

Is Insect Farming Truly a Solution to The Animal Feed Problem?

The European Union has started considering alternative feed, such as insect protein, to supply the livestock industry. Insect-derived protein as animal feed is increasingly seen as a solution to diminish the use of imported soy linked to deforestation and to supplement the use of fishmeal from depleted oceans. In the EU's commitment to tackle the climate crisis, the promises of insect farming have been embraced by policy makers but it does not seem to be the sustainable solution the EU is looking for.

The Farm to Fork strategy, a key initiative under the European Green Deal, was presented by the European Commission (EC) in 2020. It aims to accelerate the transition to a fair, healthy and environmentally-friendly food system with a neutral or positive environmental impact that helps to combat climate change and reverse biodiversity loss while ensuring safe, nutritious and sustainable food for all.

As part of the EU's commitment to sustainable food systems, the Farm to Fork strategy will reduce the European Union's dependency on imported feed such as soy, which is linked to deforestation. Instead, EU produced feed materials, including both plant protein and alternatives such as insects, should be promoted.¹ In addition to reducing soy dependence, the use of insect protein as feed is seen as having the potential to contribute to a circular economy under the condition that insects can be fed on organic waste. In this editorial we explore the effects that insect farming for feed can have on farming systems and animal welfare, including on insect welfare.

Processed animal protein (PAP), including from insects, has been prohibited for use in animal feed in the EU since 2001. The EU feed ban followed the outbreaks of bovine spongiform encephalopathy (BSE) which led to the killing of over one million cattle in the UK in the early 1990s. Insect protein has been allowed as feed in aquaculture since 2017, as well as for fur animals and in pet food,² but the feed ban has restricted the insect industry's possibilities to produce insect protein for the animal feed market and thereby their possibilities to scale up.

The EC now notes that the risks of BSE are reduced. In combination with the Farm to Fork strategy's aim to reduce the dependency on soy and make better use of protein and other feed materials produced in Europe, the EC has revised the feed ban. In August the use of PAP of porcine origin in poultry feed, and of poultry origin in pig feed was authorised. In this context, the EC also authorised insect PAP in pig and poultry feed³ under the same conditions as required for aquaculture feed. The decision was announced as "another small step in our journey towards more sustainable feed chain"⁴ and was communicated as a way to achieve "another milestone in the Farm to Fork strategy's ambition towards the use of quality and sustainable feed".⁵

The recent decision to allow insect derived protein in pig and poultry feed conflicts with the goals of the Farm to Fork strategy. On the one hand, insect protein is promoted by

the EC as an alternative feed material with the potential to reduce Europe's dependence on soy and reduce the negative environmental consequences of livestock farming.

On the other hand, the Farm to Fork strategy recognises the urgent need for a shift towards healthy, sustainable diets with more plant-based food. Moreover, it emphasises the role of improved animal welfare: less and better meat. This attention given to improved animal welfare in the Farm to Fork strategy is also linked to One Health and the target of halving the sales of antimicrobials by 2030 to curb antimicrobial resistance. The density of animals in intensive, indoor, large-scale production sites facilitates the spread of pathogens and can lead to an increased risk of disease due to stress which makes the animals more susceptible to illness.⁶

That the insect industry predicts major growth of insect farming after the authorisation of insect protein for pig and poultry feed.^{7,8} The insect industry is likely to expand after the authorisation is reflected in the European Commission Agricultural Outlook 2020–2030 which assessed the impact that insect farming would have, when fully commercialised and if all existing restrictions were lifted. It forecasts that the increased supply of insect meal and lower prices could support conventional intensive animal production.⁹ A rapid expansion of insect farming for animal feed seems, therefore, to go against the Farm to Fork strategy's objectives of improved animal welfare and real food systems transformation. Instead, insect farming for feed seems to favour intensive, indoor, large-scale production and, as a consequence, make the reduction target for antimicrobial sales more difficult to achieve.

By supplying the intensive pig and poultry farming sector with insect protein, the insect industry runs the risk of sustaining these systems rather than transforming them into the higher welfare systems envisioned in the strategy and expected by EU citizens.¹⁰

It has been argued that insect protein in pig and poultry feed contributes to improved animal welfare as insects are part of the natural diets of both poultry and pigs. However, while good nutrition is one component, a focus only on nutrition for animals in intensive systems is a too narrow view of what improved animal welfare means. From the perspective of the Five Domains model,¹¹ a positive affective state of an animal is also influenced by a good environment, good health, and opportunities to express appropriate behaviour, such as rooting and scratching. It accounts for not only the physical needs to be met but also ethological and psychological ones, and promotes the role of positive mental experiences. One example of the latter is foraging for food: searching for insects through scratching is a positive experience for poultry and therefore contributes to their welfare,¹² in line with the Five Domains model. This is not, however, what is achieved by promoting the use of insect PAP for animals confined indoors in intensive systems.

The welfare of insects also needs to be considered. Since they are bred to produce PAP they are defined as farmed animals in EU legislation.¹³ The European Food Safety Authority (EFSA) considers that the "general animal (vertebrate) health

and welfare rules should also apply for insects".¹⁴ However, Council Directive 98/58/EC concerning the protection of animals kept for farming purposes excludes any invertebrate animal.¹⁵ A major difficulty in assessing insect welfare is the current lack of scientific knowledge about the welfare needs of insects, as well as about their experiences of suffering and pain.^{16,17} There are an estimated 5.5 million insect species in the world of which only about one million species are currently known.¹⁸ The species allowed for animal feed in the EU are:

- Black soldier fly (*Hermetia illucens*)
- Common housefly (*Musca domestica*)
- Yellow mealworm (*Tenebrio molitor*)
- Lesser mealworm (*Alphitobius diaperinus*)
- House cricket (*Acheta domestica*)
- Banded cricket (*Grylloides sigillatus*)
- Field cricket (*Gryllus assimilis*)¹⁹

Of these seven species, black soldier fly, mealworm and house cricket are the species most commonly reared in Europe.²⁰ The welfare requirements of each species would need to be assessed in order for the housing systems to meet each species' environmental and species-specific needs.²¹

A recent review concludes that many insect species currently raised for both feed and food are assumed or confirmed to be capable of a range of cognitive abilities. The study finds that there is reason to believe that crickets can feel important emotions such as stress, and emphasise that the lack of knowledge about the impact of the various slaughter methods on different species of insects should be reason for special attention. Boiling is, for example, known to be painful to decapod crustaceans, and there is a strong possibility that this slaughter method is painful also to other invertebrates.²² While insects are often slaughtered by heating or boiling, mincing or freezing, the insect industry itself recognises that "the current lack of scientific evidence around invertebrate welfare makes it very difficult to develop science-based welfare rules for insect production".²³ It is also unknown if there are differences in sentience between the larvae and the grown insect.

In the absence of scientific evidence, scientific literature recommends that we should **apply the precautionary principle and treat insects as if they were sentient**.^{24,25} We should not repeat past mistakes of developing large-scale farming without knowledge about the possible welfare consequences. With fish it was only recently scientifically established that they feel pain.²⁶ By then, intensive aquaculture practices and slaughter methods with animal welfare problems had developed widely. These systems cause considerable suffering, pain and stress. Moreover, once developed and established they are difficult to reverse. The lack of scientific knowledge about sentience, pain and welfare needs of each insect species should be solved before insect farming is allowed to scale-up.²⁷

Not only are there the consequences on animal welfare, large scale insect farming may also bring unforeseeable consequences for local farming and ecosystems. With climate change and the increase of extreme weather events, there is a greater risk of accidental mass-releases from insect farms leading to the introduction of invasive alien species when farms are damaged by extreme weather.^{28,29} Moreover, a warmer climate can be more conducive to the establishment of invasive alien species. The economic consequences could be significant, considering that invasive species are the cause of a 14% reduction of global food production.³⁰ An increased risk of insect-borne pathogens should also be considered as it can pose an additional threat to the already

struggling wild-living insects such as bees, that are essential for pollination and other ecosystem services.³¹ The impact on local ecosystems can thereby, beyond the economic impact, compromise both biodiversity and food security, at least locally.

Many factors have changed the interactions between people, animals and the environment in fundamental ways. This has made the One Health approach even more important in recent years.³² One Health captures the idea that human health and animal health are interdependent and bound to the health of the ecosystem in which they exist.³³ A concept closely related to One Health is One Welfare, which reflects the benefits of high animal welfare standards also on humans and considers the relation between animal welfare, human well-being and sustainability.³⁴ These concepts can be used together as One Health–One Welfare.³⁵ The Farm to Fork strategy encompasses many of these elements as it connects improved animal welfare to sustainability.

Applying One Health–One Welfare as a perspective can initiate a more critical debate on the introduction of industrial insect farming, a debate that has been largely absent throughout the discussions on the Farm to Fork strategy and the subsequent lifting of the feed ban for insect protein. It is high time that this emergent system of industrial farming is assessed from a more critical standpoint, considering the serious lack of knowledge on several crucial aspects of management and ecology.

Insect farming for feed seems to be a false solution to the EU's sustainability challenge. Without a critical debate, the risk is that it will sustain intensive pig and poultry farming rather than lead to truly sustainable food systems where humans consume more plant-based protein as part of healthy, sustainable diets and where pigs can root and poultry are able to scratch the soil.

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