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ADDING VALUE TO ASH AND DIGESTATE (AVAnD). AN INTEGRATED OVERVIEW OF THE EFFECTS OF ASH AND DIGESTATE BLENDS ON THE SOIL-PLANT SYSTEM.

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Resource recovery from waste could play a central role in strategies tackling current worldwide sustainability problems. Focusing on the agricultural sector, waste streams represent an opportunity to break the cycle of nutrients depletion (exported with crop biomass) and incorporation by non-sustainable means such the use of inorganic fertilisers (either finite and/or highly energy intensive in their production). In this sense, digestate [D], from anaerobic digestion, and biomass ash [A], from incineration, are especially valuable since they supply, amongst other nutrients, nitrogen [N] and phosphorus [P], respectively. Whilst these waste streams could be highly heterogeneous, in general terms they present a complementary nutritional profile which could be exploited for the production of alternative fertilisers. This is precisely the overarching aim of the "Adding Value to Ash and Digestate [AVAnD]" project: the identification of a novel nutrient-recycling pathway to maximise soil quality and crop productivity utilising waste streams derived from bioenergy production. However, the application to land of novel recycled and recovered products entails the assessment of the biological and chemical interactions and the implications for ecosystems, to determine desirable and detrimental effects that might arise. Therefore, we aim to provide an insight on the AVAnD project and briefly describe and discuss some of the findings obtained so far.

Experiments were carried out at different scales and under different conditions using two different digestates ([D1], [D2]) and two ash fractions (fly [A1] and bottom [A2]). The main factor considered was fertiliser type including A/D blends, A & D alone, no fertilisation and inorganic fertilisers. Fertilisation target (63/60 kg N/P_2O_5 per ha) was the same across the different fertiliser materials. Aspects covered included nutrient availability (N-, P-forms), soil properties (DOC, pH, EC), greenhouse gas emissions (CO_2, N_2O) and plant traits (above-ground biomass, tissue elemental concentration). In a glasshouse pot experiment using a neutral loam soil that compared A/D blends and inorganic fertilisers, no significant differences on wheat biomass, tiller number and leaf areaand plant elemental composition (P, Mg, Ca, K, Mn, Na) were observed. Plant nutrient uptake behaved similarly, yet ash-based treatments had lower Mn uptake. Concerning soil properties, increased EC was primarily driven by D and secondarily by A. Digestate-based treatments lowered soil pH while A increased pH, with blending having a moderate effect. D1-based treatments primarily and A1-based treatments secondarily had higher nitrate concentrations. Based on the aforementioned statements, D1A1 was considered a suitable amendment to be used as an inorganic fertiliser replacement for wheat.