Geophysical Research Abstracts
Vol. 19, EGU2017-18467, 2017
EGU General Assembly 2017

ADDING VALUE TO ASH AND DIGESTATE (AVAnD): PERFORMANCE OF NOVEL SOIL AMENDENTS ON THE SOIL-PLANT SYSTEM UNDER GLASSHOUSE CONDITIONS

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Resource recovery from waste plays a central role in strategies tackling current worldwide sustainability problems. In this sense, two waste streams derived from bioenergy production (anaerobic digestion and incineration), digestate [D] and biomass ash [A], may be especially valuable within agriculture. These materials offer complementary plant nutrient profiles for alternative fertiliser production (i.e. nitrogen [N] from D and phosphorus [P] from A). In addition, incorporating these materials into the soil could impact upon several soil/plant characteristics, and have positive effects on ecosystem services (eg. nutrient cycling). Therefore, this present work assessed the effects of A/D blends on the soil-plant system under controlled conditions (glasshouse). The overarching aim of "Adding Value to Ash and Digestate [AVAnD]" project is to identify novel nutrient-recycling pathways to maximise soil quality and crop productivity utilising waste streams derived from bioenergy production.

Two pot experiments of 6 weeks duration were carried out [Exp. A and Exp. B] using contrasting agricultural soils (neutral loam and sandy acidic soil) and wheat as the crop. A factorial randomised block design was selected, with fertilisation treatment and soil condition (planted/unplanted) as factors. Fertilisation treatments (n=13) were applied at a rate of 63/60 kg N/P2O5 per ha and comprised: control ([C], no fertilisation), urea [U], urea+superphosphate [U+P], fly ash [A1], bottom ash [A2], U+A1; U+A2, anaerobic digestates [D1, D2] and ash/digestate blends [D1A1, D1A2, D2A1, D2A2]. Each block (n=5) contained 8 planted and 5 unplanted pots (104 planted + 65 unplanted experimental units). At the end of the experiment, all the plants were assessed for morphometric traits, while for tissue elemental analyses the total number of replicates per treatment was randomly reduced (n=5/treatment). Soil physico-chemical properties (i.e. available nitrogen, pH) were assessed in unplanted and selected planted pots.

Differences in plant growth were primarily dependant on soil type and secondarily on fertiliser type. In Exp. A, adding digestate-based treatments resulted in comparable biomass and N levels (concentration and uptake) to that of inorganic fertilisers (U+P). In Exp. B, growth was mainly related to soil pH, with higher biomass in those treatments containing A1. In relation to soil properties, the main effects were attributed to pH variation and increase of available N- / P- and EC. Based on these results, these novel materials and inorganic fertilisers induced similar effects in the soil-plant system, thus suggesting inorganic fertilisers could potentially be replaced. However, further research under field conditions, including other soil types, is required to corroborate the value of these A/D blends as land conditioners.