlik B, Saveyn HGM

2020





Maistream BIO – Mainstreaming small-scale bio-based solutions across rural Europe



MAINSTREAM BIO
MAINSTREAMING SMALL-SCALE BIO-BASED
SOLUTIONS ACROSS RURAL EUROPE

- Regional Multiactor Innovation Platforms (MIP) in 7 EU countries (Netherlands, Poland, Denmark, Sweden, Bulgaria, Spain, Ireland)
- Catalog of small-scale bio-based solutions – technologies, business models and social innovation
- Decision Support System – matching available biomass and waste streams with relevant bio-based solutions: practices, technologies, business models, and social innovation
- Bioeconomy Repository – providing educational materials and raising awareness of the bioeconomy

D2.2 Best practices for improved nutrient recycling

Algae cultivation
Ammonia stripping
Anaerobic digestion
Anaerobic digestion
Appropriate manure application
Appropriate manure storage
Ash recycling
Catch crops
Combustion/Incineration Conservation
Tillage
Fertilization plan
Fish meal production
Gasification
Hydrothermal carbonization
Increased outtake of slurry from pig stables

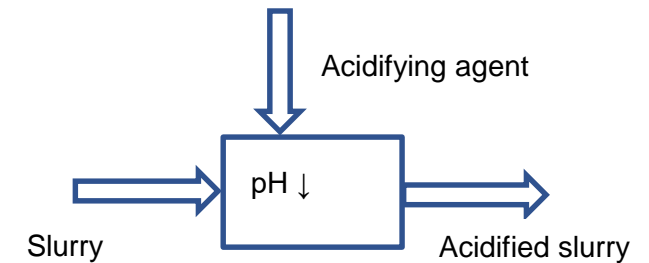
Integrated pest management
Manure composting
Mechanical Solid-liquid separation
Pelletizing/granulation
Propagation technology/precision farming
Pyrolysis
Sewage Sludge treatment
Slurry acidification
Small-scale green biorefining
Smart combined stable system
Struvite precipitation
Thermal drying
Vacuum evaporation
Waste composting/hygienization
Wetlands (collection of nutrients)



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Slurry acidification

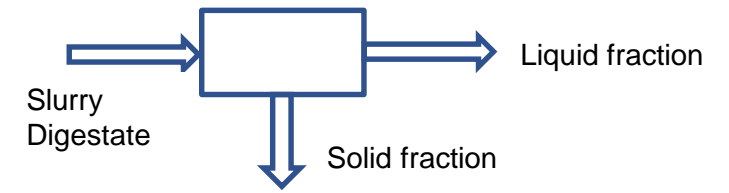
- Most commonly, H_2SO_4
- In livestock buildings, reservoirs and during field fertilization
- $NH_3 + H_2SO_4 \leftrightarrow (NH_4)_2SO_4$
- Reduction of nutrient losses from slurry – NH_3 losses reduced by 50-70%
- Higher nitrogen rate and sulphur source for plants
- Significant improvement in the health of reared animals
- No need to cover the tanks and mix the fertilizer into the soil after application



source: CDR, Jhagro



Manure & digestate separation



- Solid-liquid separation by centrifugation, pressing, chemical or membrane separation
- Most of the N and K are in the liquid fraction and P and organic matter remain in the solid fraction
- The liquid phase can also be used to irrigate crops
- The separation of 100 kg of slurry usually yields 95 kg of liquid fraction, 1% dry matter, 2.8-4.2 kg N/t, and 5 kg of solid fraction, 25-35% dry matter, 3.4-5.2 kg N/t



source: Kaisa Riiko



source: www.rotaguido.it



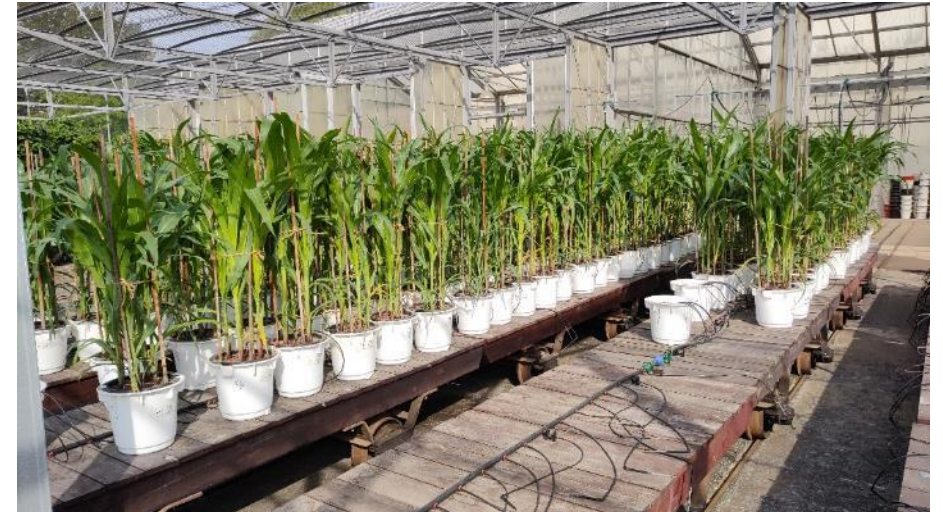
source: www.vcm-mestverwerking.be

OrgSafety – Introduction of an innovative, cheap, and environmentally friendly method of hygienization of organic waste enabling its use in fertilization



Development of innovative technology for hygienization of municipal sewage sludge and digestate from agricultural biogas plants, to meet of the safety requirements for plant fertilization

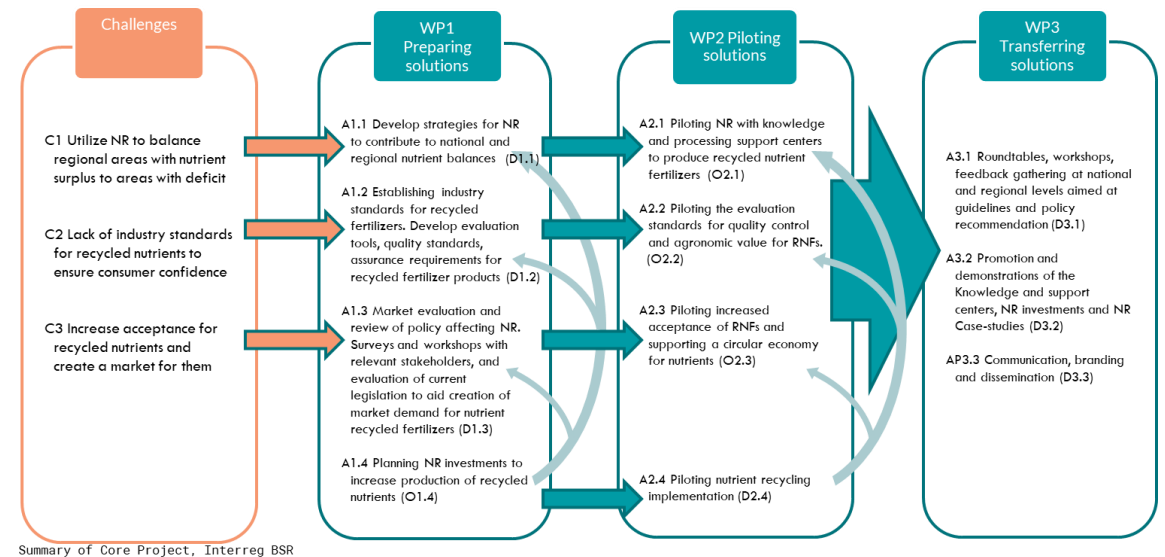
- sowing selected plant species on substrates prepared from sewage sludge or digestate and transforming it to RNF
- RNF testing for agronomic value and safety
- studies of the suitability of processed sewage sludge and digestate for fertilization, and analysis of the risk of pathogen transmission during their application
- verification of standards for the content of parasitic and bacterial elements in sewage sludge and digestate for fertilizer use



CiNURGi – Circular Nutrients for a Sustainable Baltic Sea Region

The main goal of CiNURGi is to support the implementation of the HELCOM Baltic Sea Regional Nutrient Strategy:

- Develop and promote standards for safe and sustainable recycling of nutrients
- Develop strategies for implementing nutrient recycling as a measure to improve national and regional nutrient balances
- Increase the acceptance and use of recycled nutrients
- Create business opportunities around nutrient recycling
- Improve policy coherence concerning nutrient recycling in the BSR





Thank you for your attention

