Summary of the second

# Summit of the Organic Fertiliser Industry in Europe (SOFIE)

**Brussels and online 17th – 18th January 2023**

www.phosphorusplatform.eu/SOFIE

This SCOPE Newsletter summarises the second meeting of the Organic and Organo-Mineral Fertilisers industries, SOFIE2, organised by ESPP with support of EUROFEMA, ECOFI, Fertilizers Europe and IFS (International Fertilisers Society).

**Over 230 companies, stakeholders and experts participated and met at SOFIE** (130 in Brussels and over 100 online), including from Unimer, DCM, Koppert, CCm, Ferm O Feed, Yara, Timac Roullier, Sonac, K&S, Fertecon/S&P Global, Lumbricus, Fetimanure, LBST, Omya, SEDE Veolia, Agrobiogel, Teagasc, Mills Nutrients, Deleplanque, Tessenderlo, Citribel, Compo, TEMA, Wykes, NMI, N2 Applied, Axegård, Honkajoki Oy, Protix, WEW, Benefert, Agrana, Soepenberg, Evergreen, Biocompig, Tervalis, AgroBiogel, Adas, Teagasc, EFCI, Knoell, CerTrust, Barkwith, Arche, Artemisa, European Commission, Irish Ministry for Agriculture, Danish Agricultural Agency, Copa Cogeca …

*The first SOFIE conference was held in 2019, and is summarised in www.phosphorusplatform.eu/Scope130*
*For this second SOFIE, slides, full list of participants (Brussels and online), session recordings and transcribed 'chat' are available to all registrants via the Swapcard networking app.*

**SOFIE3 is fixed for 16-17 January 2024**, see here www.phosphorusplatform.eu/SOFIE

## Contents

# Editorial

***What is SOFIE about ?***

***SOFIE 2 is the only event to bring together the organic fertiliser industry*** *(that is carbon-based fertilisers, including organo-minerals). It is a unique opportunity for face-to-face and online dialogue between producers, secondary material suppliers, science, advisory, regulators and policy makers.*

*I thank our partners, Ecofi, Eurofema, Fertilizers Europe and the International Fertilisers Society, for helping us make it happen.*

*This second SOFIE was a great networking event for reaching out to industry stakeholders to discuss the different topics during the sessions, as well as during the busy breaks. It was great to see that many people connected and shared their contacts to follow up on discussions after the conference.*

*For me personally it was good to see people enthusiastically reaching out to one other, especially in the coffee queue (these were not the fastest coffee machines! - but it was a good cup of coffee).*

***Why has ESPP created SOFIE***

***ESPP's aim is to facilitate links between the market, stakeholders, and regulators, around nutrient recovery****; and the organic fertiliser industry is one of the main actors in nutrient recycling and in bringing nutrients back to the market.*

***What was the hot potato ?***

*RENURE … vociferously supported by some, who say that allowing an increased use of manure nitrogen in Nitrate Vulnerable Zones would help address the fertiliser crisis without increasing nitrate pollution … energetically rejected by others, who say this only concerns unsustainably intensive livestock production. Maybe this was not relevant to SOFIE, as* ***RENURE seems to be about scarcely processed manures, not market-ready organic fertiliser products****? Or maybe that is the problem, and maybe political consensus could be sought around a revisited RENURE targetting refined fertiiliser products? (These are my personal opinions, not an ESPP position. See also ESPP eNews n°47)*

***See you at SOFIE3 !***

*Fired by the enthusiasm of SOFIE2,* ***we have already fixed the third SOFIE for 16th-17th January 2024****, again in Brussels and online. A call for papers will be published in coming months, after we have analysed participants' comments on SOFIE2.*

*I look forward catching up with you then, with again a good cup of coffee.*

*Robert Van Spingelen*
*ESPP President*

# SOFIE take-aways

Organic and organo-mineral fertilisers (OF/OMFs) are today recognised as a real market for refined products, offering specific agronomic performance characteristics for different crops and soils. Processing technologies deliver products adapted to farmers agronomic requirements and spreading equipment, and to market logistics.

European companies are today delivering performance organic and organo-mineral fertiliser products, based on a wide range of secondary nutrient and carbon materials, to markets at a national level, increasingly across Europe and worldwide. **Significant growth is expected both in Europe and for exports.**

Development of the Nutrient Circular Economy through organic and organo-mineral fertilisers is recognised as key to improving **EU fertiliser supply resilience and food security**, as well as contributing to sustainability and carbon storage objectives.

The current **fertilisers supply and price crisis** opens opportunities to accelerate innovation and policy changes.

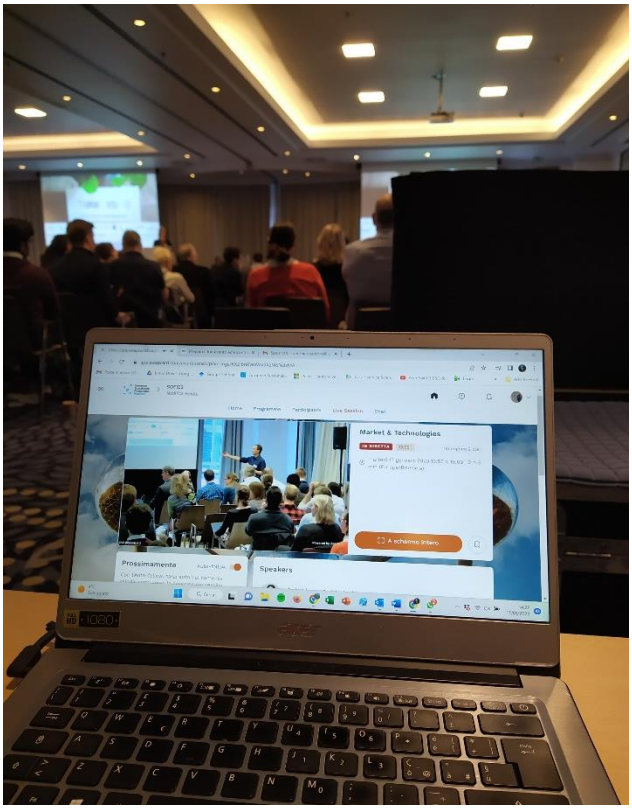
Also, order-of-magnitude **increases in biogas production and separative collection of municipal bio-waste** over the coming 5-10 years, driven by EU energy and waste policies, will generate major increases in secondary input resources (digestate and compost) for organic fertilisers production. A challenge is that separately collected household bio-waste is classified as an Animal By-Product (ABP), and so is excluded from use in EU fertilisers until the anticipated amendments of both the ABP Regulations and the EU Fertilising Products Regulation are implemented.

Agronomic effectiveness of organic fertilisers is recognised, but there is a **need for evidence and further field demonstration of performance with specific crops, in different European soils and climates**.

In particular, further field data is needed on organo-mineral fertilisers, on the nitrogen release time curve for organic fertiliser nitrogen in different conditions, as well as on the complete Life Cycle Analysis of organic fertiliser production through to use in field (including soil carbon storage, N losses in application and from soils).

The new EU Fertilising Products Regulation is recognised as a significant step forward, opening the EU market for organic and organo-mineral fertilisers, and so also for processing technologies. However, there remain significant challenges in implementation, in particular (underlined by various organisations) the **need to integrate Animal By-Product inputs (in particular manure), which are still today totally excluded from EU-label fertilising products.** It is also important that "alternative" temperature-time processing requirements, for which safety is demonstrated by experience of application under national regulations, be validated for inclusion into the FPR.

Participants also underlined that there are still very few **Notified Bodies (certification organisations)** validated for conformity assessment of organic fertilisers (but see EFCI and CerTrust presentations below) and ongoing questions about interpretation, limits to CMC materials, downstream formulation information obligations …




# What they said

| | |
|---|---|
| | *Organic fertilisers are a key element in reducing Europe's nutrient import dependency, and this is underlined in the Commission Communication on the availability and affordability of fertilisers, November 2022. Policies to support this include the FPR, CAP Strategic Plans, the proposed Soil Health Directive, INMAP and Horizon Europe.* *Oliver Sitar, European Commission, DG Agriculture* |
| copa cogeca | *Nutrient recycling and organic fertilisers can make a key contribution to fertiliser availability and sustainability. But this needs new and additional EU funding: farmers cannot deliver new objectives on nutrients without new funding. Regulatory obstacles to nutrient recycling must be lifted, including for sewage and for manures.* *Pekka Pesonen, General Secretary, Copa Cogeca* |
| Fertilizers Europe | *The objective is to efficiently feed the plant and ensure soil health. Mineral and organic fertilisers are complementary and the industries are increasingly working together to deliver optimal solutions to farmers, with support of science and field trials.* *Jacob Hansen, Antoine Hoxha, Fertilizers Europe* |
| EUROFEMA | *Organic fertilisers offer widely varying characteristics, and can be adjusted to crops, soils, climate or farmer requirements. They are a key route for the Nutrient Circular Economy and carbon fixation. Major expected increases in digestate and bio-waste substrates open great opportunities for processing to fertiliser products.* *Leon Fock, Rembert van Noort, Eurofema* |
| ecofi | *SOFIE confirms that refined organic-based fertilisers are a fast-developing industry, with a real market in Europe and for export. Existing processing technologies and formulation know-how deliver innovative products, with reliable nutrient content and agronomic performance, ensuring availability of high-quality and safe organic-based fertilisers which respond to farmers' needs.* *Jessica Fitch, Ecofi* |
| EFPRA | *Around 0.5 M t/y of animal by-products (ABPs) are currently valorised in organic fertilisers (from a total of c. 2.8 Mt/y ABPs processed by renderers). ABPs are high in nutrient content but recycling is hindered by regulatory obstacles in the ABP regulations, FPR and TSE regulation.* *Martin Alm, EFPRA* |
| YARA | *SOFIE enables Yara teams working on integrating mineral and organic fertilisers, from across Europe, to meet and to engage with companies, stakeholders and experts. Yara sees organic-based fertilisers as a growing market, coherent with performance mineral fertilisers, with sustainability benefits – but the plants' need for certain nutrients must be met to feed the world responsibly.* *Marina Ettl, Emma Burak, Yara.* |
| UNIMER | *Organo-mineral fertilisers can improve soil microbial health, plant nutrient uptake, crop yield and quality. But we need more data from crop trials. UNIMER has contributed to multi-year field trials both in Europe and worldwide.* *Esteve Casòliba Nicolás, UNIMER* |
| DCM | *DCM sells organic and organo-mineral fertilisers to professional growers and to consumers in garden centers, in Europe and worldwide. The EU FPR opens new opportunities, but also leaves challenges in this complex market..* *Karlien Vermeiren, DCM.* |
| DEN OUDEN Ferm o Feed | *Organic fertilisers and biostimulants can contribute to increasing soil organic carbon and soil health, so supporting crop climate resilience. Sharing knowledge of organic fertilisers performance characteristics with farmers is essential.* *Luuk Braam, Ferm o Feed (Den OUden Group).* |
| EBA | *The EU is world leader in biogas technology. Climate change and energy prices will drive a tenfold increase in Europe's biogas capacity in the coming decade. The trend is towards increased processing of digestates to use in organic fertilisers.* *Giulia Laura Cancian, EBA (European Biogas Association).* |

# Political context

**Oliver Sitar, European Commission, DG Agriculture,** placed SOFIE 2023 in the context of the European Commission Communication on the availability and affordability of fertilisers, November 2022 (see ESPP eNews n°72).

**The UN warned in 2022 of a global food insecurity crisis** (24th June 2022) and agricultural input cost increases are today resulting in food inflation in Europe (e.g. bread +18%, Eurostat 19th September 2022).

Natural gas prices represent over 80% of N-fertiliser production costs and Europe is also largely dependent on imports for both phosphorus and potassium. **Some 70% of Europe's 120 mineral nitrogen fertiliser production sites were not operating in September 2022**.

The European Commission strongly wants to maintain fertiliser production in Europe but has not placed sanctions on Russian fertiliser imports in order to not penalise farmers and food production.

The Commission Communication enabled Member State energy price protection for fertiliser production and specific Member State support for fertilisers and for farmers.

For the longer term, the Communication underlines the need to **move to "green" ammonia production (from renewable electricity), to improve nutrient use efficiency on farms and to develop nutrient recycling and organic-based fertilisers**.

The Common Agricultural Policy is key, in particular the Member States' Strategic Plans. 24 of these Plans include eco-measures on fertilisation and 27 include soil conservation.

Other opportunities in EU policies for organic-based fertilisers and nutrient recycling include the **link to biomethane** development (digestate upgrading to fertiliser products), the planned **Soil Health Directive** (emphasis on soil organic carbon) and **Horizon Europe** R&D funding.

**Pekka Pesonen, General Secretary, Copa Cogeca,** responded that the Commission's action to date is too much centred on mineral fertiliser, and does not sufficiently support the development of organic-based fertilisers. Nutrient recycling is key to fertiliser supply resilience and sustainability.

Europe today has sufficient food supply, thanks to our farmers, but **food inflation is a real problem**, especially for the less well off.

Copa Cogeca fully supports that food safety must be guaranteed, but considers that some current **barriers to nutrient recycling from sewage sludge, animal by-products and manure are unjustified**. Copa Cogeca calls to temporarily lift the Nitrates Directive limitation to manure nitrogen application in Nitrate Vulnerable Zones.

**Mr Pesonen strongly emphasised the "failure" of Europe to provide the financial support needed by farmers** to face rising input costs, including higher fertiliser costs. The 450M€ announced "crisis reserve" is not new money, it is moved away from existing farm support in the CAP, and the overall CAP budget is being reduced. Farmers cannot deliver more on sustainable nutrient use and recycling without more funding.

**Copa Cogeca calls for EU legislative initiatives on sewage phosphorus recycling, to develop and promote organic-based fertilisers, and to better recycle manure nutrients**. Actions needed include long-term support for farm-level investments, technology development and plant breeding.

**Jacob Hansen, Director, Fertilizers Europe**, also emphasised that fertiliser supply and agriculture are in a real crisis. Recycled nutrients and organic fertilisers can reduce EU import dependency, but mineral fertiliser inputs remain essential to ensure food production, and the EU's fertiliser industry must be saved.

The EU mineral fertiliser industry is hard hit because Russia's fertiliser exports are not sanctioned (see Politico 15/12/2022), and have increased massively (see FT 15/1/2023). Russia has increased its export tax on fertiliser (Interfax 9/1/2023), so that **EU fertiliser imports are supporting the war of aggression against Ukraine**.

Fertilizers Europe is fully supportive of nutrient recycling, and see organic fertilisers as an important route. Fertilizers Europe member companies are actively participating in SOFIE.

For Fertilizers Europe, the aim is to feed the crop. **Mineral and organic fertilisers are complementary**. The data (see table from RISE 2016) shows that Europe needs an additional c. +20 to +45% nitrogen, and an additional c. +45% phosphorus to ensure agricultural productivity, beyond that available in secondary materials.

Recycling from secondary organic materials poses important challenges, including ensuring safety and quality and logistics. The fertiliser industry has longstanding experience of recycling industrial by-products, such as sulphur from oil refining and nitrogen from caprolactam production (a widely produced chemical, used e.g. as a precursor for polyamides, see US EPA).

| | TOTAL N in stream | Recycled N | TOTAL P in stream | Recycled P |
|---|---|---|---|---|
| **Raw manure** | 7-9 | 7.1 | 1.8? | 1.75 |
| **Food chain waste** | | | | |
| Household waste | 0.5-0.7 | 0.16 | 0.11 | 0.03 |
| Slaughterhouse waste | ? | ? | 0.28 | 0.02 |
| **Sewage** | 2.3-3.1 | 0.5 | 0.32 | 0.10 |
| **Totals of these streams** | > 10-13 | >7.8 | 2.5 | 1.9 |
| **Current recycling (%)** | | **60-80%** | | **76%** |
| **Not recycled (Mt)** | | **2-5** | | **0.6** |
| **For comparison, mineral fertiliser use in crop production (Mt)** | | **10.9** | | **1.4** |
| **Not recycled nutrient as percent of mineral fertiliser** | | **18-46%** | | **43%** |

*Table from "Nutrient Recovery and Reuse (NRR) in European agriculture. A review of the issues, opportunities, and actions" RISE Foundation, 2016 (see Jacob Hansen presentation page 5)*

Secondary nutrient use efficiency can be improved both by local on-farm solutions, such as acidification of manure, which reduces ammonia losses and ensures that more N stays in the soil available to plants, and also by **developing concentrated, performance products, adapted to plant needs, to handling and spreading by farmers, and to distribution logistics**.

The mineral fertiliser industry can bring its expertise in agronomy, distribution and logistics, to work with secondary nutrient suppliers and organic fertiliser companies.

## Market & information

**Alberto Persona, S&P Global – Fertecon**, outlined how global mineral fertiliser market developments offer potential for organic fertilisers.

Fertecon effectively invented fertiliser market data and assessment based on prices from real-time deals, and is now part of S&P Global, a global data and intelligence company with over 30 000 staff.

In 2020, Covid had no significant impact on fertiliser prices, but increasing food prices from 2021 led to fertiliser price increases, further accentuated by energy prices in late 2021. Mineral fertiliser prices then increased hugely in 2022 with fears over supply from Russia and China, followed by some falling back as the EU confirmed the exclusion of Russian fertiliser exports from sanctions.

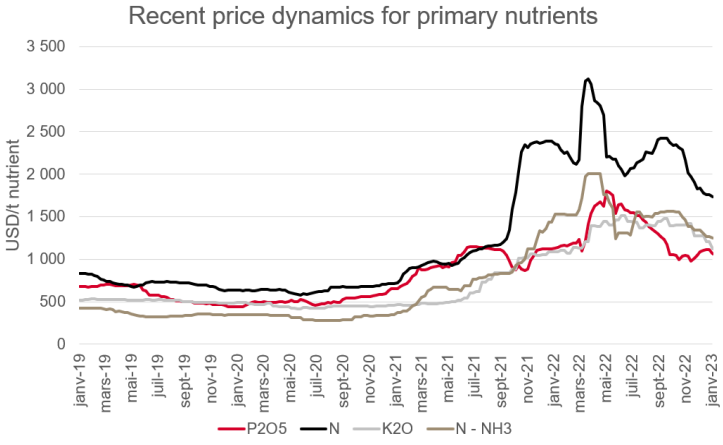
The global mineral fertiliser market is huge, with international trade of some 250 million tonnes of product per year, but **supply is highly concentrated, especially for phosphorus** (with Morocco the biggest supplier), but also for potash (Russia, Byelorussia, Canada) and to a lesser extent for nitrogen (Russia and China represent nearly one third of exports).

The EU represents around 20% of world imports for nitrogen fertilisers, and 10% for P and K.

**Policy to decrease EU import dependency should be targeted to reduce geographical concentration of imports, and to support imports from Africa where countries need investments**.

Nutrients in organic secondary resources in Europe are significant (manure, sewage, food waste …) and the biggest obstacle to their efficient agronomic reuse is **geographical disbalance, and distances between regions with high animal or human populations and regions of cropland**.

The mineral fertilisers market price for the N, P and K in manure and other secondary organic materials provides a theoretical value. However, this can only be realised if the nutrients are processed into a product adapted to farmers needs and which enables storage and delivery to the farmer where and when required.



# Operating and field experience

## Field trials in Europe: Yara

**Emma Burak, Yara**, presented initial results of field trials of organo-mineral fertilisers.

**Yara is today selling organo-mineral fertiliser in five European countries**.

This is an active element of Yara's sustainability policy, contributing to nutrient and carbon recycling.

**The trials presented, in Yorkshire, UK, on spring barley, used a pelletised organo-mineral fertiliser (OMF, 8-3-3-19) based on municipal bio-waste compost, with 45% organic matter and with 25% of nitrogen from the compost and 75% mineral nitrogen**. Mineral fertiliser (at recommended application rate 160 kgN/ha), OMF (same N application rate, but higher P) and control (no fertiliser) were trialled at six different application rates.

The first trial in 2022 showed yield with both OMF and mineral fertiliser around twice as high as control (no fertiliser). Yield with OMF was slightly lower than with the mineral fertiliser and lower tissue N suggested that the organic N was not plant-available within the first crop growth season.

However, these results may have been because 2022 was exceptionally dry, and tests suggest that the pelletised OMF required repeated wetting to disintegrate and release nutrients.

Dr. Burak concluded by suggesting that OMFs are a promising alternative to mineral fertilisers but that **there is a lack of data on N release curves from organic-based fertiliser products** in different conditions, which is needed to support farmers in defining application plans to support optimal crop yield.

*Organo-mineral fertiliser trials on spring barley in 2022*

## Field trials overseas: UNIMER

**Esteve Casòliba, UNIMER** and **Francisco Arguedas, INTA Costa Rica**, presented the UNIMER's business producing 120 000 t/y of organo-mineral fertilisers at two factories in Italy, and field trials on coffee plantations in Costa Rica.

UNIMER takes a range of secondary organic materials, which are humified, sanitised (70°C, 1 hour), combined with mineral macro-, meso- and micro-nutrients and processed to homogenous c. 6-9% humidity minipellets, gravel and granules, using for the latter a patented granulation technology. The company operates since 1969, currently employing a staff of 60 staff people.

Humic carbon is essential to maximise the organo-mineral fertiliser effectiveness. However, there is n overall **lack of metrics associated to the effective performance of organo-mineral fertilisers with crops in the field**. UNIMER has participated to date in four field trial projects: maize, wheat and hazelnuts in Italy, as well as coffee in Costa Rica.

The EU accounts for over one third of world coffee imports, establishing a coherent link between EU organo-mineral fertiliser production and coffee.

The field trial, led by Costa Rica's INTA (National Institute of Innovation and Agricultural Technology Transfer) concerns 4 000 $m^2$ in two locations. Both have high precipitation, high iron content in the soil and low organic matter after more than 50 years of coffee production. An organo-mineral complex fertiliser produced from composted poultry manure is compared to complex mineral fertiliser and no fertiliser with 2 or 3 applications per year, looking at coffee yield, soil conditions and post-harvest plant health.

*Test plot of 3 year-old Obatá coffee variety located in Tarrazú, Costa Rica, November 2018*

**Coffee yield was remarkably higher with the organo-mineral fertiliser program, exceeding by an accumulated +50%** in average, for three consecutive harvests 2018-2021, the mineral fertiliser program.

Increased harvests with 2 rather than 3 applications are probably related to change in the precipitation pattern due to climate change.

UNIMER underlines the **need for further field trial data to generate more metrics supporting the organo-mineral fertilisers' performance claims**.

## Performance processing: TEMA

**Mark Kragting, TEMA Process**, presented the company's custom-made drying – sanitisation – pelletising solutions, enabling processing of organic secondary materials and other inputs to stable, storable, transportable organic/organo-mineral fertiliser corresponding to farmers' requirements and to their spreading equipment.

The TEMA Group, with 4 000 staff worldwide and 500 million € turnover, **delivers some 50 drying/processing systems every year** to industries including biomass, minerals, chemicals and the food sector. System advantages include high efficiency, with drying and cooling in one integrated system, and resilient stainless steel construction.

In the organic fertiliser sector, TEMA has experience with manures, digestates, biomass, food waste, insect frass, etc., with drying to <10% water and pelletisation.

A number of industry customer case studies were presented:

- processing poultry manures (capacities 40 to 100 kt/y), including sanitisation, adding mineral nutrients to produce tailor-made crop specific pelletised fertilisers. Installations include Fertikal, Ferm O Feed, Veolia.

  digestate processing (capacities 40 to 100 kt/y). Electricity production from the biogas can often provide waste heat for the drying. Because input materials can vary, the process must be flexible, and must also be adaptable to produce different products according to market requirements (pellet or powder, density, nutrient contents …).

## Company showcase: Ferm O Feed

**Luuk Braam, Ferm O Feed (Den Ouden Group),** presented the company's activities, which include developing and producing organic fertilisers and biostimulants (Ferm O Feed). Den Ouden was started in 1948 and today has 300 staff. Ferm O Feed has organic fertiliser production sites in Helmond (80 000 t/y) for both solid and liquid organic fertilisers and is active in more than 75 countries worldwide.

The company is also leader in green composting in The Netherlands (13 sites, 500 000 t/y).

Climate change poses huge environmental challenges for agriculture, in particular **resilience of crops to heat, drought, high rainfall events**. Organic fertilisers can contribute to increasing soil organic carbon and soil health, so supporting crop climate resilience.

Products include organic and organo-mineral fertilisers, based on both plant and animal by-products, solid and liquid products (including fertigation, foliar), biostimulants to improve plant nutrient uptake (mycorrhiza and bacteria, amino acids, fulvic acids) and soil conditioners.

Ferm O Feed offers over twenty different organic and organo-mineral fertiliser formulations, adapted for different crops, soils and climates. The emphasis is on **accompanying farmers with knowledge and advice**, to ensure effective use of the most appropriate fertilisers accompanied by biostimulants where appropriate.

Current developments include **natural fulvic acids** recovered from drinking water treatment which can improve nutrient availability in soil and plant uptake, so are an effective complement to organic fertilisers.

Ferm O Feed sees the new EU Fertilising Products Regulation as positive for business by opening the EU market with a recognised label.

# Secondary nutrient materials

## Digestate and compost

**Verena Pfahler, German Biogas Association** (Fachband Biogas), explained that different digestates have very different nutrient contents, depending on the organic input materials.

In some cases, digestate can be used locally by farmers, but low content mean high transport costs. Liquid fraction of digestate does not achieve EU Fertilising Product Regulations PFC criteria.

A range of processes can address these obstacles, by upgrading of digestate to produce fertilising products, in particular solid/liquid separation and phosphorus recovery (P-precipitation) and nitrogen recovery (ammonia stripping).

The biogas industry sees the need to continue to develop digestate processing, in order to deliver fertilising products adapted to farmers' requirements (nutrient content) and handling (concentration).

A challenge is that studies show that consumers do not want, for example, food waste digestate, so industry needs to convince that digestates are safe. Quality Assurance Schemes (QAS) and the EU Fertilising Products Regulation can contribute to this.

**Giulia Laura Cancian, EBA (European Biogas Association),** indicated that digestate production is rapidly increasing with the ongoing fast expansion of biogas production, accelerated by the current natural gas supply crisis.

This is summarised in the EBA "Statistical Report 2022"

EBA represents some 18 000 biogas plants across Europe, with 6 billion € turnover and 220 000 jobs. Growth is currently +20%/year, with energy crop as feedstock in new biomethane plants having nearly disappeared over the last five years, and rapid increases in input from agricultural and plant residues.

**The EU objective to increase biomethane production by x10 by 2030 will be fed mainly by manure**, as well as agricultural by-products and sequential crops. This will result in high-nutrient digestates. Digestate (in the EU) is expected to contain 300 – 400 ktP/year, that is around 1/5$^{th}$ of mineral P fertiliser consumption.

Today around 2/3 of digestate is used locally on fields and only around 16% is processed to fertiliser products.

Important opportunities in the regulatory framework for digestates are expected in 2023, including the revision of the Urban Waste Water Treatment Directive (underway), the Fertilising Products Regulation (ongoing), INMAP and Soil Health Directive (expected), REDIII (renewable energy directive), Waste Framework Directive …

Expected future trends are increasing capacity of anaerobic digestion installations, to improve economics and operating efficiency. This will drive **increased processing of digestate**, as the growth in quantities and in size of installations makes local spreading more difficult.

**Irmgard Leifert, European Compost Network (ECN),** reminded that the Waste Framework Directive WFD (art. 22) requires separation of bio-waste and either recycling at source or separate collection by 31$^{st}$ December 2023. Many municipalities are not yet respecting this obligation.

"Bio-waste" is defined in the Waste Framework Directive (art.3.4) as "biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants".

The ECN data report 2022 shows that today only 17 % of municipal solid waste is separately collected and recycled through composting and anaerobic digestion. ECN suggests that to reach the EU WFD target of 65% recycling overall for all municipal waste by 2035, there is a need to double the amount of separately collected municipal bio-waste, that is to **increase bio-waste going to composting and anaerobic digestion from c. 40 Mt/y today to 80 Mt/y in 2035.**

ECN estimates quantities of nutrients in EU compost products today at around 142 Kt/y of Nitrogen, 23 Kt/y of Phosphorus and 70 Kt Potassium.

Composts vary depending on the input material, but often have low nutrient levels. Compost as such is thus generally not eligible as "Organic Fertiliser" under the EU Fertilising Products Regulation (EU FPR). Low nutrient composts will generally fit in the category "Organic Soil Improver" or can be used as a Component Material in "Growing Media" or for production of "Organo-Mineral Fertilisers".

Regulatory challenges in the EU FPR are the exclusion of "**industrial sludge**" (which could be considered to exclude some food industry waste streams) and obstacles to the recycling of animal by-products (current complete exclusion, hygienisation requirements).

**Separately collected household organic waste is classified as an Animal By-Product, so is currently excluded from input to FPR composts or digestates** (pending amendment of the ABP Regulations and of the FPR). These proposed amendments are expected to require "standard" sanitisation treatment methods as described in Annex V of EU Regulation 142/2011. These methods are not common practice for composting household or food wastes, so that most bio-waste composts will be excluded from CE-mark fertilising products. **There is a need to validate alternative transformation parameters for composting animal by-products under the Animal By-Products Regulation** to support the nutrient and carbon recycling objectives of the EU Fertilising Products Regulation and of EU Circular Economy policies.

## Insect frass: Protix

**Thijs Kapteijns, Protix**, presented organic fertilisers produced from "insect frass", the excrement from farmed insects. Frass contains relevant nutrients for plants, chitin - a natural food source for beneficial micro-organisms in soil, and organic matter.

Frass contains slow-release nitrogen and highly plant-available P and K.

Protix' Flytilizer is an example of an insect frass-based fertiliser. Flytilizer has an N-P-K ratio of 3-3-3 and contains 80% organic matter (based on 90% dry matter).

**Insect frass has an EU definition** (EU Regulation 2021/1925, see also IPIFF) which specifies quality and hygienisation criteria. Authorisation in EU Fertilising Products is pending (see ESPP eNews n°70 ABPs in FPR). Insect frass is authorised as an input to certified Organic Farming*.

** EU 2021/1165 "Dejecta of worms (vermicompost) and insect frass-substrate mixture", subject to authorisation under Animal By-Product Regulations.*

Protix has built a first industrial insect production facilities at Bergen op Zoom, The Netherlands, commissioned in 2019 and today producing over 10 000 t/y ww insect frass.

Protix is currently selling Flytilizer to organic fertiliser producers and fertiliser distributers. https://protix.eu/

## Manure

**Laia Llenas Argelaguet, BETA Technological Center** (VIC University, Spain), summarised work underway in the Horizon2020 Fertimanure project, processing manure and manure digestate to produce organic fertilising products and field testing these.

18 different products are developed, with 5 different pilot plants enabling production on-farm. Processing tested includes P-recovery from animal manure combustion ash, drying of the solid fraction of manure and use as a fertiliser, membrane treatments, freeze concentration, ammonia stripping, microalgae production, among others. The combination of different products recovered enables design of tailor-made fertilisers adapted to specific soil, climate and crop needs.

**Field tests of the resulting products show yields comparable to mineral fertilisers**, but maybe 3% lower, with comparable environmental losses from soil compared to mineral fertilisers, but lower $N_2O$ emissions for the organic-based materials.

The recovered ammonium sulphate solution (from stripping) shows to be effective as a fertiliser, but injection may be necessary to reduce ammonia losses in the field (this is already known to be the case for digestate**).** The **low concentration ammonium sulphate solutions produced** would require concentration if not used locally.

**An outstanding regulatory obstacle to market access for these products is authorisation of animal-by product derived materials** (in this case manure-derived) under the EU Fertilising Products Regulation.

## Research

**Andrea Schievano, European Commission Joint Research Centre**, summarised ongoing work reviewing literature meta-analyses relating agriculture to environment, identifying a comprehensive evidence map on organic fertilisation, but very little on "organo-mineral" fertilisers.

JRC is currently reviewing scientific literature on the links between agriculture, environment and crop production. The number of studies on use of manure or organic fertilisers has increased rapidly over the last 20 years, with over 31 000 publications identified.

**34 meta-analyses concerning organic fertilisation were selected**, after systematically screening the meta-literature, i.e. publications in which a statistical analysis combining the results of multiple scientific studies is carried out. These meta-analyses are typically based on data from hundreds of field experiments and trials.

No meta-analyses were found on "organo-mineral fertilisers", even if around 450 primary studies are potentially reporting information, after a quick search on Web of Science.

The meta-analyses generally conclude that **organic fertilisation is beneficial for soil nutrient content, soil organic carbon and soil health**, and reduces ammonia losses, as compared to mineral fertilisation. One meta-analysis suggests that organic fertilisation may negatively impact plant availability of soil nutrients and may accentuate soil methane emissions (in rice paddy fields).

The literature also suggests that higher C/N ratios in organic fertilisers correlate to lower $N_2O$ emissions, that long term (over 3 years) organic fertilisation contributes to increase crop yield, as compared to mineral fertilisation, and that soil ammonia emissions can decrease with full substitution of

mineral by organic fertilisers. In all cases, effects are highly dependent on the type of organic fertilising material, use of cover crops and other agricultural practices, soil characteristics, etc.

A recent meta-analysis of over 133 primary studies concludes that full or partial substitution of mineral by organic fertiliser can result in **c. 3.5 t $CO_{2eq}$/y/ha of carbon storage** (as net global warming potential), with around 50% of the carbon in organic fertilising materials remaining in soil for at least ten years.

**Maurice Evers, Lumbricus Research & Consultancy**, presented the soil – plant – nitrogen system, underlining that there is no "one solution" and that organic fertilisers will behave differently depending on the soil, climate, crop, humidity …

He considers that **organic fertilisers feed the organic nitrogen pool in the soil, and not directly the plant**, as plants can generally only take up mineral N (ammonium, nitrate). The organic nitrogen only becomes available to plants through microbial activity (mineralisation) in the soil.

Pot trials have shown that organic fertilising materials containing sugars (DDGS = distillers dried grains with solubles) can increase soil bacterial activity. Pot trials also show that mineral fertilisers can give a higher Nitrogen Use Efficiency within three months than tested animal- or vegetable-based organic materials. The organic fertiliser tends to result in greater root development, but this is to be expected with lower nitrogen availability.

Mr Evers concludes that it would be useful to develop a standardised **index of nitrogen release time for organic fertilisers**, to be included in communication to farmers. However, release times will also be very variable depending on temperature, soil moisture, pH.

**Harald Mikkelsen, Koppert**, discussed interactions between soil carbon storage, nutrients and soil biological activity.

The **EU lost over 60 $MtCO_2$ from land in 2019** (EEA 2022). Soil carbon loss or sequestration depends on nutrient balance and soil biology. For example, high soil nitrogen can stimulate biological activity and so in some circumstances cause soil carbon loss. Soil carbon fixation can be improved by encouraging development of mycorrhizal fungi, as plants can transfer photosynthesis-fixed carbon to fungi around roots, and the fungi uptake nutrients and water for the plant.

Case studies of **successful use of Koppert organic fertilisers in Canada and Kazakhstan** were outlined.

# Greenhouse benefits

## Carbon footprint of organic fertilisers

**Leon Fock, Eurofema**, presented carbon footprint analysis of organic fertilisers based on several different secondary input materials. This showed that carbon footprint of OFs depends mainly on the input materials, with processing representing only a minor contribution.

Eurofema was established in 2007, as a confederation of national associations of organic and organo-mineral fertiliser manufacturers, with the **aim of establishing a European market** for these products. This has been largely achieved by with the entry into application, summer 2022, of the EU Fertilising Products Regulation 2019/1009, and Eurofema is working actively on implementation of this Regulation, and on outstanding dossiers such as Animal By-Products.

A question which came out of the first SOFIE event in 2019 was: Are organic fertilisers preferable for the environment and for carbon footprint?

Analysis has been carried out by Blonk Consultants and Eurofema, using recognised LCA data bases and the **European Product Environmental Footprint (PEF) method**, comparing organic fertilisers to urea and lime. The organic fertilisers considered to be based on different input materials: manures, animal meal, plant materials (soy, agri-food by-products), minerals (Kieserite, zeolite, bentonite, lime). Carbon emissions were calculated for raw materials, transport of these materials to the fertiliser production site, drying and processing, but not for transport to the field, packing and field application.

**Transport to the fertiliser factory and drying – processing represented on average only 8% and 8% of carbon footprint**, with 84% of the footprint being from the input materials. Calculated carbon footprint of the input materials varied considerably from near zero for manures and by-products (PEF allocates emissions to meat production, not to manure) up to 4.3 $kgCO_2$-eq./kg for soy. Transport to factory and processing thus represent a higher proportion of carbon footprint (maybe 25% + 25%) for organic fertilisers based on manures or crop processing by-products.

The carbon footprint of **plant by-product or chicken manure based organo-mineral fertilisers is 0.13 – 86 $kgCO_2$-eq./kg., that is around 12 - 82% of a 14-6-8 mineral fertiliser**.

This calculation could be improved by adjusting the results per kg of nutrient rather than kg-product (or by field application ratios), by integrating packaging and transport to the field and spreading, including possible impacts on greenhouse gas emissions from soils, carbon storage in soils and possible greenhouse compensation in some input materials.

## CCm

**Peter Hammond, CCm**, presented the company's carbon fixation technology, which combines offgas $CO_2$ with digestate to stabilise nitrogen and produce a dry, pelletised organo-mineral fertiliser (see ESPP-NNP-DPP Technology Catalogue).

CCm was set up as a carbon-fixing technology for food industry companies wishing to reduce their greenhouse emissions. The process combines $CO_2$ with ammonia stripped from digestate, fixing carbon as carbonate and stabilising the nitrogen. **This can address the problem of how to produce a useable product from dilute ammonia stripping solutions**. This is then combined with stable organics from digestate cake, chalk (to enhance carbon stability), other nutrients (including recovered phosphates), then dried and pelletised to produce an organo-mineral fertiliser.

As inputs, the process requires digestate and secondary heat, e.g. from electricity production from biogas

**CCm is currently producing 15 000 t/y of organo-mineral fertiliser** from their own plants. Production will double in 2023 and will include a full-scale unit at a Walkers (Pepsico) potato processing plant.

Field trials of the fertiliser product have been ongoing for a decade, with over 100 farmers. **These show increased yield with lower N application rates compared to mineral fertilisers. Around 90% of nitrogen is crop-available within two weeks and the rest is slowly available**. Handling is fully compatible with 36m spinning-disc spreaders and has been tested with eight different spreader brands. Trials also show slower nutrient leaching, reduced atmospheric N loss, increased soil biological activity and long-term soil carbon sequestration.

The physical structure of the product pellets, which depends on fibres in the digestate cake (and so on the digester input), impacts the nutrient release pattern.

# Regulatory developments

## The EU Fertilising Products Regulation moves ahead

**Ana-Lucia Crisan, European Commission DG GROW**, explained that the EU Fertilising Products Regulation 2019/1009 (FPR) is applicable since summer 2022, and creates an EU market for Organic and Organo-Mineral Fertilisers. A key objective of this new Regulation is to facilitate the Circular Economy.

The **importance of nutrient recycling** was further underlined in the European Commission Communication on fertiliser on the availability and affordability of fertilisers, see Oliver Sitar's presentation above.

**Important amendments have already been integrated into the EU FPR since its adoption, and are now applicable**, in particular the 'STRUBIAS' criteria (CMCs12-14) for precipitated phosphates, ash-based materials, biochars and pyrolysis materials, certain recovered minerals (which can include ammonia recovery from digestates, CMC15). Adopted amendments on by-products (CMC11) and "post-processing of digestates (modification of CMC5) are not yet included into the consolidated Regulation text online and can be found here and here is there a better link ???). These are all now integrated in the published "consolidated" FPR text here.

Further amendments are currently under discussion, in particular concerning use of **certain Animal By-Products** in CMC10, and also in composts, digestates, biochars, etc.

Other development work underway includes on **digital labelling** (draft amendment expected in coming months), biodegradability criteria for polymers (fertiliser coatings, mulches …).

The Commission will **continue to consider inclusion of further materials into CMCs**, where justified by potentially significant EU trade. A first selection of possible candidate CMCs is underway following the stakeholder survey last September (see ESPP eNews n°70) and further proposals can continue to be submitted. This process will take however years rather than months for new materials, because of the need of a safety and agronomic value assessment. Modifications to existing CMCs may be faster if justified, as was the case for "post-processing" of digestates.

Considerable work is underway with CEN to develop EU standards to accompany implementation of the FPR. CEN already published 82 new Technical Specifications for fertilising products in 2022 (here). However, it is important to underline that **harmonised EU standards are not mandatory**, certification can be based on other appropriate methods, in particular where EU standards are not yet available.

The Commission has developed considerable guidance material to support companies, certification bodies (Notified Bodies) and Member States. These include the Frequently Asked Questions document (which is regularly completed and updated here), published Guidance on Labelling (here).

Guidance on Technical Document to be provided for and archived for certification is now also under development, see below.

**Laura Van Schöoll, NMI** (Nutrient Management Institute, The Netherlands), is leading development of Guidance on Technical Documentation for the FPR, under contract from DG GROW.

This technical documentation must be developed to support manufacturers in establishing the mandatory technical documentation for the **conformity assessment** and **must justify fulfilment of all applicable claims and criteria:** input materials (CMCs), product functions (PFCs), labelling. This must provide proof that all steps of conformity assessment have been appropriately carried and can include, e.g.: product, process and input material descriptions, justification of product claims, REACH, test and analysis reports, list of standards and test methods used, copy of label information …

The objective is to develop guidance in the form of a template, including links to relevant EU and other standards, list of all documents required for every PFC-CMC-Modules, a list of standards than can be used, and a **simple IT tool** to generate a product-specific list of all documents required for the Technical Documentation.

The Guidance is also intended to document a common understanding of the requirements set by the FPR and thus ensure a smooth transition and uniform implementation.

## Linking the EU FPR and national regulations

**Finbarr O'Regan, Ireland, Department of Agriculture, Food and Marine**, discussed the questions posed both to the national regulator and to companies in Ireland by divergences between the new EU FPR and existing national regulations.

Ireland's 1955 fertilisers legislation covers mineral, organo-mineral and organic fertilisers (the latter under "low nutrient") and there have been no safety concerns to date with these products. Before the FPR, the EU 2003/2003 regulation covered only mineral fertilisers, whereas the new FPR has significant overlap and divergences from the Ireland national legislation. Ireland therefore is working to update its national legislation, with the aim of ensuring coherence with the FPR whilst also **continuing to allow in Ireland products which are already on the market but may not meet the criteria in the FPR as yet** (for example some composts). The aim is to translate all FPR contaminant safety limits into Ireland's legislation as minimum requirements.

A national stakeholder consultation is currently underway in Ireland to update national compost standards.

**Ireland will also continue to apply "Mutual Recognition"** to national fertilisers from other Member States, because EU law (Regulation 2019/515 authorises refusal only for "good reason).

Products entering Ireland from the UK now also have to meet either FPR or Ireland national requirements.

An ongoing challenge is that fertilising regulations, and in particular any recycling of secondary materials, **involve many branches of national regulatory authorities** and not only fertilisers: REACH, veterinary medicines, environment (End of Waste), compost – digestate, national standards organisations, explosives precursors (Dept. of Justice), local/regional regulators … For example, national fertilisers regulations include restrictions to use for products derived from certain materials (animal by-products, sewage …), implemented by the Environment Agency (e.g. not for use on grazing or fodder crop land). The FPR does not allow for restrictions to use.

Currently Ireland has a limited list of fertilising products authorised on the market. Ireland is in the process of developing a National Fertiliser Database which will track fertilisers from import to end user and will include a catalogue of products on the market in Ireland. This is not a product register which could be seen as a "barrier to trade" but a list to facilitate accurate recording of the products path from import to end user.

These questions underline the interest of **exchange of information and coordination between Member State fertiliser regulatory authorities**, and the aim is to energise this through the EU AdCo (Administrative Cooperation Group of Member State market surveillance authorities).

**Murray Smedley, Barkwith Associates**, provided the viewpoint of an advisory company, active since 2002 in fertilisers, plant protection, biostimulants, CLP and REACH. He underlined that organic fertiliser producers need to plan ahead, to prepare information and documentation necessary for FPR certification and for other applicable regulations.

Barkwith Associates is **already providing support and regulatory advice on FPR** self-certification, interactions with Notified Bodies, identification of FPR category eligibility for products and materials (PFCs, CMCs), testing, labelling and documentation.

He summarised a number of **practical case-studies of questions facing companies** looking to obtain EU fertilising product certification:

- testing, contaminants and chemistry: what test method to use? Can testing be in-house or what requirements for external labs? How to identify labs with relevant expertise?
- Specifically for organic and organo-mineral fertilisers: further clarity is required for a number of requirements including the determination of organic carbon"

- How to address variability in input materials and in the product placed on the market?
- Labelling and suppliers: how to specify raw materials on the label? Input material information: SDS or equivalent (Safety Data Sheet)? REACH documentation of registration for use in fertilising products?
- How to ensure and document accurate production and packaging records?
- Interpretation and implementation of definitions in CMCs and PFCs.

To prepare certification and optimise future inclusion of their products under the FPR, organic fertiliser producers particularly need to define company strategies and implementation plans for **raw material sourcing and supplier documentation, product function claims and impacts on labels and on product marketing, product consistency and quality processes, suitable packaging**.

**Concerning the UK**, Mr Smedley notes that from January 2023 the transition period for adoption of EC Regulation 2003/2003 into UK Regulation ends and declarations must state 'UK Fertiliser'. The UK Authority (DEFRA) is reviewing the progress of the FPR in EU and may consider adoption – in full or part – in due course.

## Certification organisations (Notified Bodies)

NOTE: a fertiliser producer or importer can contract certification with a Notified Body in any EU Member State: there is no obligation to use a Notified Body in the producer country.

**Giel Tettelaar, EFCI, The Netherlands**, explained how Module B of FPR Conformity Assessment functions in practice. This Module enables certification on the basis of documentation provided by the fertiliser producer to the Notified Body, without requirement of onsite audits.

**Module B is applicable only under certain conditions** to organic and organo-mineral fertilisers which are not derived from waste materials, certain by-products, or animal by-products.

**Documents required for Module B certification** include test reports (e.g. required nutrients, contaminants, pathogens …), dossier justifying that each input material used respects CMC criteria and test reports for applicable CMC criteria, specifications of manufacturing process, example of label.

EFCI aims to be pragmatic in the certification procedure. An outline list of required documents is provided to customers, as a function of the PFCs/CMCs concerned. If documents submitted are incomplete or inadequate, then further documents can be submitted.

The CE certificate delivered is put publicly online and is valid for 3 or 5 years. However, **under Module B the fertiliser producer has the obligation to inform the certification body of any modification** (change of material supplier or of input materials, of process, of form of product, of colour, of label …). Updating of the CE certificate following a change may be free or may require reassessment. An option to avoid such updates for companies with many similar products or frequent small changes in supply and input materials can be to use Module D1 (see below) rather than Module B.

Module B certification with EFCI can take only a few weeks if documentation is complete as initially submitted, with a cost of hundreds to a few thousand Euros depending on the complexity.

**Dorottya Lõrincz, CerTrust, Hungary**, outlined Module D1 certification, which is applicable to any EU fertilising product containing waste-derived or animal by-product-derived inputs (CMCs 3, 5, 12, 13, 14, 15). Module D1 may also be a good option for companies which already have a quality assurance system in place, or which have many different or new products (e.g. tailor made products for different clients).

**CerTrust is accredited for the full scope of the FPR** and offers FPR certification services to fertilisers producers anywhere in Europe.

CerTrust underlines the need to **design products (inputs, process, product characteristics) to comply with the FPR**. If a product is FPR compliant, then certification will also require particular attention to technical documentation and labelling.

As a Notified Body, CerTrust can also audit and certify a company's **quality assurance system** (certificate valid 3 years). The quality assurance system is preferably, but not obligatory, ISO 9001. ISO 9001 is more targeted towards customer satisfaction, but also delivers all FPR requirements. ISO 9001 certification does not exempt from FPR certification, but the two certifications can be done together.

For FPR certifications, CerTrust provides an initial application form which requests information and documentation on CMCs used and quantities, production plants, testing laboratories, and on the quality assurance system. This questionnaire is used to require the **on-site audit, obligatory in Module D1**.

**The audit will cover not only the company placing the fertilising product on the market, but also all production plants, and plants producing CMCs used in the product (only for CMC 3, 5, 12, 13, 14, 15 materials, which are obligated to module D1)**. Where module D1 has been chosen

because of large number of products, but doesn't contain any of the cited CMCs, then "only" the final product manufacturing plant will be audited. This has cost implications. These plants must therefore also have quality assurance systems. The contract between the fertiliser producer and input material suppliers must ensure FPR obligations.

The CE certificate is valid 3 years, but with obligatory verification audits after 1 and 2 years.

Cost will vary depending on the complexity of the product, the quality assurance scheme in place, the number of product and input material production plants concerned.

## Company viewpoint: DCM

**Karlien Vermeiren, DCM**, presented the company's perspective on the EU Fertilising Products Regulation. The company welcomes the FPR as opening the European market (one certification for a product is valid across Europe) but notes that it brings new complexities and costs, and that aspects of implementation are yet to be finalised.

DCM sells organic and organo-mineral fertilisers to professional growers and to consumers via garden centres, in Europe and worldwide. The EU FPR opens new opportunities, but also leaves challenges in this complex market.

**The key advantage of the FPR is that a CE-certified product can be sold anywhere in Europe**, without the obstacles of mutual recognition and national dossiers. However, specific national use restrictions may nonetheless apply.

The Regulation also facilitates use of circular economy inputs in organic fertilisers.

On the other hand, **the FPR requires a technical dossier for each product**, which will imply significantly more compilation and maintenance.

Under the FPR, organic and organo-mineral fertilisers require Module B or D1, that is certification by a Notified Body, implying **significant certification costs**. The number of Notified Bodies is still today small, and most do not cover all conformity assessment modules, or not all PFCs/CMCs.

Significant market problems are posed by the inclusion of products with low levels of nutrients in the FPR PFC "Organic Fertilisers". This will disadvantage higher nutrient products. Therefore, **DCM would like to see a legally defined labelling category of "high nutrient" or "concentrated" Organic Fertilisers** in order to distinguish for customers in the shop between products with a high nutrient content and those with a lower nutrient content. Today, according to FPR they are all named as organic fertilisers. This would be comparable to the labelling category "Mineral fertiliser" for "Inorganic Fertilisers" with < 1% $C_{-org}$.

The FPR certification rules (e.g., for private labels) and labelling requirements require to make recipes more transparent to customers, which can mean losing proprietary know-how. An extra challenge is mixing organic fertilisers in growing media, because of FPR rules for "Blends". This will result in (tailor-made) products sold under national fertiliser regulation.

Outstanding challenges to implementation for companies include the non-inclusion to date of animal by-product derived materials under the FPR, that harmonised standards are not yet available for testing for a number of FPR criteria, and the limited number of operational Notified Bodies for certification.

## Posters

### *N2 Applied*

**The N2 Applied on-farm manure or digestate plasma treatment system both enriches nitrate N and stabilises ammonia**, by lowering pH, producing "NEO", a stabilised, storable, liquid fertiliser for local application. This prevents ammonia loss and reduces methane emissions during storage and application, and improves N uptake by crops. The poster shows field results for changes in nitrogen compounds, methane and ammonia loss reductions and crop nitrogen yield.

*On-farm plasma treatment of livestock slurry and digestate produces nitrogen fertiliser while reducing environmental emissions. Kenny L. Brown, H. Aarts, M. Nyvold (N2 Applied). https://n2applied.com Contact: kenny.brown@n2.no*

### *Fertira*

**Fertira produces organic fertilisers for professional use (Orgamé brand) and for retail**, offering customised service with a strong sustainability objective: the company indicates that 95% of raw materials are renewable, production is powered 100% by green energy and all fertiliser products are carbon neutral.

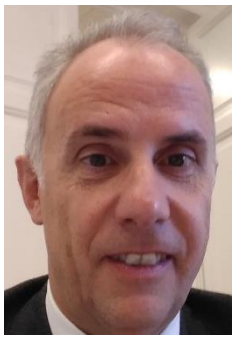
*Fertira – Premium Organic Fertilisers. Isabel Ranschaert www.fertira.com*

## Field-testing CCm's product

**Evaluating efficacy of carbon capture based organo-mineral fertilisers (OMF) to meet crop demands.** The organic fertiliser produced by CCm from potato processing waste (see in this SCOPE Newsletter) was field trialled on oilseed rape and spring barley in the UK. At all application rates tested the CCM recycled organic fertiliser showed significantly better yields than control (no fertiliser) and produced yields comparable to synthetic mineral fertiliser.

*Evaluating efficacy of carbon capture based organo-mineral fertilisers (OMF) to meet crop demands. Theodore Welby, Ruben Sakrabani, Nick Girkin (Cranfield University). www.cranfield.ac.uk/environment-and-agrifood Contact: r.sakrabani@cranfield.ac.uk*

## RecOrgFert PLUS (SBS)



**SBS Steel Belt Systems manufactures turn-key production lines, modular and scalable up to 20 000 t/y**. SBS already operates a pilot plant producing mineral-organic fertilisers from sulphur and agriculture-waste. This patented mineral-organic fertiliser can re-introduce organic components into soil.


*SBS machine for fertiliser production www.steelbeltsystems.com*

*RecOrgFert PLUS: the mineral-organic fertilizer to reverse desertification. Antonio Scialletti (SBS Steel Belt Systems SRL). www.life-recorgfertplus.eu/it/ Contact: AS@steelbeltsystems.it*

## 5R Refinery project

**New possibilities in manufacturing recycled fertilisers in Finland.** The 5R Refinery project focuses on potential for use of secondary materials in organic fertiliser production in Finland, looking at waste and side streams from forest industry (ashes, green liquor dregs, secondary sludge and primary sludge), municipal sewage sludge, dredged lake sediments. Data is collected from literature and previous studies and new laboratory analyses are carried out, including on potential resource quantity, current uses, analysis of physico-chemical properties, nutrients, contaminants.

*Mari Eronen, Mikko Rahtola - LAB University of Applied Sciences, LUT University, Natural Resources Institute Finland, Weeefiner, Nanopar, Biolan, Roxia, Versowood, Stora Enso, Metso Fibre, Kiilto Clean, City of Lappeenranta and City of Heinola. https://www.lab.fi/en/project/5r-refinery Contact: mikko.rahtola@lab.fi*

## Acidification of slurry and digestate

**Impacts on ammonia emissions and crop available nitrogen supply of acidification of pig slurry and digestate was field tested** near Mansfield, UK, for spring and autumn application (180 kgN/ha) to winter wheat. Acidification by addition of sulphuric acid to reduce pH from 7.1 to 6.3 resulted in reductions in ammonia emission of 25-35% and c. 75% when was reduced from >7.5 to 5.5. Acidification increased the fertiliser replacement value of spring slurry and digestate applications from c.25% to 50% of total N applied. These results confirm again the interest of manure and digestate acidification which is recognised as EU BAT.

*James Dowers, Ryan Higginbotham, John Williams (ADAS), David Chadwick (Bangor University), Tom Misselbrook (Rothamsted, North Wyke). Contact: john.williams@adas.co.uk*

## INPORR project

**Technologies for N and P recovery from wastewater *vs.* market readiness for the product reuse**. Assessment is underway of market readiness, commercialisation barriers, knowledge gaps and future research needs for wider upscaling of nutrient recovery (N, P) as fertilisers from wastewater. Analysis is looking at impacts on wastewater treatment plants' operation, product safety and user confidence, logistics of storage and transport, handling by farmers, agronomic performance, price, and life cycle analysis. A summary of identified challenges and the way forward is provided.

*Śniatała Bogna, Sobotka Dominika, Mąkinia Jacek, Gdansk University of Technology. https://wilis.pg.edu.pl/en/inporr bogna.sniatala@pg.edu.pl*

## Novafert project

**Novafert (Horizon 2020) aims to demonstrate nutrient recovery and recycling to fertilisers,** from 6 different waste streams and production of 25+ different inorganic and mineral fertilising products (photos below). Technical, economic, and environmental feasibility and safe use will be assessed, including operating demonstration sites and field testing of the fertilising products.

*Novel procedures and sustainable guidelines to enhance the use of alternative fertilisers. Dónal Kinsella and Novafert project team https://www.linkedin.com/company/novafert/*

## Susfert project

*Susfert project partners: Marc Spiller, University of Antwerp, and Mikael Muegge, RTDS (left), fertiliser granules (right)*

**Susfert (EU Horizon2020 BBI) aims to develop more sustainable and multifunctional fertilisers** for phosphorus and iron by combining bio-based and biodegradable coatings for controlled release, probiotics to increase nutrient availability, recovered struvite- and lignosulphonate-based "nutrigels". Bio-based lignosulphonates were used to coat calcium carbonates, to validate their potential as fertiliser coatings. Lignosulphonates have agronomic interest because of their capacity to chelate metal ions. Bio-based glycerol, xylitol and sorbitol showed to be effective plasticisers, preventing brittleness and breakage of the coatings. Micro-organisms integrated into the coating showed viability and the granules did not inhibit germination and growth of various crop plants in pot trials. Initial field trials showed promising results in potatoes. Further field trials are underway on turf, potato, and tomato plants.

*Design of biobased and bioactive fertilizer coatings. Renate Weiß and Susfert team. www.susfert.eu*

## WalNUT project

**WalNUT (Horizon 2020) aims to develop nutrient recovery and recycling from municipal wastewater and brine.** Struvite precipitation and ammonia stripping/scrubbing to ammonia solution will be tested in sewage sludge digestate at five municipal sewage works. The ammonia solution will be dried to a salt. Pot and field rials will test the fertiliser value of the ammonia salt, struvite, and combinations of these with biostimulant bacteria (Plant Growth Bacteria).

*Struvite pilot plant*

*Closing wastewater cycles for nutrient recovery. WalNUT. G. Noriega-Hevia, A. Mayor, A. González-Míguez, A. Sánchez, L. Rodríguez, C.M. Castro-Barros www.walnutproject.eu*

## Hydrothermal carbonisation

**Phosphate precipitation after HTC (hydrothermal carbonisation) of food waste, sewage sludge and swine manure** was tested at the lab scale at three temperatures (180, 210, 230°C), with and without acidification (HCl-assisted HTC) for 1h. Acidification enabled to increase the P content in liquid phase (rather than in the solid hydrochar) from 5-30% to up to 90% (HTC with acidification at 210°C). Phosphate precipitation

was carried out by increasing the pH to 9 and dosing MgCl. The precipitated phosphate species were a mixture of struvite and calcium phosphates, with reduced organic matter and metal content. Microbiological test of the process water showed that the hydrothermal treatment destroyed pathogenic microorganisms.

*Struvite from sewage sludge (left) and food waste (right)*

*Optimizing nutrient recovery by hydrothermal carbonization of biomass waste.* Ricardo Paúl Ipiales, *A. Sarrión, E. Diaz, A.F. Mohedano, M.A. de la Rubia.* https://wastevalue.es/, https://www.arquimea.com/ *Contact:* pipiales@arquimea.com

## *Nutrient Recycling Community*

**The Nutrient Recycling Community is a platform to exchange information between projects on nutrient recycling**. The Community is an initiative of Biorefine Cluster and Fertimanure project. It aims to facilitate exchange of knowledge and good practice and organise joint initiatives between R&D projects, share common research methodologies, and organise physical events (ESNI conference, summer schools). The Community has five working groups: Technologies for nutrient recovery, Agronomic performance of recycled fertiliser products, Sustainability assessment & LCA, Policy, and new business models for recycled fertilisers. Focus webinars are organised on specific themes such as on algae production, membrane systems, or ammonia stripping – scrubbing.

*Ana Robles Aguilar, Nagore Guerra Gorostegi, Nimisha Edayilam, Margherita Genua, Erik Meers, Laia Llenas Argelaguet.* www.biorefine.eu *Contact:* ana.robles@uvic.cat

# ESPP members

# Stands