

AGRIPRENEURSHIP IDEAS

BLACK SOLDIER FLY A SOLUTION TO DISPOSAL OF LARGE AMOUNTS OF ORGANIC WASTE.

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The global human population is rapidly increasing and is expected to reach 9.8 billion by 2050. This will lead to increasing demands for food production and organic waste management. Food wastes and processing residues are one component of the organic waste stream that is currently estimated at 1.3 billion tons annually. As the need for nutritious food increases, it is critical to consider sustainable production systems that include residue reuse and valorization. Recycling organic waste material (bio-waste) is still fairly limited, especially in low- and middle-income settings, although this is by far the largest fraction of all generated municipal waste. The severity of this challenge will increase in the future given the trends of rapid urbanization and growth in population. Due to growing public pressure and environmental concerns, waste experts worldwide are being called upon to develop more sustainable

methods of dealing with municipal waste that embrace the concept of a circular economy. Here, my aim is to describe the fairly novel approach of bio-waste conversion by insect larvae, using the example of the Black Soldier Fly (BSF), scientifically called *Hermetia illucens*, an approach that has obtained much attention in the past decade. Black Soldier Flies (BSF) are a type of fly commonly used to decompose organic waste into compost. The use of BSF for the waste degradation process is considered more effective than normal flies due to BSF's amazing qualities. Not only that BSF is easy to breed, their digestive system naturally destroys harmful bacteria that might be present in their food — makes them an ideal waste degradation agent. The BSF larvae are also safe for human and animal consumption, a great low-cost protein-rich food source alternative.



Black soldier flies are small, harmless insects that have the potential to provide promising solutions to two of modern agriculture's growing problems:

1. The high cost of fish and animal feed
2. The disposal of large amounts of organic waste.

Black soldier fly larvae (BSFL), *Hermetia illucens* L., have the potential to play an important role in animal feed supplements and the provision of essential amino acids. BSFL cultivation systems have a relatively small ecological footprint with respect to greenhouse gases and ammonia emissions. BSFL cultivated on organic side streams also appeared to be a potential substitute for common commercially available protein sources and could replace a fish meal or soybean meal without any adverse effects. An engineered BSF processing facility can be designed and operated to achieve certain target objectives based on the natural life cycle of BSF. These, for instance, can be to cost-effectively augment larvae quality or maximize the larval mass quantity produced within a certain time frame or based on a particular feedstock, similar to a typical livestock rearing system (chicken, beef, etc.). The primary goal, therefore, is the process bio-waste in an efficient way with regard to investment and operational costs, as well as space requirements. By processing bio-waste, threats to public health and the environment can be reduced. The technology solution consists of

feeding segregated bio-waste to BSF larvae. Larvae grow on the waste stock and reduce the waste mass. At the end of the process, larvae are harvested and, if necessary, post-processed into a suitable animal feed product. The waste residue can also be further processed and potentially sold or used as a soil amendment with fertilizing properties.

The use of BSF for the waste degradation process is considered more effective than normal flies due to BSF's amazing qualities. Not only that BSF are easy to breed, their digestive system naturally destroys harmful bacteria that might be present in their food — makes them an ideal waste degradation agent. The BSF larvae are also safe for human and animal consumption, a great low-cost protein-rich food source alternatives. The residue, a substance similar to compost, contains nutrients and organic matter and, when used in agriculture, helps to reduce soil depletion. There is no need for sophisticated high-end technology to operate such a facility. Therefore, it is suitable for low-income settings that rely mostly on simple technology and unskilled labor.

REASONS WHY BLACK SOLDIER FLY LARVAE ARE THE NEXT STEP IN SUSTAINABLE FARMING?

1. Their nutritional value is excellent

Black fly larvae can contain up to 43% of protein, and they are a great source of calcium and amino acids as well. Until they become flies, black fly larvae eat twice their own body weight every day.

2. Clean food production is faster and cheaper

Any animal that is raised for its meat has to be a clean source of food, both before and after being processed. With regular poultry or cattle, this means a lot of time, money and effort is put into turning their meat into an edible, clean product. This process is a whole lot faster and easier with black fly larvae since no matter what they eat, their digestive processes kill any bacteria they may encounter in their food.

3. Their reproduction rate is way above average

What could be better than having more available

products at a higher production rate? A black soldier fly can easily lay up to 500 eggs in one go. Also, since they only live for 6 weeks, you can expect even more eggs from the next generation of BSFL.

4. Black soldier fly larvae farming is easy

If you're looking for a fresh, organic source of protein that you can easily farm, this is it. If you put a little ramp in their feeding area with a bucket at the end, the BSFL will basically harvest themselves: just before they enter the final stage of their growth, they will look for a dark and dry place, and climb into the bucket by themselves.

5. BSFL farming is much more ethical

Black soldier fly larvae prefer to stay very close together. Also, they produce absolutely zero waste since their remains can be used as fertilizer, and take a lot less space than other animals (you can raise a ton of BSFL in a space as big as a SMART car), farming them it puts a lot less the strain on the environment

WHAT ALL YOU NEED TO START?

Organic waste, BSF larva, Trumb, PVC pipe, Card board box



AN ATTRACTIVE TREATMENT OPTION FOR BIOWASTE MANAGEMENT –BUSINESS PERSPECTIVE

- Waste biomass is converted into larvae and residue. The larvae consist of $\pm 35\%$ protein and $\pm 30\%$ crude fat. This insect protein is of high quality and is an important feed resource for chicken and fish farmers. Feed trials have confirmed it as being a suitable alternative to fish meal.

- Feeding waste to larvae has been shown to inactivate disease transmitting bacteria, such as *Salmonella* spp. This implies that the risk of disease transmission between animals and between animals and humans is reduced when using this technology at farm level or when treating waste of animal origin in general (e.g. chicken manure or slaughterhouse waste). However, risk reduction is achieved mainly through

material reduction ($\pm 80\%$) rather than through pathogen inactivation.

- Waste reduction of up to 80% on a wet weight basis has been demonstrated. If treatment is applied at the source of bio waste generation, the costs for waste transport and space requirements for landfills can, thus, be reduced drastically. Such organic waste treatment could furthermore reduce open dumping, which is still an unfortunate reality in low- and middle-income settings.

- The residue, a substance similar to compost, contains nutrients and organic matter and, when used in agriculture, helps to reduce soil depletion.

- A high waste-to-biomass conversion rate of up to 25% on a wet

weight basis has been demonstrated, which is a satisfactory output quantity from a business perspective.

- There is no need for sophisticated high-end technology to operate such a facility. Therefore, it is suitable for low-income settings that rely mostly on simple technology and unskilled labor.

