

# Project *brief*

Thünen Institute for Market Analysis

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## Amino Acids and Insect Biomass Markets as showcases for dynamics in the bioeconomy

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- The animal feed market is the main sales market for free amino acids and insect biomass. Legislation, sustainability considerations related to feed components and animal husbandry, and other feed market dynamics considerably impact the markets for amino acids and insect biomass.
- Production of free bio-based amino acids via fermentation is an established approach. Advances in animal feeding trigger the production and market entry of new free amino acids ('new products').
- Relocation of the production of main bio-based amino acids from the EU to Asia took place due to higher production costs and stringent environmental standards in the EU.
- Insect rearing and processing of insect biomass are new economic activities for the EU. Insect meal is rich in amino acids and can be used as an alternative protein source in animal feed.
- Production of insect biomass is still low in the EU, but companies are starting to upscale.

### Background and aims

The European project [BioMonitor](#) addresses the information gap in bioeconomy research by re-structuring its existing data and modelling framework. A number of case studies were conducted to close some specific information gaps. This Project brief summarises the outcomes of the case study entitled "Dynamics on the Markets for Feed Grade Amino Acids and Insect Biomass", in which we investigate the markets for free amino acids (i.e. not bound in proteins) and insect biomass and the drivers of dynamics in these markets.

### Approach

Official statistic is a preferable source of data when it comes to the monitoring system. As official statistics currently provide barely any data for our analysis, we collected further information by (i) conducting a review of scientific and grey literature, as well as checking websites of producers, respective associations and news portal and (ii) conducting three semi-structural in-depth interviews with the stakeholders.

### Market for amino acids

The production of free amino acids is based on an established technology. The main use of free amino acids is as feed additives in animal feed; they are added to offset the discrepancy between the requirements for amino acids by species and their actual presence in feed. Methionine, lysine, threonine and tryptophan are the main amino acids added to feed composed of maize or wheat and soybean meal. With the feed formulation becoming increasingly advanced, further free amino acids (valine, isoleucine) are considered for use in feed.

Global production of the four main free amino acids was estimated at around 2.8 million tons in 2011, rising to around 3.7-4.7 million tons in 2019 (**Table 1**). Production volumes of other amino acids are negligible in comparison. The underlying production processes remain the same: methionine is produced by chemical synthesis using fossil resources as feedstock, while other amino acids are produced by fermentation and are bio-based products. With a share of almost 70% in total production volume, lysine is the most important free amino acid in terms of volume.

**Table 1: Estimated global production, in 1000 tons**

Amino acid	2011	2019
Lysine	1,700	2,400– 2,800
Methionine	> 900	1,100 – 1,600
Threonine	260	200 – 260
Tryptophan	5.5	10 – 17

In 2011, production of all main free amino acids used as feed additives took place in the EU (**Table 2**). In 2020, the picture has changed significantly: The total production of free amino acids expanded, however, due to a strong increase in the production of fossil-based methionine. The share of bio-based amino acids in total production declined from 70% in 2011 to 14% in 2020. Moreover, the production of bio-based amino acids takes place in a single plant in France, originally owned by Ajinomoto and acquired by METabolic EXplorer (METEX) in May 2021. METEX

produces lysine and tryptophan as well as small quantity of isoleucine, leucine, arginine through a fermentation process. Threonine was no longer produced in the EU in 2020.

**Table 2: Estimated production in the EU, in 1000 tons**

Amino acid	2011	2020
Lysine	320	< 100
Methionine	> 150	< 675
Threonine	> 80	0
Tryptophan	> 2.5	< 7.5

The decline in the production of bio-based amino acids cannot be explained by changes in demand. Demand for lysine has been rising over the last decade, reaching around 500 tons/year in the EU in 2019. This demand is largely covered by imports, mainly from Asia. For threonine, total EU demand was estimated at around 74,000 tons/year in 2009 and fully covered by EU production. Since then, the demand for threonine in the EU has grown to around 120,000 tons/year, but no production is left in the EU: the entire production was relocated to third countries (mainly China).

The production of tryptophan as well as of some further 'new-comers' among free amino acids, such as valine, isoleucine, leucine and arginine, takes place in the EU. The use of these amino acids in feed is still rather uncommon. However, even widespread use of these amino acids in animal feed would not result in demand comparable to that for methionine, lysine, threonine and tryptophan, as they are more of a 'speciality' type of amino acids and are added to feed in even smaller quantities.

### Market for insect biomass

Insect farming is a relatively new but fast-growing sector in the EU. Hermetia (Germany), Protix (The Netherlands) and Ynsect (France) are pioneers in this sector in Europe. Over the last decade, the number of companies founded in the EU for the breeding of insects and processing of insect biomass has increased significantly (to 47 companies as of February, 2021), but most of them are still in the 'pilot phase'. In 2019 Protix opened a facility, where up to 100,000 tons/year of vegetable remnants are fed to larvae of the black soldier fly to produce about 7,500 t of insect-based ingredients. The facility features full automation and a modular design. Ynsect is building a large-scale plant in Amiens (France), which will produce up to 200,000 tons/year of ingredients.

The market for insect biomass, especially insect meal, is just emerging. Official data is not yet available, so the only currently available option to collect information is through surveys of producers. The International Platform for Insects as Food and

Feed (IPIFF) has conducted a survey of producers and estimated that around 5,000 tons of insect protein were produced in Europe in 2019. IPIFF also forecasts that production will reach 2-5 million tons by 2030.

### Drivers of the dynamics

Although markets for free amino acids and insect biomass are subject to different dynamics, both have one thing in common: they are influenced by developments in their main sales market - the animal feed market. The demand for efficient and sustainable feed is a positive driver for both. Free amino acids added to feed make it more balanced and efficient, and allow for targeted changes in feed composition, such as a reduction of soybean meal. Insect meal is an alternative protein-rich feed ingredient and can thus be used to replace other protein-rich feed ingredients such as soybean meal.

Legal regulations on placing feed ingredients on the market and use as feed for different species and farming systems could also be decisive. Free amino acids are feed additives and bringing them on the market is quite costly and time consuming. Use of free amino acids is prohibited in organic farming. Insect meal is classified as feed material and putting it on the feed market is easier. Since September 2021, insect meal can be used in feed for pig and poultry in the EU, additionally, to the earlier approved use for feeding aquaculture animals. The use in organic farming is possible, however, the needed certification is not available yet due to the absence of the respective EU organic standards.

On the production side, keeping production costs low has become essential for bio-based amino acids such as lysine and threonine. In the EU, these costs are comparatively high, not least because of high environmental standards. This has resulted in a partial or even complete relocation of the production of lysine and threonine abroad, to Asia. Production of 'new' free amino acids currently takes place in the EU, the relocation of production is not an issue at the moment, as the demand is low and comes mainly from the EU.

Research projects and investments are particularly important in order to increase the future use of insects as animal feed. High production costs, legal restrictions and reluctance to use them in animal feed, on the other hand, have a negative impact on future market development. For further positive market development, the following aspects would be particularly important: (i) the approval of new feeding substrates for insects, including former foodstuff, (ii) investments in automation, such as the development of suitable automatic feeding machines for insects, and (iii) increasing the acceptance of insect (products) in animal feed.

## Further Information

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