
**Larvae of Black Soldier Fly upcycle pig manure into highly valuable fat and proteins on the farm**

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This study aimed to optimize the rearing process of black soldier fly (BSF) larvae on solid pig manure on the farm. The optimal rearing conditions were first studied in climate rooms. Then, pilot scale bioconversion units were constructed and evaluated on the farm. Lab scale experiments took place in climate rooms. Larvae of the BSF were reared on the solid fraction of fresh pig manure at 21-24-27°C until fully grown. Before transfer to the substrate, larvae were grown on poultry meal for 5 days. Then, feeding frequency (once during the growth cycle, 1/week, every 2-3 days) and feed dose (10-15-20 mg DM/larvae/d) were varied. Fresh manure, harvested larvae, and residual substrate were analysed for dry matter (DM), nitrogen and fat. The optimal settings were applied to BSF rearing on farm in self-constructed bioconversion units. These were placed in an occupied fattening pig compartment. Larvae were immediately transferred to the substrate. Manure was stirred during the rearing process. The units were ventilated at air change rates of 30-114/h during the growing phase and up to 371/h during substrate drying. Emissions of NH₃, CH₄, N₂O and CO₂ were monitored and mass balances were made.

Rearing BSF larvae on pig manure on farm was possible: the indoor air temperature of fattening pigs was sufficiently high. A correct ventilation is crucial to enable automatic harvesting of the full-grown larvae. Harvested larvae had an average DM content of 27-33% which consisted of 45-50% protein and 20-24% fat (lab & pilot scale). Nitrogen from the substrate was transferred into the larvae (±17-21%) and into the air as NH₃ (around 30%, increasing with higher temperature). Increased levels of NH₃, CO₂ and CH₄ were measured compared to indoor air. Bioconversion rates of DM amounted to 13% (max. 15%) at lab scale and to 9-12% at pilot scale. Differences result from higher mortality rates, less favourable rearing conditions (e.g. disturbance by stirring), competition with house fly larvae, immediate transfer to the substrate, and harvest losses. Further optimization of insect rearing on farm is necessary and special attention is required for emission control and economic feasibility.
This study aimed to optimize the rearing process of black soldier fly (BSF) larvae on solid pig manure on the farm. The optimal rearing conditions were first studied in climate rooms at lab scale. Then, pilot scale bioconversion units were constructed and evaluated on the farm. Larvae of the BSF were reared on the solid fraction of fresh pig manure at 21-24-27°C until fully grown. Before transfer to the substrate, larvae were grown on poultry meal for 5 days. Then, feeding frequency (all-at-once, 1/week, every 2-3 days) and feed dose (10 15 20 mg DM/larvae/d) were varied. Fresh manure, harvested larvae, and residual substrate were analysed for dry matter (DM), nitrogen and fat. The optimal settings were applied to BSF rearing on farm in self-constructed bioconversion units. These were placed in an occupied fattening pig compartment. Larvae were immediately transferred to the substrate. Manure was stirred during the rearing process. The units were ventilated at air change rates of 30-114/h during the growing phase and up to 371/h during substrate drying. Emissions of NH$_3$, CH$_4$, N$_2$O and CO$_2$ were monitored and mass balances were made. Rearing BSF larvae on pig manure on farm was possible: the indoor air temperature of fattening pigs was sufficiently high. A correct ventilation is crucial to enable automatic harvesting of the full-grown larvae. Harvested larvae had an average DM content of 27-33% which consisted of 45-50% protein and 20-24% fat (lab & pilot scale). Nitrogen from the substrate was transferred into the larvae (17-21%) and into the air as NH$_3$ (±30%, increasing with higher temperature). Increased levels of NH$_3$, CO$_2$ and CH$_4$ were measured. Bioconversion rates of DM amounted to 13% (max. 15%) at lab scale and to 9-12% at pilot scale. Differences result from higher mortality rates, less favourable rearing conditions, competition with house fly larvae, immediate transfer to the substrate, and harvest losses. Further optimization of insect rearing on farm is necessary and special attention is required for emission control and economic feasibility.