



**Summary report of the  
ASSALZOO / FEFAC workshop on  
New protein sources – How to secure effective risk analysis.  
9 October 2015 - Piacenza**

## **Background**

The supply of proteins for feed purpose is central to the debate on food security. In the EU, the debate involves an additional dimension, i.e. the dependency of the EU in imported soya products, in other words is it possible to replace imported soya and how. Very often, alternative sources are evaluated against their nutritional value or economic viability. These are important parameters but other elements such as potential volumes and safety are also key. FEFAC and its Italian member Association, ASSALZOO organised on 9 October 2015 in Piacenza, in the margins of the EXPO Milano 2015, a workshop to analyse the EU feed protein market and the viability of some new protein sources for feed purpose, with a specific focus on the assessment and the management of the risks linked to these new protein sources. The workshop was split in three sessions.

- Session 1 to set the scene, with an overview of possible solutions to meet the demand in proteins in Europe and to provide a legislative angle.
- Session 2 getting into more details on some of these alternatives (i.e. insects, krill/algae, fermentation by-products)
- Session 3 on nutritional benefit and risk characterisation with a focus on what could be the guidance for risk assessment of new feed materials and provide the feed manufacturers perspective in terms of risk/benefit and risk management tools.

The meeting was attended by 130 participants, mostly feed manufacturers across the EU but also scientists and suppliers of feed ingredients.

## **Welcome address (Alberto Allodi – President of Assalzoo)**

Alberto Allodi reminded the challenges of managing food security globally, whereas 2 billion people suffer from overweight while 2 billions suffer from nutritional deficiencies. He pointed to the double objective of reducing food waste and developing new resources as key steps to address food security. This means in practice developing a new model for food and feed sector. As far as feed is concerned, the sourcing of proteins to feed food producing animals is the biggest challenge. Exploring new protein sources is essential but requires extreme care, in particular when it comes to safety.

## **Session 1: setting the scene**

### **Meeting the feed protein demand - Possible solutions. Marinus van Krimpen – Wageningen University (WUR)**

Marinus van Krimpen presented an overview of new protein sources that have the potential to be produced under EU conditions and that have the potential for long term supply: oilseed meals / concentrates, pulses and their concentrates, alfalfa, leaves (grass, sugar beet), algae, cereal protein concentrates and insects.

He compared all of them against a set of parameters (e.g. yield, nutritional value, Carbon Foot Print, availability in short term) and concluded that at present pea concentrate is the best alternative. He stressed in particular that growing soya in Europe yields slightly less protein / ha than wheat (0.6-1.2 t/ha vs. 1.1 t/ha) whereas seaweed and microalgae have the highest potential (from 2.5 to 15 t proteins/ha). However, in the longer run, EU produced soya remains the most promising alternative for South American soya, on the condition that yield increase from 3 to 5/ha.

Micro algae can be an interesting alternative but huge progress must be achieved as regards the yield to cover infrastructure costs. Sea algae contains a lot of mineral elements and have a low ileal digestibility, meaning that an extraction step is required before they can be used for feed purpose.

As regards insects, Marinus van Krimpen considers it as a potential source of proteins for the middle term, on the conditions that they can be grown on manure and catering reflux which requires some modifications to the legislation.

### **What can EU Institutions do to allow and promote sustainable and safe use of new protein sources? Marta Ponghellini – EU Commission**

Marta Ponghellini indicated that the promotion of new nutrient sources, not only proteins, met several of the 10 Juncker Commission priorities: i) A new boost for jobs, growth and investment, ii) a resilient energy union with a forward looking climate change policy and iii) a deeper and fairer internal market with a strengthened industrial base. With the worldwide reduction of arable land, a growing population and a demand for animal products expected to grow by 70% by 2050, the livestock sector is facing the double challenge of sourcing enough feed while reducing its impact on the environment, in particular GHG emissions.

To meet these objectives, innovation in the feed sector is key and involves three main areas: i) development of new feed materials, ii) feed use of former foodstuffs as a way to reduce food waste and iii) improvement of nutrient efficiency via feed additives. She stressed the importance of avoiding qualifying as waste former foodstuffs destined to feed use.

For the EU Commission, the new feed materials under consideration (insects, algae, etc.) are not “Novel feed” in the sense that these materials have for long been used as feed, the innovation being their production on an industrial scale. A risk assessment is performed by EFSA systematically for feed additives and where required for certain feed materials, e.g. insects, algae or former foodstuffs and specific conditions of use may be established in the framework of Regulation (EC) No 1831/2003 (feed additives) or 767/2009 (marketing and use of feed). However, other legislations shall also be taken into account, such as the TSE Regulation (EC) No 999/2001 for feed materials of animal origin, which establishes certain prohibitions the lifting of which requires a political endorsement.

As regards insects, the use of manure or catering waste is prohibited and there is no prospect for such a ban may be lifted only on the basis of scientific evidence based on data and providing there is social acceptance and therefore may not be considered in the short term.



## **Session 2: Promises and challenges**

### **Proteins of animal origin: example of insects. Elaine Fitches - Proteinsects**

Elaine Fitches stressed that the major advantage of insects is their ability to grow on various feedstocks, including waste with a very short life cycle enabling to produce in the case of fly larvae 150t/ha of proteins compared to 0.9 t/ha for soya. The level of proteins in insect meal is high between 30 and 60% and insect proteins are more digestible (86-89%) than any vegetable protein. When grown on waste, they convert 60% of the biomass into oils and fats (for biodiesel), proteins for food and feed use and novel products such as chitosan.

The four major insect species with the highest potential are house fly larvae, meal worm, super meal worm and black soldier fly. Currently, insects are grown on an industrial scale in several regions of the world, in particular China (millions of tons of dry mealworm larvae produced per year and thousands of tons of house of dried fly larvae per year) or South Africa (target of 2,000 t/year of fly larvae meal) or North America. The main outlets are bird feed, petfood and aquaculture. The sales price is around €4,000 per tonne for dried house fly larvae and €6,000 per tonne for dried mealworm. Generally speaking, she stressed that insect do not pretend to replace soya in volume but would be a useful protein complement for certain animal species.

In the EU, there are a number of legal hurdles that prevent the feeding of dried insects to food producing animals. Although the lifting of the ban on feeding fish with non-ruminant processed animal proteins was lifted in 2013, this is not applicable to processed animal proteins from insects because the concept of processed animal proteins involves elements regarding the slaughtering of insects which is not adequately addressed by the legislation.

A number of Research Projects are running to evaluate the suitability of insects for animal feeding, in particular the feed and food safety aspects. The Proteinsects project is one of these and analysed the presence of a large spectrum of chemical and microbiological contaminants, using manure as a feedstock as a kind of worst case scenario for the safety risk assessment. This extensive safety screening suggests minimal risks and that any potential risks can be mitigated by processing (e.g. microbes & heavy metals). As regards consumers acceptance, perception & media monitoring suggest a high level of support for use of insects in animal feed but also a desire for more information.

### **Proteins of marine origin. Enrico Bachis - IFFO**

Enrico Bachis reminded that the global production of fishmeal and fishoil is on a downward trend for the last 20 years and prices tend to increase. Potential sources of proteins from

marine origin are trimmings (by-products from fish processing), krill, marine worms and algae. However, in practice, the catch of krill is restricted and global production may not exceed 150,000 t / year. The major risk with krill is the presence of high levels of fluorine. Marine worms are carnivorous, i.e. not the most efficient way to produce feed proteins, and tend to accumulate contaminants.

The best alternative is currently fisheries by-product meal from both wild caught and increasingly farmed fish, which are about to represent more than 50% of the material used for production of fish meal in the near future. Fish meal from fish by-products has however a lower protein content and higher ash content than fish meal produced from caught fish.

As far as algae are concerned, there are two different types of algae requiring different processes: heterotrophic algae: produced in fermentation vessels mostly for the production of oil for human consumption, with by-products relatively low in proteins and autotrophic algae (e.g. spirulina or chlorella) using CO<sub>2</sub> and sunlight as any other plant that have been so far produced mostly for biofuels. They are however difficult to harvest and difficult to maintain pure, with the potential presence of toxic algae. The global production of spirulina and chlorella are estimated currently resp. at 15,000 and 5,000 t / year mostly for food consumption. Cost of production (around €7,000/t) has to come down to move from food to feed. Aquaculture feed presents the best possibility for using algal biomass with omega oils and protein combined. New technology (optimum protein and oil availability) and rising fishmeal and fish oil prices make this a possibility in the next 5-10 years particularly if combined with omega 3 oils in the algal cells.

### **Proteins of bacterial origin. Philippe Tacon – Phileo / COFALEC**

Philippe Tacon stressed that single cells proteins produced from fermentation may involve bacteria, yeast, fungi or microalgae. They can be grown on agricultural, human or animal products waste and is an interesting source of proteins, especially for aquaculture. EFSA established a list of microorganisms enjoying the QPS status (Qualified Presumption of Safety) which is similar to the GRAS status in the USA (Generally Recognized As Safe). By-products from fermentation may be subject to restrictions in accordance with the GM feed and food legislation (R1929/2003) if the fermentation process involves GMMOs.

As far as yeasts are concerned, a number of them are listed already in the EU Catalogue of Feed Materials, the most important for feed and food production being *Saccharomyces cerevisiae*, *Candida utilis* and *Kluyveromyces marxianus/lactis*. Yeast may be produced directly for feed purpose (i.e. primary yeasts culture) or indirectly (by-products from fermentation for other purposes such as brewery spent yeasts). Some may be used alive as probiotics or for the production of specific substances subject to feed additive status, used as immune stimulant, palatability enhancer or gut flora enhancers.

Primary yeasts undergo strictly controlled process, which in return involves high production costs. In addition, competition with bioethanol industry for feedstock (i.e. molasses) contributes further to increase the production costs.

In the brewery sector, yeasts may be reused 4 to 8 times for brewing before being inactivated and sold to the feed sector. Yeasts are also used in the bioethanol industry, in particular in the USA and Brazil and placed on the market in the form of Dried Distillers Grains with Solubles (DDGS). The volume of spent yeasts can be estimated between 150,000 and 700,000 t depending on market studies.

Yeasts contain 49% on average of highly digestible proteins and an amino acid profile close to soya and fish meal. They may not be used at high inclusion rates in the diets of a number of species (except fish) because of deposition of uric acid and risk of acidosis.

Primary yeasts are a highly sustainable alternative protein sources. However, production costs remain high due in particular to the competition with the bioethanol industry for feedstock (i.e. molasses). The process requires strict, costly control under the responsibility

of the manufacturer. If not controlled correctly, contamination of products / by-products by pathogenic microorganisms may occur (case of bacillus cereus in a by-product from fermentation recently in Italy). Attention must be also paid to the possible presence in DDGS of mycotoxins and antibiotics used in the production process and to the possible presence of material from GMMOs in by-products from fermentation. Feed safety assurance schemes have been developed to secure the chain. However, it is essential to ensure that audits are performed regularly and customers should also be careful as to the scope of the certificate (i.e. which activities/products are covered).



### **Session 3: Nutritional benefits and risk characterisation**

#### **Hazards associated with feed safety - Outcome of the 2015 FAO/WHO Expert Meeting. Daniela Battaglia – FAO**

Daniela Battaglia presented the key findings of the recent FAO expert meeting on hazards associated with feed safety that focusses on hazards associated with food safety. The purpose of this expert meeting was to:

- Update of the current state of knowledge on hazards associated with feed including feed and feed production technologies of increasing relevance
- Guidance on the most appropriate use of this information for risk analyses purposes
- Identify knowledge gaps to prioritize future work

GMO, veterinary drugs used in feed and AMR were excluded from the scope of this study.

She pointed to data gaps for certain hazards and the need to involve operators and authorities to fill this gap to allow a proper risk assessment and thereby enhance capacity building globally. She announced the establishment of a FAO platform for data collection in this sense. The experts identified a list of hazards relevant for food safety that may also impact animal health and recommended to issue tables for each hazard specifying the health impact, the source, the occurrence in feed, the transfer from feed to food, the relevance for food safety and the trend. The experts noted as emerging risk the presence of micro and nanoparticles of plastic that can contaminate fish products.

The production of insects, by-products from biofuels industries, aquatic plants, marine ingredients and feed use of former foodstuffs were identified as feed and feed production technologies of increasing relevance. Daniela Battaglia emphasised some specific hazards



linked to these emerging feed such as the presence of micro and nanoparticles of plastic that can contaminate fish products, toxins in algae, packaging material in former foodstuffs that require additional scientific information. She stressed as key work items for FAO the need to raise awareness within the food chain on the importance of maintaining safety standards of former food and/or food processing by-products and the development of guidelines for the safe production and use of insects, biofuel-by-products, feed from former food products and food processing by products.

The experts insisted also on the further development of international standards / guidelines at CODEX level in relation to feed safety (guidance for former foodstuffs, MRLs for chemical substances, review of the Code of Practice for Animal Feeding, etc.).

### **Risk profile of insects as food and feed. Tilemachos Goumperis - EFSA**

Tilemachos Goumperis presented the key highlights of the EFSA opinion on the safety insects as food and feed that was released on 8 October 2015. This opinion is not a risk assessment per se but a risk profile for an indicative list of insects based on a list of hazards commonly found in other protein sources and based on scarce available scientific data. He stressed that scientific literature confirms the suitability of insects for animal feeding with similar protein as fishmeal or soya, although with lower histidine, lysine and tryptophan levels.

As regards microbiological risks, he pointed to the importance of the substrate used to rear insects that may have a strong impact on insects microbiota and also on virus and microorganisms that can contaminate insects by contact. He noted however that the risk of infection may be modulated by a combination of the substrates used, hygienic conditions and the processing steps between farming and consumption. He nevertheless stressed that spore-forming bacteria could survive heat treatment

As regards prions, insects are not considered to be possible biological vectors and amplifiers of prions. However, they can be a mechanical vector of prion in case it would be grown on an infected substrates or environment.

The level of chemical contamination depends to a large extent of the level of contamination of the substrate. In particular, insects may accumulate heavy metals from their substrates, in particular cadmium.

Performing a full risk assessment would require a lot of data to be provided on many hazards and their transfer from different substrate to insect, as well as information on the quantities to be fed to animals.



## **Risk/benefit analysis for new protein sources – a compound feed manufacturer perspective. Angela Booth – AB AGRI**

Angela Booth stressed the historic role of the feed industry in improving the efficiency of feed use via an increase in feed conversion rate. She reminded that the stagnation of the supply of fishmeal together with a rapidly growing demand impacted seriously on quotations of fishmeal. Soya is nowadays following the same track.

When considering alternative protein sources, the feed manufacturers pay primarily attention to the benefit that farmers can expect, primarily the quality/price ratio compared to other feed.

Feed trials show that insect meals are closed to fish meal in terms of protein profile, although in a lower concentration with less essential amino acids and a slightly lower digestibility.

Other expectations from alternative protein sources relate to their environmental impact and their contribution to resource efficiency. The fact that they can be produced locally is a plus on the condition that this does not impact on efficiency.

As far as risk is concerned, she emphasised the absolute responsibility of operators all along the feed chain for the safety of the products they manufacture, store, transport or process and this starts with the suppliers of the feed ingredients.

Angela Booth insisted on the need to raise awareness among feed chain partners of their responsibility and to facilitate access to information to allow them to perform appropriate risk assessment. She reminded indeed that beyond illegal acts, a number of incidents in the feed chain have been caused by ignorance, incompetence or irresponsible acts. So evaluation of the generic safety of a feed ingredient is essential. Beyond safety, a number of other parameters require also attention from the placers on the market, i.e. anti-nutritional factors, the amount that can be used in feed (concentration in nutrients) and the palatability.

Finally, she reminded that the best ingredient is useless if not acceptable for the public and consumers and she insisted on the need to carefully pave the ground for social acceptance.

## **International Platform of Insects for Food and Feed. Antoine Hubert - IPIFF**

Antoine Hubert presented the newly established International Platform of Insects for Food and Feed gathering companies from inside and outside the EU, as well as research institutes. He stressed that insect farming has tremendously changed over the last 5 years globally, moving from artisanal to industrial scale, with implementation of HACCP based risk management systems addressing all kind of risks.

Within the EU; IFIPP members use exclusively substrate of vegetable origin or former foodstuffs containing dairy or egg products, as permitted presently by the legislation. Other substrates such as former foodstuffs containing meat or manure are not used. The main outlet apart from food is petfood, due to prohibition of insects in food producing animals. Although the use of processed animal proteins of non-ruminant origin is permitted for fish feeding, the legislation requires that these PAPS shall be produced from non-ruminant animals which have been “slaughtered” in registered establishment, which is not the case for insects for the time being.

Antoine Hubert called on authorities to remove present hurdles to the development of insect production for animal feeding, which he sees in three steps: i) allowing the use of insects in aquaculture, ii) allowing the use of insects in pig and poultry and iii) considering allowing the use of former foodstuffs containing meat and fish as substrate.



### **Conclusions. Peter Radewahn – FEFAC**

As Chairman of the FEFAC Animal Nutrition Committee, Peter Radewahn considered as take home messages:

- The fact that the alternative protein sources are not “novel feed” insofar as they have been used for long as feed, the only change is moving from artisanal to industrial scale;
- The fact that these feed materials are not waste and should never be called as such;
- The fact that moving to an industrial scale requires also for operators to meet their responsibility in terms of feed safety and this starts at the “top-of-the-pyramid”, i.e. it is essential that an effective risk management along the chain requires robust risk management system upstream;
- The fact that the development of alternative protein sources is impaired by legal obstacles; he invited the EU Commission to start considering these without delay;

He stressed that animal nutrition is the cornerstone of sustainability of the livestock sector and not just a mean to help EU livestock producers to remain competitive: animal nutrition is also a mean to tackle the challenges of animal health in enhancing gut health and thereby reduce the need for medicines. It can also contribute to improve the welfare of animals.