Black Soldier Fly Larvae: A Sustainable Feed Solution for Small-Scale Fish Farming in Ghana

GRO·FTP
Fisheries Training Programme

Author: Ivan Venkonwine Kaleo, Fisheries Commission, Ghana. email: ivan.kaleo@fishcom.gov.gh
Supervisors: Olafur Sigurgeirsson: olisig@holar.is; Theódór Kristjansson: theodor.kristjansson@hafogvatn.is

Introduction

•Aquaculture in Ghana faces rising feed costs, limiting profitability and growth, especially for small-scale farmers.

•Commercial fish feeds are often imported, expensive, and inaccessible to rural producers.

•Black Soldier Fly Larvae (BSFL) offer a high-protein, locally producible alternative, capable of reducing feed expenses.

•BSFL efficiently convert organic waste into nutrient-rich biomass, aligning with circular economy and zero-waste principles.

Objectives

- Develop a practical guide to support successful BSF larvae production by small-scale farmers.
- Propose policy actions to promote BSF larvae use in sustainable aquaculture.
- Formulate cost-effective and nutritionally adequate BSF-based diets for *Clarias* and *Tilapia* using local ingredients.
- Evaluate the economic feasibility of a small-scale BSF larvae production unit in Ghana.

Methodology

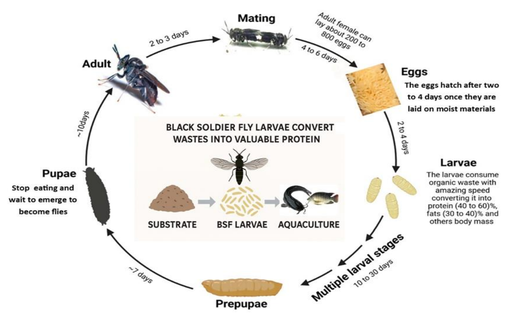

Figure 1: The life cycle of the black soldier fly.

- Reviewed literature, manuals, and videos to extract best practices and develop a practical BSF production guide tailored to smallholder farmers in Ghana.
- Used a computerised feed formulation approach to develop BSF-based diets tailored to small-scale farmers.
- Used Microsoft Excel to conduct cost analysis, nutrient balancing, and profitability comparisons between BSF-based and commercial feeds for *Clarias gariepinus* and *Oreochromis niloticus.*
- Conducted economic feasibility analysis of small-scale BSF production centres in Ghana using Excel-based cost modelling, break-even analysis, and profitability projections.

Results

Table 1. Sensitivity analysis of cash flow, payback period, and NPV under different revenue and cost scenarios.

Revenue Δ	Cost Δ	Cumulative DCF (GHC)	Net Discounted Profit (GHC)	DROI (%)	Payback period(yrs)
20%	-20%	59,534.27	41,509.27	230.25	2
20%	-10%	51,891.36	33,866.36	187.87	3
20%	-5%	48,069.90	30,044.90	166.74	3
20%	0%	44,248.45	26,223.45	145.48	2
20%	5%	40,426.99	22,401.99	124.35	2
-10%	-20%	29,364.88	11,339.88	62.91	3
0%	-5%	27,956.97	9,931.97	55.10	3
0%	0%	24,135.52	6,110.52	33.90	4
-5%	-5%	22,928.74	4,903.74	27.21	4
5%	10%	21,400.84	3,375.84	18.73	4
0%	5%	20,000.06	1,975.06	10.96	5
-20%	-20%	19,283.41	1,258.41	6.98	5
-5%	0%	18,864.28	839.28	4.66	5
10%	20%	18,806.15	781.15	4.33	5
-20%	20%	-29,288.20	-47,313.20	-262.49	-

Table 1 presents the impact of changes in revenue and cost on Net Present Value (NPV) and payback period over five years. Results show profitability is highly sensitive to cost increases and modest revenue declines.

Table 2. Cost comparison of BSFL-based feed vs. commercial feed.

Feed Type	Cost per kg (GHC)
BSFL-Based Feed	12.1
Ranaan Feed (Catfish)	15.25

BSFL-based fish feed is 21 % cheaper per kilogram to produce at farm level than commercial feed, offering a cost-effective alternative for small-scale fish farmers

Table 3. Black soldier fly larvae feed formulation and cost breakdown.

Ingredient	Formulation (% Inclusion)	Cost/kg (GhC)	Price per kg (GhC)
Fish Meal	10	1.5	15
Soybean Meal	30	3.6	6
Maize	7	0.2	2.5
Wheat Bran	20	0.6	3
BSF Meal	30	5.1	12
Premix	2	0.7	35
Palm Oil	1	0.4	40
Total	100	12.1	

BSF meal cost in Table 3 reflects the farmer's own production and processing expenses, rather than a market purchase price, to more accurately represent its true value in feed formulation.

Figure 1. Schematic layout of a small-scale Black Soldier Fly (BSF) Larvae production unit.

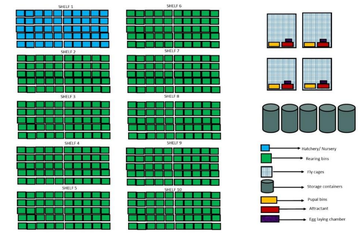

Figure 1 illustrates the layout of a small-scale BSF larvae farm, comprising ten shelving units with designated sections for hatchery/nursery bins (Shelf 1, in blue) and rearing bins (Shelves 2–10, in green). The system includes fly cages equipped with pupal bins, attractant trays, and egg-laying chambers to support continuous breeding. Storage containers are positioned for storing feed.

Summary of results

- Local production of BSFL-based feed reduces farmers' dependence on expensive commercial feeds and market price fluctuations, giving them greater control over feed supply.
- Minimising costs related to substrates, transportation, and labour is key to making BSF larvae production profitable and enabling faster recovery of initial investment.

Conclusions

- Successful adoption of BSF larvae production in Ghana requires both technical feasibility and strategic institutional backing.
- BSF larvae production is financially viable for small-scale farmers, offering short payback periods and positive returns even under varying cost scenarios.
- BSF meal is a cost-effective, nutritionally rich substitute for fish feed, helping reduce input costs for Ghanaian fish farmers.

Recommendations

Fish farmer groups are encouraged to co-establish BSF production units by pooling local skills, materials, and shared spaces, to reduce costs and maximise collective benefits.

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