

The nutritional benefits of insects in animal feed

The **forecasted population growth**, coupled with the **increasing demand for animal proteins** worldwide are two key indicators that reflect the urgency to further optimise our food-producing sectors. **New sources of feed, such as insects** and their derived products, represent an alternative which is rapidly developing across the EU. By reintroducing valuable nutrients in the agri-food chains, insects can provide a locally-produced source of nutrients for the **aquaculture, poultry or swine sectors**. Moreover, added in animal feed, such novel ingredients have also shown **positive results in terms of growth rates, development** as well as **animal health and welfare**.

Thus, the inclusion of insects in the diets of such animals will not only improve the circularity of the agri-food nexus, but will also complement the diet of farmed animals with products that respond to their nutritional needs.

The European Commission promotes the development of alternative feed ingredients

Since the development of the first Protein Report in 2018, more attention has been dedicated to improving EU's self-sufficiency in terms of protein feed materials. Considering the growing demand for meat, which will trigger an increase in the demand for feed materials on global level (intensifying the negative effects associated with the outsourcing of certain links of the animal-production value chains, such as land degradation or deforestation), it is expected that EU-produced feed ingredients will grow during the coming years. Yet, due to reduced agricultural land available, the self-sufficiency rate will remain limited. The recently launched

Farm to Fork Strategy aims at 'fostering EU-grown plant proteins as well as **alternative feed materials such as insects**, marine feed stocks and by-products from the bio-economy'

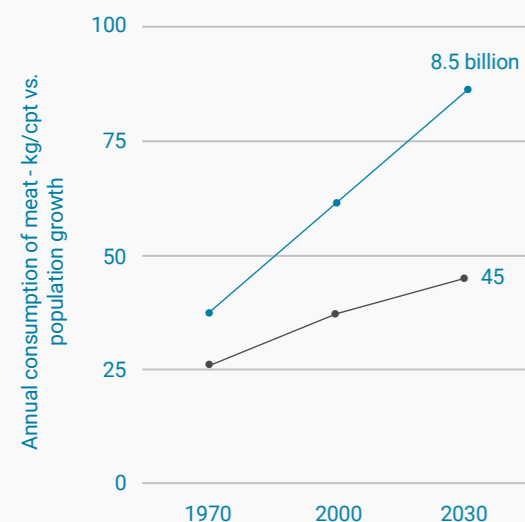


credits: European Commission

The European insect sector regards this initiative as a boost in the development of new animal nutrition products, such as insect-derived feed.

Insects are leaders in terms of land-use efficiency

Known for their reduced overall footprint, insects are among the most efficient sources of proteins in terms of output per area of land. Their fast development and growth, with several cycles of insects farmed per year, as well as the incorporation of vertical farming principles in insect farming, make insects up to **70 times more efficient than commonly-used materials of vegetal origin**.



Market outlook

A wide range of factors will impact consumers' preference with regards to meat consumption during the coming decades - with the growing population and increasing resource scarcity being the leading ones. While the annual EU meat consumption is expected to decline by 1 kg per capita by 2030' (reaching 68.6 kg - source: EU Outlook 2019-2030), an opposite trend is noticeable on a global level. According to the FAO, the meat consumption will exceed 45 kg per capita by 2030 - a 10% increase in contrast to the value from 2015. Considering the growing demand on a global level, it is very likely that the decline in pork and beef products in the EU will be compensated by an increase in exports. Thus, competition for high-quality feed ingredients will intensify in the future, confirming the necessity to improve EU's self-sufficiency with regards to feed materials.

Nutritional benefits of insects in animal feed: a 'future-proof' solution

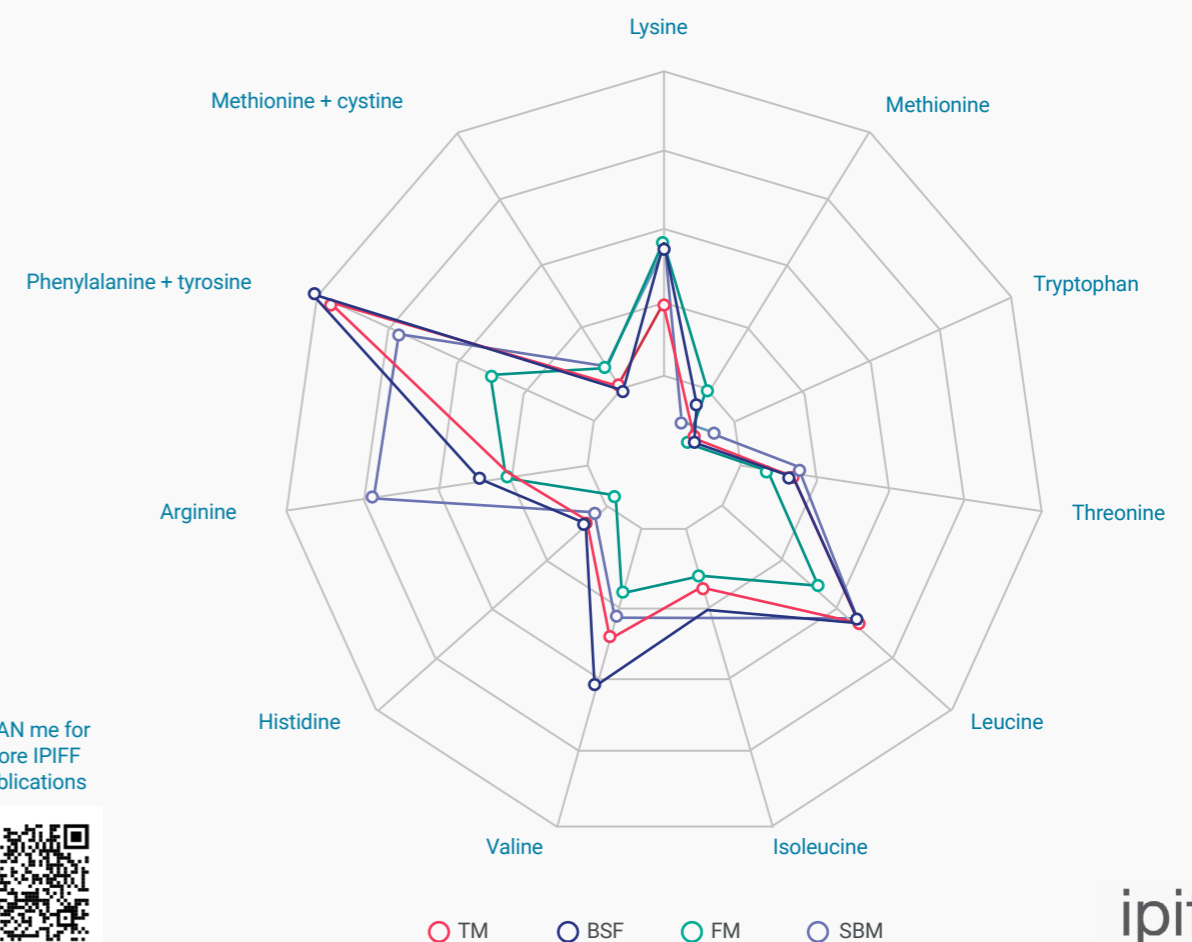
The insect meal derived from the species that are most commonly used in animal feed production contains between 55% and 76% crude protein and nutritionally valuable amino acids.

The **high content of digestible protein in insect larvae** (in dry form) makes them a potent solution to improving protein **self-sufficiency** in animal feed. According to recent reports (i.e. Rabobank, EU Joint Research Centre), the European insect sector's production capacity is expected to be between half and 1.5 million tonnes of insect protein by 2030.

Moreover, their amino acid profile corresponds to the dietary needs of fish, poultry or swine animals, with adequate levels of amino acids which are seen as limiting factors (lysine, threonine, methionine, and tryptophan).

Insects offer tailor-made solutions for feed manufacturers, contributing to the development of highly formulated feed and personalised feeding strategies

Mean amino-acids for commonly-used insect meal, in contrast to fish meal or soybean



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Source: Table 1.1 - 'Fishmeal Alternative Protein Sources for Aquaculture Feeds', L.Gasco et al., 2018

Insects are highly efficient in converting lower value by-products into higher-value protein materials. In addition, insects could also boost the feed conversion ratio of farmed animals.

Numerous trials and studies on the impact of insects and their derived ingredients on the Feed Conversion Ratio (FCR) of animals reflect the **positive outcomes** associated with their inclusion in **fish, poultry, or swine animals diets**. For example, *H. illucens* led to a 54.9% increase in the average daily weight gain of the giant freshwater prawn, while also contributing to a 32% decrease in its FCR. Similar results were observed when *T. molitor* was included in the diet of juvenile rainbow trout (FCR decreased by 25%, while a 33.7% in weight gain was noted).

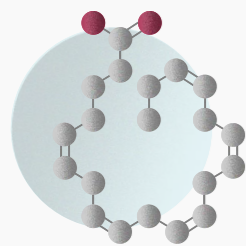
In poultry animals - among the most efficient in converting animal feed into protein - the addition of insect meal further improves the FCR, most probably due to the presence of **highly digestible protein** in insects. Average daily gain and total live weight were also increased.

“Aquaculture - among the fastest-growing food sectors in the world - dedicates great attention to the development of alternative raw materials as compound feed ingredients. In line with the nutritional requirements of aquatic species and the increased ecological footprint awareness, the inclusion of low-trophic sources of feed, such as insects, represent a promising opportunity for the fish farming sector. We are confident that our collaboration with the insect sector will provide valuable opportunities to the 'Farm to Fork' Strategy, primarily in the development of local, healthy and safe feed ingredients.

Alexandra Neyts, EATIP Secretary-General

Insects are more than protein...

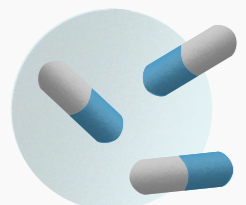
In addition to the inclusion of insect-based protein ingredients for feed applications, their use in functional feed remains equally relevant. The research around the capacity of insects to modulate animal gut health is developing at a faster pace, providing promising results.



Insect larva lipid profiles show an interesting fatty acid content. The presence of linoleic acid (omega-6, 12-33%), as well as oleic acid (11-38%), are of high importance in the development of personalised feeding strategies.



... insects contain nutrients which are generally limiting factors in animal nutrition. For example, the insufficient B12 content in ingredients for organic farming leads to nutrient deficiency and lower product quality. The absence of vitamin B12 in ingredients of vegetal origin could be complemented by including insect-derived ingredients.



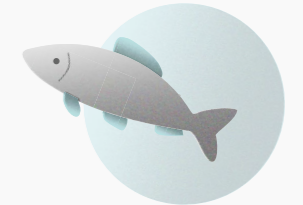
... **antimicrobial peptides found in larvae** are presently investigated for their potential in the development of novel antibiotics, mainly thanks to their **immune-boosting properties**. Moreover, the presence of chitin in fermented insect meal has been shown to reduce cecal *E.coli* and *Salmonella spp* in broiler chicks, confirming the high potential to reduce the use of antibiotics.

Consumers and farmers alike become more aware regarding the benefits of insects in animal feed

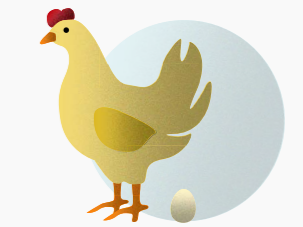
The attitude of consumers towards novel products in food and feed is influenced by the characteristics of such new ingredients, production methods, but also by taste and appearance.

01 Invertebrates are an essential part of the natural diet of fish, poultry or pigs.

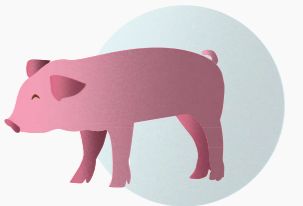
Numerous fish species have insects and other invertebrates as an essential part of their diet. Many of them have adapted their physiology in order to hunt insects that fly above the water (Nogales-Merida et al., 2018). For example, it is estimated that the diet of certain *Salmonidae* species contains up to 70% insects.



Digging and scratching the ground is part of the natural behaviour of fowl birds, such as chickens or turkeys. This innate instinct is caused by the animal's need to build a nest, as well as by the numerous 'delicacies' that are found underground: invertebrates, such as insect larvae. Trials indicate that **insects containing diets are preferred by poultry species**, most likely because of their taste and nutritive value. Moreover, recent evidence confirms that the incorporation of insects in poultry's diet would also allow them to express their natural behaviour - **reducing aggressive reactions**, such as feather pecking (Star et al., 2020).



The omnivorous diet of swine species makes them extremely versatile and adaptable. In nature, these animals would forage for roots, seeds or insect larvae - characteristics that are also visible in the behaviour of farmed pigs.



02 ... what is the farmers' attitude regarding the inclusion of insects in animal feed?

Farmers' expectations regarding alternative feed ingredients are linked to **safety, sustainability and predictability of the product**. Provided that Good Hygiene Practices (see IPIFF publications) in insect farming are respected, insects and their derived ingredients are in conformity with the EU standards on animal feed safety.

The **positive environmental credentials** associated with insect farming represent an additional motivation for farmers. Their reduced land and water use implicitly **diminish the overall footprint of the entire farming chain**, which represents an additional motivation for consumers in their search for sustainable products.

In line with market requirements, farmers expect products of predictable quality, that could complement the nutritional needs of fish, chickens or pigs. There is increasing evidence around the interesting opportunities to alter the nutritional composition of farmed insects by modifying their growing conditions or their substrate. This opens numerous possibilities for both insect and animal farms, who can collaborate on developing fit-for-purpose products for aquaculture, poultry or swine animals.

In a survey from 2015, 68% of the interviewed stakeholders (including farmers) showed their acceptance with regards to the use of insects in animal nutrition (Verbeke et al., 2015).

03 ... consumers' acceptance

Information on the sustainability of products is becoming increasingly relevant for consumers, especially when they buy food. The inclusion of locally-produced feed ingredients, such as insects, in the diet of farmed animals shows a positive attitude on the consumers' end. Presently, surveys indicate high acceptance rate for insect-fed aquaculture, poultry or pigs animals (according to the PROteINSECT study, 73% answered positively).

It is expected that, improving the knowledge of European consumers regarding the comparative advantages of farmed insects, will also contribute to increasing their acceptance with regards to their inclusion in animal feed.