

# Chickens Prefers Eating Insect Meal: Are Consumers Willing to Pay for their Eggs?

## Introduction

Poultry rearing plays a major role as an income generating activity as well as a source of livelihood for about 65% of Kenyan households. The largest commercial production is in Kiambu County, where layers are intensively reared for egg production. Recently, the Kenyan poultry sector experienced soaring and volatility of livestock feed prices, especially poultry feed prices. This is due to the high cost of protein sources which account for up to 70% of production costs. This has necessitated the need to find alternative protein sources for use as livestock feed ingredients.

There has been a growing interest by private and public sectors partnering with the International Centre of Insect Physiology and Ecology (*icipe*) to explore the use of insects for poultry feed. Black soldier fly larvae (BSFL) have been identified for mass rearing due to their ability to convert organic waste into high-quality crude protein (CP), fat, amino acids, fatty acids, vitamins and minerals that are comparable or superior to that of fishmeal and soybean. The partnerships have delved into research on assessing the profitability and consumer perception on the use of insects in layer chicken production. Farmer field trials on five dietary treatments with BSFL (0, 25, 50, 75, 100%) have been carried out in Kiambu County.

The trials expect to show that insects can be a substitute protein source in layer chicken diets. There has also been a consumer survey to identify factors that influence potential consumer perception of eggs produced from hens fed on BSFL diets. This approach significantly provided insights for developing this novel food product.

## Current challenges on the use of insect-based feed

At the moment, there is low productivity of insects hence, there is a need to increase production of insects to enable the production of insect-based feed (IBF) in the market. The availability of insects greatly impacts on IBF produced. There is a need to increase farmer training on production of insects to increase consistency in production.

There is inadequacy of farmer training on the use of IBF in the country. Therefore, there is a need to increase awareness to enable the adoption of use of insects in poultry feed. Lack of awareness compromises the uptake of IBF and subsequently the success of the entire technology.

Insect based feed is still in the early stages of testing at farmer field level. Therefore, there is need to encourage farmers to adopt the feed in order to increase use of IBF. Low use of IBF subsequently means there are no eggs produced from hens fed on IBF, therefore consumers are unaware of these products. Although some products from animals fed insect-based feeds and insect-based foods have already entered the market, there is limited research attention toward the development of consumer-driven high-value product.

In Kenya, the use of insects as food and feed may be more challenging since their consumption is only found among few communities, particularly in Western Kenya. In Western Kenya, lake flies, termites, black flies, and grasshoppers have traditionally been consumed by locals. Neophobia can be overcome by availing information to households on the

perceived benefits of consuming products produced with insect-based feed.

## Feed formulation for field trials

In 2017, Kenya Bureau of Standards (KEBS) approved the use of dried insect products in formulated conventional animal feed. BSFL larvae was milled and mixed into poultry feed according to standards set by KEBS. The larvae are rich in protein up to around 50 percent, depending on the rearing substrate used. In addition, BSFL contains amino acids, carbohydrates, fats at 30-35%, minerals and some essential vitamins which are necessary feed supplement to poultry. The cost of formulating the different diets varied with the amount of BSFL included. Cost of feed formulation of layers mash was highest in the conventional diet (US\$ 0.46), compared to 100% BSFLM at 0.42US\$ as shown in Figure 1. Cost of protein in the feed was highest in conventional feed at 49.09 US\$ while lowest in 100% BSFLM at 37.17 US\$.

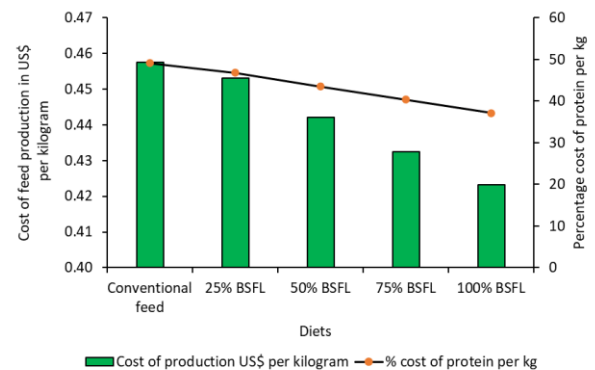


Figure 1: Cost of formulating layer chicken diets containing varying amounts of BSFL

## Egg production

It is estimated that egg production in layer chicken at peak periods is approximately 90 percent of the flock. Raising average production will therefore increase revenue. Field trials have indicated that the inclusion of BSFL at 50 and 75 percent had the highest production of eggs during the experiment period. However, the diet containing 100 percent inclusion of BSFL had the lowest production at 18 percent. This may be due to the poor digestibility of BSFL due to the high fat content.

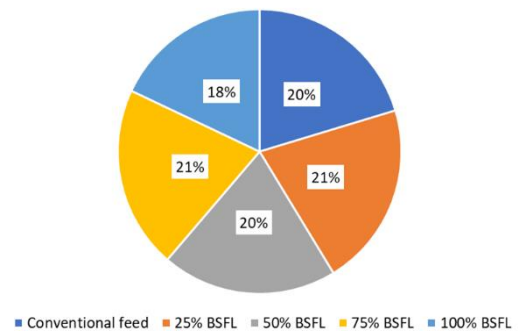
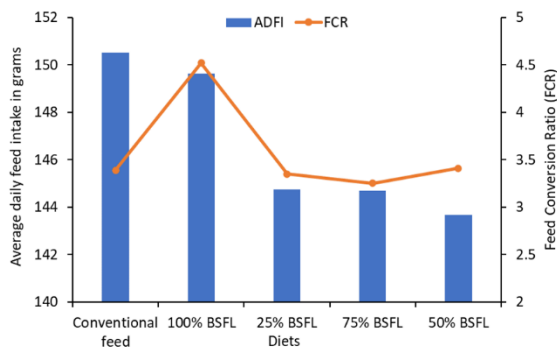


Figure 2: A comparison of total egg production of hens fed on different inclusion levels of BSFL

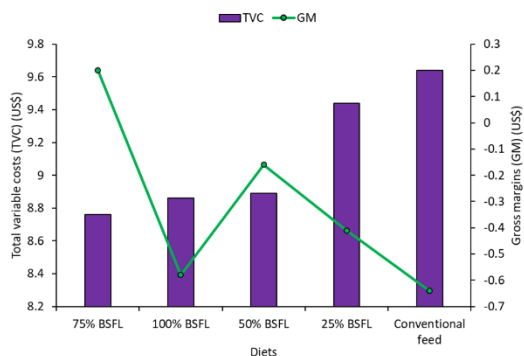
### Economic evaluation

To measure feed efficiency in layer chicken production, average daily feed intake (ADFI) and feed conversion ratio (FCR) are key components to consider. With respect to the aforementioned, BSFL can be used to complement conventional proteins to lower them and increase feed efficiency. Significant results have been recorded in this regard showing inclusion of BSFL at 75 percent had the most efficient FCR at 3.25 while inclusion of BSFL at 100 percent had the highest FCR. A high FCR in layer diet is an indication of poor feed utilization, which could be because of chitin. Chicken feeding conventional feed had the highest ADFI at 150.52g while chicken feeding on 50 percent BSFL diet had the lowest ADFI at 143.66g.



**Figure 3:** A comparison of the average daily feed intake of layer chicken across diets.

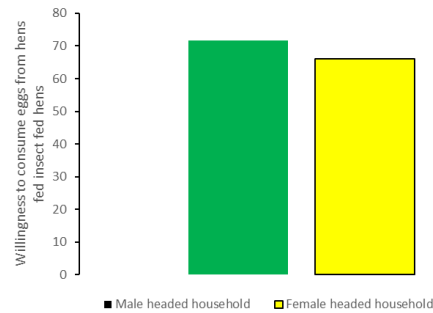
Profitability in poultry production is of key concern to farmers. The use of BSFL in layer chicken can contribute to developing a profitable agribusiness. Conventional feed which uses fishmeal had the highest total variable cost (TVC) at 9.64 US\$ and the lowest gross margin at -0.64 US. The inclusion of BSFL at 75 percent resulted into low TVC at 8.76 US\$ and the highest GM at 0.2 US\$. BSFL, through its low cost translates to lower costs in the production process and higher GM. The full potential of BSFL as a protein source will only be realized if insect production is maximized.



**Figure 4:** A comparison of Total Variable Costs (TVC) against Gross Margins (GM) involved in feeding layer chicken on varying levels of BSFL in US\$

### Willingness to consume

A sustainable business investment should also consider the long-term sustainability of an investment. With efforts to produce insect-based feed (IBF), it is important to find out if consumers who are the end users of products derived from animals fed on IBF are willing to consume them and factors that drive consumer perceptions. A consumer survey carried out indicated that 71% of male headed households were willing to consume eggs produced from hens fed on BSFL based diets in comparison to 66% of female headed households.



**Figure 5:** Gendered comparison of consumer households willing to consume eggs produced from hens fed BSFL based diets.

### Factors influencing perception of eggs produced from insect-fed hens

There are important perception indices that consumers consider in relation to eggs derived from insect fed hens: perceived benefits, ethics, traceability. These indices are significantly influenced by consumers' socioeconomic characteristics. Overall, low incomes, access to credit, off-farm income, awareness and open-air market point of sell positively and significantly influenced consumers' perception of the perceived benefit factor. The more aware a consumer is the more the benefits aspect is important. Consumers who had other sources of income other than agriculture were more likely to positively perceive the benefits factor. Average income earners in comparison to low-income earners are more concerned about the benefits of eggs but as income increases, the less the concern by consumers. Consumers who purchase eggs from open air markets were more concerned with the perceived benefits. The ethics factor was positively influenced by household size. Consumers with larger household sizes had higher likelihood of being concerned with the ethics factor. Consumers with average income were less likely to have positive perception on the ethics factor. Similarly, consumers with access to credit were less likely to positively perceive the ethics factor. Male-headed households had higher likelihoods of being concerned with the traceability factor. Finally, households who purchased eggs from open air markets and kiosks were more likely to be concerned with the traceability factor than those who purchased from other outlets.

### Policy implications

*icipe's* primary goal is to implement the use of insects in laying hen diet for improved egg production and profitability to smallholder farmers (Figure 6). This information is important for the animal feed industry, policymakers and other actors such as farmers, consumers and researchers. Therefore, awareness creation and campaigns on regulatory advances regarding the use of insects in chicken feed is crucial to support rapid uptake of this technology.



**Figure 6:** Mrs. Mourine, a female poultry farmer in Kiambu County, Kenya, said “*Black soldier fly farming turned my life around through generating income from eggs and spent hen meat as well as satisfying the nutritional needs of my family*”.

The evidence-based data generated from the market serves as a platform for the sensitization of various stakeholders on the trends of eggs (Figure 7) from laying hen fed insect-based diets as novel healthy food product. Particularly through labelling of these new products or development of alternative sale points in supermarkets or other market outlets would help in their promotion. Introduction of programs that would increase consumers’ nutrition literacy is necessary to enhance market. To increase consumer confidence and trust, safety regulatory frameworks should be developed to ensure precise insect inclusive legislation standards for regulating the production and use of insects across the food and feed value chain.



**Figure 7:** High quality eggs produced by hen fed insect-based feed.

The production of eggs from BSFL based feed should be well managed to ensure there is a distinct difference from eggs produced from the conventional feed. Feed production should be closely monitored to ensure the insect-based

products meets standards to facilitate quality, safety and efficiency before being released into the market.

Future trainings of farmers to build capacity towards sustainable production and the use of insects in poultry feed is crucial to increase their know-how on production technology and its impact on marketing of this emerging organic product for improved food and nutritional security, and livelihood enhancement.