

Lingering Questions from Insects in Aquafeeds Webinar

Insect Rearing and Feeding

1. Are you experimenting with different larval-rearing techniques and what do you recommend for someone looking to increase their egg hatching percentage?
 - Nick Piggott, Nutrition Technologies Answer: There are so many different options for small-scale production systems that this is a difficult question to answer without knowing the context of the system. Generally, I would suggest not 'harvesting' your eggs from where they are oviposited as this can damage the egg clutches – instead let them hatch from where they are in the egg collector, and collect the neonates.
 - Maye Walraven, InnovaFeed Answer: We are continuously improving our rearing technique, having based our R&D center at our pilot-scale plant. Unfortunately, the technology developed is confidential and I'm not at liberty to disclose this type of information.

2. Where do you get your insects? If they are from the same source, will there be a problem of germplasm decline after multiple generations due to the short life cycle of the insects, thus affecting the uniformity of insect nutrition levels?
 - Nick Piggott, Nutrition Technologies Answer: Locally in the country where we operate. Our fly population is well over the minimum number of individuals required for a genetically stable population, so there is little / no concern over germplasm decline within our system.
 - Maye Walraven, InnovaFeed Answer: We have internalized reproduction to provide the insects for successive batches. We keep different families in order to avoid potential issues linked to inbreeding.

3. What diseases are impacting your production?
 - Maye Walraven, InnovaFeed Answer: To date, no diseases are known or documented in literature for the Black Soldier Fly. We have never encountered diseases in our own production.

4. What do you feed your insects and do you find that the feed inputs (byproducts, palm oil, pbm, etc.) limit production and hamper cost reduction? What are the challenges with dealing with the waste supply chain and how do you achieve uniform nutritional composition of the insect from variable feed inputs?
 - Nick Piggott, Nutrition Technologies Answer: Agricultural & Industrial organic waste streams. Direct from farms, plantations & factories. This homogenous supply simplifies our supply chain, and allows us to formulate long-term feeds. We use software to formulate our feed, and use a fermentation technique to control the pH and microbiome in the feed substrate.
 - Maye Walraven, InnovaFeed Answer: We have conducted research across >150 types of agricultural by-products around the world and found that indeed the feed input has a strong impact on production performance. This is why InnovaFeed

has selected to focus on an industrial symbiosis model, by which we partner and co-locate with large agro-industrials, allowing to get a stable supply in by-products both in terms of quantity and quality. This is essential to ensure the stability and homogeneity of our end-products (compared to other models based on waste streams).

General Insects

1. Is there any indication of insects genocide when we use them at commercial scale?
 - Maye Walraven, InnovaFeed Answer: Insect farming is similar to any other type of animal farming. Its objective is to raise animals in order to feed populations, and thus does not fall within the definition of genocide, consisting in the systematic extermination of a whole species.
2. Do the insects themselves contain other ingredients that will have a requirement and negative impact on the type of object to be cultured?
 - Maye Walraven, InnovaFeed Answer: Intensive research has gone into the use of insect ingredients and no negative impact have been observed across several species (animals and plants)
3. CPF announced they will produce insects. What is your position on this?
 - Nick Piggott, Nutrition Technologies Answer: CPF have had a University research partnership for a few years. As the biggest feed manufacturer in the world, they will have a massive interest in alternative proteins and novel ingredients. We have had a good relationship with CP for a few years, and believe they will be a key driving force for developing the insect sector in the region.
 - Maye Walraven, InnovaFeed Answer: It is great to see larger players supporting the insect industry, demonstrating its attractive potential. The insect sector having emerged recently and being very innovative, a significant investment in R&D and designing the production processes is required, in order to control the very sensitive insect reproduction and life cycle. At InnovaFeed, we have developed a state-of-the-art technology, strong from a 90+ team of engineers, scientists, biotechnologists and agronomists. We see potential to forge partnerships with players such as CPF in the future.

Your ingredient versus others

1. Within the alternate protein space, how does a feedmiller choose between insect protein and single cell proteins? Are consumers of seafood demanding insect-fed seafood or just must sustainable seafood?
 - Maye Walraven, InnovaFeed Answer: Insect protein have emerged as the most promising protein source amongst alternative protein sources for three reasons:
 - It is the first industry to demonstrate its ability to scale up production (vs Single Cell Proteins) with several large-scale sites providing commercial products

- It has demonstrated the highest performance in aquaculture vs other type of alternative protein across various trials

It is a natural source of nutrients for many fish species in the wilderness thus consumers have a very high level of acceptance for insect-fed seafood

2. How could the insect production companies cooperate to gain market share? (To stimulate to a quicker and more successful shift from fishmeal to insects)
 - Nick Piggott, Nutrition Technologies Answer: Publishing and sharing results of trials is the key point, to demonstrate the effectiveness of insectmeal in aquafeeds. Fortunately, the sector is well connected and generally very supportive, so this is already happening, to a large extent. There are also industry bodies IPIFF, AFFIA, etc which coordinate activities.
 - Maye Walraven, InnovaFeed Answer: Beyond insect producers, the whole value chain can cooperate to bring to the market this alternative and sustainable solutions. This is already the case, sharing knowledge and overcoming identified challenges through initiatives like FeedX – Global Project X, that reunites several insect producers, including InnovaFeed
3. What are your views on prospects of commercially extracting Chitin from BSF larvae?
 - Maye Walraven, InnovaFeed Answer: We are looking at this opportunity from a R&D / Product development perspective. We have indications that low levels of chitin can have beneficial impacts when included in animal feed so we intentionally do not take it out of our protein products.
4. Does insect inclusion affect the extrusion and pelleting process? Does it affect feed quality?
 - Maye Walraven, InnovaFeed Answer: We have conducted some research indicating insect inclusion can have positive technical impacts on the extrusion and pelleting process.

Insects as nutrition

1. Can you explain criteria for the selection of insect larvae to use in feed?
 - Nick Piggott, Nutrition Technologies Answer: 1) a native species to the location in which it is being produced. 2) nutritional quality (crude protein & protein digestibility, range of amino acids) of the larva. 3) suitability of available feedstock for the larvae 4) bio-safety element of the production and the finished goods.
 - Maye Walraven, InnovaFeed Answer: Using insect-based feed ingredients combines both performance and sustainability. InnovaFeed has demonstrated the performance of its insect feed ingredients at zootechnical level (improving animal growth and health) and organoleptic level (using insect ingredients in animal feed can improve the taste of the final product, and reduce the amount of pollutants and unwanted substances – e.g. presence of heavy metals in the flesh of insect-fed fish)

2. Is there any general data on the amino acid composition and level of insects and fatty acid composition and level of insects, and are there any functional peptides to explain the nutritional function of insect feeds?
 - Nick Piggott, Nutrition Technologies Answer: Yes, extensive research has been done and published on all of these. JIFF is a journal that publishes exclusively on insects in food & feed, and is a very good resource.
 - Maye Walraven, InnovaFeed Answer: Yes, insects' nutritional composition is well documented – we can share amino acid and fatty acid composition upon request. We have also conducted research on functional peptides such as AMPs or peptides impacting palatability.
3. From a bureaucratic point of view are these farms considered as farms?
 - Nick Piggott, Nutrition Technologies Answer: This varies from country to country. In Malaysia it is considered a manufacturing industry, but we are regulated by the Department of Veterinary Services.
 - Maye Walraven, InnovaFeed Answer: Yes, insect farming is considered as any other animal species farming and in Europe we are regulated by local authorities with regards to health and safety procedures and controls.
4. Will these insects be compatible with African catfish? Has anyone tried it?
 - Nick Piggott, Nutrition Technologies Answer: I believe so. JIFF is a journal that publishes exclusively on insects in food & feed, and is a very good resource for questions like this.
 - Maye Walraven, InnovaFeed Answer: InnovaFeed has tested insect protein ProtiNova in catfish feed and has obtained positive results.

Maye Walraven

1. What about NovaGain specification vs your Insect proteins meal?
 - Maye Walraven, InnovaFeed Answer: NovaGain is a specific product leveraging BSF's unique properties (including lauric acid, AMPs, chitin) developed for shrimps that has a proven performance, boosting shrimps growth and decreasing FCR significantly, while increasing the resistance to common diseases.

Nick Piggott

1. As you're sourcing your business in Malaysia, how confident are you in marketing your BSF products here? When do you expect for the BSF business to bloom?
 - Nick Piggott, Nutrition Technologies Answer: Very confident. We are already working with some of the biggest organic fertiliser and plantation operators in the country who are distributing or using our frass. We are also engaged with aqua, poultry and swine feed operators, who use both the insectmeal and the insect oil in feed formulations. We are planning to expand within Malaysia in 2022, as well as expanding our footprint to other ASEAN countries.