How to boost bio-based fertilisers (BBFs) in the European market

A Joint Position Paper of the 5 RUR08 Sister projects

Contemporary agricultural operations and business outcomes greatly affect production expenditures, particularly within the fertiliser pricing structure. Key determinants, such as the Russia-Ukraine conflict and previous global events, have led to disruptions in vital sectors like food crops and fertiliser production and trade. Fertiliser prices, already historically high, surged since late 2020, fuelled by factors including the rebound from COVID-19 lockdowns, shipping disruptions, increased natural gas supply prices, and fuel costs. The combination of these factors raised immediate fears of a fertiliser shortfall, prompting import-dependent countries to seek alternatives in a tight global market. With about three-quarters of nations importing over 50 % of their fertilisers, resulting trade shocks amplified global concerns about food security.

While contending with recent fluctuations and a persistent decline in fertiliser prices since early 2022, the current situation is similar to before the beginning of 2020 and uncertainties continue to cast a shadow over both mineral and BBFs in Europe. Europe heavily relies on importing substantial quantities of natural gas to manufacture nitrogen fertilisers. Additionally, it must source nearly all its phosphate rock from globally limited and finite reserves to produce phosphate fertilisers. This emphasizes the pressing need for nutrient recycling from waste streams and the production of economically valuable BBFs in the market. Ongoing uncertainties persist for both mineral and BBFs, further complicated by the lack of clarity in prices. The fluctuating and unpredictable nature of prices adds a layer of complexity to the challenges faced by these fertilisers in the current market conditions.

*Considering the above, this position paper emphasizes the need for a clearer and more stable definition of BBF prices, advocating for financial mechanisms and stakeholder engagement. Initiatives like the 5 projects funded in the CE-**RUR-08**-2018-2019-2020 topic underscore the importance of collaborative efforts in successfully adopting newly produced fertilisers from secondary sources.*

1. Definition of prices for BBFs

The process of defining the prices of BBFs or finding relevant information on the market is extremely complex since the products are highly variable depending on the input streams and/or technologies used, streams or regions connected to seasonality issues, and trying to reach the competitiveness of the products compared to the mineral fertiliser market.

Market dynamics, encompassing demand-supply trends and competitive strategies, exert a significant influence on pricing decisions. Furthermore, innovative technologies to recover nutrients from waste streams come with increased investment and operative costs, leading to their higher costs compared to mineral ones. To overcome this important obstacle and achieve a better adoption of newly produced products on the market, it is crucial to ensure input from relevant stakeholders. Engaging over 1,500 stakeholders in the FERTIMANURE and SEA2LAND project, through questionnaires, SWOT analysis, and brainstorm sessions provided extensive input on diverse perspectives, stakeholders' attitudes and decision-making processes when purchasing new types of BBFs. It also aided in conducting a comprehensive risk analysis, contributing to a more resilient and impactful approach to the development and implementation of BBFs.

The interactive communication with multiple stakeholder groups concluded that the price is important, but it is not decisive for the purchase of fertilisers. Based on this conclusion and considering that fertilisation is one of the biggest operations costs for farmers and that BBF's price should correlate to

the price of mineral fertilisers, the FERTIMANURE and SEEA2LAND projects investigated how much farmers nowadays spend on fertilisation. The average fertiliser costs per farm differ over different regions or farm types but most respondents spend 200 – 500 EUR on annual fertilisation application per hectare.

In both projects, it was concluded that price is more important than the content of organic matter. However, when the price is compared with the risk of infection of diseases or nutrient release speed, stakeholders believe that these parameters are more important than how much the product costs.

Compared to mineral fertilisers, the cost of BBFs usually are higher due to the use of advanced technologies in their production processes Another reason is related to complex optimization processes. BBFs production is often carried out on a smaller scale compared to the large-scale, highly efficient operations of mineral fertiliser production. Limited production scale can result in higher per-unit costs for BBFs, as economies of scale may not be fully realized. Another factor contributing to the higher prices could be the research and development costs associated with the continuous improvement of formulations, technologies, and processes. Ongoing efforts to enhance the effectiveness and environmental sustainability may result in added expenses that contribute to BBFs overall cost.

Determining an exact percentage difference in cost between BBFs and standard fertilisers can be challenging, as it varies depending on specific formulations, production methods and regional factors. However, it's commonly observed that BBFs tend to be generally more expensive, with cost differentials often falling within the range of 20-50 % higher than mineral ones.

In conclusion, the interactive communication with various stakeholder groups underscores the importance of transparency in establishing a fair BBF market. Regular updates on pricing and product availability, reflecting actual market dynamics, are deemed crucial for boosting the adoption of novel BBF products. Furthermore, stakeholders believe that BBFs can potentially reduce mineral fertilisation costs since organic fertilisers will compete with mineral fertilisers causing the fertiliser producers to reduce price of their products, while enhancing soil organic matter and nutrient content. An additional segment could be a connection of BBFs price to the carbon content (connection to AgETS) to boost sustainable agri-businesses. Aligning with the European Commission's initiative on pricing agricultural emissions and incentivizing climate-friendly practices, integrating carbon pricing mechanisms within the BBF market could further encourage the adoption of environmentally sustainable agricultural practices, fostering a more resilient and climate-conscious agri-food value chain.

2. BBFs database for end-user accessibility

To overcome issues and enhance market transparency, a key recommendation is to establish a comprehensive database that would serve as the centralized repository for BBF information at the EU level, offering a strategic solution for market acceptance. The problem that would be also able to be solved is related to data that are not categorized and summarized. Therefore, the advice is to implement, and accurately update this information in both, the EU Fertilisers market observatory database and via the CAP programme.

The creation of such a database that is a part of the CAP obligatory advisory criteria and that is therefore implemented across all EU Member States is a tangible and proactive measure that addresses the current lack of clarity in the BBF landscape. By systematically cataloguing and organizing information on BBFs availability, quality, quantity and information market prices, the database becomes

a valuable resource for both producers and consumers. It not only aids in avoiding data redundancy but also provides a clear overview of the diversity and distribution of BBFs across different regions of Europe.

Importantly, this centralized database acts as a catalyst for market growth, paving the way for increased demand for BBFs. A well-informed market, supported by accurate and readily accessible data, fosters confidence among stakeholders, contributing to a more robust and sustainable BBF industry. In the long term, the establishment of such a database can play a huge role in reducing the dependency on subsidy systems, as heightened demand naturally emerges when stakeholders are empowered with knowledge about the types and availability of BBFs throughout Europe.

3. Sustainable farming incentives – BBFs subsidy practice

The production of new BBFs encounters substantial challenges in terms of economic profitability and sustainability. Achieving successful production of high-quality BBFs, competitive with traditional mineral fertilisers, demands a well-equipped production plant with all necessary pre- and post-treatments, to increase the quality and purity of products which leads to higher market price. However, the entire production cycle, along with the accompanying parts, proves to be economically burdensome, making it unattainable for the average farmer.

Economic analyses reveal negative basic profitability and return on investment, lacking economic justification for the establishment of BBF production. Further assessments present three potential avenues. Firstly, increasing input volume, specifically in the form of manure, seems promising for enhanced production and product volume, leading to higher earnings and investment returns. However, this option proves unrealistic and unsustainable, as illustrated by the example of biochar production in the German pilot plant. This plant achieves farm figures of 700-800 livestock, necessary for making the production economically viable. When comparing these figures with the average size of a livestock farm in Europe, approximately 55 heads, it becomes evident that this option is unrealistic.

The second option, an unrealistic increase in prices to make the investment profitable at the average farm level, suggests prices reaching several thousand euros per ton. Such prices, however, are not viable in the market.

The third and most pragmatic option entails subsidizing production, with a key emphasis on fostering a greener CO_2 footprint. By subsidizing BBFs, a superior carbon footprint is actively promoted through the production of nutrient-rich products with a high nutrient fertiliser replacement value. In general, calculations highlight that a subsidy per ton of input manure renders the investment profitable, ensuring favourable returns and a payback period within a framework conducive to cultivating positive farmer engagement. The considerable disparities between unsubsidized and subsidized production underscore the critical role of financial support, with the potential for a return on investment of up to 20 %. This not only positively influences the farmer's perspective but also underscores that subsidies offer a practical avenue for ecologically beneficial BBF production to achieve financial sustainability, thereby facilitating their implementation with a heightened focus on reducing the overall CO_2 impact.

Recognizing that the market may not be fully prepared for the pricing dynamics of BBFs, it is crucial to address this challenge through financial mechanisms, potentially in the form of subsidies. These subsidies play a crucial role in facilitating the market's transition to sustainable practices, making BBFs more economically viable and accessible. ***Some recommendations for subsidies to support BBF usage/production:***

- Design subsidies that would target the input costs associated with BBF production, specifically focusing on materials like **manure**. Providing financial assistance **on a per-ton basis** for produced BBFs can significantly contribute to making the overall production **economically viable.** To effectively gauge demand and assess the necessity for occasional or permanent subsidies, it is imperative to ensure a sufficient program period. It is a recommendation to support the development of the BBF sector within the existing and next CAP programming period and based on the outcomes of the support mechanisms to decide how to continue with the incentives.
- Offer grants or subsidies to farmers and industries adopting **innovative and sustainable technologies in BBF production.** This can include support for the purchase and installation of efficient processing equipment, anaerobic digesters, and other essential components required for high-quality BBF production.
- Secure payment for **not mining and increase the lifetime of finite/scarce reserves (P).**
- Introduce subsidies that incentivize **collaboration and knowledge-sharing** within the BBF production sector. Supporting **joint initiatives and partnerships** can lead to shared resources, reduced costs, and improved overall efficiency in the industry.
- Subsidies should be **embedded in existing structures** such as CAP and ETS. In the CAP, environmental services can be directly compensated on a per-hectare basis, e.g. the use of biobased products could be directly supported. Also, the CAP allows to adapt of subsidies to specific national interests.
- For **CO_2 credits**, agriculture needs to be included in the ETS. If included, farmers could be entitled to **receive carbon credits** for long-term sequestration and storage of carbon in soils, e.g., by use of biochar. Yet, credit systems need to consider potential trade-offs for carbon storage.

By implementing a comprehensive set of subsidies that address various aspects of BBF production, from input costs to market development, policymakers can create a supportive environment conducive to economic sustainability and widespread adoption of BBFs. It is crucial to carefully select the criteria for receiving subsidies. It's imperative to incorporate sustainable energy-nutritional technological solutions while ensuring alignment with regional laws. This entails devising selection criteria that not only prioritize economic viability but also promote environmentally friendly practices and nutritional value. By integrating sustainable energy solutions and adhering to regional regulations, the subsidy framework can effectively support the advancement of bio-based fertiliser production while fostering ecological sustainability and compliance with legal requirements.

In conclusion, despite the complexity of establishing prices for BBFs, ensuring consistent updates on pricing and product availability aligned with market dynamics is essential for encouraging widespread adoption. The evolving interests of end users emphasize the need for ongoing efforts to raise awareness, facilitated by a centralized database and potential subsidies.

This approach guarantees an upsurge in both the application and production of novel products, contributing significantly to reducing reliance on mineral fertilisers and positively impacting the environment.

4. References and Relevant Documents

[1] https://www.ifpri.org/blog/russia-ukraine-war-after-year-impacts-fertilizer-production-prices-and-trade-flows

[2] https://www.ers.usda.gov/amber-waves/2023/september/global-fertilizer-market-challenged-by-russia-s-invasion-of-ukraine/

[3] Fertiliser market overview

[4] FERTIMANURE Business plans and business models (Deliverable 6.4)

[5] FERTIMANURE Inventory of Stakeholder Groups (Deliverable 6.3)

[6] FERTIMANURE Report on the Market Landscape Analysis and End-user Preferences in the Project-Participating EU States (Deliverable 1.2)

[7] FERTIMANURE SWOT analysis and Specially designed questionnaire (Task 6.3 Market analysis for new BBFs and TMFs and Task 6.4 SWOT analysis)

[8] SEA2LAND Inventory of Stakeholder Groups (Deliverable 8.1)

[9] SEA2LAND Questionnaire on the production and market uptake of BBFs from fishing by-products (Task 8.2 Market analysis)

ANNEX. Complementary information for justification of the statements made in the position paper.

A.1. List of BBFs in different sister projects

FERTIMANURE *(list of tested BBFs)*	
FERTIMANURE	• *Mineral fertilisers: Ammonium-based fertilisers: ammonium sulphate, ammonium nitrate and ammonium water; and phosphorus-based fertilisers: phosphorus-rich ashes and phosphoric acid* • *Organo-mineral fertilisers: nutrient (NPK) rich concentrate, K-rich liquid fertiliser* • *Organic fertiliser: P rich fertiliser* • *Organic amendments: soil conditioner, phosphorus and potassium-rich biochars from different feedstocks and technologies, biodried organic amendment* • *Amino acid-based biostimulants* • *More added-value products: on-farm and centralised TMFs, biologically activated BBFs*
LEX4BIO *(list of tested BBFs)*	
LEX4BIO	*Both N- and P-BBFs* *Selection of a wide range of BBFs to cover PFC/CMC categories as widely as possible, including 42 N-BBFs and 41 P-BBFs* *BBFs were either already on the market or in the development stage at a relatively high TRL*
SEA2LAND	
SEA2LAND	• *Plant biostimulants: Foliar fertiliser, Amino acids, organic matter and humic extract. Foliar fertiliser with N and amino acids, Foliar fertiliser with amino acids, humic extract, organic matter, Fertiliser with humic acids, Amino acids and peptides* • *Organic fertilisers: Bokashi pellet, Chithin-rich fertiliser, Fish sludge pelleted fertiliser, Fish mix pelleted fertiliser, Protein fraction, Organic amendment, Peptone, Salmon bones flour* • *Organic fertilisers (with potential biostimulant effect): NPK solution with amino acids, Hydrolysates* • *Growing media/soil improvers: Vermicompost and/or substrate, Biochar-compost composite, compost* • *Liming agent: CaCO3*
RUSTICA	
RUSTICA	*The production of 3 types of bio-based fertilisers blends for circular re-use of nutrients present in fruit/vegetable waste streams, adapted to the local demand.*