Using Black Soldier Flies for Waste Processing

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Black Soldier Fly Waste Processing

Black soldier flies (*Hermetia illucens*) provide an efficient method for converting food waste and manure into nutrient-rich material that can be used as a soil amendment. Similar to composting, black soldier fly larvae consume organic materials and transform them into frass, a nutrient-rich residual material. During the process, larvae generate heat and accelerate the decomposition of organic matter, while also reducing pathogens, heavy metals, pharmaceutical and pesticide residues. Compared with traditional composting, black soldier fly bioconversion can occur much more rapidly, with finished material produced in approximately 15–20 days. The larvae can also process materials that are often excluded from traditional composting systems, including dairy products, meat, and citrus.

The resulting frass contains chitin, a component of the larval exoskeleton that can contribute to natural pest suppression when applied to agricultural soils. In addition to providing nutrients and organic matter, frass can provide potential benefits for soil health and plant protection.

Black soldier fly larvae are detritivores, meaning they feed on decaying organic matter. During their approximately 12-day larval stage, they consume and break down waste before slowing their feeding and entering the pupal stage. In a managed system, larvae can be collected and used as a high-protein feed source for fish, poultry, and livestock, or they can be allowed to pupate and produce adults for continued reproduction and subsequent waste processing.

(Photo source: Purdue Extension Publication E-276)

Figure 1. Black Solder Fly Larvae

Adult black soldier flies have a short lifespan of approximately six days and lack functional mouthparts, meaning they do not bite or feed as adults. Their biology also differs from that of many nuisance flies because they are not typically associated with transmitting disease through feeding.

(Photo source: Purdue Extension Publication E-276)

Figure 2. Black Soldier Fly Adult

Although black soldier flies originated in tropical and subtropical regions, they are now distributed throughout much of the world. Their tropical origin, however, limits their ability to survive cold temperatures. In Utah,

high mortality occurs below ~50°F, meaning populations typically cannot overwinter outdoors. For year-round production, populations can be maintained in enclosed, netted structures such as greenhouses, barns, or garages where temperature and environmental conditions can be controlled.

Black soldier flies prefer to lay their eggs in thin, dark spaces located near a food source. Suitable egg-laying materials can include corrugated cardboard, narrow gaps between wooden slats, or double layers of egg cartons positioned above the waste. Once eggs hatch, larvae should be provided with a small amount of starter food before being transferred to larger quantities of waste. Approximately 1 gram of black soldier fly eggs can process up to 5 kg of food waste, although processing capacity depends on environmental conditions, larval density, and the characteristics of the feedstock.

Black soldier fly processing can also provide benefits for manure management. Black soldier fly larvae can reduce fecal bacteria and other contaminants, including certain xenobiotic compounds. The process can also reduce manure moisture, potentially improving its storability and handling. Like traditional composting, black soldier fly bioconversion promotes biological transformation and microbial activity, resulting in a material that can contribute organic matter and nutrients to soil.

Successful black soldier fly systems require appropriate carbon-to-nitrogen (C) ratios, moisture levels, temperature, and larval populations. Because the system can operate in relatively small spaces, it may be particularly useful for small farms, urban farms, gardens, and other operations with limited space. In addition, food waste and manure can often be obtained locally, providing an opportunity to convert locally available organic waste into useful agricultural products rather than sending it to a landfill.

Overall, black soldier fly bioconversion offers a rapid approach to organic waste management that can simultaneously reduce waste volume, recycle nutrients, produce soil amendments, and generate a high-protein larval feed source. This makes BSF systems a potentially valuable component of circular nutrient management on farms and gardens.

Sources/Other Resources:

Ingwell, L. PurdueExtensionEntm]. (2025, April 18). Composting with black soldier fly [Video]. Youtube. https://www.youtube.com/watch?v=ZCaYZEIVtyw

Liu, T., Klammsteiner, T., Dregulo, A. M., Kumar, V., Zhou, Y., Zhang, Z., & Awasthi, M. K. (2022). Black soldier fly larvae for organic manure recycling and its potential for a circular bioeconomy: A review. *Science of the Total Environment, 833*, 155122. https://doi.org/10.1016/j.scitotenv.2022.155122

Terrell, C., & Ingwell, L. (2022, November). *Black soldier fly composting guide*. Purdue University Extension, Department of Entomology. https://extension.entm.purdue.edu/publications/E-276/E-276.html