ANAEROBIC DIGESTATES AS A NUTRIENT SOURCE

RELACS
IMPROVING INPUTS FOR ORGANIC FARMING

UNIVERSITÄT HOHENHEIM

Anaerobic digestates as a nutrient source for organic farming

Problem

There is a need to find new and sustainable nutrient sources for organic farming. Urban (food) waste can be a highly valuable source with low environmental impact and high recycling efficiency. This source can be used to compensate for the negative nutrient balances in organic farming. However, it must be treated to become hygienic, biologically stable, and easy to handle.

Solution

Anaerobic digestion of food and organic waste in a closed system produces fertiliser (digestates) and energy while avoiding greenhouse gas (GHG) emission. Storage in a closed system minimises losses of nutrients like nitrogen (N) and potassium (K).

Outcome

Anaerobic digestion maintains the ratios of nutrients in the feedstock by avoiding nutrient losses, thus enabling more balanced nutrient flows. Furthermore, the end product has a higher nitrogen fertiliser value than compost of the same amount of waste.

Applicability box

Input used

☐ Copper	☐ Anthelmintics
☐ Mineral oil	☐ Antibiotics
x Fertilisers	☐ Vitamins

Geographical coverage
No geographical limitations

Application time
Immediately before crop establishment or in early stages of crop growth

Required time
Not applicable

Period of impact
Mainly on the current crop, to a lower extent the succeeding crop

Equipment
More sophisticated liquid manure spreader, with devices to introduce the manure into soil

Best in
Non-legume crops with high N demand

Practical recommendations

- Keep the fertiliser in a closed environment for as long as possible. Digestates have a high nitrogen loss potential after treatment when exposed to air.
- Incorporate digestates directly after field application, e.g., through slurry injection (Picture 1), instead of using a broadcast spreader such as a traditional (liquid) manure spreader. This helps to reduce ammonia losses.
- Nitrogen use efficiency from digestates is higher in spring crops than in winter crops when incorporated into the soil before crop establishment.
- For crops with wide row distances (e.g., maize), concentrated application by strip-till is more efficient in terms of nitrogen and phosphorus fertiliser value.
- Solid-liquid separation can increase the applicability and versatility of digestates. The liquid fraction is high in nitrogen and potassium and low in phosphorus, while the solid fraction is high in organic matter and phosphorus.
- The solid fraction has a high risk of nitrogen loss. Apply it as soon as possible after separation or store it in a closed container. Composting it increases the risk of nitrogen loss and does not provide an advantage on soil organic matter compared to the application of non-composted solid digestates.

Picture 1: Use of sophisticated spreading techniques like injection is important to reduce gaseous nitrogen losses and increase nitrogen fertiliser value (Photo: Kurt Möller, University of Hohenheim)
Picture 2: Strip-till application stimulates maize roots and increases nitrogen and phosphorus fertiliser effects (Photo: Kurt Möller, University of Hohenheim)

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PRACTICE ABSTRACT

On-farm application

System approach

- Recycling nutrients from household waste via anaerobic digestion is coherent with the core values of organic farming. It combines a high recycling efficiency with a low environmental impact (low ammonia emissions, low GHG emissions, credits for renewable energy, etc.).
- The high share of ammoniacal nitrogen in liquid digestates (typically 10-20% higher than in slurries) is a consequence of nitrogen mineralisation combined with low nitrogen losses.

Evaluation

- Around 180 million tonnes of digestate are produced in the EU per year (Corden et al., 2019).
- Digestates of food waste contain high nutrient concentrations on a dry matter base. The risk of soil contamination by potentially toxic elements is usually lower than with compost due to a more favourable nutrient ratio (e.g., phosphorus or nitrogen) (Weissengruber et al., 2018).
- The current EU regulation (EC) No. 889/2008 authorises the use of various digestates for organic production, namely: liquid animal excrements after controlled fermentation, fermented mixture of household waste, fermented mixture of vegetable matter, biogas digestate containing animal by-products co-digested with material of plant or animal origin.

Further information

Video

- Using digestate as a renewable bio-based fertiliser (EN). Available at https://youtu.be/N9_JAVl4MoQ.

Further readings

Corden, C. et al. (2019). Digestate and compost as fertilisers: Risk assessment and risk management options. Available at https://www.circularonline.co.uk/wp-content/uploads/2019/11/EN-ReportDigestateandcompostasfertilisers-Feb-2019.pdf.

Möller, K. (2016). Assessment of Alternative Phosphorus Fertilizers for Organic Farming: Compost and Digestates from Urban Organic Wastes. Available at https://www.fibl.org/de/shop/1699-compost-and-digestates.html.

Weissengruber, l. et al. (2018). Long-term soil accumulation of potentially toxic elements and selected organic pollutants through application of recycled phosphorus fertilisers for organic farming conditions. Nutrient Cycling in Agroecosystems 110, 427–449. Available at https://link.springer.com/article/10.1007/s10705-018-9907-9.

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RELACS: 'Replacement of Contentious Inputs in Organic Farming Systems' (RELACS) builds on results of previous research projects and takes far-advanced solutions forward. As a system approach to sustainable agriculture, organic farming aims to effectively manage ecological processes whilst lowering dependence on off-farm inputs. The RELACS partners will evaluate solutions to further reduce the use of external inputs and, if needed, develop and adopt cost-efficient and environmentally safe tools and technologies.

Project website: www.relacs-project.eu

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