Black Soldier Fly Technology and Convert Manure Into Valuable Fertiliser

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Black Soldier Fly (*Hermetia illucens*, BSF) farming provides an alternative low-cost waste management solution for converting agricultural waste into high quality insect meal (BSF larvae as animal feed) and a valuable fertiliser (BSF casting residue or frass). However, BSF frass has a high ammonium content that could result in nitrogen (N) loss following its application to land via leaching, volatilization and runoff. One solution is to further process the frass by coating it with solid fatty acids (LCFA), another waste by-product from BSF farming. The aim of this study was to investigate the slow-releasing effect of N after coating the BSF frass with three different fatty acids (lauric, myristic and stearic acid). LCFA coated frass was hypothesised to release mineral N more slowly compared to the untreated frass because the hydrophobic LCFA would decrease the solubilization of N in the frass. Also, the increased C:N ratio (>25) of the LCFA coated frass amendment will favour microbial N immobilization. Soil was amended with three frass LCFA treatments, an untreated frass only treatment and a control (unfertilized), the N application rate was 100kg/ha. The soil was incubated for 56 days at 25℃ and maintained at 40% field capacity moisture. The impact of treatments on bacterial diversity was assessed by PCR amplification of bacterial 16s rRNA V3-V4 and next generation DNA sequencing on the Mi-seq platform. A significantly lower mineral N concentration occurred in soil treated with LCFA processed frass compared to frass-only treatment, and mineral N release was slowest for stearic acid processed frass. LCFA processed frass reduced the relative abundance of ammonia-oxidizing bacteria (AOB) compared to frass only treatment and all the frass treatments reduced the relative abundance of ammonia-oxidizing archaea (AOA) compared to nil control. These results suggest that LCFA coated frass plays an important role in regulating the microbial community structure, particularly those microbes involved in soil N cycling. Modifying frass by coating it with LCFA has the potential to be developed as a slow release fertilizer for cereals by delaying the N release until mid-stem elongation to ensure optimal N uptake. This will lead to reduced soil N loss, improved fertilizer use efficiency and increase profitability via improved crop yield and lower production costs.