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## Events

### Nutrients, aquatic methane emissions and climate change: 22-27 June 2021

[ASLO](#) (Association for the Sciences of Limnology and Oceanography) [Special Session \(SS06\)](#) on **Methane Accumulation in Oxidic Aquatic Environments: Sources, Sinks and Subsequent Fluxes to The Atmosphere**. Within the 2021 Aquatic Sciences Meeting (online, 22-27 June 2021). In partnership with the [Leibniz Institute of Freshwater Ecology and Inland Fisheries](#) (IGB) and ASLO, ESPP and SPA will follow-up with a webinar to exchange between science, water stakeholders and policy makers on implications of aquatic methane emissions for nutrient management. Proposals for input are welcome.

ASLO special session on methane in oxidic aquatic environments: <https://www.aslo.org/2021-virtual-meeting/session-list/>

Contact Mina Bizic [mbizic@igb-berlin.de](mailto:mbizic@igb-berlin.de)

To contribute to the ESPP- SPA- IGB webinar: contact [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

### New dates for ESPC4: 20-22 June 2022

The 4th European Sustainable Phosphorus Conference (ESPC4) is postponed (because of Covid). New dates are **20-22 June 2022 in Vienna**. PERM, the European Phosphorus Research Meeting will be held virtually 2<sup>nd</sup> June 2021, see below.

Updates: see [www.phosphorusplatform.eu](http://www.phosphorusplatform.eu) and <https://phosphorusplatform.eu/espc4>

### 4th Phosphorus in Europe Research Meeting (PERM): 2 June 2021

This meeting, co-organised by ESPP, Biorefine Cluster Europe and ETA Renewable Energies, will link science, industry, agriculture and policy makers. EU-funded projects on nutrient sustainability and phosphorus recycling (Horizon2020, Interreg, LIFE...) and national and company nutrient projects will present, enabling dialogue and synergies. PERM will address how to improve uptake of project recommendations by policy makers and users, through to market, and identify perspectives for research and policy, and implementation gaps.

In parallel to PERM, ESPP is updating our online 'inventory' of nutrient-related R&D projects [here](#).

PERM4 – online – 2<sup>nd</sup> June 2021: event website: [www.phosphorusplatform.eu/PERM4](http://www.phosphorusplatform.eu/PERM4)

Proposals are welcome for presentations of studies into what factors in nutrient R&D projects improve uptake of conclusions by policy makers, industry and users.

**If you wish your project to be included** in the programme and/or added to the inventory of projects, please contact [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)



### P-efficiency in poultry farming: 22 April 2021

A stakeholder webinar will present and discuss the results of the [PeGaSus](#) (ERA-NET) research project (Phosphorus efficiency in the chicken *Gallus gallus* and pig *Sus scrofa*) **22nd April 2021, 15h-17h CEST** Topics will cover feeding strategies, animal physiology and genetics, soil agro-ecosystems, phosphorus re-use and recycling options, measures of farmers' economic performance, legislative aspects on manure management, and governance & policy instruments.

Programme and registration: [http://pegasus.fbn-dummerstorf.de/stakeholder\\_workshop.html](http://pegasus.fbn-dummerstorf.de/stakeholder_workshop.html)

### Nordic Circular Materials Conference: 21-22 April

This two day virtual conference (270 Euros registration) includes a session on phosphorus, 22nd April, 13h – 14h30 CEST, with EasyMining, LKAB, RISE, Grängesberg appetite mining project, University of Borås, Technical University of Denmark DTU.

<https://www.circularmaterialsconference.se/>

### Digestates in the new EU Fertilising Products Regulation: 28 April

Presentation of an evaluation by EBA (European Biogas Association) and ECN (European Compost Network) of the interest to place compost or digestate organic fertilisers on the market under the new EU Fertilising Products Regulation and discussion with the European Commission

"Digestate valorisation under the Eu Fertilising Products Regulation", 28 April 2021, 10h-12h CEST online

<https://attendee.gotowebinar.com/register/1601772252033859597>

### AquaEnviro Wastewater Resource Recovery Conference: 13 May 2021

One day conference **13 May 2021** on resource recovery from wastewaters and biosolids, covering nutrient recovery, hydrogen and other materials: experience from pilot and full scale plants; market pull, user confidence and business models, regulatory framework, links to net zero carbon 2030 agenda for the UK wastewater industry.

"The Art of the Possible: Resource Recovery from Wastewater and Bioresources", May 13<sup>th</sup> 2021 online

<https://conferences.aquaenviro.co.uk/events/conferences/resource-recovery-from-wastewater/>

## Policy

### ESPP webinar on waste-grown algae

The webinar organised by ESPP with EABA (European Algae Biomass Association, 22<sup>nd</sup> March 2021, brought together over 400 participants online (from 700 registrants, all of whom have access to meeting networking) including the European Commission (ENV, GROW, MARE, SANTE, RTD, EASME, JRC). Presentations identified and illustrated regulatory questions around valorisation of algae and plants grown using secondary resources in a range of sectors (municipal wastewater, green waste, eutrophication remediation, cement industry (CO<sub>2</sub> capture), aquaculture, manure digestate, dairy processing ...) with active discussion in the chat. Questions raised included waste status of algae, contaminants and safety, use in animal feed or fish feed, use in Organic Farming, human food, biofuels ... ESPP will now develop a summary of this webinar, including a list of regulatory questions and opportunities, and work on proposals to take these forward (see below a first action on End-of-Waste status for secondary materials from waste waters).

Event webpage: slides, Chat transcript: [www.phosphorusplatform.eu/algae2021](http://www.phosphorusplatform.eu/algae2021)

Full recording of webinar can be seen on ESPP's YouTube channel

<https://www.youtube.com/channel/UCMid-39A1MT-3pzjoY58qiQ>

### End-of-Waste status for secondary materials from waste waters

The European Commission is currently defining a list of secondary material streams for "scoping of development of EU End-of-Waste and By-Product criteria", as specified in the EU [Circular Economy Action Plan](#) (11<sup>th</sup> March 2020, ESPP [eNews n°42](#)). This Action Plan cites "Food, water and nutrients" as one of seven identified Key Product Value Chains. As an action from ESPP's webinar on regulatory status of waste-grown algae (see above), ESPP is preparing with a number of companies and stakeholders, a joint letter requesting that specific recovered material streams from municipal wastewater (and biomass-derived wastewaters) should be considered for EU End-of-Waste status: algae and biomass grown in waste waters, fibres & polymers etc., nitrogen stripping, phosphate salts for industrial applications. The draft letter is available here and companies and organisations interested to co-sign are invited to contact ESPP.

Contact: [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

## EU integrated nutrient management action plan

The European Commission has announced that it will prepare in 2021 an Integrated Nutrient Management Action Plan (INMAP), as announced in the Farm-to-Fork Strategy and in the new EU Circular Economy Action Plan. After wide consultation of our members and network of stakeholders, ESPP has prepared and submitted to the European Commission proposals for the objectives, content and implementation tools of such an Action Plan. ESPP's input presents a proposed ambitious EU strategy on nutrients, across all relevant policy areas, and a comprehensive set of concrete policy actions and tools. ESPP is open for further comments and input on this document, in that the development of the EU INMAP Action Plan is expected in 2021 to include consultations enabling to make further input.

ESPP input to INMAP 27/3/2021 [www.phosphorusplatform.eu/regulatory](http://www.phosphorusplatform.eu/regulatory)

EU Farm-to-Fork Strategy, COM(2020)381, 20th May 2020 [here](#)

EU new Circular Economy Action Plan, COM(2020)98, 11th March 2020 [here](#)

## EU Fertilising Products Regulation

Good progress was noted on several dossiers at the [EU Fertilisers Expert Group](#) 18-19 March 2021. The meeting also received updates on the European Commission (DG Environment) study underway into contaminants and possible risks of organic-containing and of mineral fertilisers (see detail and call for data in ESPP [eNews n°52](#)), ECHA work underway towards restrictions on [microplastics](#) under REACH, and on the update of the EU Organic Farming regulation annex listing fertilising materials authorised for use in Organic Farming. It was noted that the principle of inclusion of sewage-recovered struvite and calcined phosphates in Organic Farming was approved by the EU scientific committee (EGTOP) in [2016](#). ESPP requested that, as the STRUBIAS criteria are now finalised (subject to formal adoption and publication, see below), the Commission should now engage discussions to define the conditions and legal wording for inclusion of these two materials into the next update of the Organic Farming regulation annexes.

EU Fertilising Products Regulation 2019/1009 [https://ec.europa.eu/growth/sectors/chemicals/specific-chemicals\\_en](https://ec.europa.eu/growth/sectors/chemicals/specific-chemicals_en)

EU Fertilisers Expert Group documents (CIRCAB): <https://circabc.europa.eu/ui/group/36ec94c7-575b-44dc-a6e9-4ace02907f2f>

### STRUBIAS criteria finalised

This meeting technically validated the finalised texts of the "STRUBIAS" criteria to add struvite and phosphate salts, ash / ash derived materials and pyrolysis materials (inc. HTC, biochars) as component materials in the EU Fertilising Products Regulation. Except some minor tidying of legal wording, the criteria remain as published for the public consultation (see ESPP eNews [n°51](#)). Hopefully, the finalised criteria will now be published in coming months, in time for the entry into implementation of the new Fertilising Products Regulation itself in June 2022.

STRUBIAS criteria, as published for the public consultation February 2021)

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12136-Pyrolysis-and-gasification-materials-in-EU-fertilising-products>

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12162-Thermal-oxidation-materials-and-derivates-in-EU-fertilising-products>

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12163-Precipitated-phosphate-salts-and-derivates-in-EU-fertilising-products>

### Fertiliser additives and REACH

Following the Joint Letter coordinated by ESPP and signed by a number of industry federations and companies (mineral fertilisers, organic fertilisers, biostimulants, see ESPP eNews [n°51](#)), the European Commission provided answers on several points in a proposed update to the "Frequently Asked Questions" document, which is [published](#) and regularly extended and updated on the Commission website, and which provides guidance on interpretation and implementation of the Regulation.

The proposed additional FAQs clarify that:

- Additives used in fertilisers must be REACH registered for use "in" fertilising products (not "as"), coherent with Recital 26 of the Regulation. This is important, in that e.g. a granulation agent does not have as its function to be a fertilising product, but its safety for use in a fertilising product should be verified.
- For recovered products, art. 2(7)(d) of REACH can be used (Registration is not necessary, but appropriate information must be available)
- Detectable traces of unreacted agents or processing agents in final fertiliser products
- Substances which evolve over time or react when in contact with soil.
- Further clarifications concerning the definition of "precursors" of CMCs (chemicals which react together to produce a CMC)

European Commission "FAQ" for the Fertilising Products Regulation [here](#) (current version online = 21/12/2020).

Joint industry letter and European Commission reply [here](#).

## Possible new approach for by-products

The European Commission presented progress of work on criteria for use of by-products as component materials (CMC11) in CE-mark fertilising products.

It is now under consideration to specify not only a short, limitative list of certain by-products, with specific contaminant and other criteria for each one, but also to add a category “CMC-WW” which could cover any by-product coming from a “production process or gas processing / gas emissions control process” which is reach registered, relevant for trade, has agronomic value, offers “high purity” and does not contain specified contaminants (to be defined). Questions raised are: will this concern organic materials or only mineral chemical by-products? Will it concern by-products from waste treatment processes or waste recycling processes?

To date, only four categories of by-product were proposed for inclusion in the short list for CMC11, from: fossil fuel refining (possibly widened to some chemical industry by-products, such as ammonium from caprolactum ...), refining of minerals, ores and metals (but phosphogypsum seems to be not included), some gas cleaning systems (but not from waste or manure treatment, see below), processing of biomass, water, food, drink, biorefineries, including from the pulp and paper industries.

*“Technical proposals for by-products as component materials for EU Fertilising Products” (2<sup>nd</sup> report), European Commission JRC, 27<sup>th</sup> November 2020 [here](#). Comments must be submitted via a member of the EU Fertilising Products Expert Group. ESPP is a member, so you can send comment to [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu) and we will forward them.*

*JRC proposals for CMC-WW see document “2021.03.18 CMC 11 CRITERIA\_JRC STUDY PROGRESS.PDF” at the Fertilising Products Expert Group CIRCAB site <https://circabc.europa.eu/ui/group/36ec94c7-575b-44dc-a6e9-4ace02907f2f>*

## Technical adjustments and clarifications

The meeting also validated in principle a number of technical modifications to the Annexes of the EU Fertilising Products Regulation concerning traces of substances subject to limits for food and feed (limit values, labelling), clarifications concerning fertilising products which also have a plant protection effect, typologies of micronutrient fertilisers, contaminants in certain growing media, acceptance of natural, biodegradable and soluble polymers (e.g. in processing and handling additives), chelating agents, tolerance rules for labelling, fiberised plant materials, category 2 & 3 animal by products (including manures) in composts and digestates.

*Draft document “Fertilising products - technical update”*

*<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12135-Technical-amendments-to-the-annexes-to-the-Fertilising-Products-Regulation>*

## EBIC ECOFI position on Animal By-Products

The industry associations EBIC (biostimulants) and ECOFI (organic fertilisers) have published a detailed 30-page position paper on Animal By-Products (ABPs) in the EU Fertilising Products Regulation (FPR). The paper underlines that there is a long history of safe use for a range of Animal By-Products (many of which have significant nutrient content), for example in over 62 000 controls in Italy, only nine cases required further investigation for pathogens, and all nine were finally determined to be negative for contamination. EBIC and ECOFI raise six questions about the process for establishing the ABP End-Points necessary for their use in EU fertilising products in the FPR. The paper provides detailed information on the transformation, legal status, FPR relevance, risks and management for 20 different ABPs today used in fertilising products. The document reminds that art. 46(4) of the FPR obliges the European Commission to engage an assessment to establish whether certain ABPs already widely used in Europe in fertilising products can be included in FPR CE-mark fertilisers and questions why some materials in this list are not in the terms of reference of the mandate given to EFSA in May 2020 (2020-0088 [here](#), see ESPP eNews n°50): meat and bone meal, hydrolysed proteins Cat3, processed manure, glycerine etc from biofuels, derived products from blood, hoofs and horns. EBIC and EFSA also question why existing End Points in the Animal By-Product Regulation 142/2011 seem to be opened to question, but not others. The question is also raised as to why the mandate to EFSA does not take into account that the FPR will ensure certain safety levels through the limits to contamination and pathogens fixed in the PFCs.

*EBIC & ECOFI joint position “End points for animal by-products used in EU Fertilising Products should recognise the history of safe use of many common materials”, European Biostimulants Industry Council (EBIC) and the European Consortium of the Organic-Based Fertilizer Industry (ECOFI), March 2021 [here](#).*

## Organic Farming

### Public consultation on authorised inputs for Organic Farming

The European Commission has opened a public consultation (to 23 April 2021) on a proposed update to the annex of the EU Organic Farming Regulation 2018/848 which specifies which substances can be used in Organic Farming in Europe, in particular as fertilisers, soil conditioners, pesticides and disinfectants.

Iron(III) phosphate (ferric phosphate) and diammonium phosphate (only in traps) are authorised as pesticides and phosphoric acid for cleaning/disinfection.

Authorised P-containing secondary nutrient sources containing phosphorus include (subject generally to specific conditions or criteria): materials of plant origin, manures ("factory farming origin forbidden"), source-separated household organic waste, biogas digestate, some animal by-products, algae, sawdust and wood ash ("not chemically treated after felling"), soft ground rock phosphate (subject to EU Fertilising Products Regulation contaminant limits), aluminium-calcium phosphate, Thomas phosphate slag, mollusc waste and crustacean chitin (from sustainable fisheries or Organic aquaculture), certain anoxic organic-rich freshwater sediment, biochars from plant materials.

Authorised P-containing animal feeds include a number of phosphate chemicals "of mineral origin" and fishmeal/oils/etc from sustainable fisheries (with specific conditions).

Monocalcium phosphate is authorised in Organic bakery products (raising agent) and diammonium phosphate in Organic alcoholic beverages.

ESPP will input to the public consultation underlining that Organic farms often have negative phosphorus, potassium and sulphur balances, and that increasing use of recycled phosphorus materials is needed to maintain Organic Farming productivity and soil health and to achieve the Farm-to-Fork target of 25% Organic Farming in Europe. ESPP underlines also that Regulation 2018/848 art.5(c) specifies as a "general principle" of Organic Farming "the recycling of wastes and by-products of plant and animal origin as input in plant and livestock production". ESPP will request that the positive EGTOP Opinion of 2/2/2016 on acceptance of struvite and calcined phosphates from municipal wastewater should be implemented, and that other recycled phosphate materials should be assessed for acceptance into Organic Farming.

Public consultation to 23 April 2021: "Organic farming - list of products & substances authorised in organic production (update)" [here](#).

### EU Action Plan for Organic farming and aquaculture

The European Commission has published an "Action Plan for the Development of Organic Production", aiming to increase Organic production in the context of the Green Deal target of 25% of EU agricultural land by 2030 (compared to 8.5% in 2019, and an estimate of 15-18% by 2030 if no action is taken beyond current policies). Member States are asked to fix national targets to achieve together this EU total. The Action Plan has three axes (23 actions): promote Organic food and products ensure consumer trust (including public purchasing), conversion from conventional to Organic agriculture and improving the contribution of Organic Farming to sustainability, and an emphasis on supportive R&D. Action 16 includes developing animal feeds based on algae, aquaculture wastes and insects. Action 23 aims at more efficient use of resources and (alongside biodegradable and compostable plastics) will "promote ... the reduction of nutrient release". The Action Plan however fails to mention recycling (except one mention of plastics) and does not address how increased Organic production can be achieved without new sources of nutrient input, in particular – for sustainability objectives – recycled nutrients.

European Commission Communication "on an Action Plan for the Development of Organic Production", 25<sup>th</sup> March 2021, COM(2021)141 - SWD(2021)65 [here](#) and [annex](#)

### RELACS Organic Farming & recycled nutrients webinars

[FiBL](#) and [RELACS](#) are organising five 2-hour webinars to exchange between researchers and Organic farming stakeholders to gather knowledge on potential risks of use of recycled fertilisers.

To date, this webinar series has some 140 registrants (including nearly 20 speakers), with around 70 researchers and over 30 Organic Farming organisations and a range of other stakeholders.

#### Remaining webinars:

- How to recycle nutrients from human excreta, **12 April 2021**, 14h – 16h Paris summer time (CEST)
- Socioeconomic aspects and final discussion, **22 April 2021**, 10h – 12h Paris summer time (CEST)

To register, contact: [kurse@fibl.org](mailto:kurse@fibl.org)

## RELACS setting the scene

The first webinar (3 March 2021) set the scene. A survey of over 70 Organic farms by RELACS shows concern about contaminants, especially in composts and digestates, particularly from household wastes.

**Marie Reimer, Hohenheim University** summarised data on European Organic farm nutrient balances. The balance is often positive for nitrogen but negative for phosphorus and potassium, especially in specialist arable Organic farms (without livestock). Farms which rely largely on BNF (biological nitrogen fixation) have more negative P and K balances (see further information in ESPP [eNews n°49](#)).

**Jakob Magid, Copenhagen University**, presented field trials in Denmark ([CRUCIAL study](#)) over nearly twenty years, applying sewage sludge to levels equivalent to two centuries normal application. So far no unwanted effects (except nutrient loss) have been found on soil and crops caused by recycling of societal wastes in accelerated amounts. Heavy metals in sewage sludge have fallen considerably over recent years. Copper and zinc need to be reduced in animal feeds, to reduce levels in manure. Also, a [risk assessment](#) concluded that the risk associated with agricultural use of Danish sewage sludge is comparable to that of animal slurry, once the EU limits for Zn and Cu addition to pig feed have been fully implemented, which should be the case from 2022.

**Erik Smolders, KU Leuven**, explained that copper and zinc, mainly from manures, and cadmium, mainly from mineral phosphate fertilisers, are the main concerns in agriculture. However, plant availability of metals is more important than loads, and this depends on soil type.

Discussion concluded that Organic farming needs to increase nutrient use efficiency in order to improve productivity and sustainability, and to increase nutrient inputs in some Organic systems such as arable and vegetables. Organic farmers in Denmark tend to consider that it would be preferable to use recycled nutrients from societal wastes, including in the longer term from municipal sewage, over using conventional manure. Questions were raised on whether easily soluble recycled fertilisers could be acceptable.

## Organic contaminants and other risks

The second webinar (11 March 2021) discussed the scientific data on the risks of organic chemicals, microplastics and pathogens in manure and sewage sludge.

**Stephen Smith, Imperial College London**, explained that contaminants in sewage sludge have been considerably reduced over the last few decades. Most toxic chemicals are adsorbed in soil, so have low biological activity, and negligible crop uptake, so that use on cropland seems to not be a concern. Transfer to diet via livestock does however require attention but studies spiking cattle feed with sewage sludge showed very low and temporary, or non-detectable, transfer to milk (see ESPP [Scope Newsletter n°126](#)). There are over 23 000 chemicals [registered](#) under REACH in the EU, of over 100 000 on the [chemicals inventory](#). Many enter secondary resource streams and can pose risks in recycling. Problematic chemicals today are brominated dioxins (resulting from brominated flame retardants), chlorinated alkanes (restricted under POP regulations, but still present in secondary resources) and PFAS/PFOS (perfluorinated chemicals, for which EU further restrictions are now being discussed). QSAR (modelling) analysis of new brominated flame retardants introduced to replace banned substances suggests that these will also prove problematic in the future. Overall, halogenated chemicals are problematic, and the solution is to stop producing and using these. Another problem is the illegal presence of restricted substances in imported articles.

**Moritz Bigalke, University of Bern**, presented current understanding on microplastics. Significant levels can be present in sewage sludge or composts. The main inputs to soils seem to generally be vehicle tire dust, sewage sludge, compost and agricultural films. While most studies show ecotoxicological impact only at high concentrations of microplastics, one study (Rodriguez-Seijo et al. [2017](#)) suggest that microplastics may impact earthworms at environmentally relevant levels. Microplastics are mobile in soils, can modify soil properties and impact plants (see ESPP [eNews n°38](#)). A major difficulty is the absence of standard methods for analysing microplastics in soils and their impacts on soil organisms.

**Annika Nordin, SLU** (Swedish Agricultural University), presented pathogens in sewage sludge and manures. Treatments such as composting, anaerobic digestion or ammonia sanitisation reduce pathogens to low and safe levels, while storage or alkaline treatment are not efficient against helminth eggs (which are a big problem e.g. in Africa). The EU Sewage Sludge Directive today still allows spreading of untreated sewage sludge if ploughed in within 24 hours.

Discussion concluded that more research is needed into microplastics and into the fate and risk assessment of organic chemical contaminants in soil-plant systems. Input should perhaps be made to the European Commission to propose that the current revision of the Sewage Sludge Directive should ban the spreading of untreated sewage sludge.

## Digestates, composts, nutrient recycling

The third RELACS webinar (17 March 2021) saw several presentations on recycled nutrient materials.

**Kurt Möller, Hohenheim University**, presented studies on composts and digestates, showing considerably preferable LCA for anaerobic digestion compared to composting, and also much lower nitrogen losses during processing, but a higher N loss risk for digestates after field application. The long-term fertiliser efficiency of P and K in organic fertilizers is nearly 100 %, but the long term N efficiency varies in a wide range, for compost it is only 20-40%, whereas it can be nearly 70 to 80% for digestates.

Both, N losses during storage and after field applications, and low efficiencies in the field affect the stoichiometry of nutrients in organic manures, mainly the N/P- and the N/K-ratio. Therefore, the use of composts (e.g. from food waste) to provide N to crops can result in nutrient imbalances in the soil, leading over time to e.g. phosphorus accumulation. Any treatment approach should emphasize on reduction of any kind of nutrient losses.

**Elke Bloem, Julius Kühn Institute** and [PROMISE](#) (Baltic Bonus project), summarised a study looking at mesophilic anaerobic digesters treating over 40 different input materials including sewage sludge, pig, cattle and poultry manure and maize (as a reference). Eight antibiotics were measured in input materials and in digestate (sulfonamids, tetracyclines, fluoroquinolones). At least one antibiotic was detected in 70-90% of input manures and 100% of sewage samples, with similar detection levels in digestate. Anaerobic digestion reduced median antibiotic levels by around 50%, but high levels were still present e.g. in poultry manure digestates. For comparison, literature data suggests reduction levels of 30% - 100% in composting, very variable even for the same substance in different composting systems (depending on time, temperature, pH, aeration ...). The PROMISE study also carried out ecotox tests using *Sinapsis alba* (white mustard), showing effect concentrations of the order of 1 000 x higher than worst case calculated soil concentrations. However, the tests also showed that effects of several antibiotics are more than cumulative (synergistic) and should be considered. Also, some literature studies suggest that antibiotics may stimulate antibiotic resistant genes (AGRs) at significantly lower concentrations.

**Anne-Kristin Løes, NORSØK**, summarised studies on use of hydrolysed fish processing and seaweed processing wastes as fertilisers. Ground fish waste treated in formic acid (pH4) showed to be a very effective nitrogen and phosphorus fertiliser (hydrolysed proteins) in a field trial with rye grass, producing as much biomass as the reference treatment with the same N dose supplied as poultry manure, but with a much more rapid growth response. In the trial, this material was also tested with fibre residue from processing of rockweed (seaweed), from the company ALGEA (Syngenta), rich in K, S, Mg. Both of these residues are currently generally incinerated. Fish processing residues from caught wild fish are currently authorised for use in Organic Farming, whereas this is not clear for fish residues from aquaculture (category 2 waste not accepted; fish excrements not accepted). For further information, see Ahuja et al. [review](#) on fish waste based fertilisers.

**Erik Meers, Gent University**, presented a number of projects working on different routes for processing digestates to generate fertiliser materials, as a solution to transfer excess nutrients from intensive livestock regions to regions needing nutrients for arable production.

**Participants** discussed manures from digestate, questioning that such processing may only necessary or economic (as opposed to local use of the digestate) in intensive and concentrated livestock production, which is against the principles of Organic Farming.

## Research

### Farmer survey on preferences for bio-based fertilisers

The Horizon2020 R&D project, [Fertimanure](#) (ESPP member, see ESPP [eNews n°41](#) Innovative nutrient recovery from secondary sources: production of high-added value FERTILISERS from animal MANURE) has opened a survey of fertiliser users (in Europe, Argentina, Chile). Forty-seven questions ask about farm type and size, soil sampling, farm fertiliser management plan, fertiliser application costs, readiness to switch to Organic Farming or to bio-based fertilisers, familiarity with regulations, qualities considered important for bio-based fertilisers, materials considered acceptable in bio-based fertilisers, etc.

Fertiliser user questionnaire: <https://www.fertimanure.eu/en/news/consult/26>

### Why Phosphorus Use Efficiency in aquaculture needs to improve

An overview of global phosphorus flows in fish production (capture and aquaculture) shows that the net P flow has changed from positive + c. 0.5 MtP/y (more P in harvested fish, both captured and cultured) in the 1960's – 1970's to negative – c. 1 MtP/y (more P used in aquaculture than harvested). P in harvested fish is an order of magnitude larger than other P pathways from water to land (migratory fish, seabirds, deposition). P input to aquatic systems from aquaculture globally is estimated at c. 2 MtP/y (2016), rising rapidly since the 1990's with the expansion of aquaculture. This compares to estimates of losses from croplands and manure of 4 - 5 MtP/y (not including losses related to land use change) and of total river P discharge to oceans of 4 – 22 MtP/y. ESPP note: these numbers are coherent with global phosphate rock mining of 17 – 24 MtP/y ([ESPP Factsheet](#)). The authors estimate that c. 0.3 MtP/y of mineral phosphate is used in aquaculture feed. The authors estimate that global average Phosphorus Use Efficiency (PUE) in aquaculture is c. 20%, higher for finfish than for crustaceans. China represents nearly 60% of global aquaculture P input. In China, upper values for PUE are 44% for finfish and 24% for crustaceans. PRE (Phosphorus Retention Efficiency), that is % of input P retained in fish biomass in feeding experiments, can be higher, e.g. 44% median PRE for carp, which represents c. 40% of world aquaculture production. The authors estimate that an increase of global aquaculture PUE to 48% would be necessary to achieve “net zero” flows in fish capture and production, which would be very demanding. The authors note that aquaculture shows net P use (input – harvest) / protein of c. 0.3 g/g compared to 0.03 – 0.14 g/g calculated for crop-livestock systems.

Huang et al. 2021 “The shift of phosphorus transfers in global fisheries and aquaculture” <https://doi.org/10.1038/s41467-019-14242-7>

## Eutrophication drives lake CO<sub>2</sub> emissions or uptake

Net influx and efflux of CO<sub>2</sub> was calculated for 15 eutrophic, shallow lakes (< 7m) in Iowa, USA (mostly manmade lakes), for which long term water chemistry survey data was available 2000 to 2010. Additionally, dissolved inorganic carbon (DIC) was isotope tested, and dissolved organic matter (DOM) was analysed. Without eutrophication, lakes are generally net sources of CO<sub>2</sub> to the atmosphere (efflux). In this study of eutrophic lakes, five lakes showed net CO<sub>2</sub> influx (sink) of c. -50 to -1800 mmolCO<sub>2</sub>/m<sup>2</sup>/day (average during the ice free season = c. 8 months), whereas ten showed net efflux (emission) of c. 320 – 11 800 mmolCO<sub>2</sub>/m<sup>2</sup>/day, showing values significantly higher than previously reported in literature. For the lake with the highest net efflux (Badger Lake, 0.17 km<sup>2</sup>) this represents around 21 000 tCO<sub>2</sub>/year (based on 8 months). The carbon analysis showed that in all fifteen lakes, the DIC was derived from degradation of lake carbon (e.g. from sediment), mineral dissolution and atmospheric uptake, and not from degradation of land runoff organic carbon. CO<sub>2</sub> efflux from the lakes was correlated to total nitrogen and to watershed wetlands. Conclusions are that although algal blooms resulting from eutrophication can cause lakes to uptake CO<sub>2</sub> from the atmosphere for periods of months, eutrophication can cause wide changes in CO<sub>2</sub> influx or efflux, including in some cases high CO<sub>2</sub> emissions. The large effluxes are hypothesised to possibly be related to photodegradation of nitrate and nitrite, related to high nitrogen inputs to the lakes.

Morales-Williams et al. 2021 "Eutrophication Drives Extreme Seasonal CO<sub>2</sub> Flux in Lake Ecosystems" *Ecosystems* (2021) 24: 434–450  
<https://doi.org/10.1007/s10021-020-00527-2>

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