



NUTRI•KNOW

WEBINAR N°4

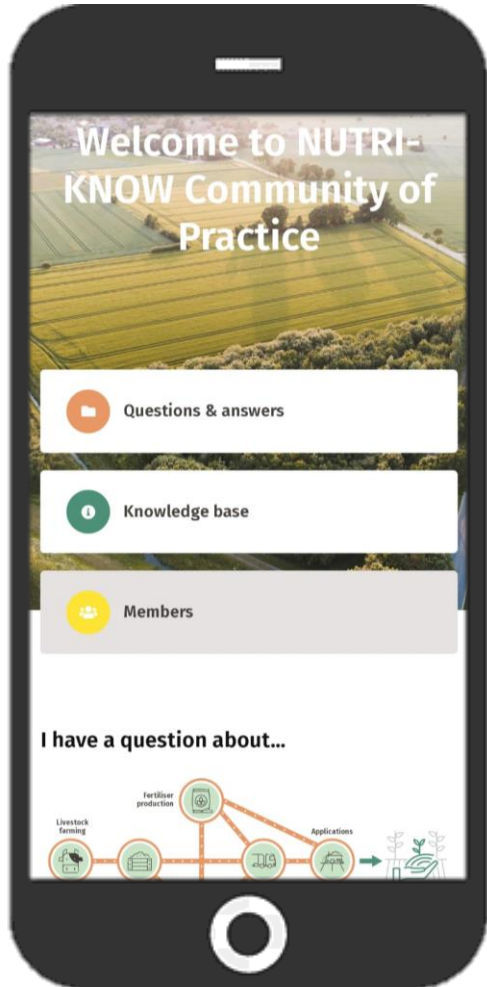
Processing Technologies for Nutrient Management

29th October 2024





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NUTRI•KNOW

Time: 10:30 – 11:30AM

- October 8: Introduction webinar
- October 15: Livestock Farming
- October 22: Application
- **October 29: Processing Technologies**
- November 5: Fertiliser Production
- November 12: Transport
- November 19: Storage Systems

Overview webinar series

Register via www.nutri-know.eu/nutri-know-webinars



UVIC
UNIVERSITAT DE VIC
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DE CATALUNYA



Generalitat de Catalunya
Departament d'Acció Climàtica,
Alimentació i Agenda Rural



GHENT
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Association for Food Development Activists



AARHUS UNIVERSITY



FEDERACIÓ DE
COOPERATIVES
AGRÀRIES
DE CATALUNYA



WE & B
Water, Environment and
Business for Development



Biogas



INTERNATIONAL ORGANIZATION OF
AGRICULTURAL ORGANIZATIONS
IOA



ESCI
European Science
Communication Institute



CRPA



Processing Technologies for agricultural waste processing



- Restricted nutrient application on the field
- Intensive livestock
- Nutrient scarcity
- Volatile prices for fossil-based mineral fertilisers



Process agricultural products

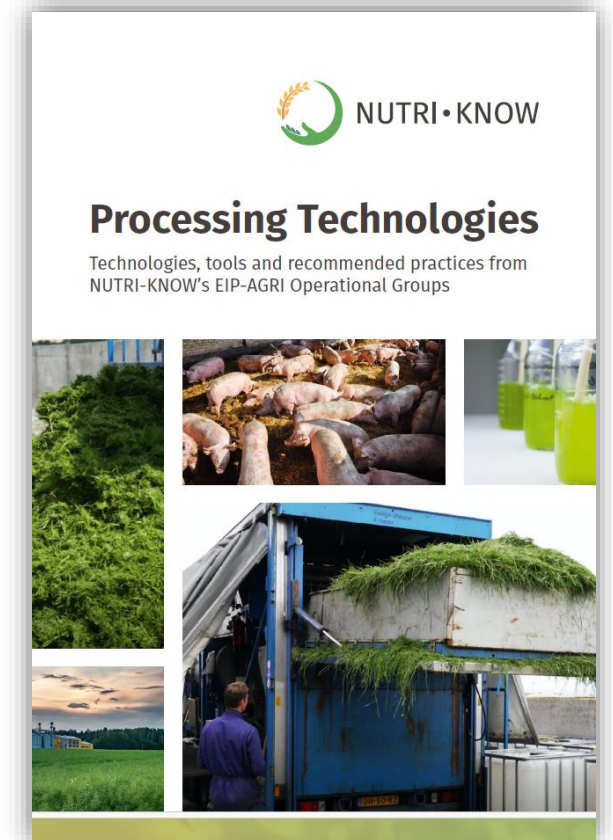


- Better quality
- Fertiliser production
- Energy generation
- Mitigation environmental impact



Processing Technologies for Nutrient Management

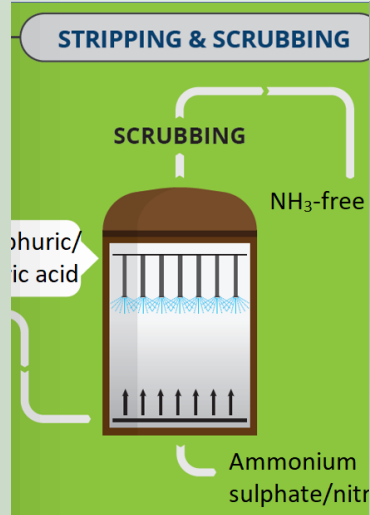
- Case 1: Slurry Concentrator (UVIC)
- Case 2: Recovery of ammonium salts from manure (UGent)
- Case 3: Struvite (CRPA)
- Case 4: Pocket digestion (Inagro)
- Case 5: Grass Biorefinery (Teagasc)
- Q&A



Information on the other technologies via https://www.nutri-know.eu/wp-content/uploads/2024/10/Nutriknow_Booklets.zip



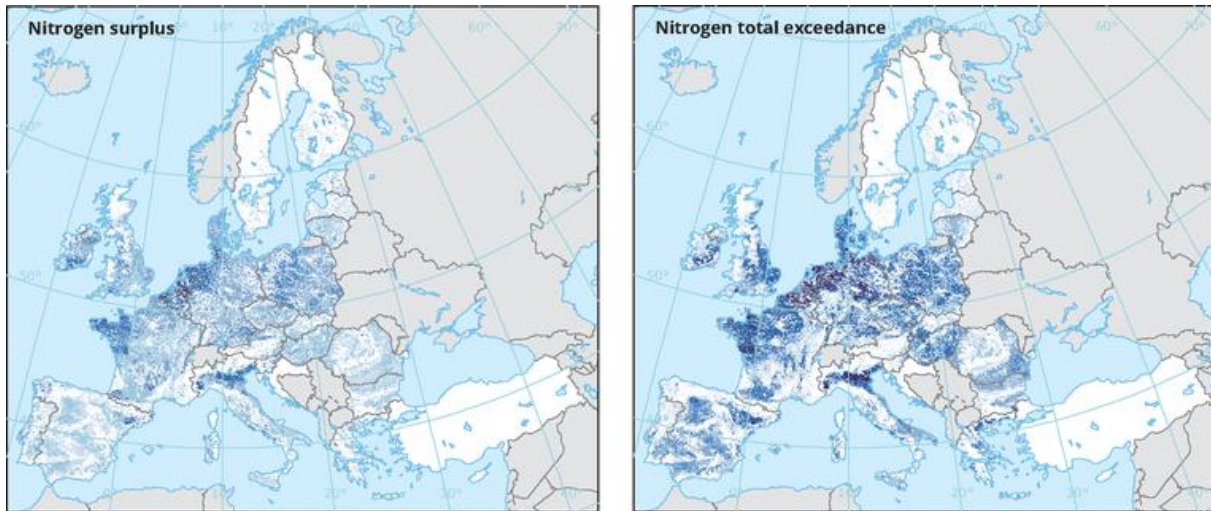
Processing Technologies for Nutrient Management



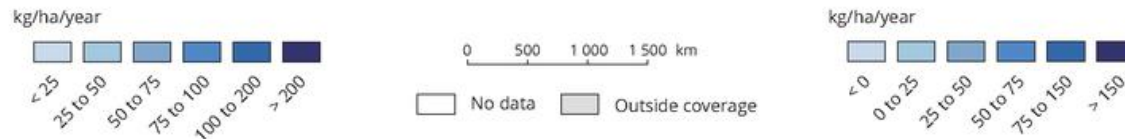


Slurry concentrator Context

Nitrogen surplus

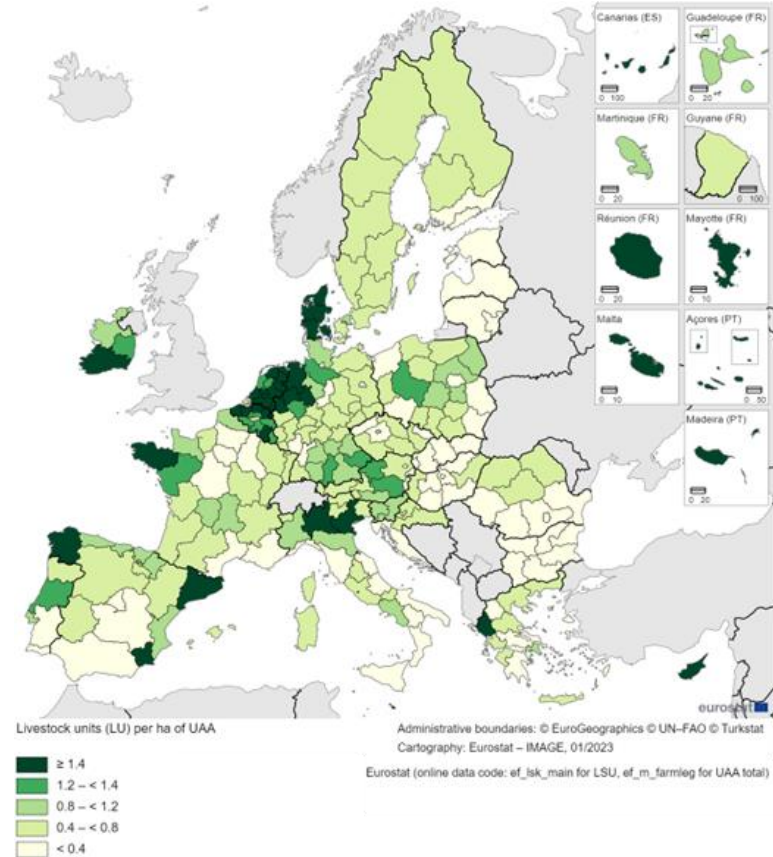


Nitrogen surplus and exceedances of critical nitrogen inputs to agricultural land in view of adverse impacts on water quality



Source: European Environment Agency
Published 03 Dec 2019 | Modified 20 Sept 2024

Livestock density



Livestock units (LU) per ha of UAA
Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat – IMAGE, 01/2023
Eurostat (online data code: ef_lsk_main for LSU, ef_m_farming for UAA total)

Source: Eurostat
Data from January 2023. Planned update: 26 January 2026 (with data from the Farm Structure Survey 2023).



Slurry concentrator Technology





Slurry concentrator Technology





Slurry concentrator

How it works?



Concentrator
lifting structure

Floats

Concentrator

Diluted phase
output





Slurry concentrator

The equipment used to manage the two fractions is the same (tractor with a pump and a slurry tanker) which reduces investment costs, but also operating costs.





Slurry concentrator RESULTS

- **Increased Efficiency:** differentiated management of the two phases **minimises transport costs** and **optimises nutrient application** to the soil, both from an agronomic and environmental point of view.
- **Cost Savings:** using the **same equipment** for application. Slurry concentrator can be a **shared solution** for a group of farmers.
- **Enhanced Monitoring and Precision:** The system enables easier monitoring of applied nutrients to the soil.

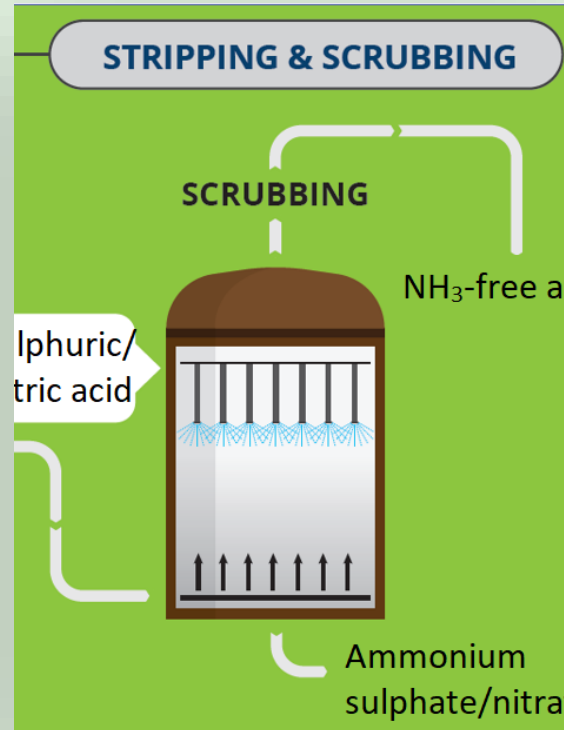


Slurry concentrator CURRENT STATUS

- New business model
- Patent at national level
- The Cooperative Plana de Vic offers a free simulation of the viability of the slurry concentrator (CONTECH-ONE) on your farm.
- Contact: Pau Parés ppares@planadevic.cat

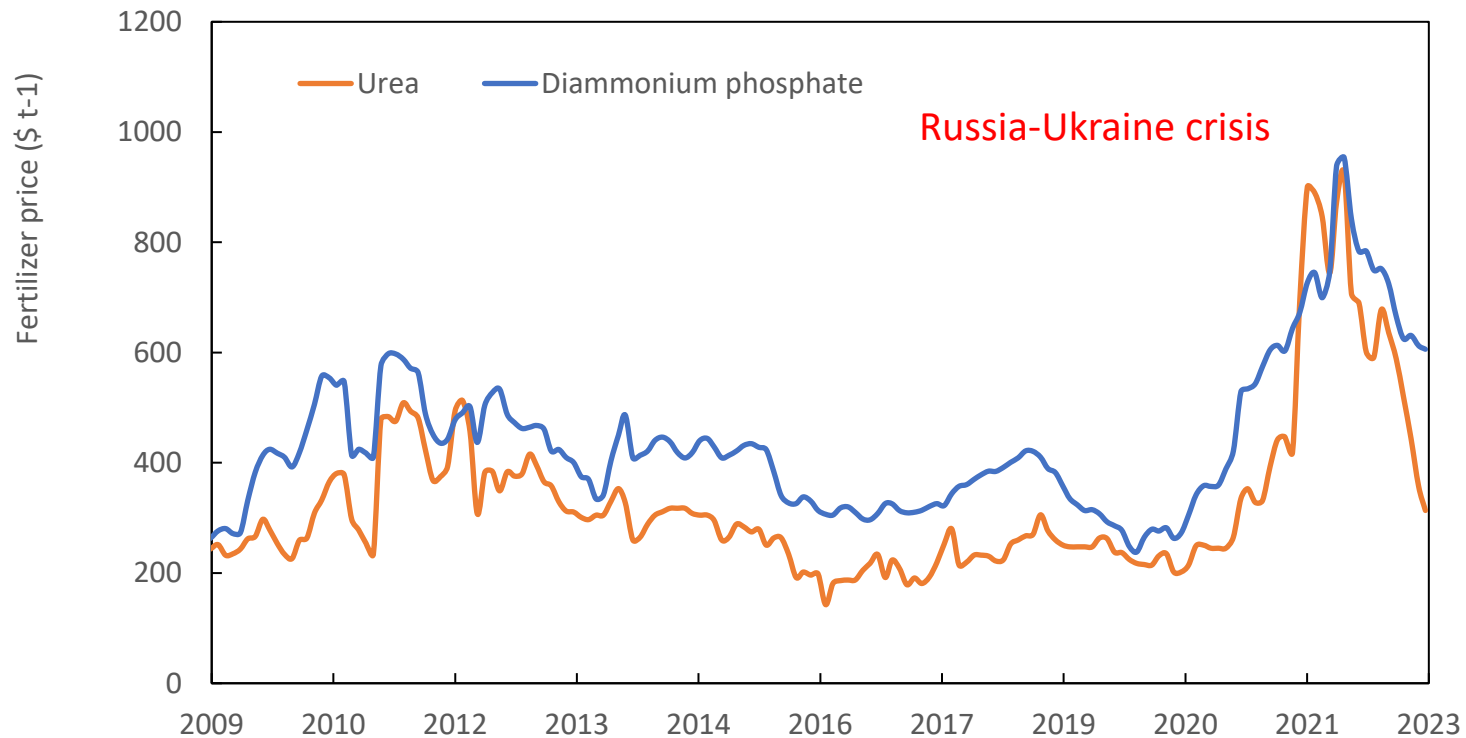


Processing Technologies for Nutrient Management





Challenge of manure application



Animal manure & derivatives can be alternative fertiliser sources

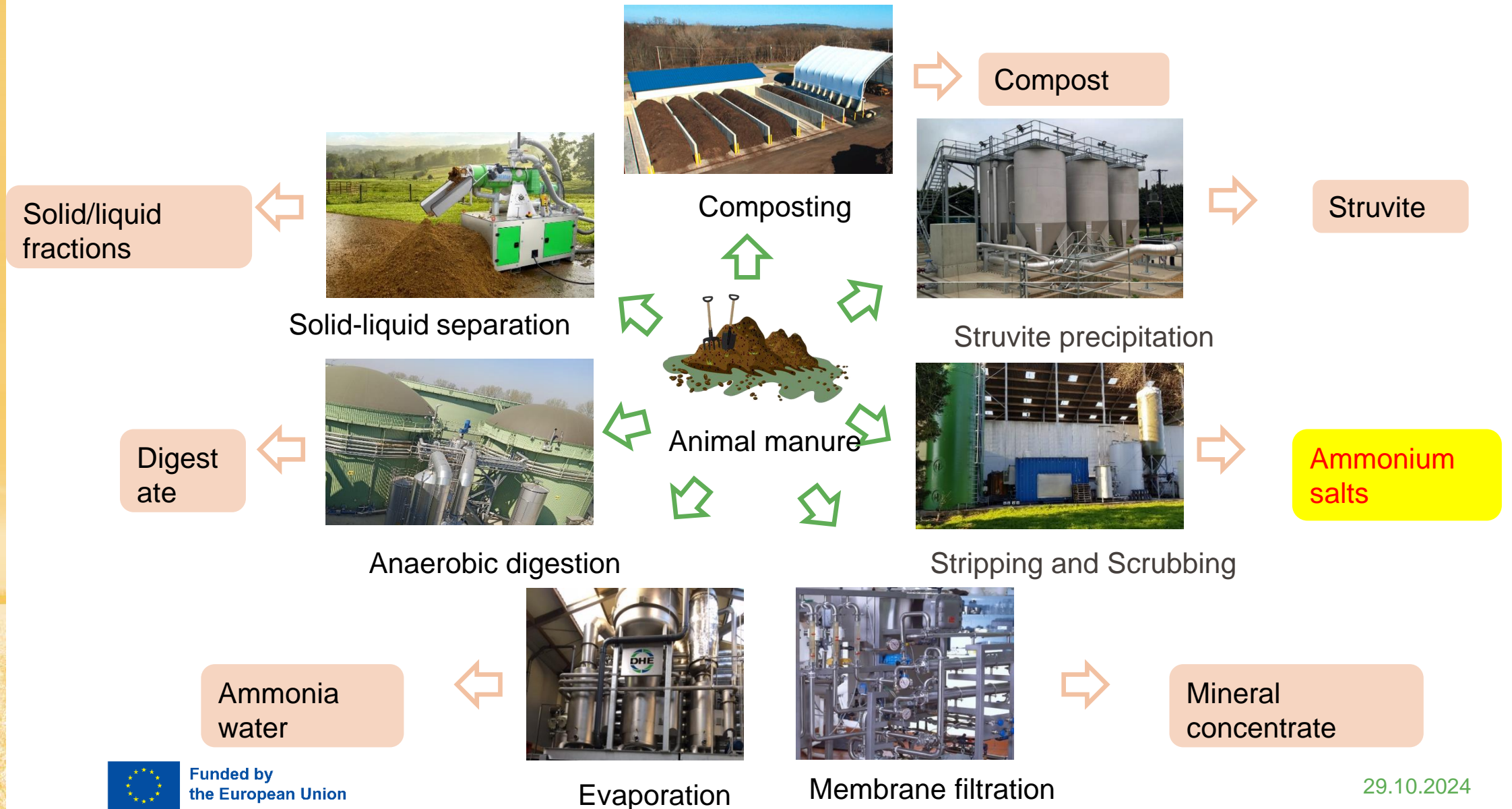


Nitrates Directive

In Nitrate vulnerable zones,
< 170 kg N ha⁻¹ yr⁻¹

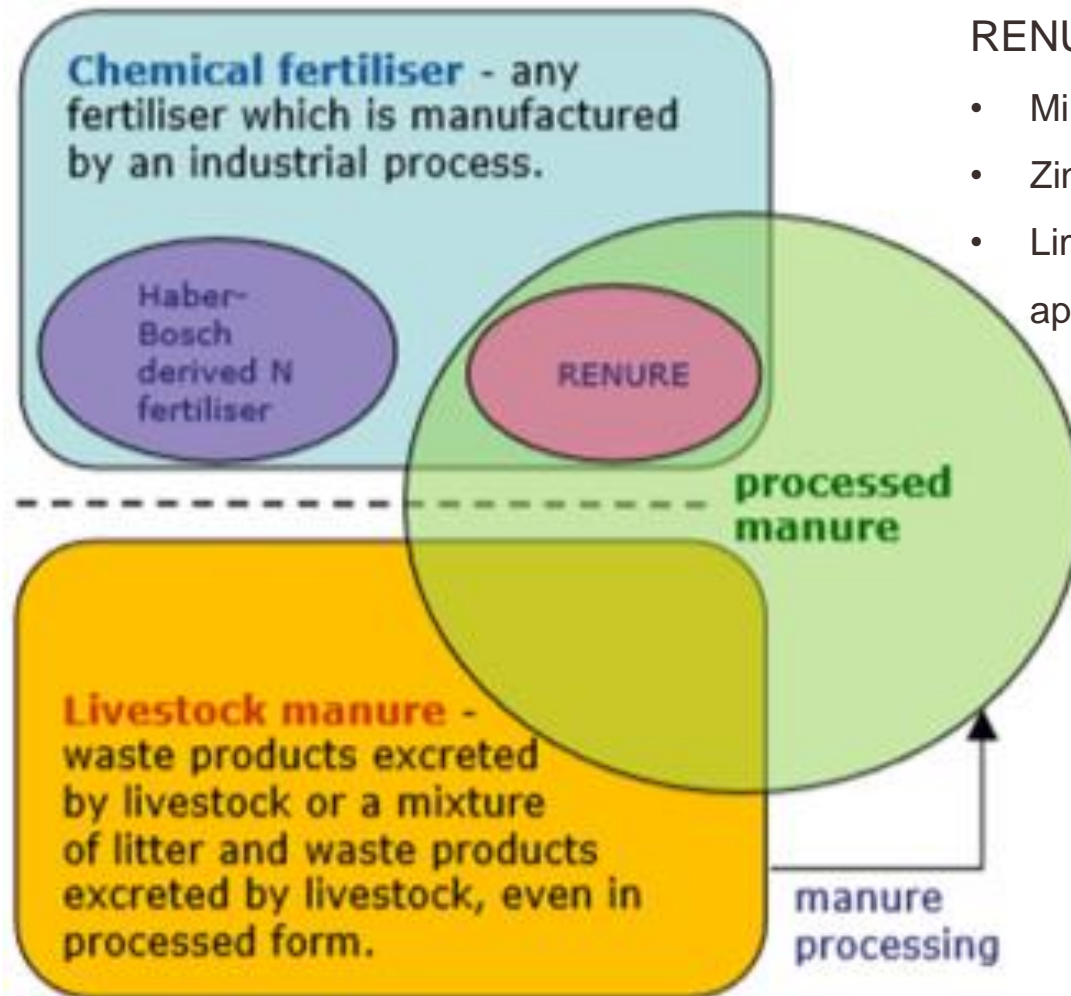


Manure processing technologies





RENURE: recovered nitrogen from manure



RENURE criteria proposed by Joint Research Center (JRC):

- Minerale N /total N ratio > 90% or organic C /total N ratio < 3
- Zinc < 300 mg/kg dw, Copper < 800 mg/kg dw
- Limiting nutrient losses and ammonia emissions during storage and application steps.

Ammonium salts (RENURE products)

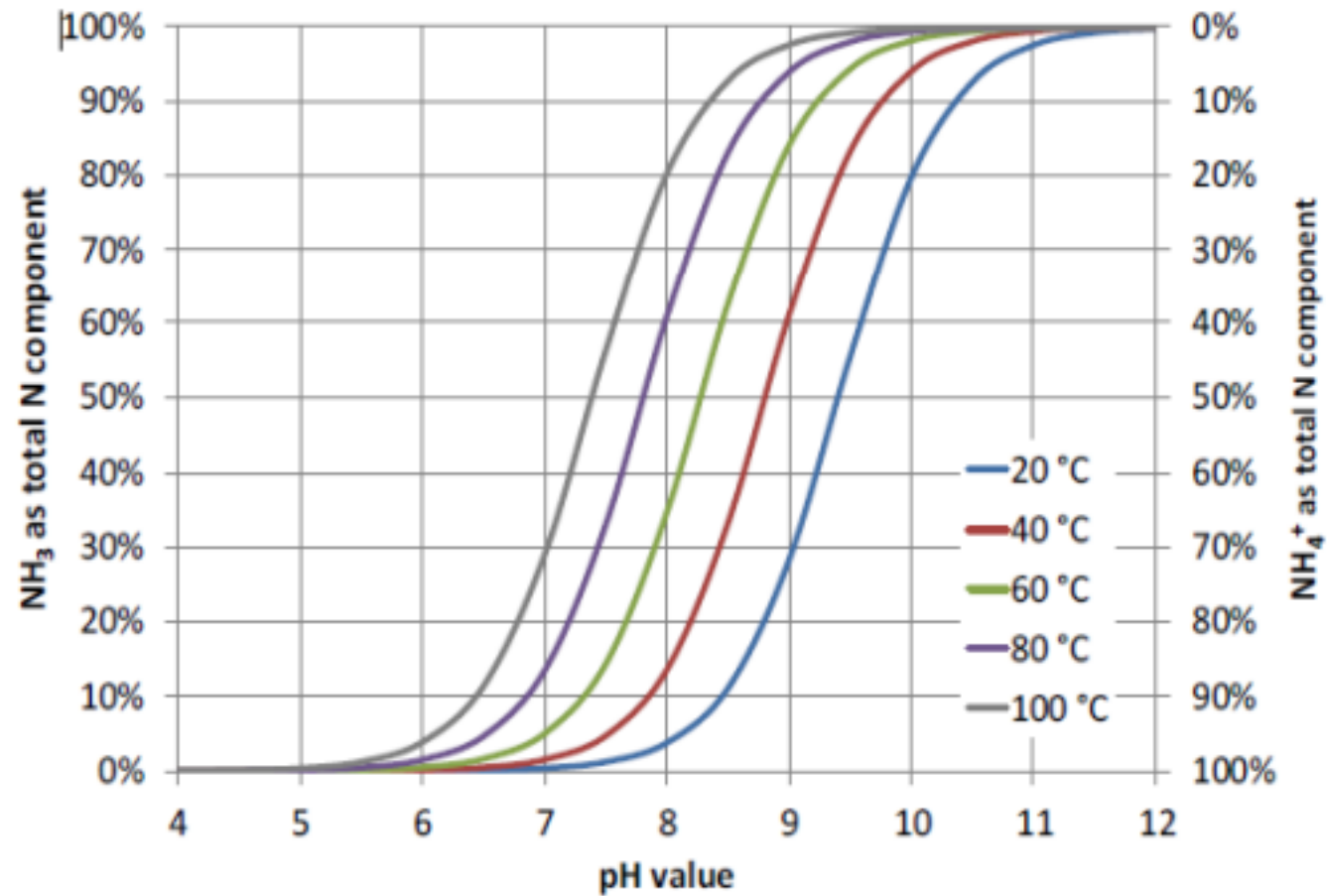


Stripping and scrubbing process



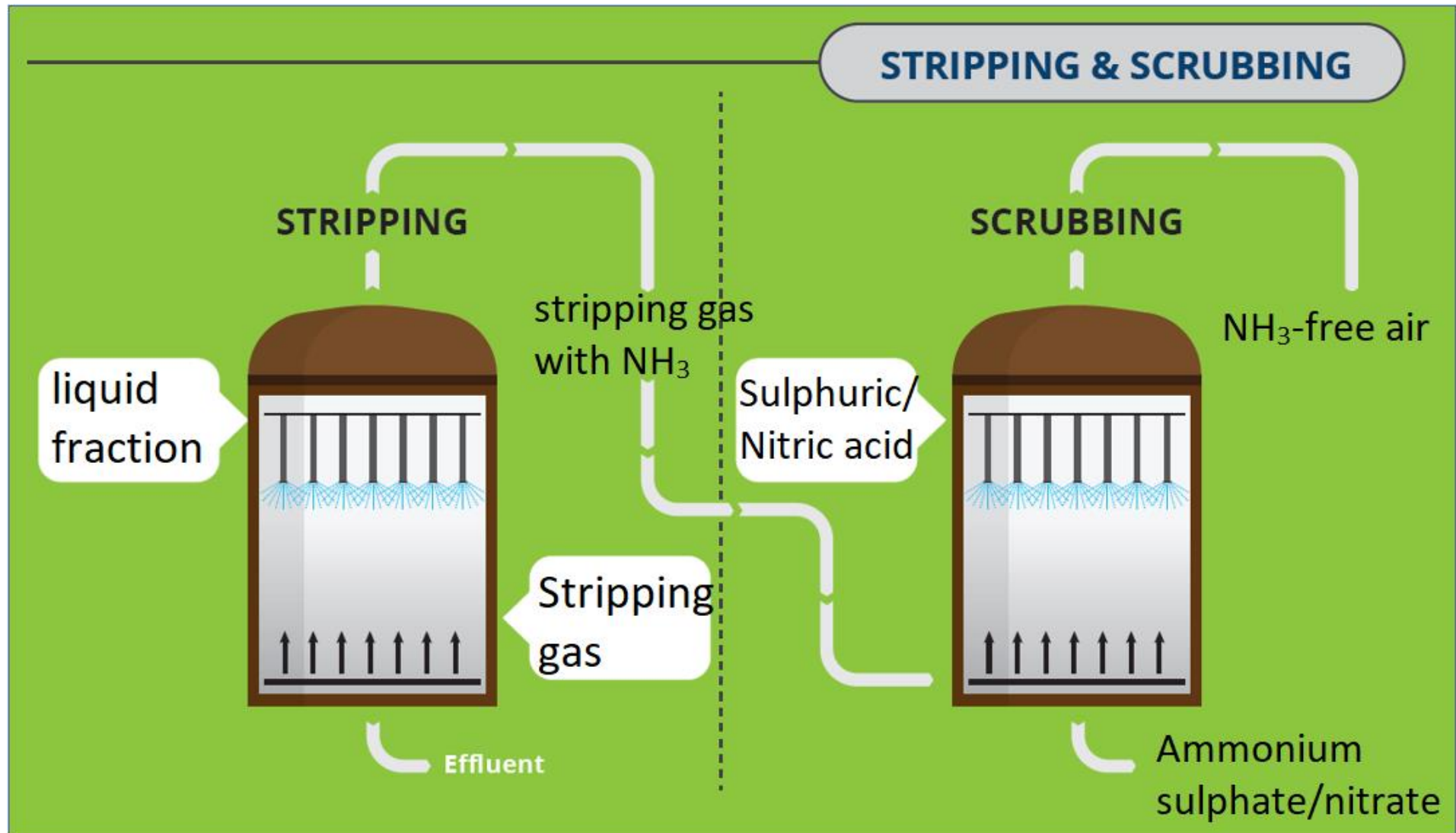
Stripping and scrubbing process

Equilibrium between $\text{NH}_3 \rightleftharpoons \text{NH}_4^+$





Stripping and scrubbing process





Ammonium salts as alternative fertilisers



	Ammonium sulphate	Ammonium nitrate
pH	5-7 (slightly acidic)	
Nitrogen %	8%	10-15% (50/50 ammonium/nitrate ratio)
Sulphur %	9 (of 23% SO ₃)	0
Density (ton/m ³)	1.15-1.2 (pure minerals no organic particles)	



Injection of ammonium salts to reduce ammonia emissions during application



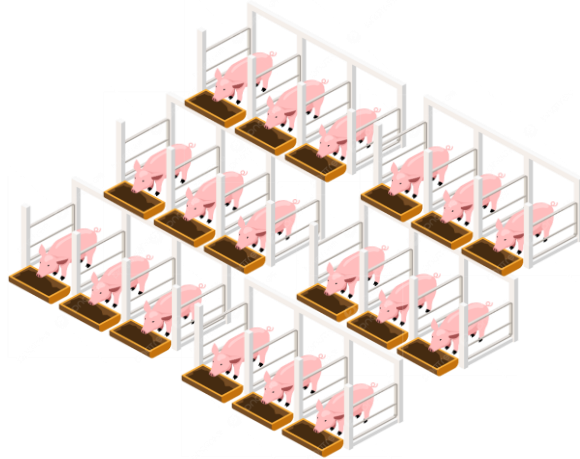
Five field trials were conducted in 2022 and 2023 with potato, maize and winter wheat. Results indicated that the **ammonium nitrate recovered from animal manure performs as well as artificial fertilizers (urea and calcium ammonium nitrate)** in terms of effectiveness and fertilizing value.



Cost-benefit analysis

The economic viability of implementing an ammonia stripper is highly dependent on:

- The **manure type**: including the amount of total N present in the manure flow to be treated and the ratio of mineral N to organic N.
- The **existing treatment pathway** such as anaerobic digester or nitrification-denitrification
- The **scale** of the farm, i.e. the amount of manure to be processed;
- **Manure pressure** given the Nitrates Directive and the implementation of the RENURE criteria



Desired economies of scale
~20,000 tonnes of manure per year



Installation cost approximately € 100-150 /1000L
(estimated by June 2023)

29.10.2024



Current status: intaking RENURE in EU regulations

On 8th March 2024, NUTRI-KNOW contributed to in submitting Joint Feedback on the Nitrates Directive Evaluation of several European Research Projects, highlighting the implementation of the RENURE criterion and the adaptation of the legal status of ammonium salts as alternative fertilisers.

Feedback letter on Nitrates Directive Evaluation

1 April 2024

The transition to a circular economy is crucial for reducing the environmental impact of different frameworks (H2020, Horizon Europe, INTERREG) to provide both EU projects across scientific technical evidence and policy-oriented advice, on topics related to circular economy in general and nutrient (recycling) in particular. In this light, the projects subscribing to the current call feedback call, have joined forces to provide the following Feedback letter. Our feedback compiled feedback is based on the insights from the various project activities.

The Nitrates Directive

A group of EU-funded projects, including NUTRI-KNOW, have joined forces to provide feedback on the Nitrates Directive. The Nitrates Directive (Council Directive 91/676/EEC) concerning the protection of waters against pollution caused by nitrates from agricultural sources ("the Nitrates Directive") is a key piece of legislation to achieve this target and other objectives of the EU Green Deal.

ReNure

One of the key concepts discussed in the feedback is ReNure. ReNure products are designed to minimise the risk of ammonia emissions from processed manure. The ReNure Criterion, developed through the SAFER initiative, focuses on the safe use of processed manure products. These products are designed to minimise the risk of ammonia emissions from processed manure. The ReNure Criterion, developed through the SAFER initiative, focuses on the safe use of processed manure products. These products are designed to minimise the risk of ammonia emissions from processed manure.

Joint Feedback on the Nitrates Directive Evaluation of European Research Projects

ABOUT THE EUROPEAN RESEARCH PROJECTS

We welcome the opportunity to give feedback on the Evaluation of the Nitrates Directive. The EU has made enormous progress in the implementation of circular economy solutions. Due to a continued commitment to research (2020) and practical implementation (INTERREG), the recovery and use of nutrients from wastes and residues is stimulated and facilitated. This is in line with the new legal framework within the Circular Economy Action Plan (CEAP) (FPR, WFD, CAP-Farm to Fork) under the EU Green Deal.

The European Commission has mandated and demanded a number of EU projects across different frameworks (H2020, Horizon Europe, INTERREG) to provide both EU projects across scientific technical evidence and policy-oriented advice, on topics related to circular economy in general and nutrient (recycling) in particular. In this light, the projects subscribing to the current call feedback call, have joined forces to provide the following Feedback letter. Our feedback compiled feedback is based on the insights from the various project activities.

The Biodiversity³ and the Farm to Fork⁴ strategies set a common objective of reducing nutrient losses in the environment by at least 50% by 2030, while preserving soil fertility. Council Directive 91/676/EEC⁵ concerning the protection of waters against pollution caused by nitrates from agricultural sources ("the Nitrates Directive") is a key piece of legislation to achieve this target and other objectives of the EU Green Deal.

The Nitrates Directive has been introduced more than 30 years ago and has not been amended since. Whereas the goal of the Directive remains relevant, the Directive itself urgently needs to be aligned with other legislation such as the Fertilising Product Regulation and the Animal By-Product Regulation. Nitrates Directive.

The current wording and strict interpretation of the definition of livestock manure, and the delay of the flagship achievement ReNure are seriously obstructing the market entry and use of valuable recycled N-fertilising products. Moreover, it also counteracts other EU goals for circularity that are laid down in other pieces of EU law.

COMMUNICATION FROM THE COMMISSION - A new Circular Economy Action Plan For a cleaner and more competitive Europe COM(2020)98 final

Communication from the Commission - The European Green Deal COM(2019)640 final

Communication from the Commission - EU Biodiversity Strategy for 2030 - Bringing nature back into our lives COM(2020)380 final

Communication from the Commission - The European Green Deal COM(2019)640 final

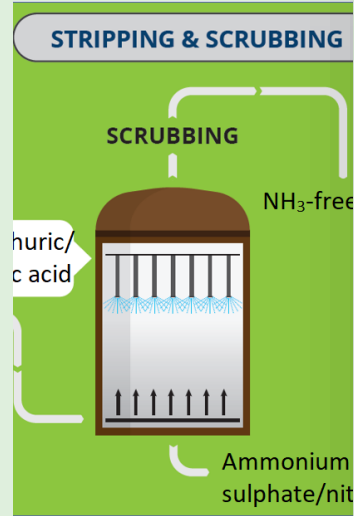
Council Directive (91/676/EEC) concerning the protection of waters against pollution caused by nitrates from agricultural sources

[Read the full feedback letter](#)



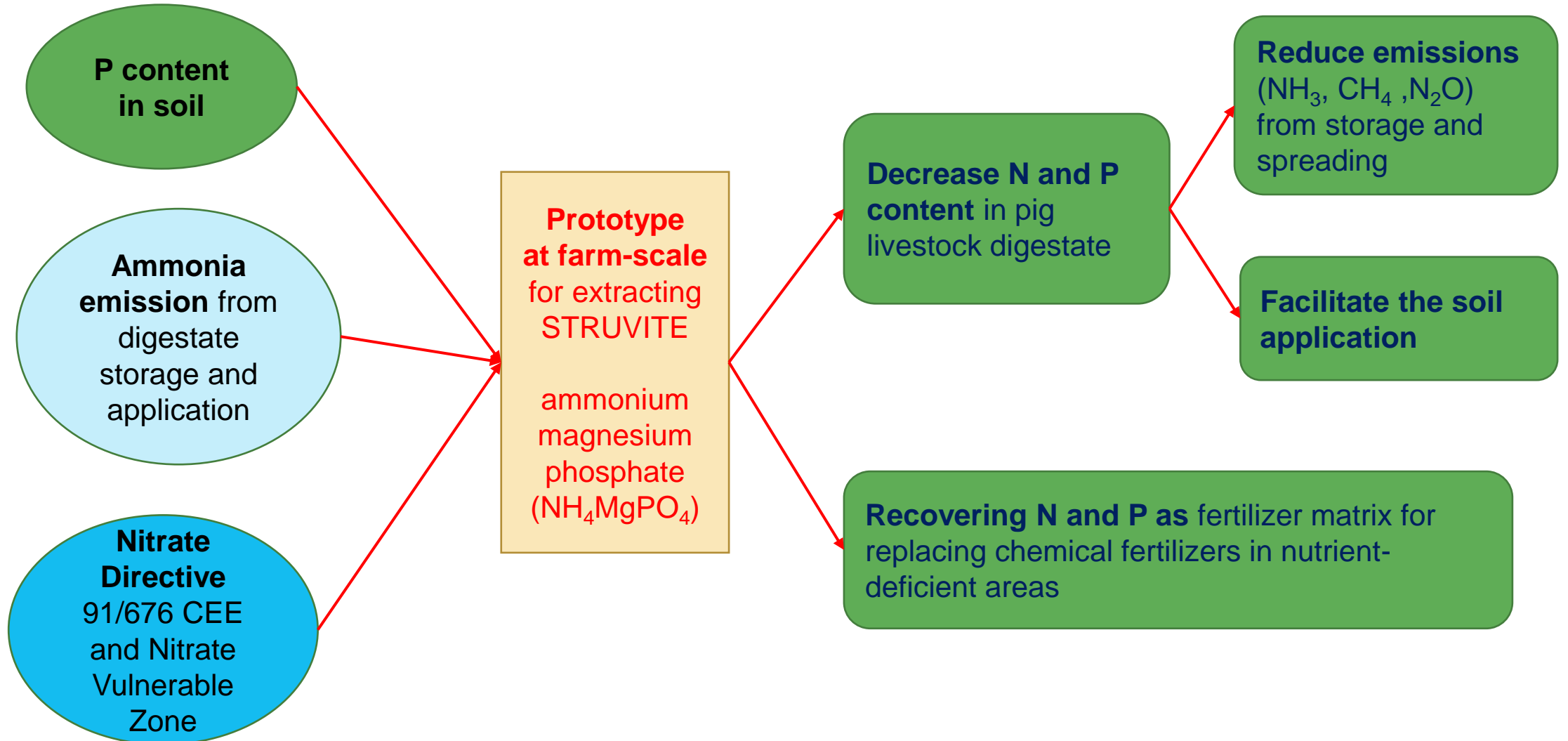
Processing Technologies for Nutrient Management

3. OG Struvite





OG Struvite: Context and goals



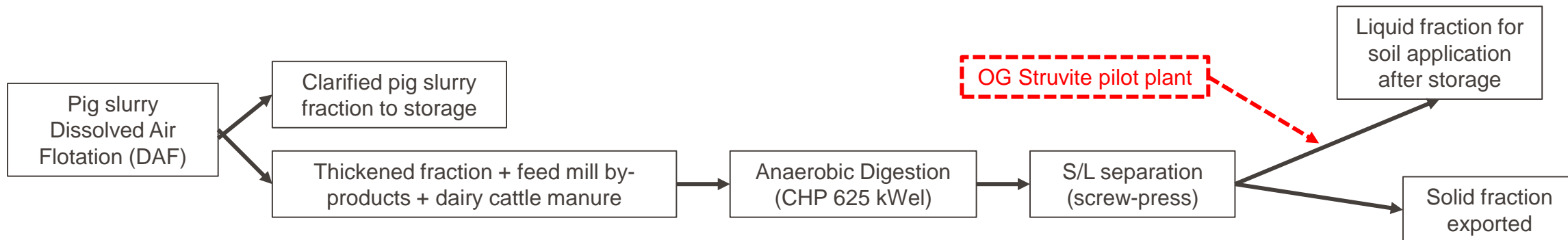


Colombaro pig farm: Modena, Emilia Romagna (IT)



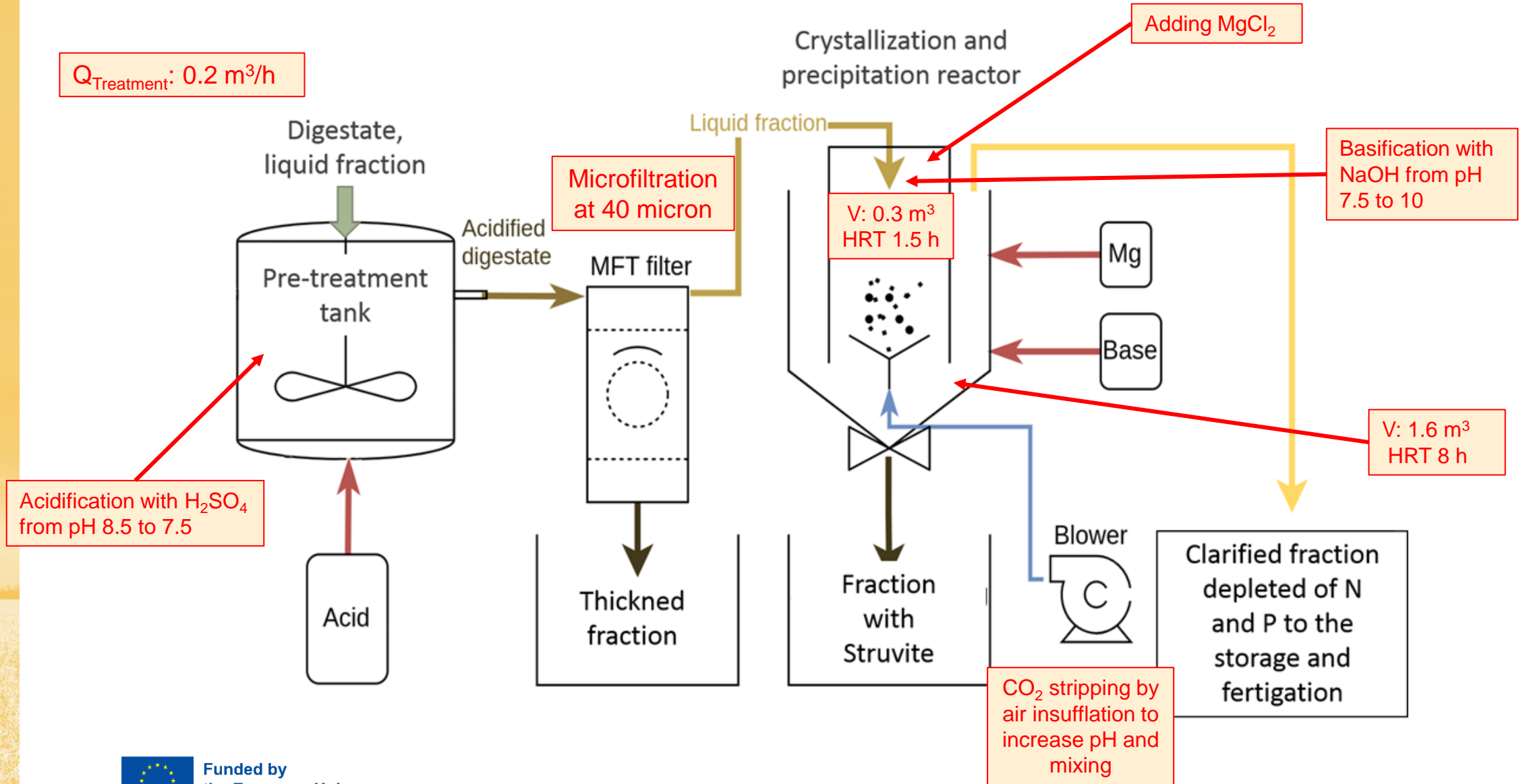
Main pig livestock data

- 15000 animal place
- Growing and fattening pig phase: 30 – 170 kg/pig
- Parma ham PDO supply chain





Layout of the treatment





Struvite prototype



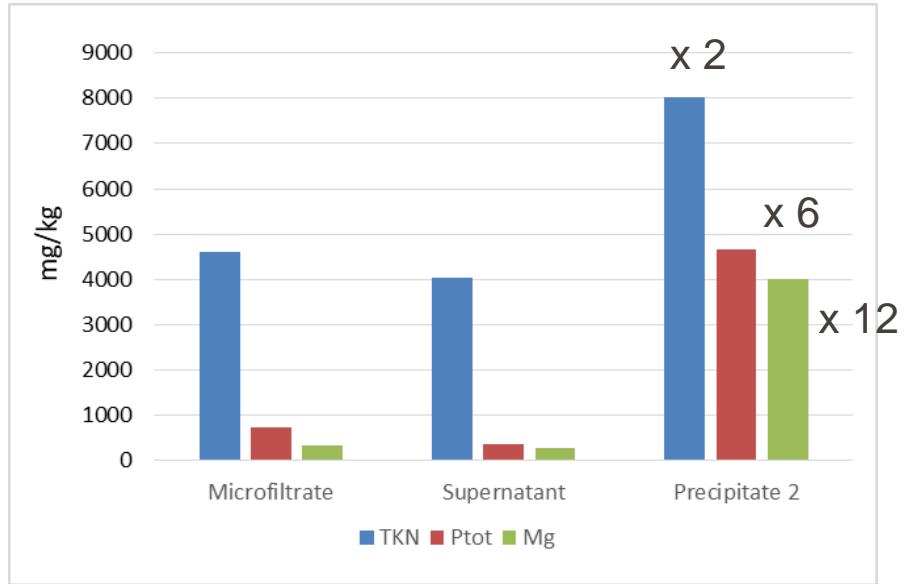
Funded by
the European Union



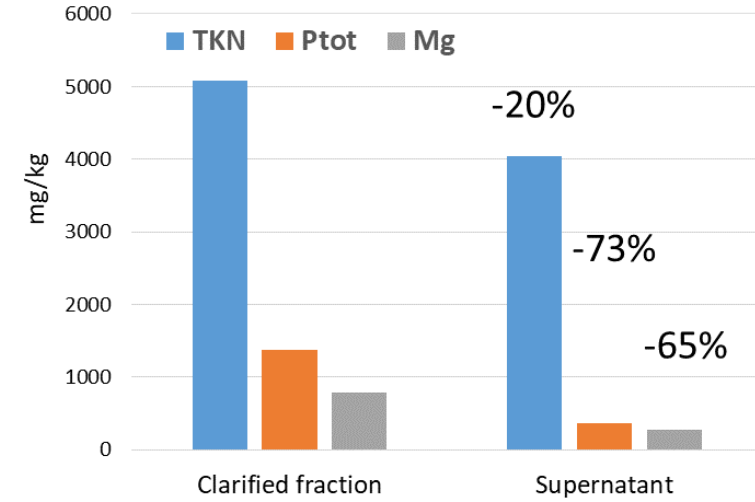
OG Struvite: treatment efficiency



Nutrient concentration by struvite reactor



Digestate nutrient depleting



	Qflow	P recovery efficiency
	%	% input P
Input (clarified digestate)	100	
Thickened fraction	29	37
Supernatant	64	
Struvite Precipitate	7	24 (61) - 63





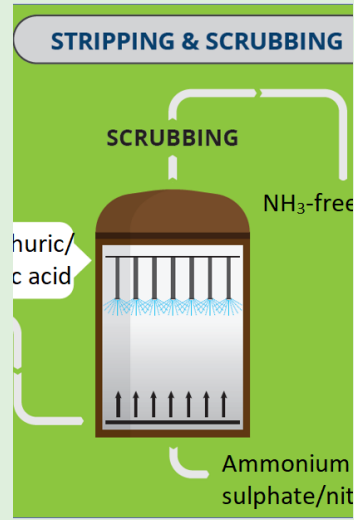
Conclusions

- STRUVITE system to recover phosphorus and nitrogen from digestate are technically feasible but this treatment has still to be further more efficient;
- Precipitate containing struvite should be used as “raw material” for the production of phosphate fertilizers to replace phosphate rocks;
- Technologies for nutrients recovery also allow to reduce emissions;
- The high concentration of solids in the digestate, even if subjected to S/L separation and microfiltration, is a critical issue.





Processing Technologies for Nutrient Management



Farm-scale anaerobic digestion

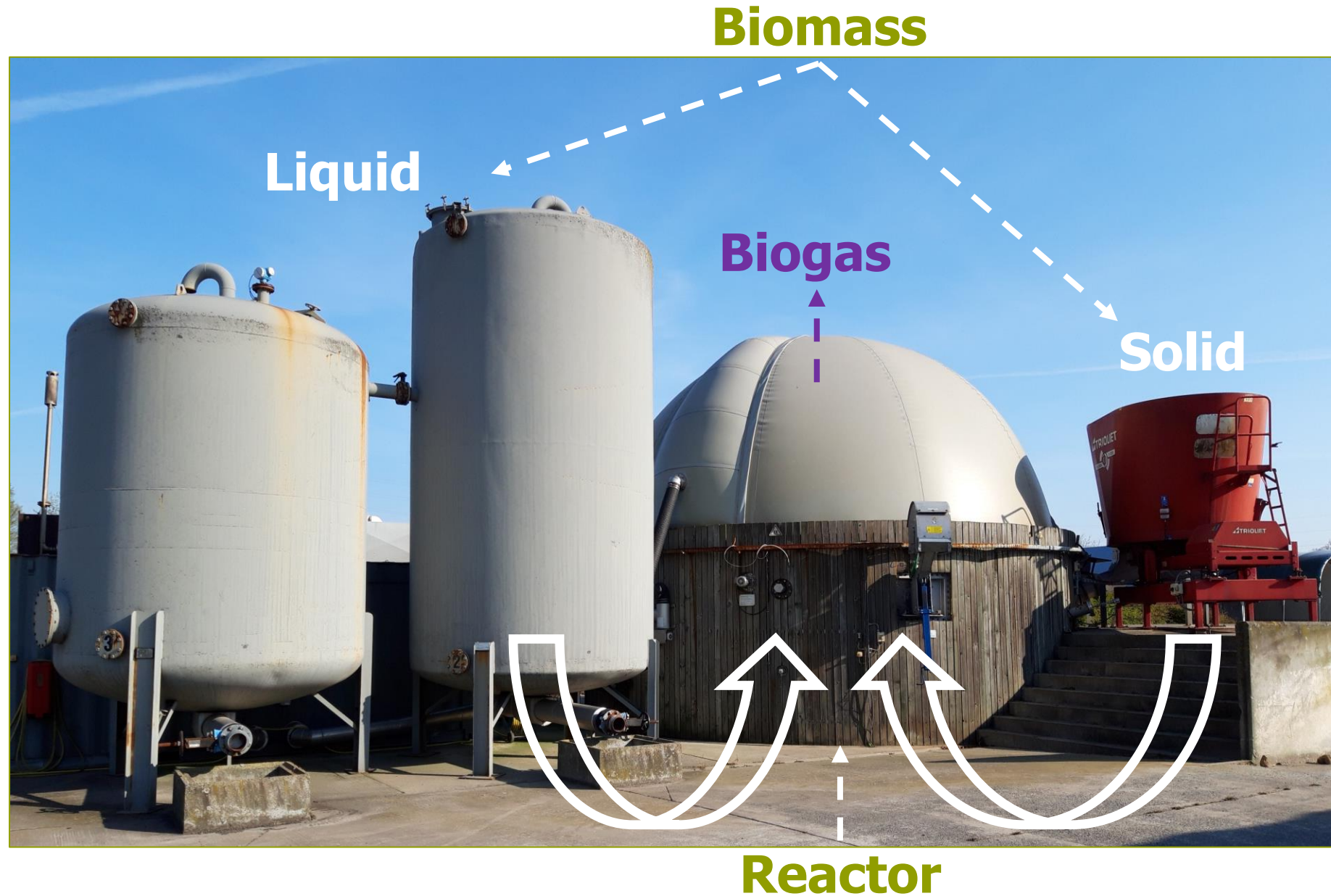
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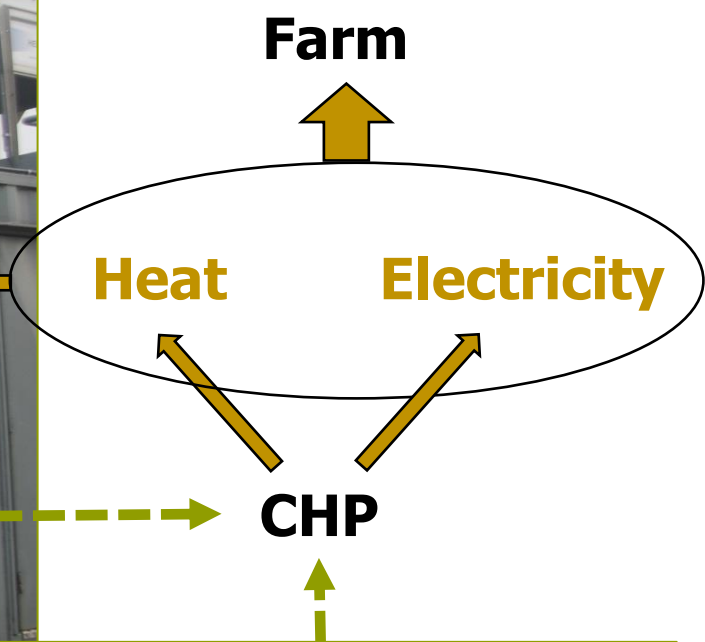


● What?

Anaerobic digestion

Anaerobic digestion



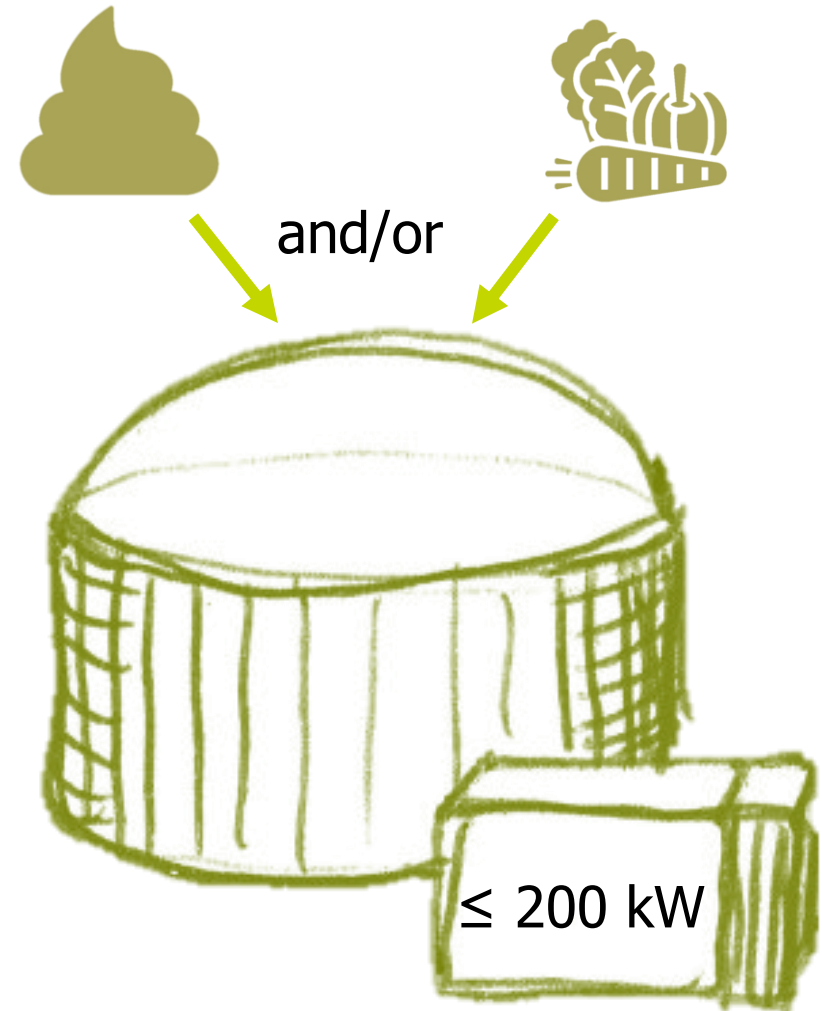


Digestate
(external storage)

Biogas —————→ **50-75% CH₄**
(methane)

Farm-scale anaerobic digestion

- Proprietary biomass
- ≤ 5.000 ton biomass/year
- Co- vs. mono-digestion



● What?

Digestate

Digestate

- = Digested biomass
- Fertiliser
- DM en OM ↓
- Mineral nitrogen ↑

	DM (%)	OM (%)	N_{tot} (kg/ton FM)	N_{min} (kg/ton FM)	P₂O₅ (kg/ton FM)	K₂O (kg/ton FM)
Slurry	9,83	7,54	4,31	2,07	1,6	4,33
Digestate	6,54	4,69	3,91	2,46	1,4	4,33

Source: Inagro & Boerenbond (2014).

Digestate

- Division nitrogen availability
 - 20% more N_{\min} → immediately available
 - Difficult to degrade OM → available later
- Crop
 - Quick uptake after application
 - N-uptake in autumn (cover crop)



● Why?

Why?

Pros

Self-sufficient in energy

Continuous, renewable energy

GHG ↓

Fertilisation value: N_{\min} ↑

Profitable investment (farm-dependent)

Cons

Daily monitoring

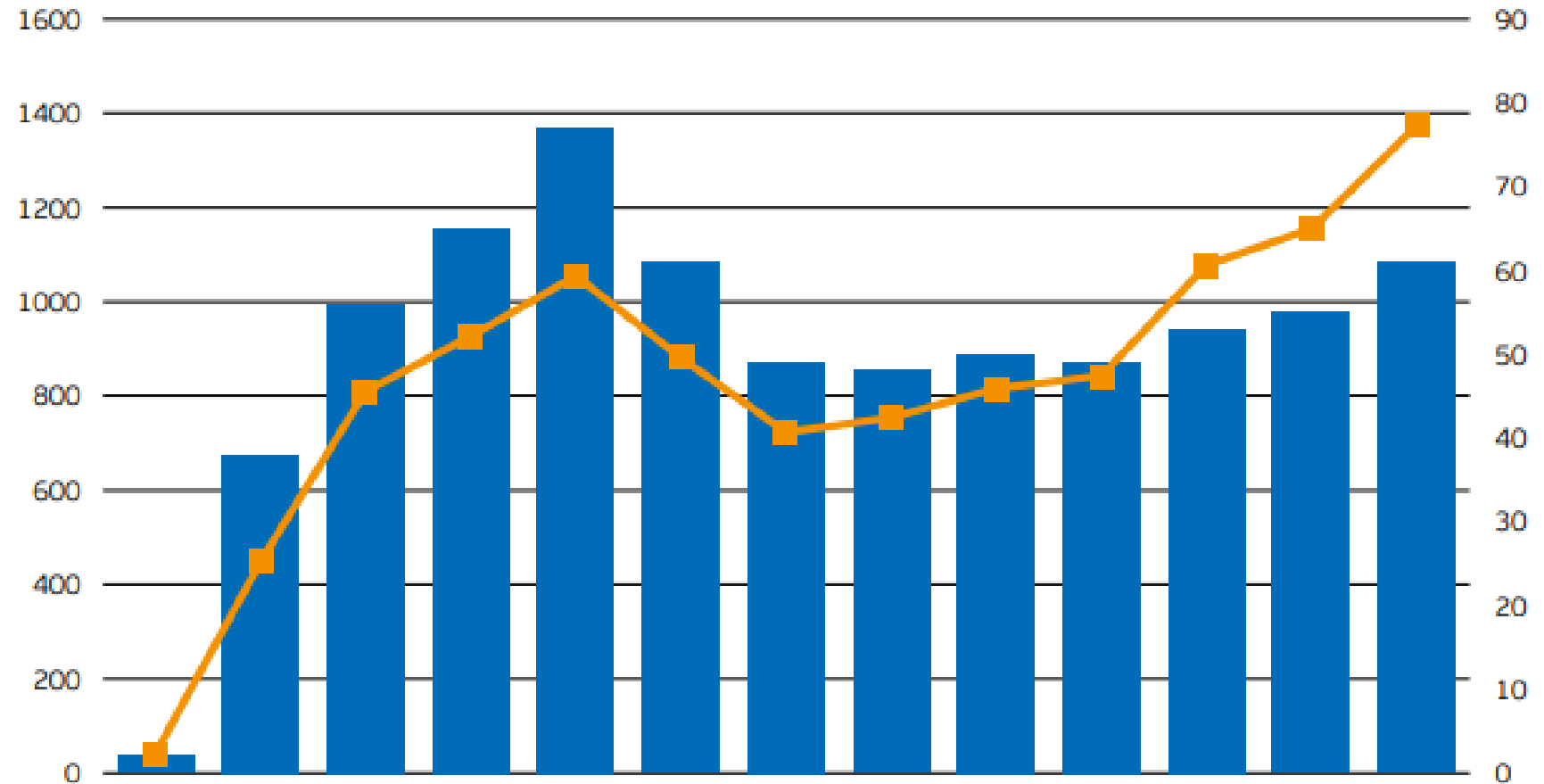
Administrative chaos

Image

Legislative framework

Flanders

Electrical power (kWe)



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number	2	38	56	65	77	61	49	48	50	49	53	55	61
Electrical power	41	448	810	927	1055	881	723	754	816	843	1078	1155	1374

Biogas-E, 2024, The Flemish biogas sector in 2023.



Thank you.

ines.verleden@inagro.be



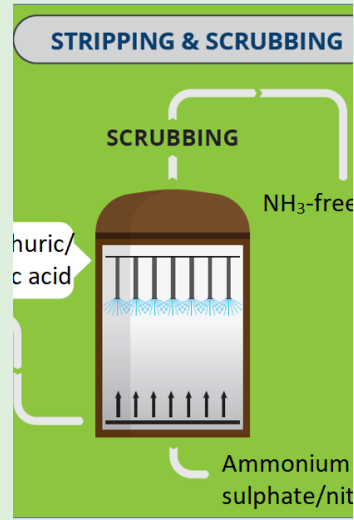
Europees Landbouwfonds
voor Plattelandsontwikkeling:
Europa investeert
in zijn platteland



inagro 
ONDERZOEK & ADVIES IN LAND- & TUINBOUW



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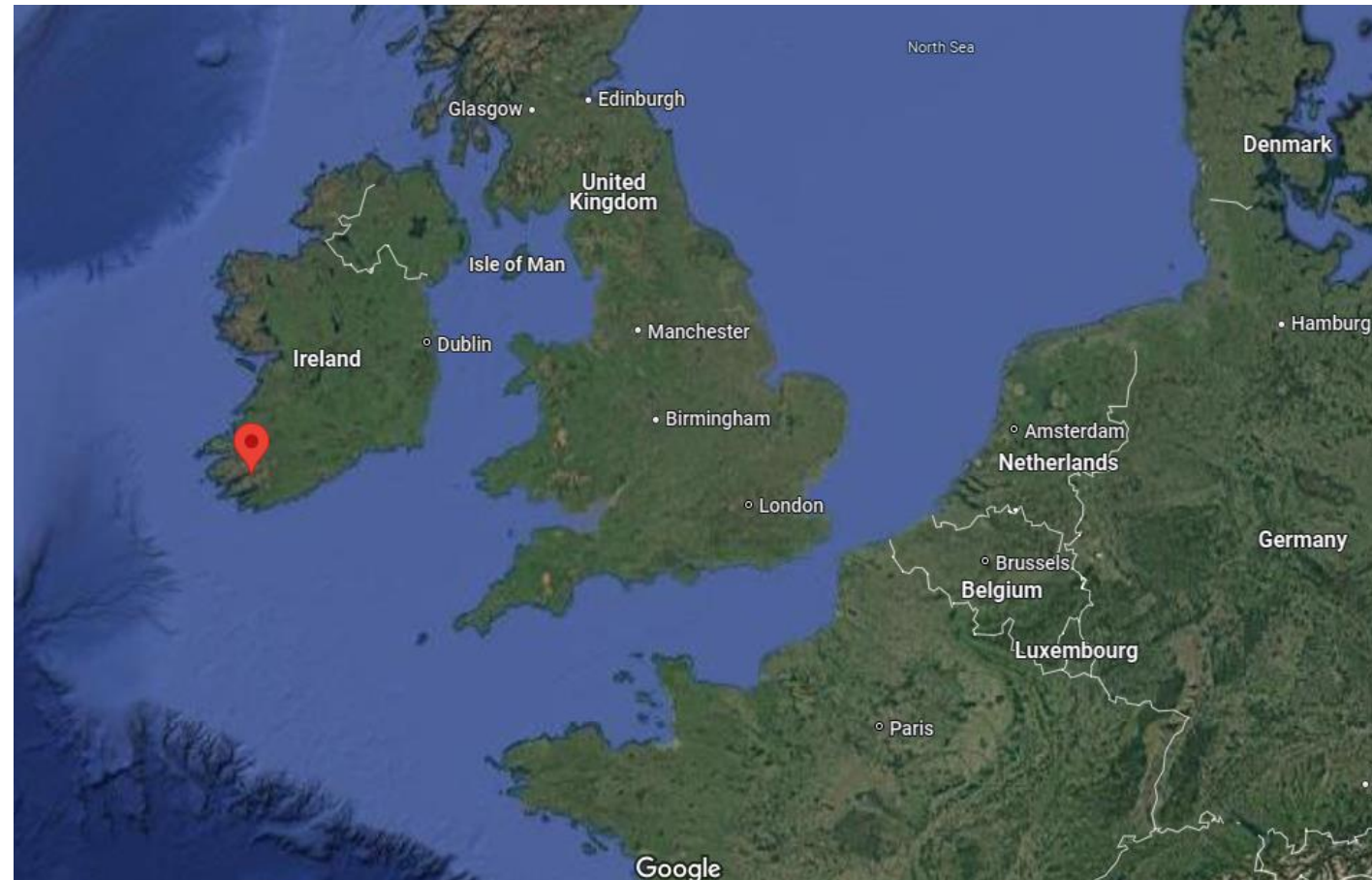




Biorefinery Glas



- Operation group (OG) 10
- South West Ireland.
- Pilot scale.





Biorefinery Glas



- Processes grass into four products.
- Refines unused protein.
- 50% into press cake.



- + 40% usable Pr/Ha.
- N and P losses -25%.



Press Cake Silage.

- Alternative animal feed from grass.
- Grass silage supplementation.
- NUE increase



- Reduces methane concentration in the rumen
- Reduces N and P excreted..
- Increases grass value.





High Protein Pig Feed.

- Higher-than-average daily intake
- Higher than average daily gain
- Replaces up to 50% of soya in diet.



- Reduces transport distances and import cost
- Reduced emissions.
- Increased farm efficiency and income.





Grass Whey; a Biobased Fertiliser.

- Produced from Biorefinery Streams
- Acts as a bio-stimulant.
- More chlorophyll availability.



- Nutrient values similar to slurry
- Reduces mineral fertiliser costs.
- Increases grass value.



BIOREFINERY
GLAS



NUTRI•KNOW

Q&A

Next Webinars – Register via www.nutri-know.eu/nutri-know-webinars

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November 12: Transport

November 19: Storage Systems