NUTRI•KNOW

WEBINAR Nº3

Application

22th October 2024

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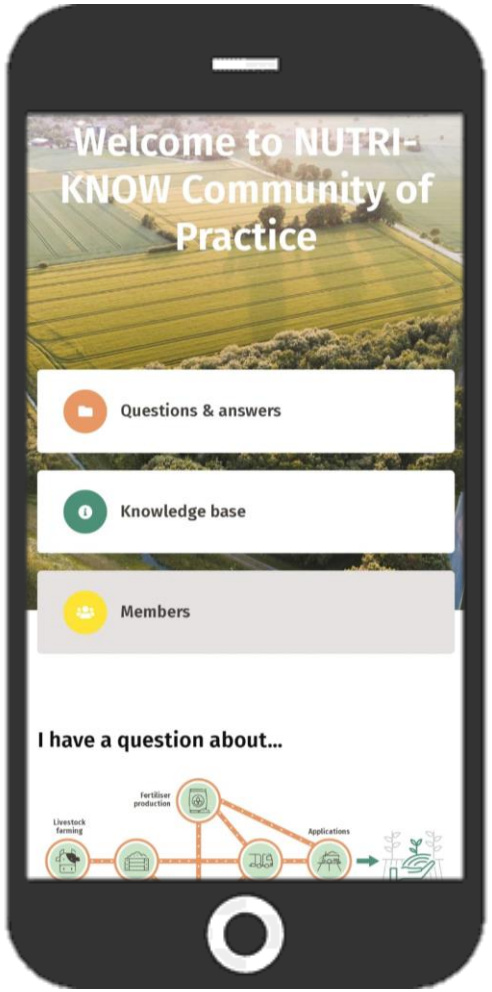
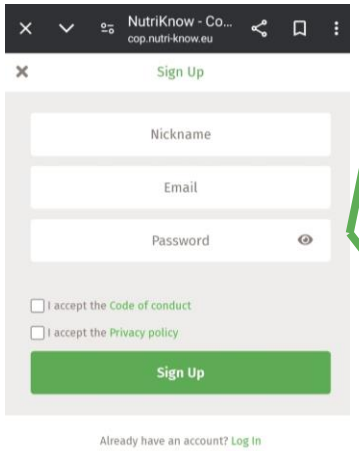
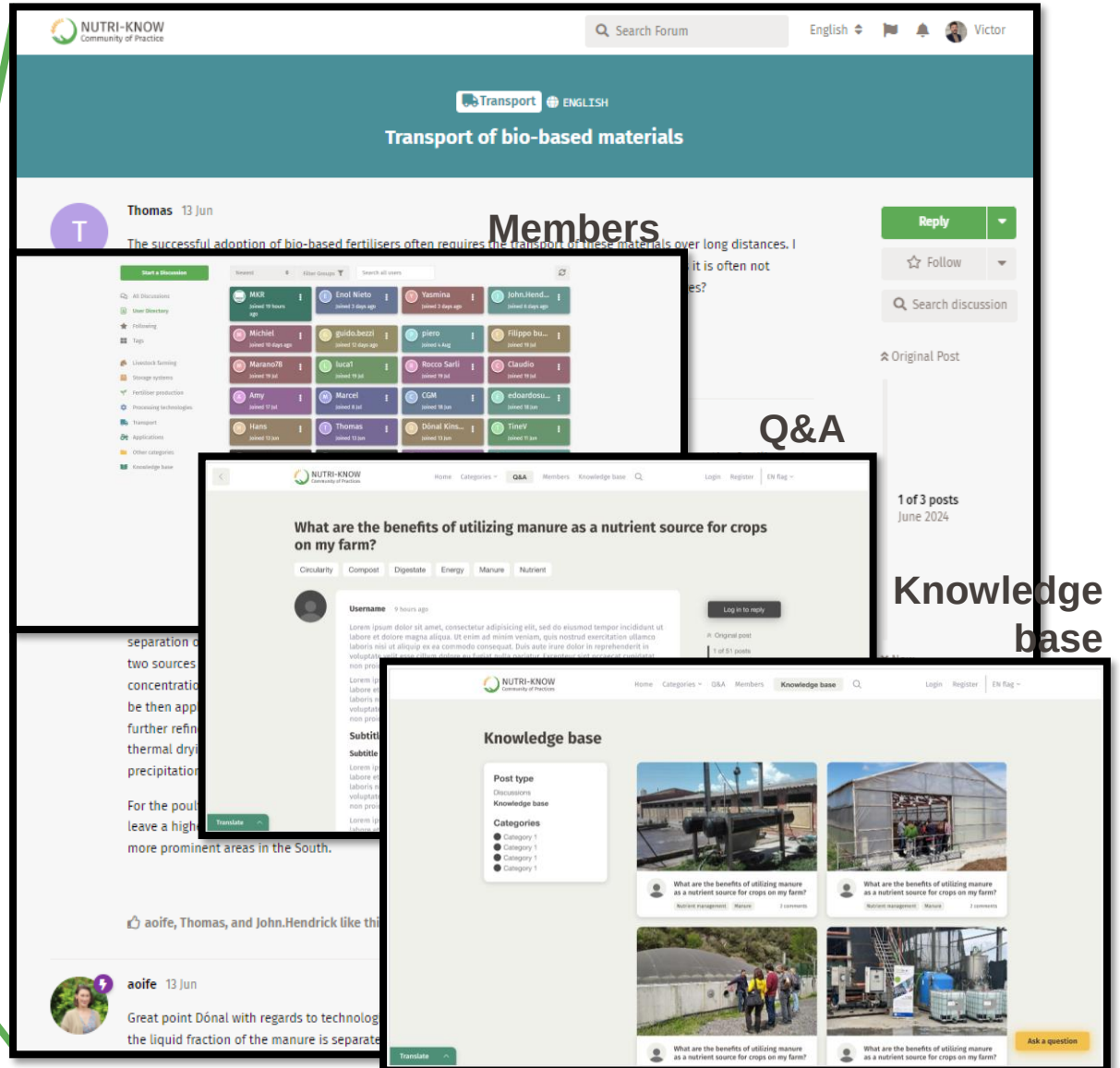


Sign up and explore!





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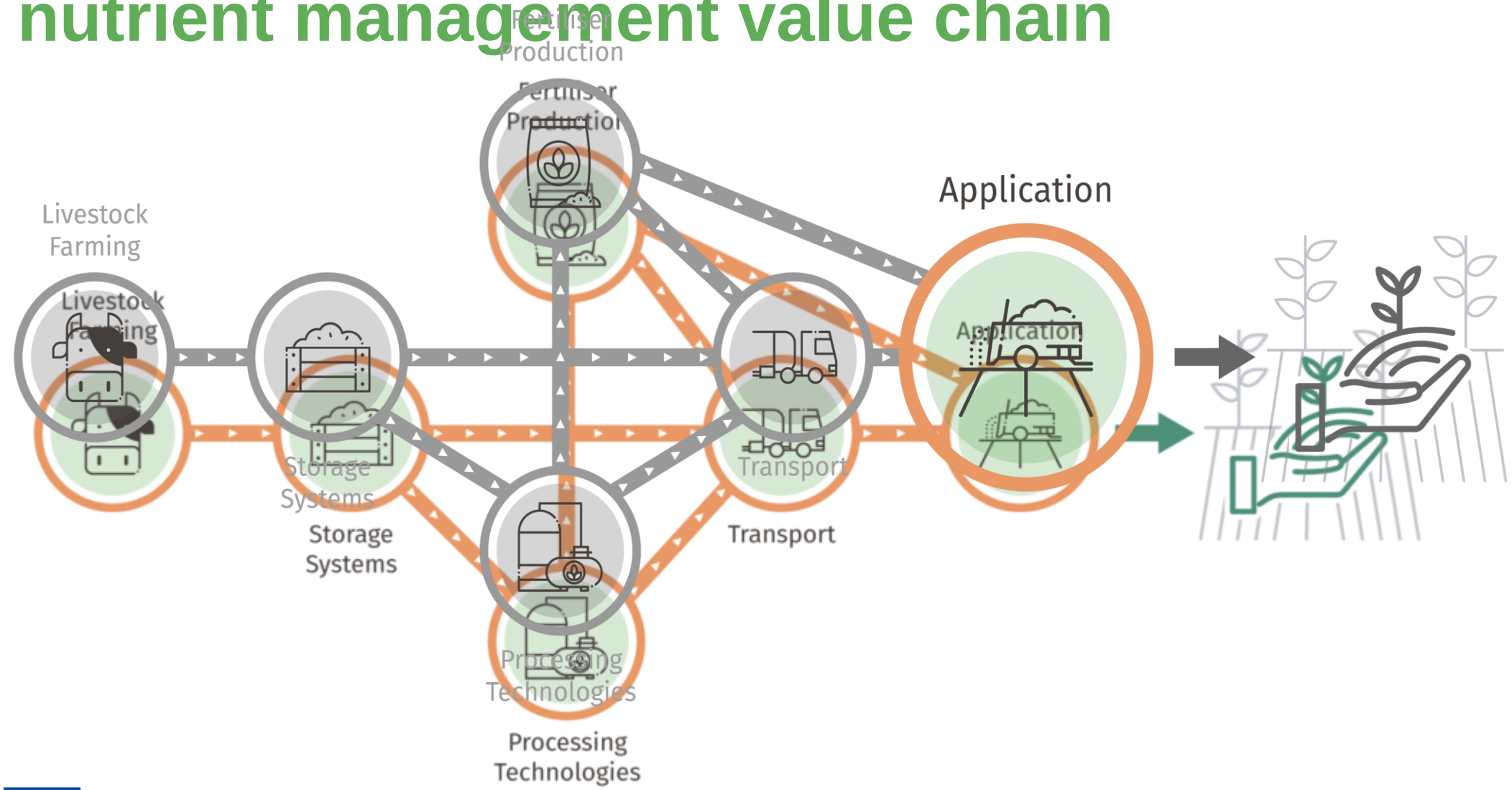
Application: the last but important step in the nutrient management value chain



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Nutrient application at farm/field

Manually VS Machinery

More beyond…

- Nutrient type
- Farming system
- Availability of technologies and tools
- Associated management on soil, crop, water, etc.

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Farm2Fork Strategy: Sustainable Target for 2030

Reduce by 50% the overall use and risk of **chemical pesticides** and reduce use by 50% of more hazardous **pesticides**

Reduce **nutrient losses** by at least 50% while ensuring no deterioration in soil fertility; this will reduce use of **fertilisers** by at least 20 %

Reduce sales of **antimicrobials** for farmed animals by 50%

Achieve at least 25% of the EU's agricultural land under **organic farming** and a significant increase in **organic aquaculture**

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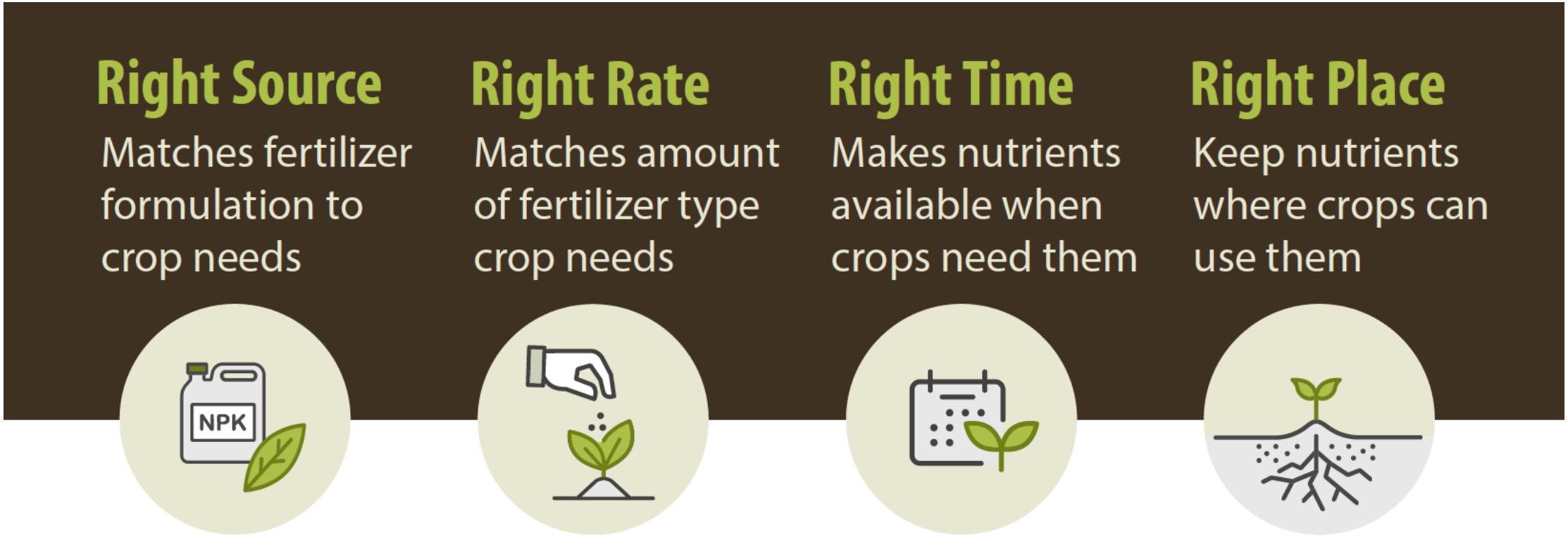
4R principle for nutrient application at field



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Innovations for nutrient application

- **2 manure management tools to reduce application cost (including labor, transport, machinery) and increase precision fertilisation efficiency;**
  - Slurry concentrator
  - On-site conductivity meter
- **2 technologies to recover nutrients from manure;**
  - Ammonium salts recovery
  - Struvite precipitation
- **3 management strategies to integrated the fertilisation, crop, soil and water practices.**
  - Fertigation with microfiltered digestate
  - Green manure application
  - Water protection improvement plan

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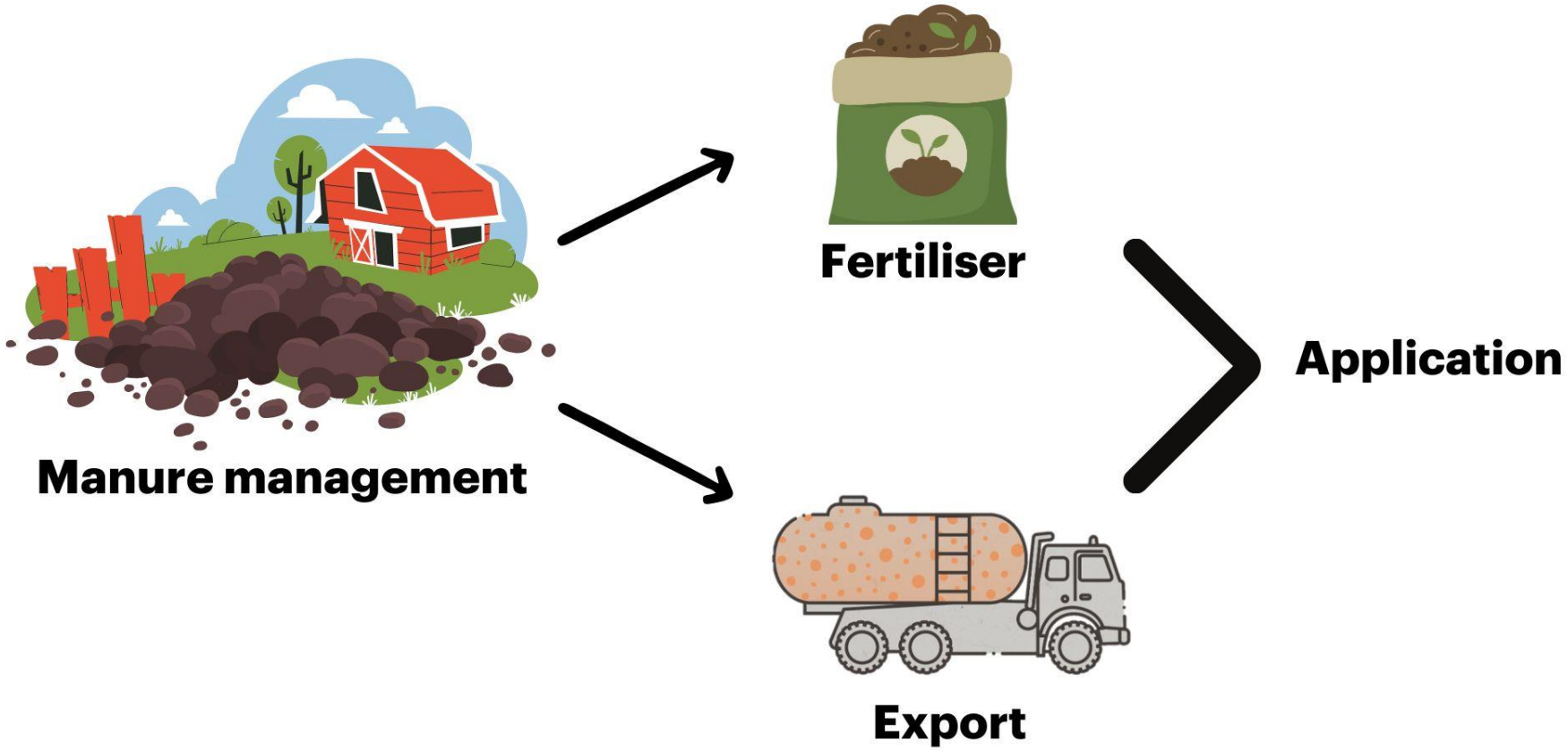
Slurry concentrator
CONTEXT



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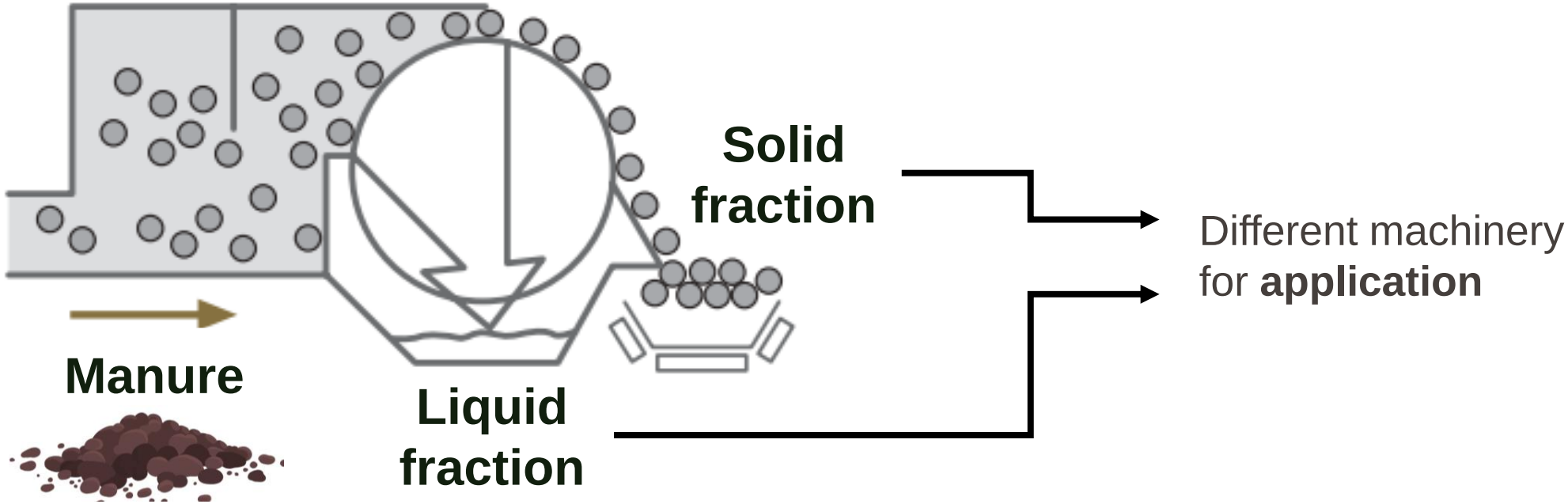
Slurry concentrator CONTEXT

Solid-liquid separators



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Slurry concentrator

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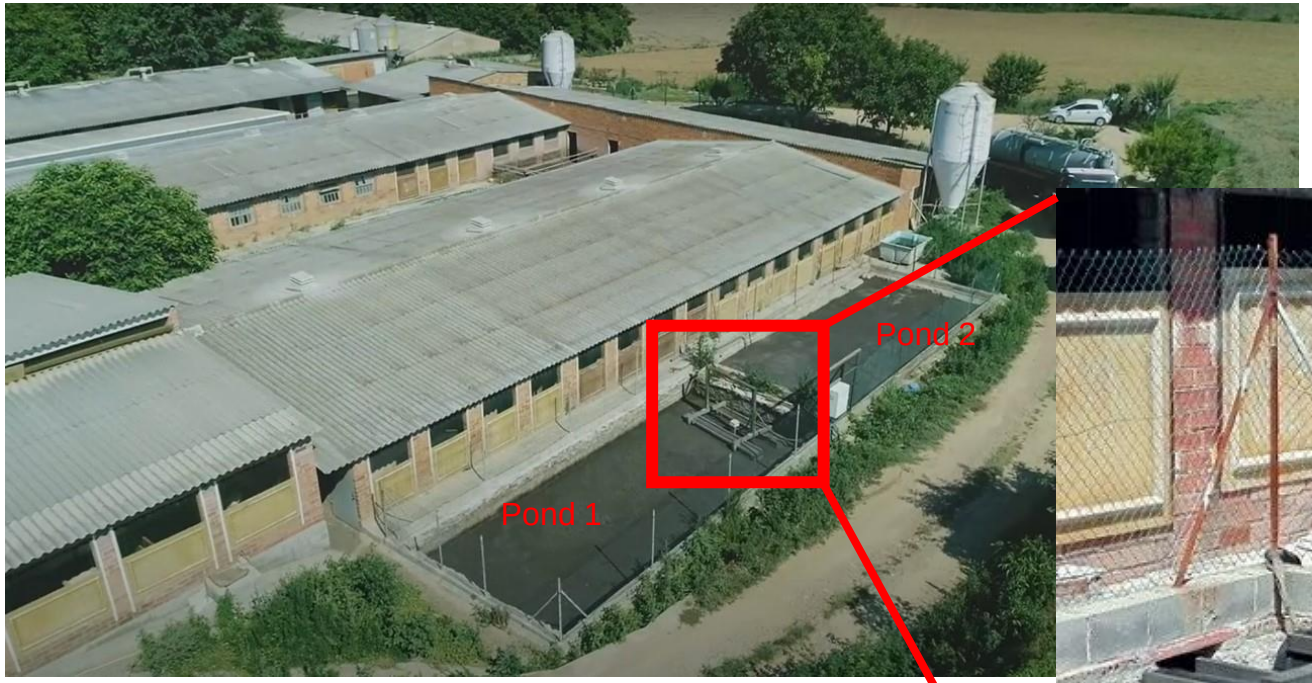
Slurry concentrator



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Slurry concentrator

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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.

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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.

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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

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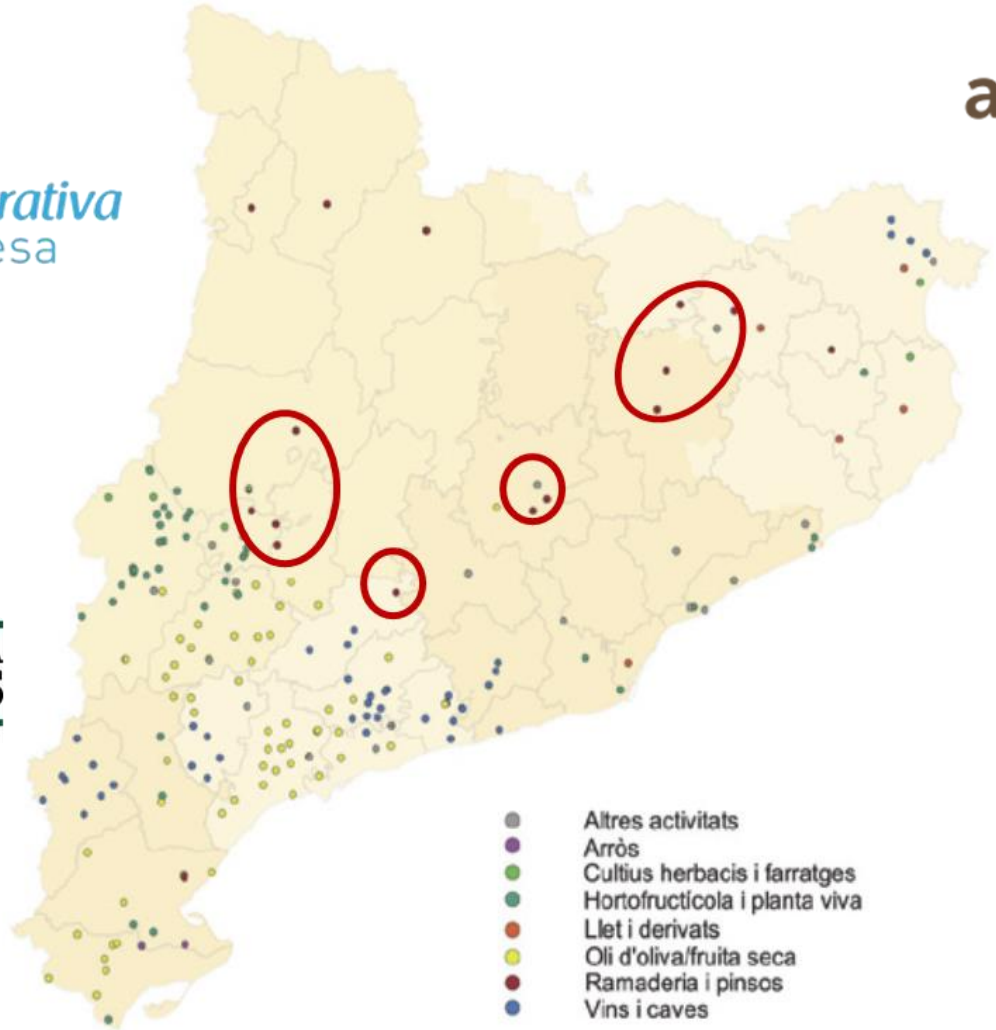
Manure Management Tools



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Manure Management Tools

Step 1. Use of conductimeters

Step 2. Application

Step 3. Training sessions

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Manure Management Tools

PLANA DE VIC COOPERATIVA
Junts cuidem l'origen

- Use of manure liquid fraction
- Use of band spreaders before sowing and burial
- Use of hoses on first growing

10 Different applications:

- 3 treatments before sowing
  - No fertilization
  - 50kg N/ha of compost
  - 100kg N/ha of compost
- 7 different treatments on first growing with compost, manure liquid fraction and mineral fertilizers

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Manure Management Tools

agrocat

- One application of slurry before sowing and burial
- 5 different treatments: (application on first growing)
  - Control – no treatment
  - Dose of 70kg N/ha applied with band spreader
  - Dose of 70kg N/ha applied with hose
  - Dose of 120kg N/ha applied with hose
  - Mineral fertilizer

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Manure Management Tools

- Double crop: barley (winter) and corn (summer)
- Manure liquid fraction and mineral fertilizers applied with hoses
- 4 treatments for each crop
  - Barley (winter)
    - Mineral fertilizer before sowing
    - Dose of 170kg N/ha of slurry before sowing
    - Dose of 70kg N/ha of slurry on first growing
    - Mineral fertilizer on first growing
  - Corn (summer)
    - Dose of 100kg N/ha of slurry before sowing
    - 2 application of slurry dose of 170kg N/ha before sowing
    - Mineral fertilizer on first growing

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Manure Management Tools
CONCLUSIONS

- Application with hoses gives more uniformity and nitrogen efficiency, reduces bad smells and helps to apply needed doses.
- Use of conductimeters helps estimate needs of nutrient soils and correct dose of slurry.
- Application of manure liquid fraction on first growing allows the application on the right moment.
- It is needed to plan applications and perform the best practices during crops growth.

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RENURE: recovered nitrogen from manure

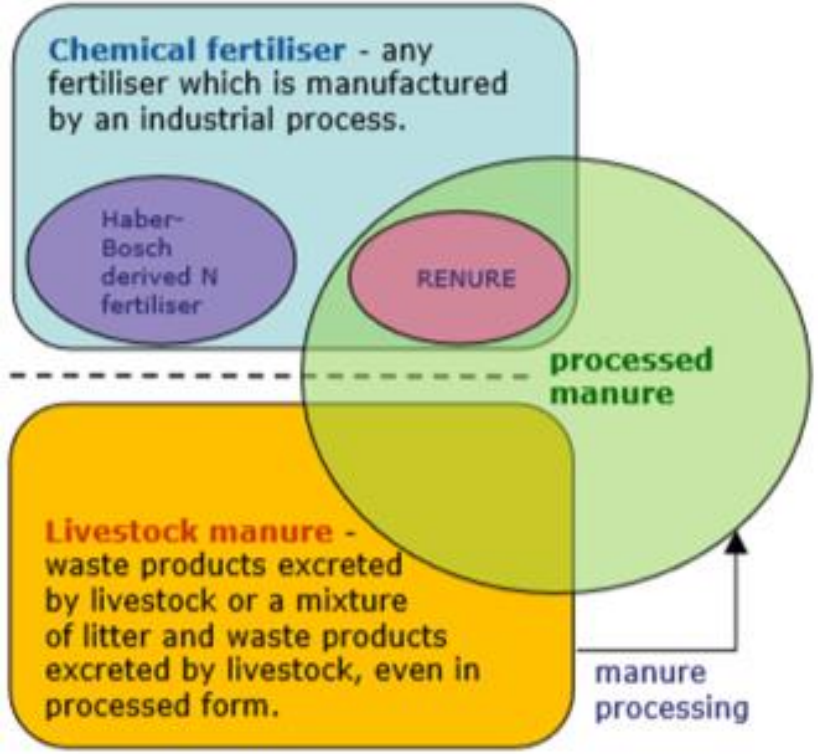
RENURE criteria proposed by Joint Research Center (JRC):

- 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.

But, according to the Nitrates Directive (91/676/EEC):

RENURE products are still limited by the status of animal manure with application below 170 kg N/ha/yr.



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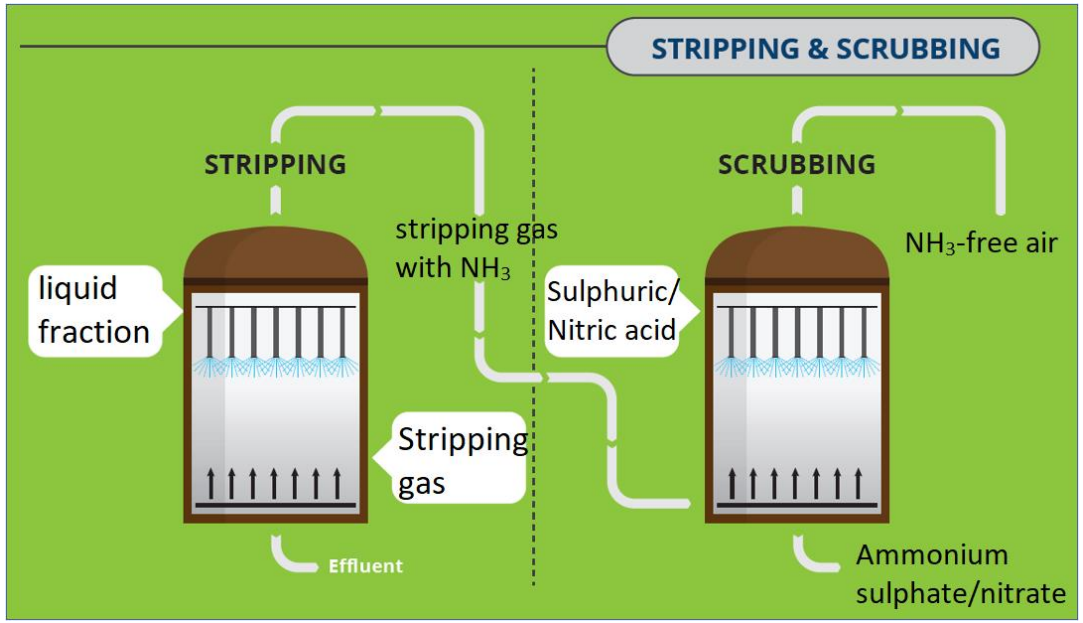
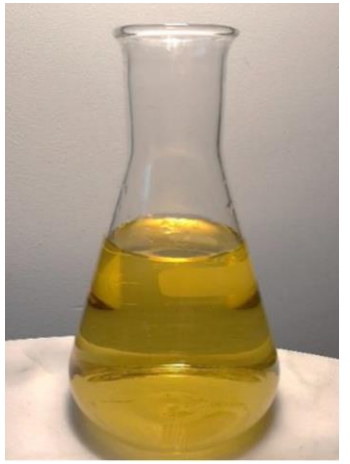
RENURE: REcovered Nitrogen from manURE



Ammonium sulphate



Ammonium nitrate

	Ammonium sulphate	Ammonium nitrate
Nitrogen %	8%	10-15% (50/50 ammonium/nitrate ratio)
Sulphur %	9 (of 23% SO_3)	0
Density (ton/m³)	1.2	1.15

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RENURE: recovered nitrogen from manure

Application of ammonium salts to grass and vegetable crops through injection to reduce ammonia emissions

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RENURE: recovered nitrogen from manure

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.

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STRUVITE - Digestate treatment to reduce emissions from digestate application

A main goal of Struvite OG is to **decrease the nitrogen (N) and phosphorus (P) content** in livestock digestate in order to **reduce atmospheric emissions** (NH_3, CH_4 ,N_2O) from spreading phases and to **facilitate the soil application** of phosphorus-depleted digestates;

To do this OG designed and implemented a prototype at farm-scale for producing and extracting **STRUVITE - hydrated ammonium magnesium phosphate ($NH_4MgPO_4 \cdot 6H_2O$)** recovering **N and P from digestate**.

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STRUVITE - Digestate treatment to reduce emissions from digestate application

	Ammonia (*) (NH_3-N/N applied)	Nitrous oxide (N_2O-N/N applied)	as sum of ammonia-N and nitrous oxide-N (N/N applied)	N emission reduction
	[%]	[%]	[%]	[%]
Clarified fraction	64	2	66	-
Treated surnatant	52	2	54	19%
Thicknened	51	2	53	19%

(*) high ammonia emissions factors because soil burial didn't take place within 24 hours for experimental monitoring reasons

Static chamber method for nitrous oxide emissions (monitoring for 1 month after spreading)

Nitrogen emissions (NH_3 + N_2O) from **land application** of treated matrices were 19% lower than for clarified digestate

- Treated surnatant for nitrogen content depleted
- Thickened fraction because slightly acidified

Wind Tunnel (Lockyer, 1984; Meisinger et al., 2001) with ammonia capture in acid solution to investigate ammonia emission (monitoring for 7 days after spreading)

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STRUVITE - Digestate treatment to reduce emissions from digestate application

- After the Struvite treatment, the supernatant fraction was significantly depleted in phosphorus (-73%) and nitrogen (-20%) compared to input clarified digestate;
- Precipitate containing struvite should be exploited by fertilizer producers and it should be used as “raw material” for the production of phosphate fertilizers to replace phosphate minerals;
- Technologies for nutrients recovery from slurry and digestate also allow to reduce emissions derived from digestate soil application (air and soil);

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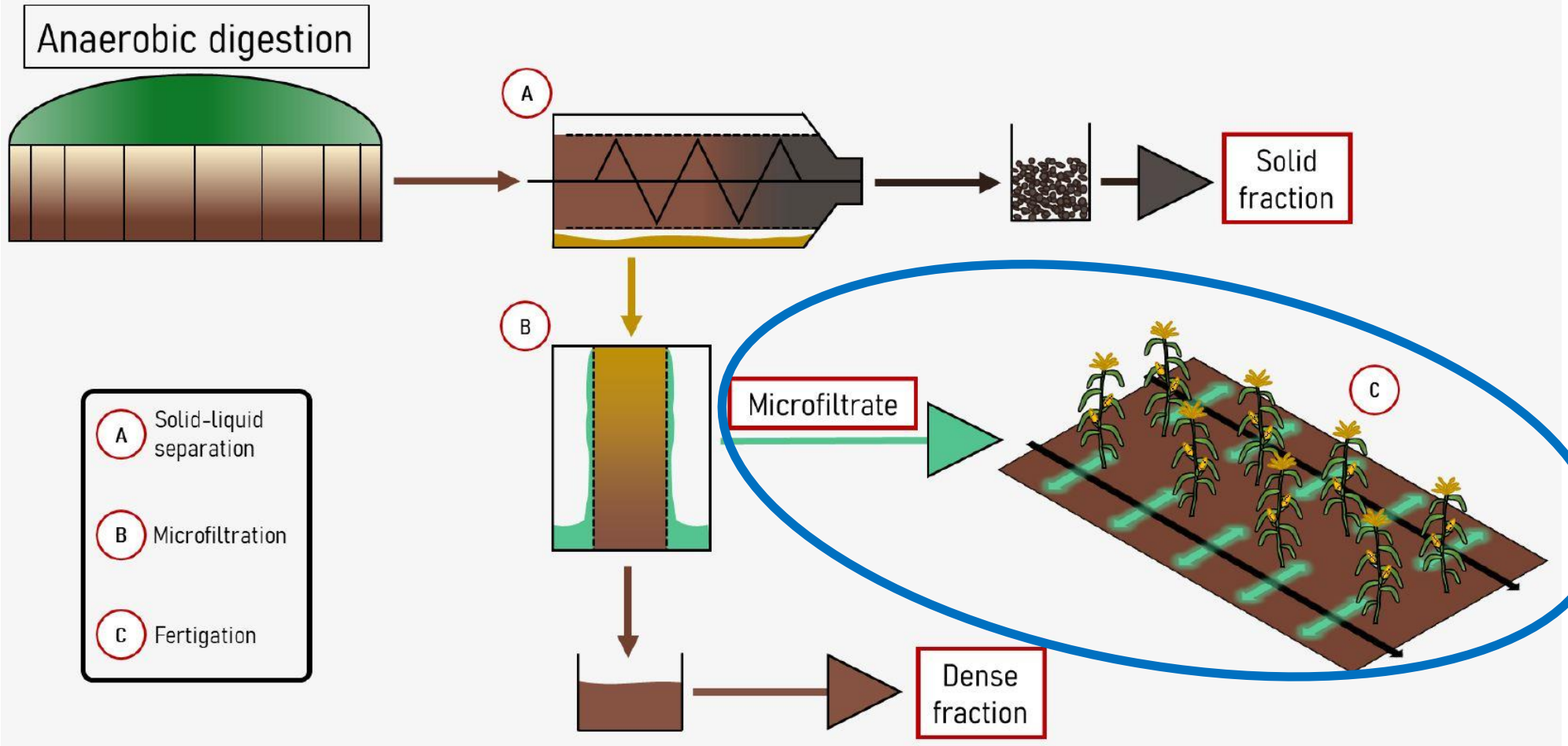
SOS_AQUAE - Fertigation with microfiltered digestate

@ CAT COOPERATIVE / CORREGGIO *@ LEONA FARM / CODIGORO*



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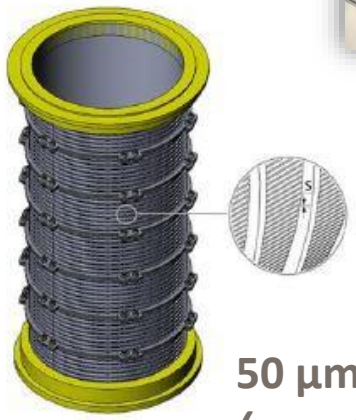
SOS_AQUAE – The keystone: the microfilter



This is now a commercial equipment applicable to full scale.

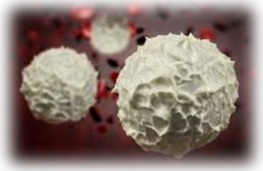
Manufactured by WAMGROUP.

Flow rate up to 10 m^3/hour of microfiltered digestate produced.

particles larger than 50 µm are removed

50 µm = 0,05 mm

(equal to three white blood cells)



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SOS_AQUAE - Fertigation with microfiltered digestate

- **by sprinkler irrigation (@Leona Farm, on maize)**

one part microfiltered for every 10 parts water (2 applications)

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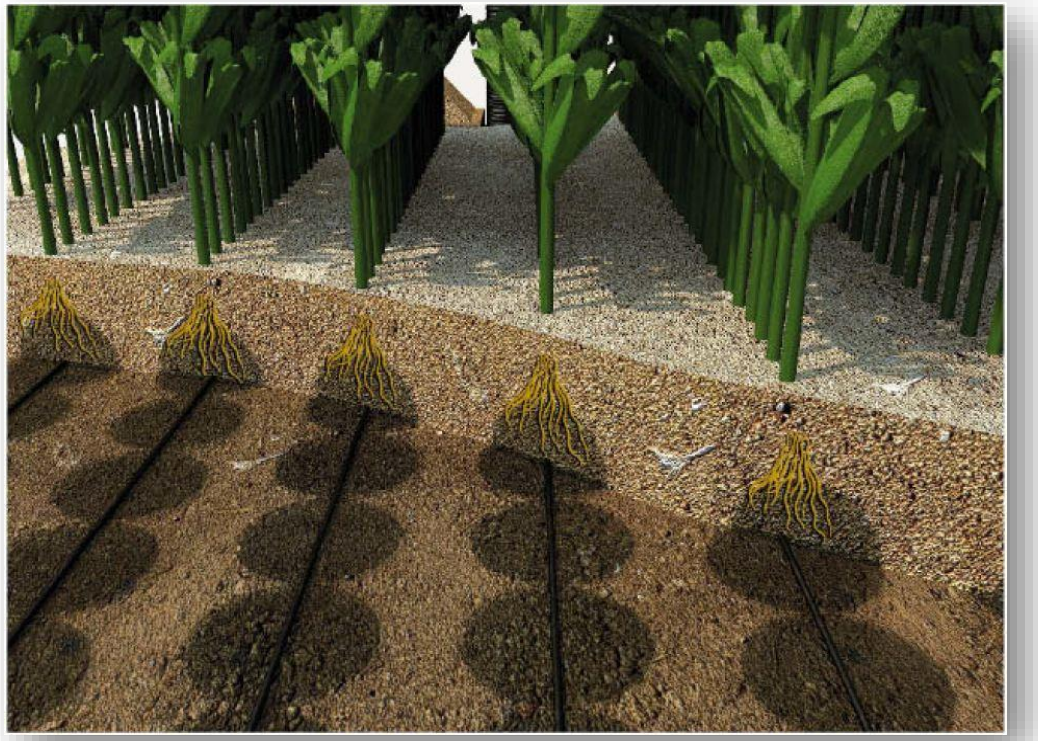
SOS_AQUAE - Fertigation with microfiltered digestate

- **by subsurface drip lines irrigation (@CAT Coop, on maize, sorghum)**



one part microfiltered for every 20-30 parts water (5-10 applications)

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SOS_AQUAE - 4R principle for nutrient application at field

RIGHT SOURCE – digestate is obtained mainly from livestock manure and plant materials

RIGHT RATE - possible to match the amount of nutrients the crop needs (digestate analysis are required)

RIGHT TIME - digestate supplied when plants are growing and need nutrients

RIGHT PLACE - nutrients carried with water, where crops can use them

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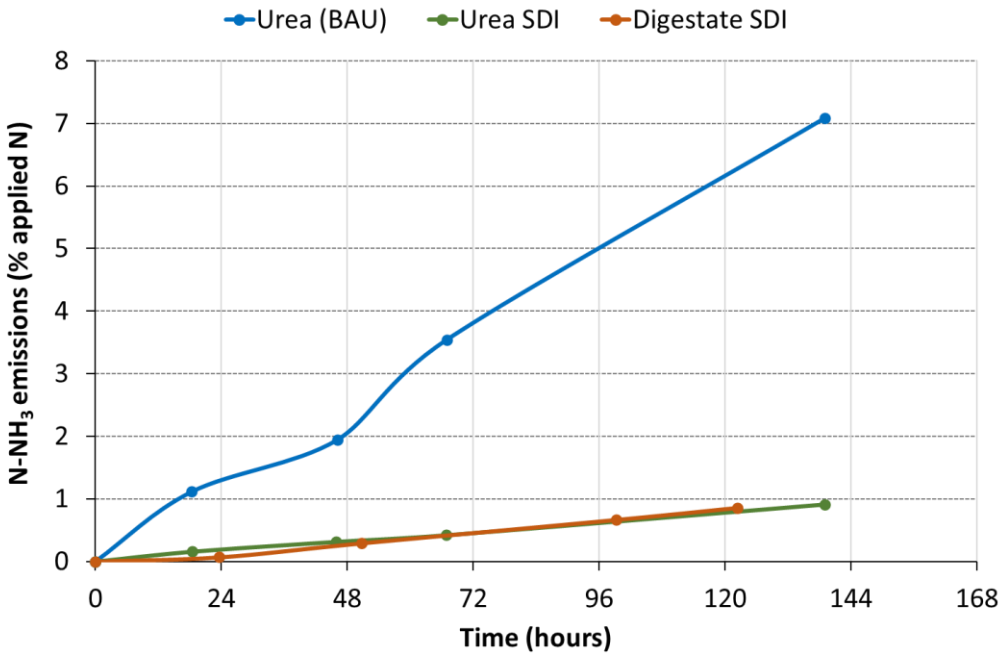
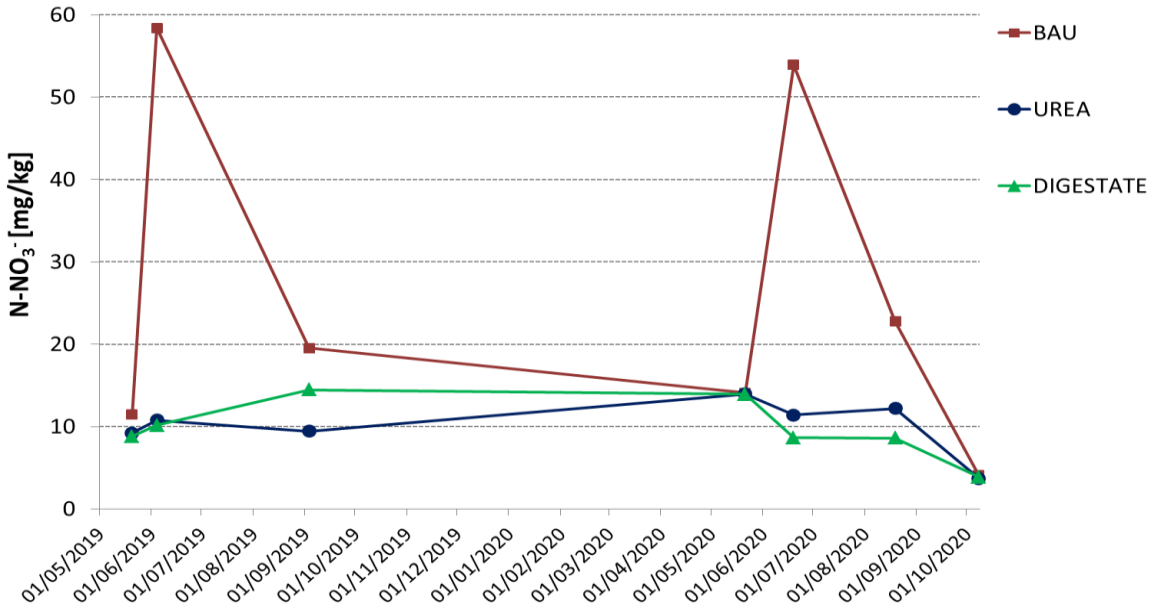
SOS_AQUAE reduces N emissions and leaching

With fertigation via SDI, ammonia emissions are reduced to ultra-low levels



Peaks in soil nitrate concentration after fertilization with raw urea in BAU. Not in SDI



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SOS_AQUAE - Fertigation with microfiltered digestate

Complete pilot plants at farm scale developed and validated (TRL 8-9)

Compared with normal practices of slurry/digestate use, microfiltered digestate to fertigation:

- ✓ Strongly reduce ammonia emissions and minimize nitrate leaching/runoff
- ✓ Increase nutrient use efficiency of digestate/slurry
- ✓ Make possible to replace (completely, or almost) mineral fertilisers

<u>Logistical aspects must be considered because microfiltered fertiliser is largely composed of water, as the raw digestate from which it is obtained</u>

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About MOPS

- Maximising Organic Production Systems (MOPS) EIP project ran between 2018 and 2021 funded by Ireland's Rural Development Programme

- Worked with 11 organic horticulture growers to optimise production methods and increase the supply of Irish organic horticulture produce

- Developed and implemented organic cropping programmes to better meet quality requirements and continuity of supply as well as build market development capacities through grower collaboration

- Soil and nutrient management practices were a key part of optimising production methods - all principles transferable to different organic crop management contexts

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MAXIMIZING ORGANIC PRODUCTION SYSTEMS

IRISH ORGANIC ASSOCIATION • IOA •

Green manure trials

- Trials of mixed green manures, summer (over 2 months) and winter (over 6 months), carried out on 1 organic farm (southeast of Ireland)

- Results showed consistent beneficial effects than in the control over the 3 years including:
  - higher concentrations of nutrients overall,
  - greater soil organic matter content,
  - more and greater functional diversity of soil bacteria,
  - better weed control,
  - more beneficial insects, and
  - earlier-developing cash crops


Green Manure Trial

Positive effects of the winter green manures (Cash crops: broccoli & Red oak lettuce)

	Oats/rye/vetch/ clovers (Wild Atlantic mix)	Rye/vetch	Ryegrass/clover (Landsberger)	Control
Biomass	++++	+++	++	+
Perennial weed control	+++	++++	++	+
Beneficial insects	++	+	+++	++
Soil nutrient levels	++	++	++	+
Soil organic carbon	++++	+++	++	+

Source: MOPS Final Report 2021

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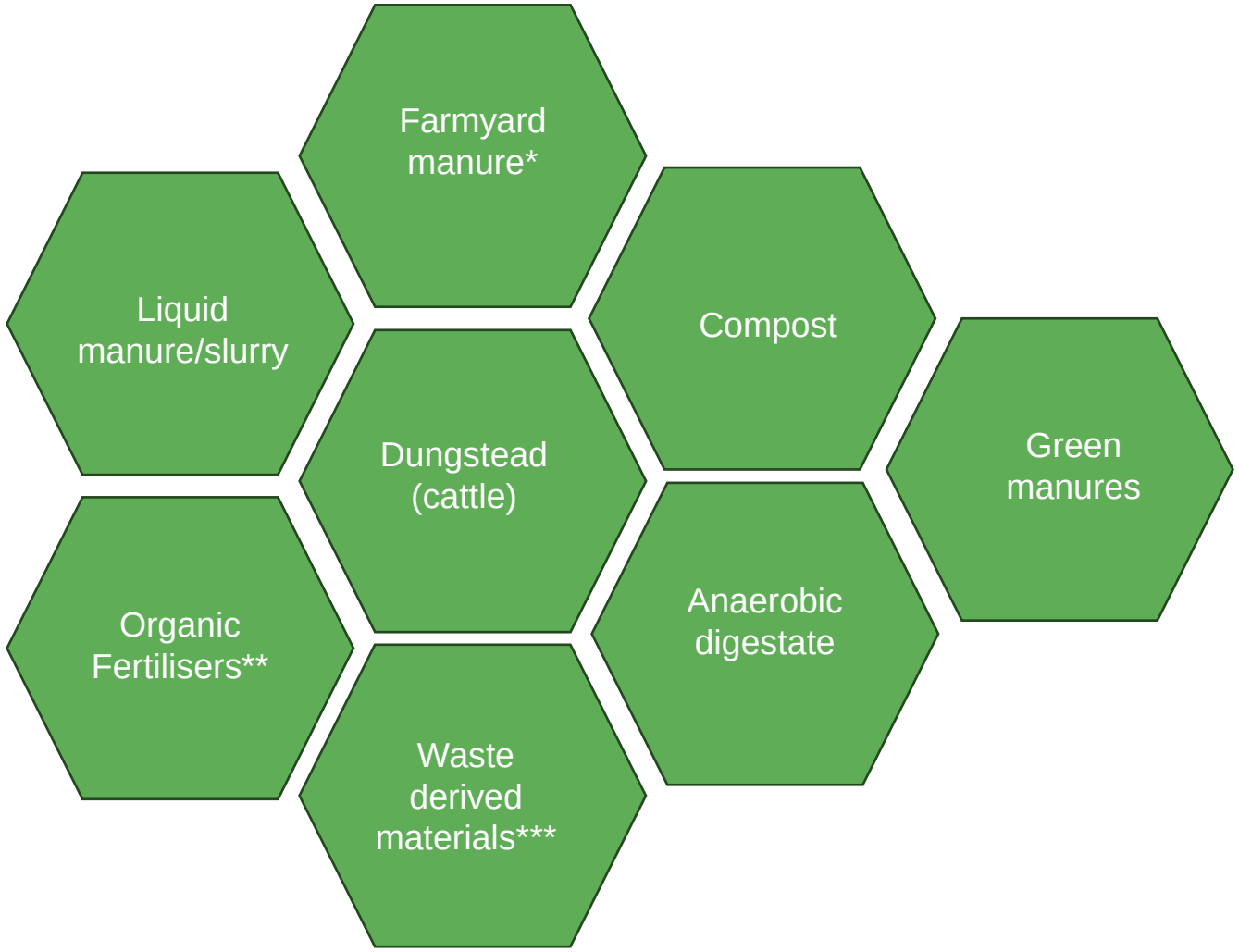
Sampling & Best Use Organic Materials



Bespoke farm assessments taking account of:

- Soil Type
- Nutrient Status
- Previous Cropping and rotation
- Sampling crop leaf tissue
- Manure application history
- Crop Nutrient Requirements

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*Cattle, poultry, sheep
**granular/pelleted
***Mushroom compost/corn husk

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Project Results

- Green manure trials showed beneficial agronomic effects for successive cash crops over three years, with higher soil nutrient concentrations, more beneficial insects, greater functional soil diversity, greater soil organic matter and better weed control.
- More effective use of organic material, improved streamlining of crop selection, increased efficiencies through optimised production due to increased specialisation and grower collaboration
- Trade and collaborative relationships improved, with significant increases in total sales turnover by the participating growers and large increases in trade in Irish organic produce amongst organic growers across the island

Trade - Participating and non-participating growers

Trade growth between 2019/2020 and 2020/2021	Year-Over-Year Growth
Total sales turnover organic fresh produce for 11 MOPS project growers	↑40%
Total sales own-grown organic crops for 11 MOPS project growers	↑11%
Trade between MOPS project growers	↑62%
Fresh produce purchases from ROI/NI suppliers/growers other than MOPS growers	↑371%

Source: MOPS Final Report 2021

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Further information

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GROWERS REPORT

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

The European Agricultural Fund for Rural Development: Europe investing in rural areas

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Duncannon Blue Flag Farming & Communities Scheme

- EIP Operational Group

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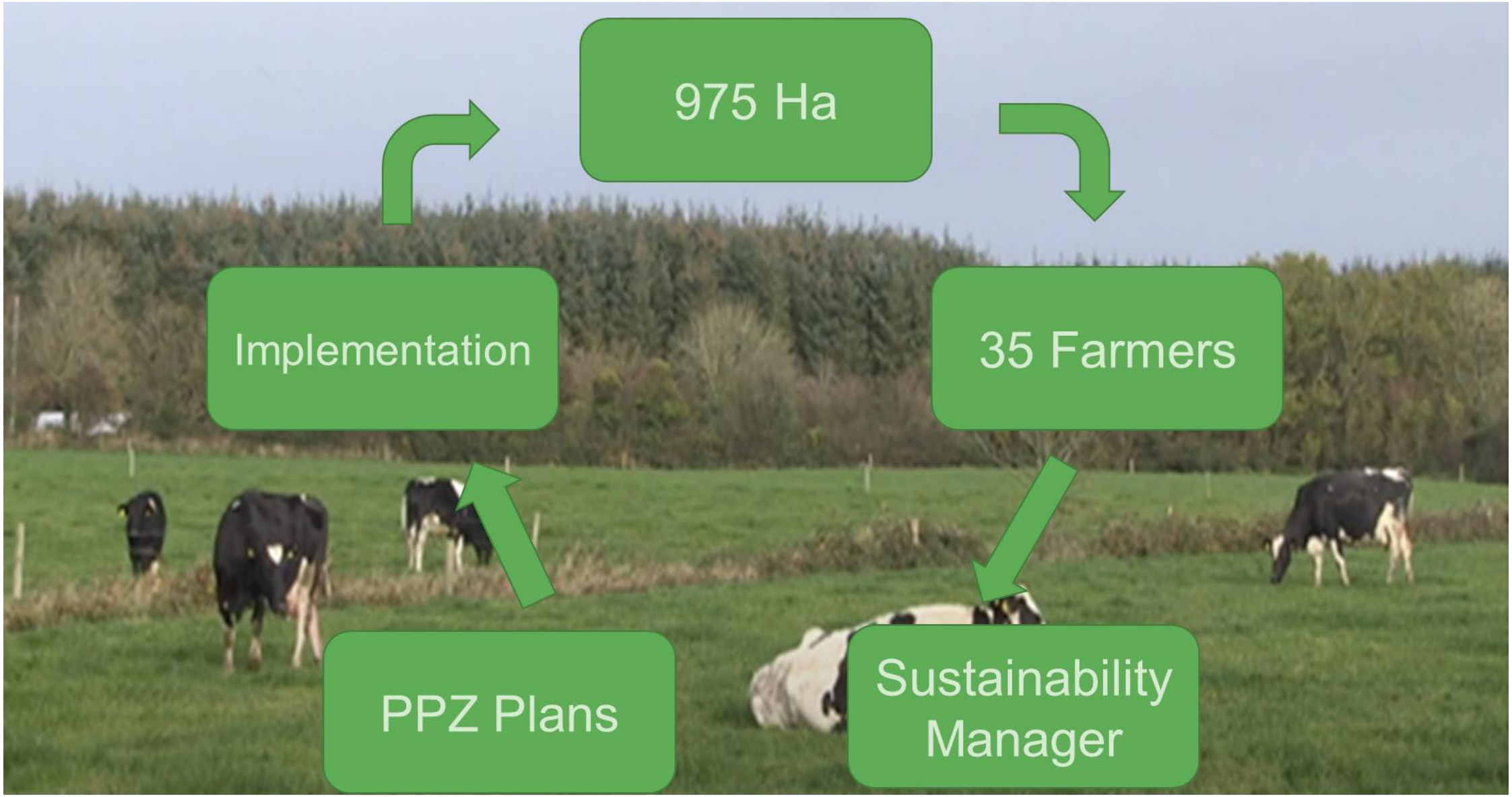

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Water Protection Improvement works

- Watercourses (15.5km)
- Drinking points
- Water troughs (20m)
- Soil sampling & NMP (100%)
- Buffer zones (10m)
- Sediment traps
- Farm roadways
- LESS
- Riparian zones (native)
- Hedgerow planting
- Arable Grass margins (1.2km)
- Winter cover crops

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The application booklet

- Introduction of the booklet
- State-of-art of nutrient application practices
- Cases of technologies, tools and recommended practices from NUTRI-KNOW engaged OGs
  1. Slurry concentrator for reducing operational costs and enabling precision fertilisation (UVIC)
  2. Manure management tool (FCAC)
  3. Ammonium salts recovery from manure (UGENT)
  4. Struvite precipitation from digestate (CRPA)
  5. Innovative agrosystems integrating minimal tillage, fertigation and injection technologies (CRPA)
  6. Short-term incorporation of green manure (MOPS)
  7. Pollution Potential Zone (PPZ) management maps for water protection improvement (TEAGASC)
- Summary and outlooks

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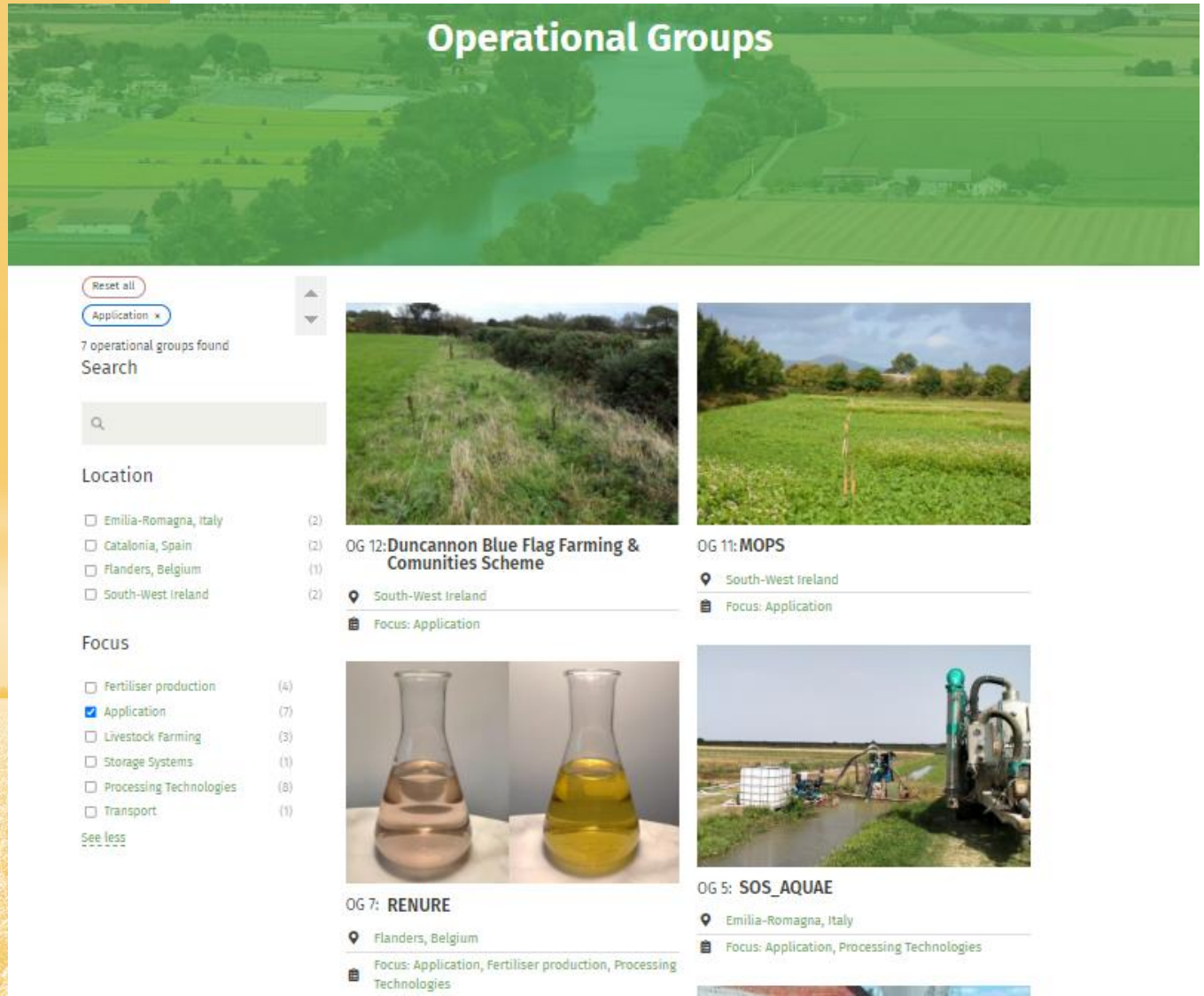
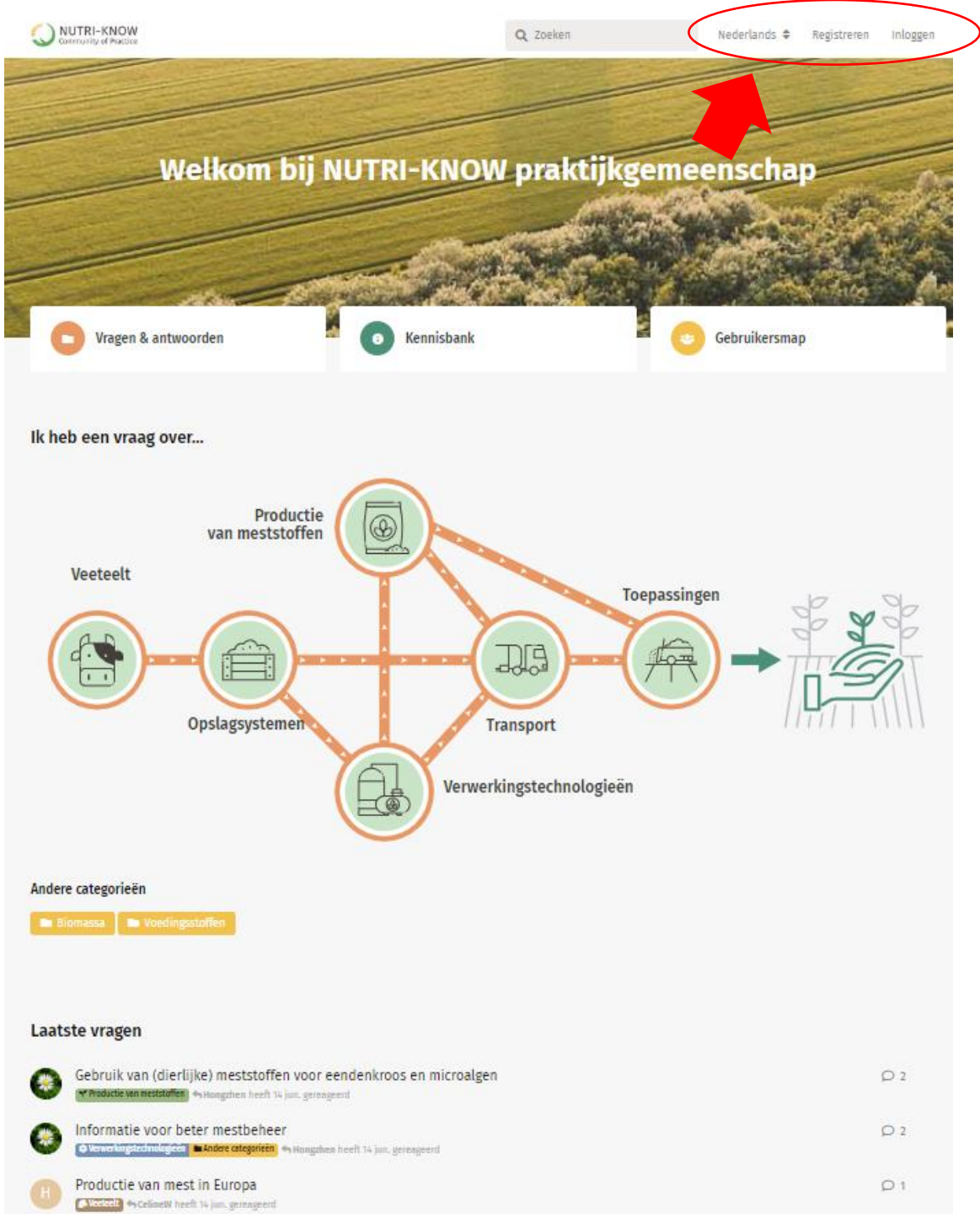
For more info

www.nutri-know.eu





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Thank you for your attention!

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