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Events

ESPC4 Full programme now online

This is the major event on phosphorus sustainability in Europe, taking place every 2-3 years. The full programme of speakers for the **4th European Sustainable Phosphorus Conference, Vienna, 15-17 June 2020**, is now [published](#). Registration is now open on [Eventbrite](#). Sessions cover city and regional actions on nutrient stewardship, business case examples of phosphorus recycling, policy tools, research perspectives and new technologies for P-recovery from research to industrial implementation in Europe and worldwide.

ESPC4 is jointly organised by the European Sustainable Phosphorus Platform (ESPP) and Proman Consulting, with support of the **City of Vienna** (Municipal Department 48 (MA48); Waste Management, Street Cleaning and Vehicle Fleet) and of **Borealis, EasyMining, WKU and LAT**.

Registration: [Eventbrite](#)

Conference programme, hotel lists, etc: <http://www.phosphorusplatform.eu/espc4>

See note below on Corona virus.

4th European Phosphorus Research Meeting (PERM)

The third day of ESPC4 (**17th June, Vienna**) will be the 4th European Phosphorus Research Meeting, showcasing R&D into phosphorus recycling and recycled products and new approaches to phosphorus stewardship. This is a unique opportunity to meet and exchange with other projects working on phosphorus, and to discuss research perspectives with the European Commission, industry and stakeholders. The meeting will be limited to around 100 participants, 20 project flash presentations and around 20 posters, in order to enable dialogue, discussion and networking. To participate: register as below and contact info@phosphorusplatform.eu

Co-organised by ESPP, **Biorefine Cluster Europe, TU Wien, Proman Consulting.**

Registration with booking for ESPC4: [Eventbrite](#)

Conference programme, hotel lists, etc: <http://www.phosphorusplatform.eu/espc4>

See note below on Corona virus.



Workshop on iron phosphate chemistry applied to phosphorus stewardship

ESPP, with WETSUS, INCOPA, INRAE Rennes and the Horizon 2020 projects P-TRAP and SUSFERT, is organising a science and implementation workshop on iron phosphate chemistry in different systems (sediments, soil, agriculture, waste water and sewage sludge). The objective is to improve understanding of applied iron phosphate chemistry in these systems, to develop phosphorus recycling, eutrophication management and better agronomic use of secondary resources. The 1.5 day workshop will be held in **Utrecht, the Netherlands 13-14 July, 2020** and include a networking dinner. The themes will cover: Iron phosphorus interactions in sediments, in soils and engineered systems, Strategies for phosphorus release and P-recovery from iron phosphates, Iron - phosphate interactions in agriculture and Markets for recovered iron phosphate materials. Proposals for posters, presentations or specific questions to address are welcome

Utrecht, the Netherlands 13-14 July, 2020. See note below on Corona virus. Registration: [here](#)
Contact: sara@phosphorusplatform.eu

RAMIRAN 2020

Europe's leading manure and organic resources recycling conference, RAMIRAN, will take place in Cambridge, UK, 14-17 September 2020. The RAMIRAN network was established 25 years ago and the biennial conference attracts some 250 participants. This year's RAMIRAN will look at "Managing Organic Resources in a Changing Environment", including nutrient utilisation, soil quality, air and water, best practices, treatment technologies and policy. Abstract submission until 1st March 2019.

www.ramiran2020.org

Corona virus situation

ESPP is monitoring with concern the Corona virus development. For the events above planned by ESPP in June (ESPC4, PERM) and July (iron phosphorus workshop), in agreement with the City of Vienna for ESPC4 and PERM, it is not at present justified to postpone. However, if the developing situation does necessitate postponement of either of these events, then all registrations will be transferred to the new date to be fixed. If this is not possible for the registrant, then partial reimbursement will be made (minus non-recoverable costs). All registrants will be directly updated of developments by email.

ESPP members

Veolia and Yara to present Nutrient Upcycling Alliance

Global resource recovery company Veolia and leading crop nutrition company Yara, both members of ESPP, have launched a "Nutrient Upcycling Alliance", to implement a sustainable and economically viable food system through hands-on, business driven projects. The Food initiative of the Ellen MacArthur Foundation has provided circular economy knowledge support to inform the strategy and policy objectives, which will be developed with companies in the food industry and with farmers. (The Ellen MacArthur Foundation published a report on "Cities and Circular Economy for Food" in 2019, see ESPP eNews [n°31](#)). The two companies are already working together on operational initiatives to launch new nutrient recovery installations in a number of major European cities and to transform the recovered nutrients into performance fertiliser products. They are developing actions to recover nutrients and recycle to quality mineral fertilisers, with Yara's expertise, and to organo-mineral fertilisers, in combination with Veolia's subsidiary Sede Angibaud. The objective is also to collect and process (non-edible) food waste in cities to recycle to agriculture. A first joint development is already operational in Oslo (VEAS), recovering ammonia from sewage sludge methane production and processing to nitrogen fertilisers. The Nutrient Upcycling Alliance (NUA) will be presented at the 4th European Sustainable Phosphorus Platform ([ESPC4](#)).

"Veolia and Yara partner to propel European circular economy"

<https://www.yara.com/corporate-releases/veolia-and-yara-partner-to-propel-european-circular-economy/>

New ESPP member: Fertimanure project

The FERTIMANURE project (Innovative nutrient recovery from secondary sources: production of high-added value FERTILISERS from animal MANURE, Horizon 2020, 2020-2023) is a new ESPP member, represented by project coordinator BETA Technological Center (UVIC-UCC, Vic, Spain). The project will examine innovative technologies for nutrient recovery and manure recycling, as well as the development of innovative nutrient management routes and circular economy business models. Five on-farm nutrient recovery pilot plants will be demonstrated in Belgium, France, Germany, The Netherlands and Spain. With different combinations of on-farm and centralised production and processing of manure and sub-products, eleven different bio-based fertilisers and twenty tailor-made fertilisers will be developed and assessed, including fertilising product adequacy tested in greenhouse and field, quality and safety, and sustainability. The project includes 21 partners from Belgium, Croatia, France, Germany, Italy, The Netherlands, Poland, Spain and Argentina, including Fertilizers Europe, Greenwin cluster Belgium, the French Chamber of Agriculture (APCA), and the European Landowners Association (ELO).

Contact: Laia Ilenas Argelaguet (FERTIMANURE PI) laia.ilenas@uvic.cat

Innovation

Eutrophication solution from down-under

Australian innovation company Marine Easy Clean, manufacturers of The Water Cleanser (TWC) is looking to demonstrate in Europe its passive technology solution to address eutrophication in natural systems, fresh or saltwater, or to improve waste nutrient cycling in aquaculture. The TWC block restores natural bacterial balance without releasing chemicals. It contains very many microscopic capillaries, the size of which allow the proliferation of bacterial inhabitation and a non-soluble source of organic carbon (wax) which together enable rapid development of naturally present Bacillus bacteria. These release enzymes which break down organic matter in water, rendering bioavailable phosphorus and nitrogen. This enables “green” chloroplast and diatom algae to develop, providing food to crustaceans, shellfish and fish, rather than toxic Cyanobacteria (blue green algae) which develop when there is too much phosphorus and insufficient available nitrogen. The uptake of phosphorus by the “green” algae leads to low water phosphate levels, so reducing eutrophication symptoms and restoring natural ecosystem balance. In tank systems, this also improves aquaculture productivity. The Bacillus also decompose natural oils, which tend to accumulate in eutrophic waters and which can reduce surface oxygen exchange. Because the Bacillus largely function without oxygen, they do not generate oxygen depletion (dead zones). Published tests show the effectiveness of the TWC blocks in 100 litre tanks (using polluted water from the Rio de Janeiro lagoon), as well as in fish and crayfish production tanks. TWC is looking for research, industry or public partners to test the system in Europe, in restoration of eutrophied waters (fresh or salt) or in aquaculture (in tank systems, or to address ‘dead zones’ below open-water aquaculture pens).

<https://www.marineeasyclean.com.au/>

Regulatory

EU consultation on “Farm to Fork” strategy: closes 16th March

The European Commission has opened to 16th March 2020 a public consultation on the ‘Roadmap’ for an EU Sustainable Food (‘farm to fork’) strategy. The proposed roadmap underlines that globally, the food system generates 20-30% of greenhouse emissions, as well as to air, soil and water pollution and biodiversity loss, and that around 20% of EU food production is lost as waste whilst 7% of the EU population cannot “afford a quality meal every second day”, yet obesity and diet related disease and health costs are rising. Four objectives are defined for the strategy: sustainable primary food production, sustainable food processing and food services, sustainable food consumption and a “shift towards healthy, sustainable diets” and reducing food waste. The inclusion of diet in EU policy objectives is a significant landmark and it is stated that the Commission will propose actions to help consumers choose healthy and sustainable diets by providing better food information, including on “nutritional value”. Actions cited include to reduce the use of fertilisers and establishing Advisory Groups on the Food Chain and on Aquaculture.

For memory, the EU Regulation on Food Information [1169/2011](#) makes obligatory, for pre-packed foods, ‘front of pack’ information on content of calories, fat, saturates, carbohydrate, sugars, protein and salt. Other nutritional information, including levels of minerals (including phosphorus) is voluntary.

EU public consultation to 16th March 2020:

https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2020-941864_en

EU “SafeManure”: not “end-of-manure”

ESPP and the German Phosphorus Platform (DPP) participated at the expert & stakeholders meeting to input to the draft EU report “*SafeManure: Developing criteria for safe use of processed manure in Nitrates Vulnerable Zones above the threshold established by the Nitrates Directive*”, at JRC Seville, 28-30 January 2020. The meeting clarified that this proposal aims to facilitate, under specified conditions, the use of “processed” manure to replace mineral fertiliser in some regions with high livestock density, that is: authorisation of use at levels higher than the 170 kgN/ha general limit for manure and processed manure fixed by the Nitrates Directive, up to the higher limits regionally applicable for non-manure fertilisers. This concerns particularly the liquid fraction of solid/liquid separated manure, processed manure digestates, animal urine separated in the stable or process-separated and some “mineral concentrates” (a category which is poorly defined). The materials defined by the criteria, termed ‘ReNure’ materials, would continue to be classified as manures, and would not be given End of Waste status. The conditions for use would have to be specifically defined in Member State / Region ‘Nitrate Vulnerable Zone Action Programmes’, subject to case-by-case European Commission validation (the proposed ReNure criteria include requirements to define regional specifications on both ReNure and other fertiliser application, field management ...). In discussion, the obligation was added to ensure appropriate management of phosphorus in Action Programmes where ReNure materials use derogations are included. ReNure status would thus be specific to a given region, would not be transferrable to another region, and would confer neither EU nor national fertiliser status (the materials remain “manure in a processed form”).

ESPP expressed regret that the European Commission has not so far been considered our submitted proposals to clarify “end of manure” status, for materials which are “mineral fertilisers”, referring to the definition in the EU Fertilising Product Regulation (FPR), that is < 1% organic carbon / DM. ESPP suggests that such materials, derived wholly or partly from manure, should be no longer treated as “processed manure” under the Nitrates Directive, without modification of regional Action Programmes. We suggest that this would respect the Nitrates Directive text, by limiting to products which clearly do not resemble manure or pose leaching or pollution risks. ESPP has written to the European Commission (DG Environment) request that this possibility be assessed.

JRC “interim” version of the SafeManure report, as discussed at the meeting, and now undergoing finalisation by JRC:
www.phosphorusplatform.eu/regulatory

European Commission announces STRUBIAS annexes for 2021

The European Commission has published on its “Have your say” public website, a preliminary information (not dated) announcing an expected future public consultation (dates not announced) on the new criteria for use of ‘STRUBIAS’ materials as components for CE-Mark fertilisers (CMCs), under the EU Fertilising Products Regulation: struvite and [precipitated phosphate salts](#), ashes and “[thermal oxidation materials](#)” and [biochars](#), pyrolysis and gasification materials. These pages indicate expected adoption of these three criteria “First quarter 2021”, that is before the date of entry into application of the Fertilising Products Regulation in July 2022. The proposed criteria texts are not published here, but are (according to our information) essentially the same as those proposed in the JRC report (see ESPP eNews [n°36](#)) and are available on the ESPP website (under Activities -> [Regulatory](#)). It was expected to finalise discussion of these criteria at the EU Fertilisers Working Group planned end March 2020, but this meeting has been postponed due to Corona virus.

<https://ec.europa.eu/info/law/better-regulation/have-your-say>

Danish assessment concludes sewage sludge safe for Organic Farming

An assessment of risks related to use of sewage sludge and pig or cattle slurry has been published by Copenhagen University and the Danish National Food Institute (DTU). This follows from a 2017 report of the Danish Organic (Farming) Business Development Team which recommended that Organic Farmers should be allowed to use nutrients from treated municipal wastewater. The assessment finds that the main risks from pig and cattle slurry are copper and zinc, but that these will decrease with regulations prohibiting addition of these elements to pig feed in 2019 and 2022 respectively. Other contaminants showed no significant risk, with the summed risk of all organic contaminants (including antibiotic resistance) “low” for soil (but with a risk for oestrogen for farrowing pigs). For sewage sludge, the only contaminants with PEC/PNEC >1 (Predicted Environmental Concentration / Predicted No Effect Concentration) were phthalates and triclocarbon (but for triclocarbon there was no data for Danish sludge and estimates were based on US numbers). Organic contaminants in sewage sludge are not expected to accumulate in soil. Metal compounds would only reach PNEC after long periods of repeated sludge application: the most critical being zinc at 100 years. Veterinary medicine residues in sewage sludge are considered of “low concern” and the risk from antibiotic resistance is no higher than for manures and is likely to be not significant. Overall, sewage sludge is considered to not represent a higher risk to soil organisms than pig or cattle slurry.

“Assessment of risks related to agricultural use of sewage sludge, pig and cattle slurry”, K. Eggers Pedersen et al., University of Copenhagen and DTU Food, National Food Institute, Denmark, December 2019, ISBN 978-87-996274-2-4
https://plen.ku.dk/raadgivning/rapporter/Assessment_of_risks_related_to_agricultural_use_of_sewage_sludge_pig_and_cattle_slurry.pdf

ESPP requests withdrawal of EU-funded study on composts and digestates

As indicated in ESPP eNews [n°37](#), the European Commission has published a study on contaminants in composts and digestates, proposing possible EU-wide restrictions, using “Risk Management” measures under EU chemical regulation REACH. Despite both compost and digestate being exempted from REACH “Registration”, REACH can still be used to impose bans or restrictions.

ESPP’s comments were elaborated with the European Compost Network (ECN), the European Biogas Association (EBA), Growing Media Europe and the water industry (Eureau). ESPP underlines that the report fails to consider reduction of contaminants at source as a priority, does not offer a science-based risk assessment, ignores existing risk assessments, is not coherent with the EU Fertilising Products Regulation and contains no assessment of cost/benefit nor of overall life cycle impacts. For example, key conclusions on pharmaceuticals seem to be based on the “opinion” of just one “expert”. A proposed ban of compost and digestate with sewage sludge as an input (contrary to authorisation under several Member States’ national fertiliser legislation) seems to be based on this one “opinion” on pharmaceuticals, on dioxins and furans (which are not a particularly relevant contaminant in sewage sludge, and are decreasing) and on copper and zinc (which are micro-nutrients, c.f. their treatment under the EU Fertilising Products Regulation). Incoherent and unrealistic contaminant limits are proposed for various other substances, including nickel and mercury. Indeed, the study does not even define which “composts” and “digestates” are covered, seeming to include a wide range of waste inputs which may not be relevant.

ESPP comments on the AMEC study: www.phosphorusplatform.eu/regulatory
AMEC study: “Digestate and compost as fertilisers: Risk assessment and risk management options. Final Report” Ramboll – Peter Fisk – WOOD (ref. 40039CL00313, 8th February 2019)

The Green Deal and EU economic policy

IEEP (Institute for European Environment Policy) has published a paper proposing to reform the European Semester to implement the Commission's Green Deal and Sustainable Development Goals (SDGs). The Semester was adopted by Council in 2010 as a tool for economic and fiscal coordination in the EU, with objectives of convergence, stability and economic growth, and coordinates in a six month cycle Member States' policies including structural reforms, fiscality and macroeconomic balances. A social element was added to the Semester in 2013, but environment is still largely absent: 21 green growth indicators are mostly on energy and DG ENVI is not involved in the process (led by GROW, ECFIN, EMPL, FISMA). However, in December 2019, the Commission [published](#) an "Annual Sustainable Growth Strategy", replacing the previous years' "Annual Growth Survey". This refers to the importance of material resources and ecosystem services. IEEP suggest this should be implemented by introducing sustainability and wellbeing into the European Semester process. IEEP propose 8 sustainability dimensions, including green economy, green taxes and incentives, green R&D and innovation and sustainable industry. IEEP propose to use 15 existing indicators as an environmental sustainability scoreboard, including % of water bodies in Good Ecological Status, soil sealing, eco-innovation index, greenhouse gas emissions from agriculture, material consumption per capita and years of life lost due to particulate air pollution.

"Delivering the Green Deal: the role of a reformed European Semester within a new sustainable economy strategy", IEEP, C. Charveriat & E. Bodin, 2020

Communications

The Baltic Sea of Opportunity

An 18 minute film from the Baltic BONUS RETURN project explains visually, for a general public audience, that phosphorus can be transformed from a problematic pollutant to an economic resource. Phosphorus is essential for life, agriculture and global food security. But losses are the biggest cause of eutrophication, devastating the Baltic. Jakob Granit, Swedish Agency for Marine and Water Management, explains the need to reduce nutrient loads into agriculture and to take nutrients, accumulated in the past, out of water and from sediments. Solutions exist to transform phosphorus waste into a sustainable resource. Examples presented include Wodociagi Slupsk, Poland, producing compost from sewage sludge which is then sold as a fertiliser in Poland. Jon Wessling, LRF (Federation of Swedish Farmers) explains that they recommend the use of sewage sludge in agriculture. Innovations tested in the BONUS RETURN project are presented. BioPhree Aquacare (see ESPP [eNews n°29](#)) is tested at Knivsta, Sweden, on a sewage works discharge stream. This process uses adsorbents to remove phosphorus from dilute streams, such as surface waters, which then can be regenerated to recover phosphorus. The Ravita (Helsinki HSY) P-removal and recovery process is tested in Finland (see SCOPE Newsletter [n°132](#)). TerraNova, a continuous hydrothermal hydrolysis carbonisation process (see SCOPE Newsletter [n°132](#)) will be tested on sewage sludge in Gävle, Sweden, producing a biochar-type fertiliser. The film underlines the challenges of regulatory obstacles to nutrient recycling and the opportunities of the new EU Fertilising Products Regulation.

The Baltic Sea of Opportunity <https://www.bonusreturn.eu/sea-of-opportunity-film/>

US Sustainable Phosphorus Alliance webinar on P and food

The 9th webinar organised by the US Sustainable Phosphorus Alliance, 18th February and can be watched [here](#) discussed phosphorus and food. **Jaime Urbarri's** presentation suggested that US food phosphorus levels are considerably higher than the RDA (recommended daily allowance = recommended minimum dietary intake) and that there is evidence that increased phosphorus levels in blood are linked to risk of arterial calcification, and so cardiovascular disease. However, most of the papers referenced only show a link with diet for kidney disease patients, not for the general population. He emphasised the absence of information about levels of phosphate food additives in different foods, which can be important because these additives are absorbed into the body more than phosphorus in plant materials in foods. **Jim Elser** underlined that the world's phosphorus footprint (mined phosphorus per capita) has increased nearly 40% since the 1960s and that the key cause is increasing meat content of diets. **David Vaccari** presented an analysis of possible routes to reduce phosphorus consumption, showing that important action points are reducing food waste, improving fertiliser and improving the use efficiency of phosphorus in livestock production (in particular, better use of manure). With current practices, he estimates that without fertilisers from rock phosphate, only a world population of around 2.5 billion could be fed, but that this could be increased to over 10 billion by significant improvements in these action points, and to 15 billion if this were combined with a reduction in meat in diet.

Sustainable Phosphorus Alliance videos and webinars:
https://www.youtube.com/channel/UCNFDQTfeT7mGsMY_YOqMonA

European Commission publishes conclusions on resource recovery

The conclusions on resource recovery from wastewater, from the workshop organised by four Horizon 2020 projects (SMART-Plant, nextGen, Hydrousa and Project-O) and the European Commission (EASME) at the 2019 IWA Resource Recovery conference, have now been [published](#) by the European Commission. The workshop agreed the following recommendations to further nutrient recovery and recycling: promote a positive image for recycling nutrients; need for stable regulatory support; importance of networking of competence, platforms and data benchmarking; difficulties posed by disparate implementation of End-of-Waste in different Member States and regions. The workshop recommended to promote and support nutrient recycling in Horizon Europe, and to develop better coordination of End-of-Waste, Water Policy and Circular Economy policies between Member States.

Report. Post-Conference workshop @IWAR2019. "H2020 Water Innovations for Sustainable Impacts in Industries and Utilities" [here](#).

Circularity Gap Report 2020

The Circle Economy report 2020 indicates that global circularity has fallen from 9.1% (% of recycled materials in total resource consumption) to 8.6% from 2018 to 2020. The report underlines that circularity is key to achieving climate objectives. Nutrition is the second biggest user of resources, after housing/infrastructure, and consumes 21 billion tonnes of resources per year worldwide, out of a total of around 100 billion t/y entering the global economy (of which 92 bt extracted, just over 8 bt recycled). The report notes the need for better data and monitoring, including on the quality and composition of materials recycled. Sophisticated infographics illustrate global flows and country circularity levels. This suggests that companies closest to circularity include Sri Lanka, Georgia, Cuba, Jamaica. The least circular countries include the UAE, Burkina Faso and Luxembourg, with Austria, Belgium, Denmark, Estonia, Finland, Latvia and Sweden classed in the next-to-worst. Company CEOs cited as supporting the report include DSM and Royal Philips.

The Circularity Gap [Report 2020](#), Circle Economy, CGRI, Platform for Accelerating the Circular Economy (PACE).

Industrial Phosphorus Chemistry Symposium

The first Industrial Phosphorus Chemistry Symposium (IndPhos) took place in April 2019 back-to-back with the 16th European Workshop on Phosphorus Chemistry ([EWPC](#)). Willem Schipper, Schipper Consulting, focussed on options to make industrial uses of phosphorus more sustainable and more circular. Chris Harris, Solvay, showcased a wide range of applications of organophosphorus chemistry, including as flame retardants, in mining, scale and corrosion control in water treatment, agriculture, medicine and as ligands for catalysts in industrial applications. Thomas Schaub, BASF presented new phosphorus-containing catalysts for the hydrogenation of esters and for the synthesis of sodium acrylate based on CO₂ and ethylene. Jan-Gerd Hansel, Lanxess, discussed the development of halogen-free flame retardants, in particular new poly(alkylene phosphate) esters as flame retardants in polyurethane foams. Steven van Zutphen, Italmatch, explained the industrial, regulatory and health and safety issues in scale-up of new chemistries from bench to multi-ton reactor scale. Reinhard Sommerlade, independent process design chemist, presented industrial uses of phosphorus-based photo-initiators, such as bis(acyl)phosphine oxides (BAPOs). Irradiation breaks the phosphorus - acyl carbon bond in these compounds, initiating emission-free polymerization of monomeric or oligomeric polymer precursors for various applications. Hansjörg Grützmacher, ETH, Zurich, discussed synthesis and application of new and sustainable building blocks in phosphorus chemistry, emphasising the need to combine innovation with recyclability and industrial feasibility.

Indphos was organised by Chris Slootweg, University of Amsterdam, with support from Solvay, OCP, Lanxess, Magritek, Strem, Glindemann, Springer, the Royal Society of Chemistry and the European Journal of Inorganic Chemistry <https://ewpc16.com/indphos/>

IFA Forum on Plant Nutrition

The "High-level Forum on Sustainable Plant Nutrition", Versailles, France, November 2019, was chaired by David Nabarro, [4SD](#), 2018 World Food Prize [laureate](#), and brought together the fertiliser industry, fertiliser industry stakeholders, funding and policy organisations and scientists. Prefacing the forum conclusions, Mostafa Terrab, OCP and IFA Chair, underlined that mineral fertilisers underpin around half of global food production, and that fertilisers will continue to be vital to feed the world, with improved soil health, water management and crop genetics. The forum addressed five challenges to global agricultural systems, and defined five recommendations to the fertilisers industry. The challenges to agriculture are: producing more with lower inputs, whilst improving nutritional quality; balancing productivity and environment; preserving natural resources; reducing climate emissions, including by improving nutrient use efficiency (NUE); training and empowering farmers. World hunger has increased for the last three years to 2019, today impacting over 800 million people. Some 2 billion people suffer from micronutrient malnutrition, impairing physical and mental development and the immune system. Whereas in some communities over-consumption of animal protein damages health. Recommendations to the fertiliser business are: new business models, including "from volume to value-added", energy efficiency and circularity, including externalities in true cost accounting; building partnerships from farmers to consumers; collecting and using big data; technology innovation, such as micronutrient fertilisers, nutrient delivery efficient fertilisers, bio-stimulants, precision agriculture; promoting public policies which support human nutrition, carbon sequestration and reduced nutrient pollution.

IFA High Level Forum on Sustainable Plant Nutrition "Toward a new paradigm for sustainable plant nutrition", 18-20 November 2019, Versailles, France <https://www.highlevelforum.org>

IFA: potential disruptors of the mineral fertilisers market

The IFA (International Fertilizer Association, the world fertiliser industry federation) marketing conference, Dubai, March 2020, included a session on potential disruptors of conventional mineral fertiliser markets. Armelle Gruère, IFA, listed potential market disruptors identified by IFA: increasing nutrient recycling, bio-stimulants, crop strains requiring less nutrients (e.g. nitrogen fixing), new fertiliser types, policies (regulation, subsidies), agriculture system changes in particular IT and big data, biofuels, diet changes. Derek Oliphant, Agbio Investor, noted that the global market for agriculture intrants is 250 billion US\$, of which around 60 bn\$ fertilisers and around 2 bn\$ bio-stimulants. The bio-stimulants market is growing at >10%/year, and the EU is 40% of the world market. Development of crop strains (seeds) with improved nutrient use efficiency is today less of an industry priority than pest resistance. Ravinda Shrotriya, presented production of vegetables in urban hydroponics. Using artificial light, around 8 kWh energy is needed per kg vegetables, but water and intrant use efficiency are very high. Marina Simonova, IFA, indicated that world greenhouse area is growing +5%/year, generating demand for water-soluble fertilisers (e.g. MAP). Together, speciality fertilisers (water soluble, coated, slow or controlled release, nitrogen-stabilised / eutrophication inhibited) are growing at 4%/year and today represent 10% in value of world mineral fertiliser sales. Chris Thornton, ESPP, explained that the potential for nutrient recycling is significant, but that data is lacking. The quantity of phosphorus in manures in Europe is of the same order as that used in mineral fertilisers, and the quantity in sewage, organic solid wastes and animal by-products is a further one third of mineral fertilisers. There is a lack of data as to how much of these secondary nutrients is today recycled, and are really potentially recyclable, both at the global level (no reliable phosphorus flow study) and at the EU level (no monitoring, no update since Kimo Van Dijk's 2015 [paper](#) (2005 data)). ESPP presented examples of companies operating or building full-scale nutrient recycling today, either in organic (composts, organic fertilisers) or mineral forms (recovered ammonia, phosphorus), with large industrial operators (Veolia, Suez, ICL, Borealis, Fertiberia, Outotec, Ragn-Sells/EasyMining, ...), SMEs (Ostara, NuReSys, N2-Applied ...) and cities/regions (Kanton Zurich, Vienna ...).

IFA Marketing Conference Dubai [3-5 March 2020](#)

Measures for better manure nutrient use presented for HELCOM

The Baltic Sea Interreg platform project [SuMaNu](#) (Sustainable Manure and Nutrient Management for Reduction of Nutrient Loss in the Baltic Sea Region) compiles best practises in organic fertilizer use, manure management and processing. It will deliver recommendations to help implement the forthcoming Regional Nutrient Recycling Strategy for the Baltic Sea riparian countries prepared in HELCOM. Preliminary (draft) recommendations were presented for discussion at a workshop on nutrient recycling measures arranged on 4-5 February in Helsinki, Finland, with HELCOM, the Finland Ministries of the Environment and of Agriculture of Finland as well as key coordinating actors of the EU Strategy for the Baltic Sea Region. The SuMaNu platform draft recommendations address the importance of optimised fertilisation planning, manure management, measures to address regional nutrient surpluses, management of safety and hygienic risks with respect to trace elements and organic contaminants; and knowledge transfer.

More information on the workshop and the HELCOM Regional Nutrient Recycling Strategy [here](#)
Follow progress of the SuMaNu platform here: balticsumanu.eu

Review of fertiliser recycling from manure in Norway

NIBIO (Norwegian Institute of Bioeconomy Research) has published a literature review and assessment of manure treatment technologies and recycled fertilisers from manure. In Norway, around 8 400 tP/y of mineral fertiliser are applied, as well as some 12 000 tP/y in manure, resulting in an annual soil P accumulation of around 12 000 tP/y, probably mainly due to over-application of manure in livestock intense regions. Livestock production in Norway is concentrated in the South-West (especially in Rogaland county). A currently ongoing revision of national fertiliser regulations is expected to reduce phosphorus application rates, and so lead to manure treatment and transport. Manure treatment technologies summarised are solid/liquid separation (sedimentation, centrifuge, filtration with or without pressure); upgrading of solid or liquid fractions (drying and pelletising, composting, combustion, pyrolysis, precipitation, concentration); anaerobic digestion; acidification. Literature shows that most pig and cattle manure separated fractions showed similar plant phosphorus uptake to mineral fertilisers, including when polymer flocculants were used to improve separation. Thermal treatments (drying, pyrolysis, combustion), however, tend to reduce phosphorus availability, especially at higher temperatures. The plant availability of inorganic chemicals recovered from manure depends on their chemical and physical characteristics. The effects of anaerobic digestion on manure plant availability are considered not clear from the limited data available. Composting may reduce plant P availability. Acidification tends to improve plant P availability, but also reduces separation efficiencies. NIBIO concludes that manure processing technologies are available which can improve phosphorus management and increase recycling, and which ensure good plant P availability.

"Manure-based recycling fertilisers. A literature review of treatment technologies and their effect on phosphorus fertilisation effects", E. Brod, NIBIO report vol.4, n°91, [2018](#)

EIP-Agri: new pig and poultry feed

The EU-funded “EIP-Agri” (European Innovation Partnership) has published conclusions on “New feed for pigs and poultry” assessing new feed sources and feeding strategies. Based on costs, nutritional value and sustainability, five priority feed sources are identified: bakery products (food industry waste bread or biscuits), protein extracted from green biomass such as grass or clover, insects, micro-algae (e.g. harvested seaweed such as kelp, or algae grown on waste streams such as digestate) and single-cell protein (e.g. from bacteria cultured on wastes). Some of these products offer pro-biotic benefits as well as feed value. Identified challenges include ensuring consistent nutritional characteristics; risks of contamination by e.g. packaging (bakery products) or toxins (algae, bacteria); logistics of production, processing, storage and transport; public acceptance and integration into Organic Farming. Further research is necessary into improving fat / protein / micronutrient balances in different materials, processing, digestibility and into analysis techniques.

EIP-Agri Focus Group “New feed for pigs and poultry”, [final report](#), January 2020

Science and research

Review of P fertiliser performance of recycled nutrient products

200 published studies testing the phosphate fertilisation effect of a wide range of different recycled nutrient materials are reviewed, covering recovered minerals (calcium phosphates, struvite, etc), various treated and untreated ashes, pyrolysis products, sewage sludges, digestates. The authors conclude that some recycled products offer phosphate fertiliser effectiveness comparable to commercial, water-soluble, mineral fertilisers, but that plant growth tests show widely varying results. Plant availability in some recycled nutrient products can depend considerably on conditions in the production process, and on levels of iron, aluminium and calcium, in particular of iron. Plant availability will also depend on the physical form of the material, e.g. crystal structure and particle size. Variability also results from the lack of standardisation between testing methods. The authors consider that standard chemical extraction methods (water solubility, NAC neutral ammonium citrate, citric acid, formic acid) do not provide good indications of plant availability. They consider that NAC can dissolve iron and aluminium phosphates (e.g. in sewage sludge) or complex calcium phosphates (eg. Whitlockite) which are poorly plant available. Citric acid P solubility can be affected by calcite or dolomite which bind to citrate ligands. The authors suggest that alternative methods such as sequential fractionation, soil incubation or soil P sink methods should be developed.

“Agronomic performance of P recycling fertilizers and methods to predict it: a review”, S. Kratz, C. Vogel, C. Adam, *Nutr Cycl Agroecosyst*, 115, pages 1–39 (2019) [DOI](#)

Effectiveness of fertiliser and manure in long term field trial

Data is presented of a 20 year field trial testing eight combinations of mineral fertilisers and composted pig manure applied in Spring (control, manure only, N, NP and NPK with or without manure) on maize and soybean in Liaoning Province, China. Where crops received fertiliser plus manure, this was additive: e.g. P in mineral fertiliser when applied was always c. 23 kgP/ha/y, with additional c. 10 kgP/ha/y when manure was also applied. In this scenario, mineral fertilisers were the principal route to ensure phosphorus budgets and increase soil available P, enabling improved and more reliable crop yield and nutrient use efficiency (NUE). The authors conclude that long term application of mineral fertiliser and manure together considerably increase the conversion of residual fertiliser P (the P not taken up by the crop) to soil available P. However, the data also suggests that fertiliser plus manure resulted in excess P application (total P input 36 vs. P uptake in crops 22 kgP/ha/y) whereas mineral fertiliser corresponded to a nearly balanced P budget (NPK: P input 23, crop offtake 20 kgP/ha/y) and manure only to a P deficit (input 9, offtake 15 kgP/ha/y). In most years, Phosphorus Use Efficiency (PUE) was significantly higher with manure application only (note: this may be the result of the P deficit) but was similar for NPK+manure compared to NPK, despite the P over-application, suggesting that manure does improve overall Phosphorus Use Efficiency.

“Mineral fertilizers with recycled manure boost crop yield and P balance in a long-term field trial”, C. Ning et al., *Nutr Cycl Agroecosyst* 2020 [DOI](#)

Phosphorus flows in global aquaculture

An assessment of phosphorus flows in global aquaculture and fish harvesting suggests that around 10% of world phosphate production is used in aquaculture: estimate of 2.04 MtP/y used in aquaculture, compared to world P production from phosphate rock of around 20 MtP/y (see ESPP [Factsheet](#)). This compares to FAO (2016, p4) estimate that fish (only) accounts for 6.7% of world diet protein. The authors estimate total harvest of P in fish and seafood at 1.1 MtP/y, with around 60% from captured fish and seafood and around 40% from aquaculture production. This means that around 1.6 MtP/y is net lost in aquaculture (input P minus harvested P), mainly to aquatic systems. The authors estimate that the total harvested P in fish and seafood was 0.21 MtP/y in 1950 and the input to aquaculture then only 0.1 mtP/y, so that the overall P budget has changed from net positive to negative. These estimates of P use in aquaculture are calculated by multiplying production of different species by estimated Phosphorus Use Efficiencies, inferred from farm-level data for different species. The result is nearly two times higher than that obtained (2.04 vs 1.11 MtP/y) by multiplying estimated aquaculture farm area by World Fish database nutrient input/surface data. This P input to agriculture includes both P fed directly to the fish or crustaceans (in fish meal or in plant materials used in feed) and also fertilisers (both mineral or organic, such as manures) input to aquaculture systems to grow vegetation to feed fish (but not fertilisers used to grow crops used to make fish feed).

“The shift of phosphorus transfers in global fisheries and aquaculture”, Y. Huang et al., *Nature Communications* (2020) 11:355 [DOI](#)

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