

# Towards a knowledge-driven agriculture in Europe: an overview of ready-for-practice technologies and products for nitrogen and phosphorus recovery

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## Abstract text

Food and water security are dependent on the sustainable use of phosphorus (P) and nitrogen (N). However, there is no single solution to achieve a more sustainable agriculture. Nutrient recovery and recycling from waste streams (like manure) is an important approach to develop environmentally sustainable and biologically efficient fertilizers. However, improvement of nutrient use efficiency (NUE) has been listed among today's most critical and daunting issues (Thompson, 2012). It was reported that NUE of crop and livestock system in the EU-27 amounts only 20% for N (Leip et al., 2014) and 30% for P (van Dijk et al., 2016). This can be seen as a result of the intensified independence between crop production and animal husbandry, and insufficient processing of generated agro-waste.

Nutrient recycling in agriculture has been practiced from ancient times by incorporation of crop residues and manure application. This approach is currently, however, hampered by (1) the intensive development of animal husbandry which continues to generate large amount of manure that in certain regions (e.g. Flanders, Belgium) exceeds the nutrient demand of surrounding farmland; (2) high variability of nutrients in waste streams which makes them non-competitive with conventional mineral fertilizers; and (3) uncertainty on heavy metals additives and pathogens that might exist in certain waste streams and could pose uncertain risk to human health and environment. Up to date, various technologies have been developed to recover nutrients from waste streams in the form of safe and marketable bio-based products. However, implementation of these innovative technologies and products is limited due to knowledge gap between researchers, market, and farmers. Therefore, there is an urgent need to spread the knowledge on ready-for-practice technologies and products for nutrient recovery around Europe in order to accelerate the transition towards knowledge-driven sustainable agriculture.

In the current study, we collected information on more than 200 technologies and products from H2020/FP7/LIFE/Interreg NWE project websites, Operational Groups, as well as questionnaires. A database referring to 78 projects, 138 technologies, and 143 products was generated after quality evaluation. In a next phase these solutions will be scrutinized through close cooperation with a Farmer Advisory Board, together with innovative technology providers and expert stakeholders. The objective is to reach a list of 100 mature, market ready technologies and products for the public, which will act as catalyst to promote the wider implementation and marketing of innovative research results.

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## References

van Dijk, K.C., Lesschen, J.P., Oenema, O., 2016. Phosphorus flows and balances of the European Union Member States. *Science of The Total Environment*. 542, 1078–1093.

Leip, A., Weiss, F., Lesschen, J.P., Westhoek, H., 2014. The nitrogen footprint of food products in the European Union. *The Journal of Agricultural Science*. 152, 20–33.

Thompson, Helen. 2012. Food science deserves a place at the table – US agricultural research chief aims to raise the profile of farming and nutrition science. *Nature*, July 12.