Organic 3.0 and the use of recycling fertilizers from wastewater

Olivier Duboc[1], Jakob Santner[2], Franz Zehetner[3], Walter Wenzel[1]

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Abstract

The depletion of fossil nutrient reserves and the intrinsic nature of farms as open entities through which nutrients flow, will require introducing more recycling fertilizers in Organic Agriculture (OA). Processes exist to safely recover nutrients from wastewater, and some products have been considered suitable for Organic 3.0. While the safety issue has the highest priority, characterization of fertilizer behaviour in soil is also an important aspect that requires appropriate testing methods. Phosphorus (P) can be recovered in forms that are compatible with the principles of OA, however, nitrogen (N) and micronutrient recovery has not received much attention and remains challenging.

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Introduction

Organic agriculture (OA) started in the early 20th century deemed as a more sustainable alternative to conventional practices (Organic 1.0; 1900 - 1970). It is a growing sector with a set of standards that were established over the past 40 years (Organic 2.0; 1970 - 2015). Organic 3.0 (2015-) was characterized as "innovation with research" (Rahmann et al. 2016) while the objective was set to "warrant sustainable agriculture and nutrition beyond the niche" (Niggli et al. 2015).

Soil fertility management in OA focuses on the interplay of various ecosystem components through the management of soil physical, chemical and biological properties, crop rotation, biodiversity, etc. Notwithstanding the necessity to make use of ecosystem processes to enhance soil fertility (Bender et al. 2016), nutrients must be replenished if yield is declining and other management practices cannot solve the problem alone. Farms being open entities which thrive by selling products with the nutrients they contain, macro- and micronutrients are gradually transferred to urban centres even when animal manures and other farm wastes are recycled. Although N can be fixed from atmospheric N_2 by legumes, this practice has its cost in particular for stockless organic farms which may grow legumes mainly for N fixation, possibly reducing the proportion of marketable crops in the rotation. Scarcity of macro- and micronutrient fossil reserves (de Haes et al. 2012) will require that the agricultural sector increases nutrient recycling from municipal solid waste and wastewater. Municipal sewage sludge (MSS) is the major residual nutrient stream, but it is often not readily applicable as fertilizer, as it may contain a multitude of organic and inorganic contaminants.

The use of new (mainly P-) fertilizers recycled from MSS in OA is discussed in strategic documents about Organic 3.0 (Niggli et al. 2015; Rahmann et al. 2016). Precipitation products such as struvite, or calcined P from MSS ash may be considered compatible with the principles of OA (European Commission 2016; Wollmann and Möller 2015). More generally "all human waste products could

[1] University of Natural Resources and Life Sciences (BOKU), Institute of Soil Research, Konrad-Lorenz-Strasse 24, 3430 Tulln, Austria. eMail: olivier.duboc@boku.ac.at

[2] BOKU, Division of Agronomy, Konrad-Lorenz-Strasse 24, 3430 Tulln, Austria.

[3] BOKU, Institute of Soil Research, Peter Jordan Straße 82, 1190 Vienna, Austria.