

Compliance methods for N- and P-BBFs

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Bio-based fertilisers (BBFs) have gained popularity as a more sustainable source of nutrients in agriculture than conventional synthetic or mined fertilisers, but predicting the nitrogen (N) and phosphorus (P) bioavailability of BBFs is crucial for their proper and efficient use in agriculture. To address this, we conducted a comprehensive assessment of potentially mineralizable N and carbon (C) content, as well as NH₃ volatilisation, for a representative selection of 42 N-BBFs, and explored various chemical extraction methods to predict their N bioavailability. With respect to P-BBFs, we tested the P extractability of thirty BBFs through six different extraction methods and related P extractability to P uptake as determined by a suite of three pot experiments conducted up to maturity in different soils and conditions.

The 84-day aerobic incubations showed a cumulative mineral N and C release varying between -13% of amended N (composts) and 106% of amended N (digestates) and between 10% of amended C (composts) and 117% of amended C (liquid plant-based and animal by-product BBFs), respectively. Based on the results of the mineralisation assays, N-BBFs were classified into five significantly different groups, which however did not match the current component material category (CMC) and product function category (PFC) classification systems applied in the new EU Fertiliser Regulation. Potential NH₃ volatilisation was best predicted by a categorisation based on the original feedstock and processing technology. Water-extractable P was not well correlated to plant P uptake, while the coefficient of determination (R^2) was around 0.5 for the other extraction methods. Besides, additional factors like difficulty and reproducibility of the methods as well as investment and time required should be taken into account when recommending an extraction method for fertilizer compliance testing.

In conclusion, we have identified potential proxies and compliance methods to predict N- and P-bioavailability of a wide range of BBFs. Since the classification of BBFs according to the fertiliser product regulation showed no relation to neither N mineralisation, NH₃ volatilisation nor P release, we recommend to use the identified chemical indicators for the development of a novel BBF classification system.

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