RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

POLICY BRIEF 2

Reality check on the feasibility of circularity in the food system

Key messages

We highlight four key challenges that must be addressed to stimulate the development of circular bio-based fertilisers:

- Bio-based fertilisers have high production and transportation costs
- Bio-based fertilisers may contain impurities and contaminants
- Sustainable solutions in the bioeconomy are region-specific

Point of departure

Europe emphasises the importance of circular bio-based fertilisers for sustainable food systems. This is also reflected in the Farm to Fork Strategy, which calls for the urgent need to reduce nutrient losses to the environment. In this strategy, the European Commission also refers to the production of bio-based fertilisers as a 'largely untapped potential for farmers and their cooperatives'. Moreover, Europe has set an ambitious goal to drastically reduce the use of mineral fertilisers by 2030. Europe also stresses the need for a transition towards a circular economy, which includes a circular food system where waste generation is reduced and the potential of by-products is fully exploited.

Several European H2020 projects focus on bio-based fertilisers. The RUSTICA project demonstrates that circular bio-based fertilisers have the potential to be as effective as mineral fertilisers.

Problems encountered

Circularity has been put forward as a key requirement for more sustainable food systems. The principles of a circular food system include recycling nutrients from agricultural residue streams and food processing waste through the development of bio-based fertilisers and their application to improve soil health and crop production. Here, we highlight three key challenges that must be addressed to stimulate the development and use of bio-based fertilisers.

First, while the environmental impact of bio-based fertilisers is often lower compared to mineral fertilisers, their production costs are typically higher. Therefore, economic support is needed to make bio-based fertilisers competitive with mineral alternatives, especially during the initial market penetration phase. This situation may change as technologies evolve or if the costs of mineral fertilisers increase. Additionally, R&D can focus on ways to lower production, reducing the need for economic support.

To tackle this crucial aspect, leveraging Life Cycle Costing analysis and determining the final production costs can provide valuable insights. Additionally, comprehensive assessment of environmental impacts is needed. This can be achieved through a Life Cycle Analysis that compares mineral and bio-based fertilisers. Such an assessment should include the transportation of feedstocks, as the distance between where feedstocks for bio-based fertilisers are produced, such as farms, and where bio-based fertilisers are manufactured may pose a considerable challenge. Large volumes and high transportation costs may hinder the feasibility of profitable business cases.

Second, circular bio-based fertilisers may contain impurities or contaminants. The key question is how to reconcile the possible presence of impurities and biotic or abiotic contaminants in residues or waste streams with the goal of reusing them in agricultural production systems. Impurities and contaminants do not necessarily represent an environmental or human health risk if concentrations remain below safe limits. Therefore, clear guidelines or standards should be established to define these safe limits, taking into account environmental, animal, and human health considerations. These guidelines and standards should be accompanied with straightforward communication directed at all actors in the food chain. Transparent communication and sensibilisation awareness-raising are essential to overcoming the current cultural aversion to using certain residues in food production.

Finally, circularity ideally implies that the reuse or recycling of waste and residues is carried out at the regional level. This requires consideration of the availability of feedstock, technological expertise, and the regional policy framework. These factors should be kept in mind when scaling circular concepts to European and global levels. Some solutions or technologies may be perfectly valid in one region but not necessarily feasible or sustainable in another. In many regions, the availability of feedstock from agri-food residues and waste streams may be insufficient or inconsistent to support the efficient production or commercialization of bio-based fertilisers. This could be due to limited residue and waste production, to competing demands for these residue streams (such as animal feed or fuel), or high transport costs.

Request to policy makers

Europe should align investment, regulation, and support with its ambitions as outlined in the Farm to Fork Strategy and the Green Deal. Economic and legislative obstacles hinder research and innovation aimed at developing more circular food systems. Opportunities for improvement lie not only in incentivising bio-based fertilisers, but also in harmonising guidelines, communication, and awareness-raising about circular food systems. Additionally, there is a need to decouple sustainability concepts to gain support for hybrid products and to recognise that different regional contexts require different solutions. Regional diversity significantly impacts agricultural production, making circularity more sustainable in some regions than in others.

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