



Transforming Aquaculture through Black Soldier Fly Innovation: A Youth Success Story from Machakos County

County:	Machakos		
Sector/s:	Fish farming, aquaculture	Sub-sector/Theme:	Aquaculture , Alternative Feed Technologies
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Target Audience:	County Governments departments of fisheries, aquaculture practitioners, agricultural extension officers		
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Introduction:

In the heart of Machakos County, fish farmers are grappling with a persistent challenge that threatens the growth of aquaculture: the high cost and limited availability of quality fish feeds. Despite the region's growing interest in fish farming as a source of nutrition and income, many small-scale producers find themselves priced out of commercial feeds, which often account for over 60% of production costs. The reliance on imported ingredients and centralized manufacturing has created a supply chain that is both expensive and inaccessible for rural farmers. As a result, feed-related constraints continue to stifle productivity, profitability, and the promise of aquaculture as a pathway to food security and economic empowerment.

The adoption of Black Soldier Fly (BSF) technology is transforming aquaculture by offering a sustainable and cost-effective alternative for fish feed production. Recent studies have highlighted the remarkable potential of BSF (*Hermetia illucens*) as an eco-friendly high-protein source sustainable alternative to conventional azolla fish feed, particularly suited for aquaculture systems. Renowned for their efficiency in decomposing organic waste, BSF larvae, commonly known as maggots can convert a wide array of biodegradable materials into high-quality protein.

This innovative approach is gaining momentum among both small- and large-scale fish farmers, driven by its affordability, environmental benefits, and capacity to reduce reliance on conventional feed inputs. By integrating BSF into aquaculture value chains, farmers are not only lowering production costs but also contributing to circular economy practices that enhance sustainability across the sector.



Machakos County Government has emerged at the forefront in insect-based protein farming. With the growing demand for sustainable animal feed, the County Government through the Department of Agriculture and Fisheries Development in partnership the Aquaculture Business Development Program (ABDP), has promoted BSF farming as an innovative solution for waste management, fish feed production, and youth employment. This initiative has not only improved fish farming & livestock nutrition but also contributed to environmental sustainability by recycling organic waste.

Implementation of the practice (Solution Path):

Machakos County Government Department of Agriculture and Fisheries through the ABDP and its partners supported beneficiaries by providing training on obtaining alternative feeds from BSF, which has positively impacted their livelihoods in aquaculture. BSF is not only cheap to obtain and rear but also derived from waste materials, making it a viable solution.

The training provided by the Agricultural Business Development Programme (ABDP) has significantly empowered aquaculture beneficiaries, equipping them with practical skills and innovative approaches to fish farming. One standout example is Titus Muema, a youth fish farmer from Machakos County, who transformed his livelihood by applying the knowledge gained through the programme and conducting further research on Black Soldier Fly (BSF) technology as a sustainable feed alternative.

BSF larvae (*Hermetia illucens*) are known for their ability to convert organic waste into protein-rich biomass, making them an ideal substitute for conventional fish feed. Titus collects organic waste from kitchen scraps & hotels, agricultural byproducts or market waste from Machakos town and its' environs. He feeds it to the larvae which rapidly converts it to biomass. The larvae grow quickly, reaching harvestable size in about 14 days where they are separated from the waste and cleaned. The harvested larvae are either fed directly to fish (especially catfish and tilapia), dried and ground into protein-rich fish feeds or pressed for oil which is also used in aquafeeds. BSF feeds are ideal for fish farming due to their high protein content (38-50% dry weight), a fat content of up to 35%, including omega-3 and omega-6 fatty acids as well as amino acids that are ideal for fish growth and immunity. BSF feeds sustainable and impactful in that they reduce reliance on fishmeal while closing nutrition gaps by recycling waste into feed and cutting feed costs for farmers.

Before joining the programme, Titus struggled financially, particularly to purchase commercial feed. However, the training he received introduced him to alternative feed options and connected him with a network of fellow beneficiaries some of whom had become trainers themselves.

Inspired by a session organized by ABDP, Titus took initiative experimenting with BSF production. His efforts paid impact of BSF on his fish growth has been remarkable, and his entrepreneurial spirit has led him to supply BSF larvae and feed to other farmers in the region.

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Titus currently produces an average of 150 kilograms of BSF larvae, selling them from Kshs 140 to 170Kshs per kilogram. Titus Muemas' journey exemplifies how targeted training, innovation, and youth engagement can drive sustainable transformation in rural aquaculture.



Picture 1: a farmer tending to a BSF farm in a farm in Machakos County

Results of the practice (outputs and outcomes)

- Through this initiative, farmers such as Titus Muema have seen an **increase in fish productivity**: Farmers have reported improved growth rates and health in poultry, fish, and pigs fed with BSF-based feed.
- **Waste Reduction**: being a peri-urban set-up, Machakos generates a lot of organic waste. BSF rearing has promoted organic waste recycling consequently reducing environmental pollution and promoting cleaner communities especially in the sub-urban setups in Machakos County.
- **Economic Benefits**: Farmers saved costs on expensive commercial feeds such as azolla and generated income by selling surplus BSF products.
- **Scalability**: The model has been replicated in neighbouring counties, demonstrating its potential for wider adoption. Titus Muema has mentored other youths in Machakos County on this venture and have adopted the initiative.

Machakos County Government through the Department of Agriculture and Fisheries has proven that Black Soldier Fly farming is not just an experimental idea but a profitable, eco-friendly agribusiness. By turning waste into wealth, the County has created jobs, reduced feed costs for fish farmers, and promoted a circular economy. With continued investment, Machakos County could become East Africa's hub for sustainable insect protein production.

Lessons learnt:

- ✓ Youth are highly responsive to practical, low-cost innovations when supported with mentorship
- ✓ BSF technology is scalable and adaptable to local contexts with minimal investment
- ✓ Peer-to-peer learning enhances adoption and builds community resilience
- ✓ Organic waste is an underutilized resource with high economic potential in aquaculture

Recommendations:

- Expanding training programs on BSF farming to reach more farmers and youth groups is highly recommended to ensure large scale production and an amplified impact.
- The integration of BSF production into County agricultural policies and waste management strategies is also recommended to ensure better planning and budgetary allocation.
- Establishing local BSF nurseries at ward level and distributing key inputs, such as pond liners, predator nets, and starter stock will be necessary support towards localized propagation. These efforts should go together with technical guidance on water harvesting and pond construction

Further Reading:

1. Machakos County Government Website - Machakos.go.ke
2. Aquaculture Business Development Program (ABDP) - <https://www.abdpku.org/>

Pictorial

Picture 2: Titus Muema's BSF production warehouse in Machakos County