

Why are insects not allowed in animal feed?



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Whitepaper

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Insects in feed

Insects are the future. We need to identify alternative protein sources with urgency, and insects have great potential in contributing to global food security. Insect-based feed products could have a similar market to fishmeal and soy, which are presently the major components used in feed formulae for aquaculture and livestock. Also, it takes much less feed and land to produce a kilogram of insect protein than a kilogram of meat protein.

However, the relevant current legislation and regulation must be reviewed to make sure this type of mini-livestock is allowed to make their way into animal feed.

This whitepaper contains valuable information on the advantages and disadvantages of insects in animal feed. It also gives you a clear view on the current legislations and the changes that need to be made. Why are insects not allowed in animal feed?

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Elaine Fitches, Co-ordinator of the PROteINSECT project at FERA: "To enable protein from insects to become a significant component of animal feed, European legislation must be changed if we want to allow it to be fed to pigs and poultry as well as fish. Our work in PROteINSECT is establishing the evidence base that this is a sustainable, safe and economic source of protein, delivering quality food for human consumption as well as significant environmental benefits."

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Advantages of insect meal

Alternative to meat

Besides its use for animal diets, insects also have many advantages when it comes to being alternative protein sources for humans. Insects – **‘mini livestock’** – have a tiny ecological footprint when compared with meat. As stated earlier, it takes much less feed and land to produce a kilogram of insect protein than a kilogram of meat protein. The nutritional value of insects is similar to that of beef. In addition, insects contain a lot of healthy, polyunsaturated fatty acids and minerals, such as iron.

The fact that more alternatives to meat hit the market is very much needed, because the rapid increase in the global population and the growth in prosperity are causing a huge rise in the demand for animal protein. The possibilities of using regular sources of animal protein are limited. Insects are a promising new source of food, and are part of the staple diet of around two billion people in large areas of the world. China, Thailand, the United States and even the Netherlands are already farming insects for human consumption on a large scale.

Sustainable feed ingredient

PROteINSECT was prompted by the increase in the meat consumption in developing countries and thus the need to tap into alternative feed sources. “Insects are increasingly recognized as an excellent protein alternative for use in animal feed,” a project briefing document read, noting that many species are highly nutritious and their production has a lower environmental impact than other feed sources. According to the project, insects can be reared quickly and easily on organic waste, such as vegetables and domestic waste, which would lead to a 60% reduction of that waste.

Less costly

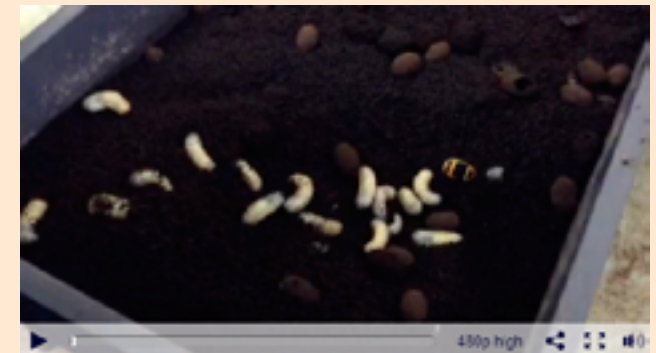
A young French company, Ynsect, has identified **a cheap, nourishing and locally sourced alternative** to soybeans as a vital source of protein in animal feed. Black soldier flies, common housefly larvae, silkworms and yellow mealworms were named as among the most promising species for industrial feed output in a report earlier this year by the FAO, the United Nations food agency. According to the FAO, protein such as meat meal, fishmeal and soy meal make up 60 to 70% of the price of feed.

Better meat quality

Yaohui Che, who works on a farm in Guangdong province, says: “Feeding the chicken with insects improves the immune system of the chicken. Also, it greatly improves chicken meat quality.” See the PROteINSECT-project video, where researchers learn how the Chinese use insects in feed. It is hoped that this transfer of knowledge and expertise will help European feed producers to also take advantage of this novel source of protein.

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Videos



AllAboutFeed visited Kreca, the leading insect farm in Europe. Watch this video to learn what it entails to grow insects in large volumes, for human food and pet food.



A team of researchers from the EU-funded project PROteINSECT, who are investigating the potential of fly larvae as a novel protein source for animal feed, travelled to China to learn from farmers who are already growing insects to be used as a feed ingredient.

More sustainable protein production

In the video on the previous page, Elaine Fitches, PROteINSECT Co-ordinator at Fera in the UK (The Food & Environment Research Agency) explains why finding alternative protein sources for animal feed is so important. "We have a growing global population, people are eating more and more meat, and therefore we need to produce protein more sustainably."

FAO estimates that the world needs to **increase its food production by 70%** by 2050 in order to serve a global population of nine billion. Animal feed production is increasingly competing for resources (land, water and fertilizer) with human food and fuel production, urbanisation and nature.

How companies react

Dutch feed company Coppens and Dutch insect producer Protix Biosystems have signed an agreement to include insect meal in livestock feed. When legislation allows, the companies have everything in place to start using the insect meal. They will be using 200 tonnes insect fat and 300 tonnes insect protein. This amount can be incorporated in

15,000 tonnes of compound feed. The fat and protein is made from the larvae of the black soldier fly. Protix produces 2.5 to 3 tonnes of insects per week.

The black soldier fly is chosen for its short life cycle and the ability to produce a lot of eggs. The (purified) fat, extracted from the larvae, is already allowed to be used in animal diets, that will be the main focus for Coppens. The fat has been purified to a purity level of at least 99.5% at low FFA% (free fatty acid). Coppens wants to incorporate the insect based ingredients for specialized diets, such as for piglets. The high digestibility of the ingredients make it very suitable for young animals. Both companies emphasize that insects are part of the natural diet of chickens and pigs. Chitin, found in the exoskeleton from insects, have an anti-microbial effect. The effects of insect nutrients on the health of piglets will be further investigated.

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Most suitable insects

Worldwide more than 1,900 insect species are edible. Practice shows that especially the larvae of **the black soldier fly, the housefly and the mealworm** are well suitable for the use of large scale organic waste streams and the large scale production of proteins and therefore usable for the feed and food industry and pharmaceutical applications.

Especially important is the realization of large-scale production (from niche market to main stream market). The founders envision that within 7 years we will see 80 large(r) production facilities with a turnover of €420 million.

Insects are cold blooded and can therefore **efficiently upgrade low-value biomass** into high-quality protein. The highest crude protein content was found in the pupa of the house fly (65.7% of DM) and the lowest levels in the larvae of the black soldier fly (38,9% of DM).

Case: AgriProtein – insects in fishmeal

By Jason J. Drew

AgriProtein takes waste nutrients from slaughterhouses – blood and guts – and feeds this to the eggs laid by their fly breeding stock. These eggs hatch into larvae and grow at an extraordinary rate, once you take away the environmental factors that stop this happening in nature (like birds and fish eating them). Larvae are a natural food source for fish and chickens.

One kilo of fly eggs turns into 380 kg of larvae in 72 hours. Larvae are what free range chickens in field and fish in streams eat as part of their natural diet. The chemical composition of fishmeal is almost exactly the same as that of fly larvae – which is why it was chosen as a substitute when AgriProtein began to industrialize the food chain.

So they have copied nature and led the process of making protein from waste nutrients profitable, sustainably and on a large scale. They believe they can produce the feed at scale for around US \$900 per tonne, which compares favourably with fishmeal – which is currently around US \$1,350 per tonne, and likely to rise unless the oceans can be better managed.

The world urgently needs new and sustainable sources of protein. Fly larvae fed on existing waste nutrient sources is one of these. Perhaps the adage is true “where there is muck there is money” – and sustainability!

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Current state on the use of insect meal in animal feed and action points defined by IPFF

target market

Insect PAP when insects are fed with former foodstuffs including meat and fish

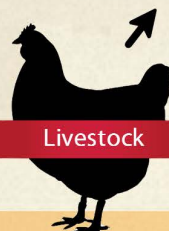
Insect PAP when insects are fed with 100% vegetable feedstock

Insect derived products when insects are fed with manure



Petfood

Start open discussion with DG Sanco for release



Livestock

Currently under discussion with DG Sanco



Aquaculture

Develop dossier strategy with DG Sanco and EFSA for risk analysis and strategy for allowance



Non-feed markets

To be discussed. Exclusion of manure as feedstock by co-developing other markets creates transparency to avoid risk aversion on manure as potential livestock.

strategy to tackle regulatory limitations

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Tip: earthworms

Mr Charles Azizi Dara, a foreman in the machinery section at MUARIK (Scientists at Makerere University Agricultural Institute Kabonyolo), says the team started rearing earthworms about a year ago. It was an initiative to address the use of organic manure by farmers growing crops. “Farmers can venture into earthworms

rearing as a side business, because the process is not labour-intensive and besides, farmers who grow crops and rear either chicken or fish can gain in both ways, because the waste matter of these worms can be used as manure, which will result into high yields of the crops,” Dara said.

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Disadvantages of insect meal

More knowledge needed

Of over 1300 respondents across 71 countries, the overwhelming majority (88,2%) believed that more information should be available on the use of insects as a food source for both animals and humans. Whilst 66% said that the larvae of flies are a suitable source of protein for use in animal feed, more than half (52,4%) would be put off eating fish, chicken or pork fed on a diet containing insect protein, because they don't know enough about the topic.

Rhonda Smith of PROteINSECT: "[...]there is a clear desire for more information on this topic to be made available – and we need continued public engagement to increase awareness."

Hendrik de Vor, general manager at Coppens, indicates that the production costs for insect meal are still relatively high. But he does see potential in further development of the concept. For instance, he wants to use insects in feed for piglets, but the effects of insect nutrients on the health of piglets still need to be further investigated.

Legislative and regulatory problems

At the moment, the use of insects in animal feed is prohibited. As stated earlier, the purified fat extracted from the larvae is already allowed to be used in animal diets. However, the use of the insect protein (fat extracted) in animal feed is still prohibited due to different feed safety and quality laws, for example the **TSE regulation**.

These laws often have no good place for insects and insects are often prompted in the category of 'farm animals'. They can therefore not be processed to feed to other farm animals. So, insects are considered animal protein and as such due to current TSE legislation not permitted to be used in feed for pigs and poultry. Also the GMP+ certification must be adapted for insects.

Attention will also need to be paid to legislation covering the **safe use of substrates**, such as vegetable and domestic waste and manure, on which insects can be reared most economically.

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Further upscaling needed

For example, when insects would replace 5% of the feed for broilers in the Netherlands, then an amount of about **75,000 tonnes of insects** would be needed. A viable production unit of insects can supply about 1 tonne per day (i.e. 365 tonnes per year). For this production volume about 200 of small scale insects companies would be needed. For large-scale application, therefore further upscaling is a must.

Need for risk assessment

There is a need for evaluation of nutrient digestibility of (processed) insects as feed ingredient. Potential beneficial functional properties of insect protein need to be further investigated in order to create an added value for insect protein. The Essential Amino Acid Index of the black soldier fly, the common housefly and the yellow mealworm are above one, indicating that these protein sources provided in general more of the essential amino acids than required for broilers as well as growing pigs. For **full replacement** of soybean meal in fattening pig and broiler diets, large quantities (685 kilotonne annually) of insects are required. Replacing 5% in compound feed for broilers means that 72 kilotonne of insects a year is required.

Also, further risk assessment of use of insects as feed ingredient is required to develop new regulations.

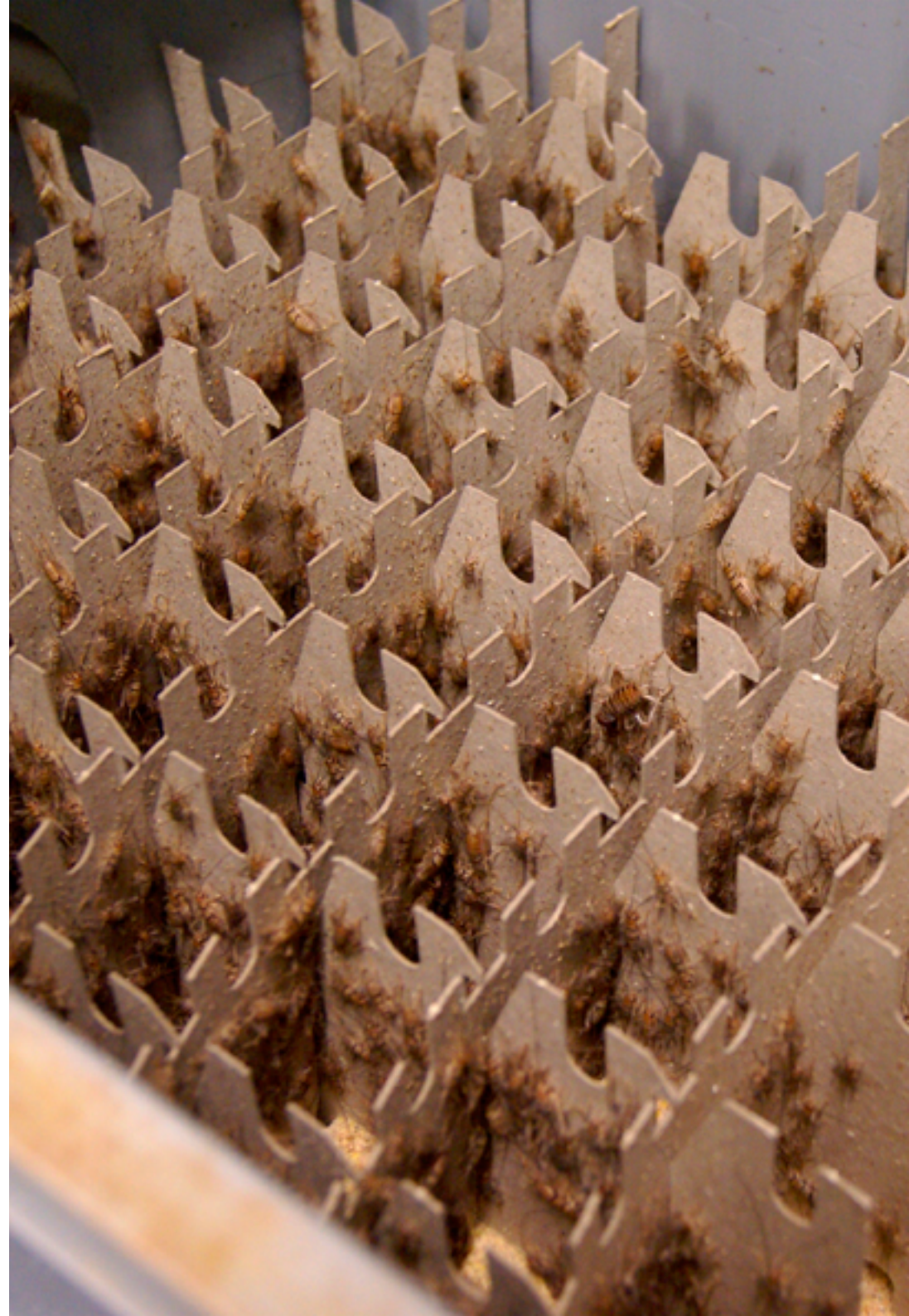
Expensive processing methods

Insects like larvae of the three species named above, need to be further processed in order to get them into a form in which they are usable in the feed industry. Shelf life of insects is increased significantly by processing methods like freezing/freeze drying, however these methods are expensive.

Animal welfare for insects

Animal welfare issues are also relevant to insect rearing facilities. Insects in daily life are often seen as pests and contaminants. But as soon they are farmed for food and feed, animal welfare rules about husbandry and killing come into play. But there is still lack of knowledge about this topic. To ensure that insects are farmed with no pain, injury and disease, but also without discomfort, it needs to be defined to what extent the subjective concepts of pain and discomfort are applicable to insects. Wageningen University carried out a study to examine whether insects are able to feel pain.

[READ THE STUDY](#)



What needs to be done?

Cost price reduction

This is required to be able to use insects as a protein source in pig and poultry diets on an economically feasible basis.

Possibilities to decrease the cost price are:

- Increase of feed efficiency of insects and the use of cheap biowaste products;
- Reduction of labour costs by mechanization, automation and logistics;
- Reduction of housing costs by increasing the size of insect rearing companies and more efficient use of buildings;
- Reduction of energy use, heat exchange and optimal ventilation;
- Use of high-productive protein rich insects;
- Decreasing processing costs.



Additional research

Currently the production volume of insects in rearing companies in the Netherlands is low and the market is mainly focused on zoos and pet shops (to feed birds, reptiles, mammals and amphibians). To introduce insects as a feed ingredient in the pig and poultry feed chain, additional research on the following subjects is recommended:

- Feeding value;
- Inclusion levels in poultry and pig diets;
- Functional properties of the feed ingredient;
- Safety when using biowaste as a rearing substrate;
- Extraction of nutrients;
- Shelf-life;
- Use of left-over substrates and residue products of insects.

Overall

To make use of insects as a feed ingredient in pig and poultry diets on a large scale, it is important to:

- Increase the scale of insect production further with a continuous quantity and quality;
- Decrease the cost price of insect rearing further, in order to be competitive with currently used protein sources;
- Further develop the insect chain with stakeholders (suppliers of organic side-streams, insect rearing companies, processing industry of insects, animal feed industry, pig and poultry producers and retail);
- Start a lobby on European level to accept insects as a feed ingredient for livestock.

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So...

the overall advantages are that insects have a well-balanced nutrient profile that meets amino acid requirements for humans and livestock. They are high in polyunsaturated fatty acids and generally rich in micronutrients and vitamins. Depending on their feed, insects even pose a considerable alternative to fishmeal in feed formulae. In addition to their nutritional benefits, rearing insects seems to be more environmentally friendly with regards to greenhouse gas production, water consumption and land requirement. Species selection based on suitability for mass production and characteristics such as robustness and protein/biomass supply is key.

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Yet...

insects are still not allowed in animal feed, because legislation forbids incorporating insects into animal diets. Laws consider insects as being livestock and so they can not be fed to other livestock such as pigs and poultry (BSE rules). Another main obstacle that has to be removed is the speed of scaling up insect production. Also the achievement of cost reductions poses a problem. Insect rearing for food and feed remains a sector in its infancy, and key future challenges will likely emerge as the field evolves.

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Reading tips

The Insect Cookbook

Insects are not yet allowed in animal feed, but until then 'the Insect Cookbook - Food for a Sustainable Planet' is a great read for anyone who is interested in the way insects influence human cuisine. This book outlines the benefits of and need for insects as a sustainable future source of protein and features interviews with influential people like Kofi Annan and René Redzepi.

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Book by FAO

Look up the book 'Edible insects – Future prospects for food and feed security'. This publication marks the first attempt by FAO to document all aspects of the insect food and feed value chain, with the aim of enabling a comprehensive assessment of the contribution of insect to food and feed security.

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Background story by Emmy Koeleman

The article 'Insects crawling their way into feed regulation', about the regulatory boundaries of insect meal, appeared in the August issue of AllAboutFeed. It can now be downloaded on AllAboutFeed.net

[READ IT ONLINE](#)

Scientific journal

The first scientific journal on the use of insects in food and feed is planned for 2015. It will be published by Wageningen Academic Publishers. The 'Journal of Insects as Food and Feed' covers edible insects from harvesting in the wild through to industrial scale. At the end of the edible food or feed chain, marketing issues, consumer acceptance, regulation and legislation pose new research challenges.

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