Upcycling Food Waste into Black Soldier Fly Meal as a Sustainable Protein Source in Post-Weaning Piglet Diets

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Abstract

Food waste and food loss are major global challenges, with over 1 billion tons discarded annually — the equivalent of more than 1 billion meals wasted daily (UNEP, 2024). At the same time, about 2.3 billion people faced moderate or severe food insecurity in 2024 (FAO et al., 2025). Valorizing bio-waste into high-value feed ingredients offers a circular solution to address both waste reduction and protein demand.

Black soldier fly larvae (*Hermetia illucens* L., 1758) efficiently transform organic side streams into nutrient-rich biomass (Dörper et al., 2021). In this study, 4730 kg of local fruits, vegetables, bread, and brewery by-products were bioconverted into 555 kg of larvae. After drying and defatting, the resulting meal was analyzed for proximate composition, amino acid and fatty acid profiles, ash, carbohydrate content, and digestibility.

A feeding trial was conducted under organic farming conditions with 72 post-weaning piglets. Diets replaced 15%, 25%, and 35% of the protein core with defatted larvae meal over six weeks. Growth, feed efficiency, and diarrhea incidence were recorded to evaluate zootechnical and health effects. The trial aims to define an optimal inclusion rate as a sustainable alternative to soybean meal, linking waste valorization with food security and pig production sustainability.