



REPUBLIC OF KENYA



REVOLUTIONIZING CHICKEN NUTRITION: UNLEASHING THE POWER OF BLACK SOLDIER FLY LARVAE



Introduction

Chicken farming stands as a central economic activity in the livestock industry, not only providing financial opportunities but also playing a crucial role in achieving food and nutrition security. However, this enterprise requires a delicate balance between minimizing investment and maximizing profits. In chicken production, more than 70% of the total costs are associated with the provision of feed. Finding economical, yet high-quality protein feed resources becomes a critical task for chicken producers and animal feed manufacturers. Protein is vital for growth and productivity, but small-scale farmers typically encounter financial challenges in obtaining this critical resource.

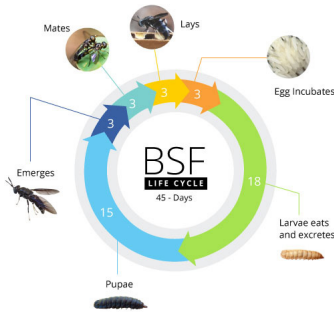
In response to this dilemma, KALRO is promoting the use of Black Soldier Fly larvae as a novel protein source in chicken feed compositions. This brochure contains the transformational impacts in research, illustrating how Black Soldier Fly larvae, in the form of a meal, may revolutionise chicken farming.

Research has effectively substituted conventional protein sources with Black Soldier Fly larvae meal, efficiently fulfilling their protein needs. The direct influence on chicken performance, growth, and production is apparent, particularly in broiler and layer chickens, where Feed Conversion Ratios (FCR) improve, and laying hens experience enhanced egg quality and quantity.

Background

The global surge in population, alongside challenges like climate change and resource scarcity, necessitates a re-evaluation of inputs in the animal feed industry. Conventional protein sources like fish meal and soya face challenges of scarcity and high costs due to environmental factors and competition with human consumption. To address this, there is a growing need for cost-effective alternatives. Insects, particularly the black soldier fly, present a promising solution due to their nutrient-rich composition, efficient lifecycle, high density tolerance, low water requirements, minimal greenhouse gas emissions, and abundance in crude protein, fat, and micronutrients. Embracing such alternatives is crucial for ensuring

sustainable and affordable protein sources for animal feeds in the face of evolving global challenges.



The life cycle of Black Soldier Fly (source: www.pinterest.com)



Black Soldier fly Love cage for mating and oviposition



Puparium cage



Adult Black Soldier Fly

Benefits of Black Soldier Fly

Black soldier fly larvae have emerged as a sustainable and highly nutritious feed source for chicken. With a protein content ranging from 40-45% on a dry matter basis, these larvae offer a rich source of essential amino acids crucial for muscle development, feather growth, and overall chicken health. Additionally, black soldier fly larvae provide healthy fats, including essential fatty acids, contributing to energy production, nutrient absorption, and maintaining optimal feather and body condition. Their composition includes macro minerals like calcium and phosphorus, supporting bone development and eggshell formation in laying hens.

Moreover, these larvae contain a spectrum of vitamins and micro minerals, including B-vitamins essential for metabolism.

Black soldier fly larvae offers more than just nutritional benefits in chicken feeding; they align with sustainable farming practices by efficiently converting organic waste into protein, thereby diminishing the environmental impact of waste disposal. In comparison to traditional protein sources like soya beans and fish meal, rearing black soldier flies proves to be more cost-effective and environmentally friendly. As the agricultural landscape shifts towards widespread adoption of alternative protein sources, black soldier flies emerge as a transformative element for sustainable and affordable chicken farming. Their impressive feed conversion efficiency further underscores their potential to enhance overall chicken nutrition. To benefit from these advantages, it is recommended to seek guidance from chicken nutrition experts to ensure proper formulation and a well-balanced diet when integrating black soldier fly larvae into chicken feeding programs.

The Crucial Role of Substrate Composition for Sustainability and Nutritional Value of Black Soldier Fly Larvae

The substrate composition is a critical factor in black soldier fly larvae production, influencing their nutritional content, growth, and efficiency in waste conversion. Choosing substrates rich in organic matter enhances the larvae's protein content, aligning to produce nutritionally dense feed. Opting for sustainable and locally available substrates contributes to the overall cost-effectiveness and environmental impact of the production process. Ensuring the absence of harmful substances is vital for the safety and quality of the larvae. In essence, the selection of an appropriate substrate is pivotal for the success, sustainability, and nutritional value of black soldier fly larvae production. The table below illustrates the composition of black soldier fly larvae reared on various substrates.

Composition of Black Soldier Fly larvae from three rearing substrates

Parameter	SUBSTRATE (% dry matter)		
	Chicken manure	Kitchen waste	Spent grains
Dry Matter	80.7	87.7	83.1
Ash	9.3	9.6	11.6
Organic Matter	59.8	90.4	88.4
Crude protein	41.1	33.0	41.3
Neutral Detergent Fibre	21.9	20.4	28.6
Acid detergent Fibre	12.6	13.2	15.0
Ether Extract	30.1	34.3	31.0



Black Soldier Fly Larvae (Hermetia illucens)



Smallscale Black Soldier Fly rearing unit

Black Soldier Fly Larvae in Feed Formulation

Feed formulation is a critical aspect of chicken production, impacting health, growth, and overall performance. A well-balanced diet tailored to specific life stages ensures optimal immune function, disease resistance, and reproductive success. It plays a key role in achieving target growth rates, weights, and high-quality meat or eggs. Economically, feed formulation influences efficiency, resource utilization, and production costs, contributing to the viability of chicken farming. Environmental sustainability is also addressed through minimised nutrient excretion. The adaptability of formulations to different production systems promotes uniform flock performance. In essence, feed formulation is essential for fostering health, productivity, and sustainability in chicken farming. Including black soldier fly larvae in feed formulations is a strategic and sustainable choice, positively impacting the health, productivity, and environmental sustainability of chicken production. The tables provided below illustrate feed formulas incorporating a 20% inclusion of black soldier fly larvae (BSFL) for chicks aged 0-8 weeks, growers aged 9-18 weeks, and layers mash for birds aged 19-78 weeks.

Chick starter mash	
Ingredient	Amount in 100 Kg
Ground whole maize	30.0
Maize germ	9.5
Wheat Pollard	10.0
Wheat Bran	15.0
Soya DoC	5.0
Sunflower cake	7.0
Black soldier fly larvae	20.0
DL-Methionine	0.2
Lysine	0.2
Threonine	0.15
Diamond V	0.15
Chick premix	0.25
Salt	0.3
Dicalcium Phosphate	0.3
Limestone	2.0

Chemical composition	
ME Kcal/kg	2,680
Crude protein	19
Crude Fibre	5.2

Growers mash	
Ingredient	Amount in 100 Kg
Ground whole maize	20.0
Maize germ	17.0
Wheat Pollard	18.0
Wheat Bran	22.0
Black soldier fly larvae	20.0
Diamond V	0.13
Grower premix	0.25
Salt	0.3
Di-Calcium Phosphate	0.3
Limestone	2.0
Chemical composition	
ME Kcal/kg	2,628
Crude protein %	16
Crude Fibre %	4.5

Layer mash	
Ingredient	Amount in 100 Kg
Ground whole maize	30.0
Maize germ	13.7
Wheat Pollard	8.0
Wheat Bran	4.5
Sunflower cake	12.0
Black soldier fly larvae	20.0
DL-Methionine	0.15
Lysine	0.15
Diamond V	0.13
Layer premix	0.25
Salt	0.3
Dicalcium Phosphate pellets	0.8
Limestone	10.0
Chemical composition	
ME Kcal/kg	2,567
Crude protein %	17
Crude Fibre %	5.8

Navigating Challenges of Feeding Black Soldier Fly Larvae to Chicken

Incorporating black soldier fly larvae (BSFL) into chicken diets involves several challenges, including regulatory, consumer, economic, and technological issues. The regulatory approval process for insect-based feed components is ever-changing, especially when it comes to the use of various biological wastes as substrates in BSFL production. Public perception and understanding of the safety and quality of products obtained from chicken fed with BSFL have a considerable impact on consumer acceptance of the end products.

Economies of scale and efficient production methods are critical for making BSFL feeds economically viable compared to conventional sources, while feed formulation knowledge is required for properly balancing nutritional profiles. Scaling up production, getting quality larvae, and maintaining consistent nutritional content are all challenges that might have an impact on the dependability of BSFL-in chicken feeds. Continuous research and development efforts are required to optimise manufacturing processes, improve nutritional content and finally support the sustainable integration of BSFL into chicken diets.

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