How NUTRIENT RECYLING AND REUSE FOR AGRICULTURE is a crucial component of a circular economy and how policy makers can support it

AN INFORMATION SHEET FOR POLICY MAKERS

The globe today is facing a series of potentially catastrophic challenges that pose an existential threat to the world, including the EU – climate change, environmental degradation, and a growing population demanding ever more limited resources. In its flagship Green Deal strategy, the European Commission strives to set up a plan to transform the Union's economy into a modern, resource efficient and competitive economy which can meet these challenges head on.

Recovering and reusing nutrients from biowaste is a crucial component of a biobased circular economy and will contribute to Europe's transition to a carbon neutral economy, can support the decoupling of economic growth from resource use, and help restore biodiversity and cut pollution.

Nitrogen, phosphorus and potassium are essential for plant growth. About 75% of all phosphorus used in fertilisers in the EU comes from mineral sources – mostly imported, and mined from non-renewable phosphorus rock; and 65% of nitrogen used in fertilisers is mineral nitrogen – produced through the Haber Bosch process, a process that consumes large amounts of fossil fuels such as natural gas[1]. These nutrients are added to the land for crops to grow, removed from the land in the harvest and then eventually converted into waste as they journey through the food system. The greatest nutrient surpluses occur in areas of concentrated livestock production (through manure) and in urban areas (in sewage sludge and food and municipal waste). This accumulation of nutrients, and the overapplication of nutrients, is having severe adverse effects on soil, air and water quality and threatening the long-term sustainability of EU agriculture.

Nutrients available in waste streams are a valuable resource that if effectively recovered, can be reused, and in a manner that better suits crop requirements. Their recovery from biowaste to reuse in agriculture presents an enormous opportunity to contribute to the EU meeting the targets set out in its ambitious and much needed Green Deal.

At biogas plants across Europe, entrepreneurs are working with novel nutrient recovery technologies to extract nutrients from the biowaste and tailor them to farmers needs to replace synthetic mineral fertilisers, produce soil improvers and alternatives for peat based potting soil. They are converting recovered fibres to replace plant plots in the horticultural industries and are set to make an important contribution to meeting the EU's Renewable Energy Targets[2] through their production of biogas.

Policy makers have already recognised nutrient recovery from biowaste as a vital component of the circular economy, not least in the development of a Fertilising Products Regulation[3], the release of the

[1] https://risefoundation.eu/wp-content/uploads/2020/07/2016_RISE_NRR_Full_EN.pdf

[2] https://ec.europa.eu/energy/topics/renewable-energy/directive-targets-and-rules/renewable-energy-targets_en

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32003R2003

RENURE study[4] for the Nitrates Directive, and the recognition of nutrient recovery in the Farm to Fork Strategy[5] and the New Circular Economy Action Plan[6]. However, the full potential of nutrient recovery and reuse from our biowastes will not be recognised until the products can compete on a level playing field with other (synthetic) fertilising products. Working with organic waste materials is complex and requires expensive technologies and like in many industries in our linear economy, reusing materials often comes at a higher cost than developing products from virgin materials. The technology to recover nutrients from biowaste is well developed and applicable at the industrial scale, as shown by the SYSTEMIC project. **But greater incentives are needed to stimulate the market for recovered nutrients in order to scale up the circular economy to enable the objectives of the Green Deal to be met.**

The European Parliament and Council have recognised in their Fit for 55 package[7] the need to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are in line with the climate goals agreed by the Council and the European Parliament, including the revision of the EU Emissions Trading Scheme, an inclusion of greenhouse gas emissions and removals from land use, land change and forestry (LULUCF), and a revision of the renewable energy directive. In this policy brief we argue that policy makers must ensure that we use this opportunity to ensure that the recovery of nutrients from biowaste at biogas plants is strongly considered in the review of these legislations.

The aim of this paper is therefore to inform policy makers regarding both the policy barriers that need to be overcome, and possible policy opportunities which can be developed within the Fit for 55 framework and beyond.

[4] file:///C:/Users/ehler001/Downloads/jrc121636_pdf_version_safemanure.pdf
[5] https://ec.europa.eu/info/sites/default/files/communication-annex-farm-fork-green-deal_en.pdf
[6] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN
[7] https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/#

1. The Nitrates Directive (91/676/EEC).

Both the use of manure, and products from manure, are regulated by the Nitrates Directive (91/676/EEC). This Directive aims to protect waters against pollution caused by nitrates from agricultural sources. Some regions are therefore designated as 'Nitrate Vulnerable Zones' (NVZ) where an application limit of 170 kg N of livestock manure/ha/year applies. As the nitrogen requirement of the crop maybe higher than this application standard, the crops' additional nitrogen needs must be met with synthetic mineral fertilisers.

'Livestock manure' is defined as 'waste products excreted by livestock, even in processed form' (art. 2(g))[8]. So today, nitrogenous mineral fertilising products derived from manure are subjected to the same application limits as manure. They therefore compete with manure as a nitrogen source. As manure is abundantly available in many livestock producing regions of the EU, farmers are unlikely to want to pay for recovered nutrients from manure when the recovered products are also restricted by the same application limit. This means that creating added value for recovered nutrients can be extremely challenging. If farmers could use nutrients recovered from manure under the same conditions as synthetic fertilisers in NVZ, thereby removing them from the application standard of 170 kg N/ha/year, this could be a major boost for creating a market for the recovered nutrients and therefore the feasibility of business cases of NRR in Europe, and allow the manure to be used locally rather than transported over long distances.

The European Commission has recognised this barrier and the European Commission's Joint Research Centre has recently published the RENURE[9] report (Recovered Nitrogen from manURE) which proposes criteria to authorise manure-derived recycled nitrogen fertilising products to be used above the application standard of 170 kg N/ha for manure-derived nitrogen fixed by the Nitrates Directive. If approved, this presents a fantastic opportunity for moving European agriculture towards a circular economy. However, barriers remain. Firstly, there is still a way to go before the RENURE products are approved. Currently the RENURE report remains a communication, policy makers need to ensure that there is timely follow through to translate the report into legislation as soon as possible. Secondly, once approved, it will be up to the Member States how and if they wish to apply it. This has the potential to create an uneven playing field within Europe due to differences in implementation. Finally, RENURE criteria does not give the RENURE approved products an automatic Animal By-Product End Point. This means that RENURE materials will be subject to additional regional regulations (mutual recognition) when traded internationally, thereby limiting their access to markets (for more on the Animal By Product regulation, see point 2. below).

[8] Nitrates Directive, article 2g. (g) 'livestock manure': means waste products excreted by livestock: or a mixture of litter and waste products excreted by livestock, even in processed form;

[9] SYSTEMIC contributed to the SAFEMANURE study which led into the RENURE report through the submission of product factsheets on Ammonium Sulphate, Ammonium Nitrate, Ammonium Water, Mineral concentrate and liquid fraction digestate, all of which can be found here.

Policy recommendations:

- The RENURE criteria needs to be approved and adopted in EU27 legally without delay.
- There needs to be harmonised implementation of RENURE criteria for each Member State (without additional regional conditions).
- Incentives are needed to stimulate the greater use of recovered mineral fertilisers to meet with the crop requirements and without causing environmental pollution.
- If with time it is shown that incentives alone are insufficient, stricter limits should be applied to the direct application of untreated, low nitrogen fertiliser replacement value (NFRV) raw manure and digestate onto agricultural land.
- There needs to be strict monitoring of the amounts of RENURE produced and used on agricultural land.

2. The Fertilising Products Regulation (EC/2019/1009)

Regulation of the European Parliament and of the Council laying down rules on the making available on the market of CE marked fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009

In July 2019, the EU Fertilising Products Regulation for free trade of fertilising products was published with the objective of placing secondary raw materials on the EU fertiliser market in order to better facilitate a circular nutrient economy. Whereas the previous EU fertiliser regulation 2003/2003[10] only regulated fertilisers from chemical (synthetic) origin for free trade, the new regulation also regulates fertilising products from animal and vegetative origin and thus provides an excellent regulatory tool for the free trade of fertilising products from renewable resources (including animal manure and products thereof) and potential access to important new markets. Free trade is particularly important for plants which operate near Member State borders who are currently forced into lengthy and costly bilateral negotiations to have their products approved in neighbouring Member States.

The fertilising products regulation lays out seven product function categories (PFC) (groups of fertilising products) which can only be produced from designated component material categories (CMC). Currently 11 CMCs are designated and there are three new CMCs (struvite, biochar and ash). These three new CMCs will be added *before* the new regulation has come into force next year.

Processed manure will be regulated by CMC 10 ABP, but it also is an animal by-product (ABP). ABPs are regulated by the regulation on ABP EC/1069/2009 and EC/142/2011 which fall under the responsibility of DG SANTÉ and which is thus responsible for assessing the criteria for CMC 10: the so-called endpoints of ABP regulation[11]. DG SANTÉ has not yet determined the final endpoints of ABP regulation and thus the designation of animal products of CMC 10 is still not clear. Until DG SANTÉ can give the endpoints for ABPs and designated animal by-products, it will not be possible to harmonise the free trade of fertilising products made from manure.

[10] Regulation (EC) No 2003/2003 of the European Parliament and of the Council of 13 October 2003 relating to fertilisers https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32003R2003

[11] An 'end point' in the manufacturing of animal by-products is a point after which the processed products are no longer subject to the regulation as relevant potential risks have been eliminated. Examples of potential sources of risk to the public or animal health could be: outbreaks of transmissible spongiform encephalopathies (BSE) and the occurrence of dioxins in feedstuffs.

So whilst the Fertilising Product Regulation is a major step forward supporting the expansion of NRR to a wider market, the delay by DG SANTÉ to designate ABP of CMC 10 with their final endpoints for ABP regulation hinders free trade of fertilising products based on manure.

Policy recommendations:

- SYSTEMIC urges DG SANTE to speed up the definition of designation of the Animal By Products and the criteria for their end points for fertilising products from manure.
- Nutrient recovery processes like nitrogen stripping, evaporation, and nano filtration produces products that do not contain substances that may pose a threat to human health or the environment. Such products should be awarded ABP end point.

3. The European Emission Trading System (EU ETS)

The EU ETS presents a unique opportunity to provide incentives for nutrient recovery and reuse. Extending the EU ETS to farms is already widely discussed and may be proposed by the European Commission in the context of the Carbon Farming Initiative expected for Q3/2021. It could also be applied to nutrient recovery and reuse in the following ways, thereby providing the much-needed financial incentive to promote an attractive and growing market for recovered nutrients.

For the manufacturers of biobased fertilisers and tailor-made fertilising products

Nitrogen fertilisers produced through Haber Bosch process produce 3 - 4 tonnes of CO_2 per 1 tonne of nitrogen. The production of a biobased nitrogen fertiliser produces much less CO_2 than a conventional N fertiliser due to its use of residual heat, renewable electricity and, where available, secondary materials (e.g. gypsum from flue gas cleaning). Therefore, producers of biobased fertilisers could receive a payment for the comparable saving of CO_2 emissions. As an example, a plant that produces the biobased Ammonium Sulphate with 8% Nitrogen could receive up to 4 * € 59 (carbon price as of 27th August 2021) * 0.08 = €18.88 per tonne of Ammonium Sulphate (fertiliser) product.

And through the production of biomethane. Biogas plants can upgrade their biogas into biomethane which can be used as a renewable replacement to natural gas emitting 2 kg CO_2/m^3 methane and can therefore apply an equivalent carbon price for avoided emissions of € 0.12/m^3 (at current prices of € 59/t CO_2). This approach could replace the current feed-in tariff system that varies per member state and is typically perceived as too expensive for consumers or taxpayers. An ETS scheme-based incentive would be applicable EU wide and could provide a level playing field for biogas producers.

For the farmers

The farmers could receive a fee if digestate or manure (Nutrient Fertiliser Replacement Value (NFRV) of about 50%) is replaced by recovered nutrients with a high NFRV (which causes less losses to the environment, and therefore should be rewarded). This could be based on the same calculation as for the producers of the biobased fertilisers. For every tonne of synthetic nitrogen fertiliser replaced by biobased nitrogen fertiliser they would get ½ the carbon price based on the evidence-based assumption that synthetic nitrogen fertiliser is twice as nutrient efficient as untreated manure.

For the fertiliser industry

The fertiliser industry is already a part of the ETS and in theory, has to buy carbon credits. However, we currently have a system whereby around 90% of industry credits are given for free, leaving little incentive to reduce emissions. However, if these 'free' credits are phased out, it will become

increasingly advantageous for the fertiliser industry to buy in recovered N and P rich products to blend into their own fertilisers. Such a scheme would have to be flanked by a Carbon Border Adjustment Mechanism (CBAM) to provide a level playing field for European nitrogen fertiliser producers in the global context.

Failing that, the second option would be to establish and incremental obligatory binding quota system for biobased ammonia in synthetic N fertilisers with clear targets. A similar approach could be applied as has been used for ethanol quotas in gasoline.

Policy recommendations:

To certify comparable CO_2 savings made through nutrient recovery and reuse as carbon credits in the EU ETS scheme, in particular:

- To farmers using biobased recovered fertilisers
- For the fertiliser industry to reduce its own carbon emissions through the inclusion of recovered nutrients in the production of its own fertilisers
- To the producers of biobased fertilisers both for a) the comparable CO_2 savings made in producing the biobased fertilisers vis a vis synthetic fertilisers and b) for the production of biomethane as a renewable energy.

For more information on SYSTEMIC or questions concerning the recommendations please contact us:

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