Processed biowaste digestates as fertilizer and soil additive in agriculture

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Introduction, Material and Methods

Using biowaste in biogas plants is an established process that will become more important due to the mandatory separate collection of biowaste in Germany established in 2015. Current policy's aim is to recycle valuable compounds in digestates, which are usually composted and, if necessary, further processed.

To test the effects of such biowaste digestates on soil ecology and crop growth a three-year field trial was carried out, which was supplemented by pot experiments, experiments with rhizoboxes and phytotoxicological tests. Furthermore, the carbon mineralization rate of the digestates was determined using a CarbO2Bot® (prw electronics, Germany), earthworm avoidance tests were performed and species and abundance of earthworms were investigated in the field trial.

In addition to agglomeration and pelleting, various additives (meat-and-bone meal (MBM), Calcium ammonium nitrate (CAN), bentonite, straw) were tested to investigate the possibility of influencing the digestates' chemical-physical properties.

Results

- The content of readily available nitrogen is low. In the pot experiments, the plants withdrew a maximum of only 12% of the applied nitrogen.
- The digestates contain significant amounts of phosphorus and potassium. These are better plant available than nitrogen.
- After application of the tested products, a significant increase in the soil-pH values was detected.
- In the soil respiration studies, about 20% of the applied carbon was mineralized in the first 100 days.
- The use of composted digestates from biowaste promotes the activity of microorganisms in the soil.
- The investigations in earthworm abundance in the field remained inconclusive. The avoidance tests showed no limitation of the habitat function within the meaning of the ISO standard 17512-1 (2008).
- A phytotoxicity of the digestates existed only in isolated cases and was not dose-dependent, but due to punctual contamination.
- The addition of nitrogen-containing compounds such as CAN or MBM significantly increases the direct fertilizing effect of the products. Depending on the ammonium content, phytotoxic effects were observed. These are larger with the addition of mineral fertilizers than with organic N compounds. Clay minerals partially reduced this phytotoxicity.