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BSF Technology: An Environmental Solution for Smallholder Livestock, Fish and Crop Producers in Ghana

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Background

Globally, agriculture produces approximately 23.7 million tons of food daily (FAO, 2017), but this comes at a high environmental cost. The sector accounts for around 21% of global greenhouse gas emissions and places pressure on ecosystems (Duque-Acevedo et al., 2020). Typically, only 30–40% of crops such as grains, fruits, or tubers are harvested, while 60–70% becomes agricultural waste. Moreover, it is estimated that about 40% (2.5 billion tons) of harvested crop produce is lost or goes to waste (WWF, 2021). Urban population is another major source of household waste. With an urban population for 2023 estimated at 20 million, Ghana produces 3 million tons of household waste per year, and about 54-67% of which is organic. Accra alone generates up to 1 million tons per year. Much of this waste is left to decompose or is burned or ends up in landfills, contributing to pollution and climate change and health hazards. With population growth and global food demand rising, innovative solutions are urgently needed to sustainably manage waste from agricultural, urban and food systems.

Black Soldier Fly (BSF) technology offers a promising, sustainable method for managing organic waste. The Black Soldier Fly (*Hermetia illucens*) (Fig.1 A) produces protein-rich larvae (Fig. 1B) and creates organic fertilizer (Fig. 1C). This fly is not harmful to humans unlike house flies that can transmit diseases.

By integrating BSF technology into Ghana's agricultural and waste management systems, the country can reduce the negative impact of agriculture, especially on climate change and environmental degradation, improve food security, and support smallholder farmers through sustainable, locally based innovations.

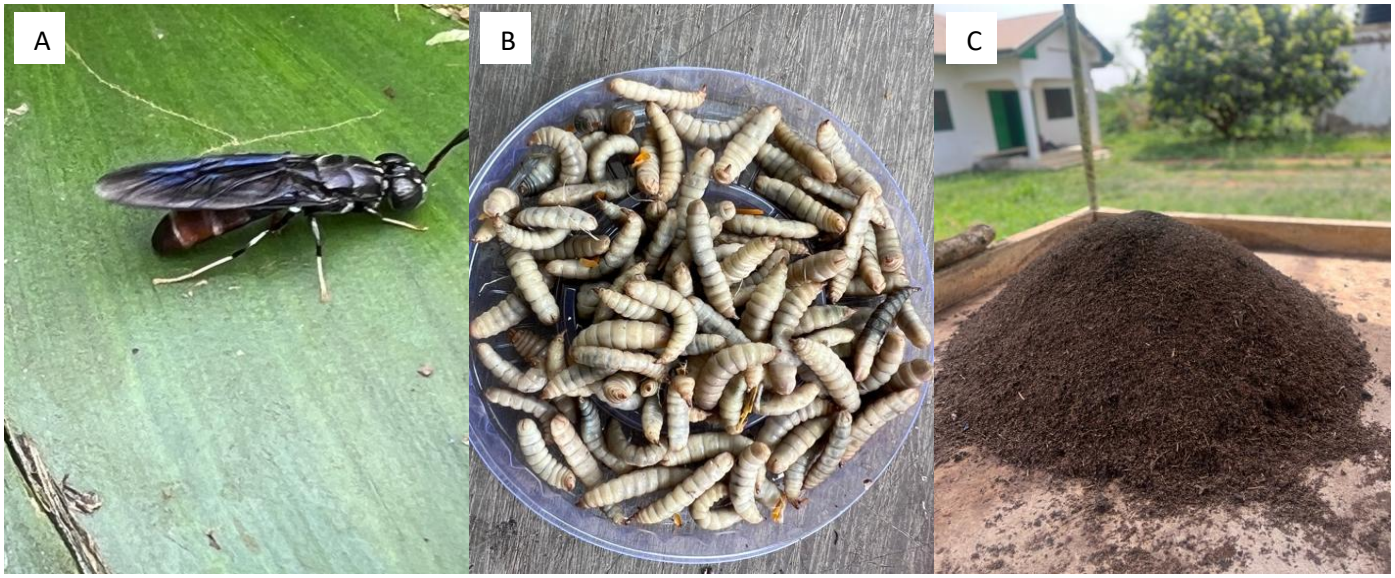

Figure 1: Black Soldier Fly (A), Harvested Black Soldier Larvae (B) and Organic fertilizer (C). Source: BBEST Project/BNARI

Existing but Insufficient Solution

Smallholder livestock, fish, and crop producers face increasing challenges due to the high cost and limited accessibility of conventional agricultural inputs such as fishmeal, soymeal, and synthetic fertilizers (Makkar et al., 2014). These inputs are not only economically burdensome but also environmentally and ethically unsustainable. These factors highlight the urgent need for affordable, sustainable alternatives that support productivity, reduce ecological impact, and promote ethical food system practices.

Furthermore, conventional methods of managing waste from agriculture and food systems such as open burning and composting result in high emission of greenhouse gases. Open burning of agricultural residues releases large amounts of greenhouse gases (GHGs) which contribute significantly to climate change. Aside GHGs, open burning releases environmental pollutants such as particulate matter, black carbon, toxic chemicals and heavy metals, which can settle on soil, water bodies, and crops, entering the food chain and posing risks to microorganisms, plants, animals, and humans. Composting requires suitable sites to prevent nutrient runoff, involves costs for equipment and labor, and may produce odors if not managed properly.

Solution by the BBEST Project

Black Soldier Fly technology (Fig. 2) is a biologically based, circular solution that effectively addresses the mounting organic waste challenges in agriculture and food systems. Agriculture and food systems produce large volumes of organic waste, including crop residues, animal manure and spoiled food and by-products from food processing. Similarly, traditional waste management methods (e.g., landfilling, open burning, and poor composting) lead to Greenhouse gas emissions (methane, CO_2), odour and pest problems and water and soil pollution (Makkar et al., 2014).

The larvae of the BSF consumes and converts organic waste into useful products. Black Soldier Fly larvae can digest a wide range of biodegradable waste efficiently within a short time. The BSF larvae can reduce waste volume by up to 70% through consumption. The process converts low-value waste into high-value biomass and residue. This protein-rich larvae biomass is deployed as animal feed (fish, poultry, pigs). Likewise, the residue (BSF Frass) is a biofertilizer, rich in nutrients and beneficial microbes. The BSF larvae can be used to produce larval fat/oil which is used in animal feed or industrial applications.

Figure 2: Black Soldier Fly technology illustrating circular bioeconomy. Source: BNARI

Black Soldier fly technology diverts organic waste from landfills, reducing pollution and greenhouse gas emissions. The technology minimizes foul odour, pest infestations, and disease vectors in agricultural settings. Economic benefits derived from the technology include reduction in the costs of waste disposal for farms and food processors, provision of alternative sources of income through the sale of larvae, oil, and fertilizer and reduction on dependence on expensive feed sources like fishmeal and soybean meal. The technology enhances soil health through application of frass, improving crop productivity, Enables circular farming systems by reintegrating nutrients and biomass. Black Soldier fly technology enhances social benefits of mankind. These include the promotion of green jobs in waste collection, insect farming, and product marketing. Supports food security through cost-effective feed inputs for livestock and fish.

Conclusion

Black Soldier Fly technology offers a sustainable solution to Ghana's organic waste, costly animal feed, and declining soil fertility. It supports a circular bioeconomy and improves livelihoods, especially for youth and women. This technology offers practical and sustainable solution to Ghana's growing waste management and environmental health challenges, especially in urban centers like Accra where organic waste dominates.

However, adoption is limited by the absence of national regulations, safety standards, and policy integration. Challenges such as low awareness, technical gaps, and stigma persist. Addressing these requires clear guidelines, biosecurity protocols, targeted training, financial incentives, and strategic investment to unlock BSF's potential for food security, climate resilience, and inclusive rural development.

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References

Duque-Acevedo, M., Belmonte-Ureña, L. J., Cortes-García, F. J., & Camacho-Ferre, F. (2020). *Agricultural waste: Review of the evolution, approaches, and perspectives on alternative uses*. *Global Ecology and Conservation*, *22*, e00902. https://doi.org/10.1016/j.gecco.2020.e00902

Food and Agriculture Organization of the United Nations (FAO), 2017. Strategic Work of FAO for Sustainable Food and Agriculture. http://www.fao.org/3/a-i6488e.pdf.

Makkar, H. P. S., Tran, G., Heuzé, V., & Ankers, P. (2014). *State-of-the-art on use of insects as animal feed*. *Animal Feed Science and Technology*, *197*, 1–33. https://doi.org/10.1016/j.anifeedsci.2014.07.008

WWF, U. (2021). Driven to waste: The global impact of food loss and waste on farms. *Retrieved from WWF*.

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