Industrial use of agricultural materials as feedstock for biobased plastics

The transition from a fossil-based to a renewable, biobased economy is of essential importance if the European Union wants to achieve its goal set in the European Green Deal to become climate neutral by 2050. This transition requires the collaboration of the materials and manufactured products sectors, and, in particular, the plastics industry, by using alternative sustainable feedstocks, such as biobased feedstocks.

Bioplastics encompass a family of different materials that are biobased, biodegradable, or both. 'Biobased' means the material or product is fully or partly derived from biomass[1]. 'Biodegradable' refers to a biochemical metabolisation process during which micro-organisms available in the environment convert materials into natural substances such as water, carbon dioxide, and biomass.

Using biomass for industrial purposes, such as the production of bioplastics, has major benefits. It reduces the dependency on limited fossil resources and reduces greenhouse gas emissions. Through the introduction of legislative framework incentives, bioplastics can make an important contribution to the bioeconomy. This is aligned with the Commision's new Working Programme and strategies such as the Clean Industrial Deal. It is also enabling the implementation of the cascading principle[2].

Playing an important role within the circular economy, the bioplastics industry has developed dynamically in recent years and has a significant growth potential. Global production capacities for biobased plastics are predicted to grow from about 2.47 million tonnes in 2024 to approximately 5.73 million tonnes in 2029. Maintained access to sustainably grown biomass is critical to guarantee this growth.

[1] To increase the amount of plastics based on renewable resources on the market and decrease dependence on depletable feedstocks, such as crude oil, the mass balance approach is a complementary step that can be necessary for a fossil-free future. Find out more about it in European Bioplastics' position paper.
[2] The principle „aims to achieve the resource efficiency of biomass use by prioritising, wherever possible, the material use of biomass over its energy use, thus increasing the amount of biomass available within the system. Such an alignment is intended to ensure fair access to the biomass raw material market for the development of innovative, high value-added bio-based solutions and a sustainable circular bioeconomy" according to the Renewable Energy Directive (EU) 2023/2413, recital 10 (also known as RED III).

The use of primary[3] agricultural biomass as valuable source for bioplastics

Today, bioplastics are commonly made from sugar and carbohydrate-rich plants, such as corn, wheat or sugar beet. Currently, these agricultural crops and others can be used to efficiently produce bioplastic, using limited land and solid yields. The industry started with the use of agricultural crops as a raw material for producing bioplastics for several reasons: (i) they come at enabling cost; (ii) they are widely available; (iii) they are relatively fast renewed; (iv) the sugars are easily accessible; (v) the composition is stable, and (vi) they have a high relative land-use efficiency[4]. Based on these crops a market for bioplastics is being built, and funds can be generated to innovate at every stage of the value chain.

Primary agricultural biomass can be produced sustainably and efficiently

The mechanisms to grow renewable feedstock for a continuously developing bioeconomy do not have to conflict with the need to reverse climate change and to provide sufficient (healthy) food for a growing world population, as also confirmed in the BIC & RCI report issued in 2025[5]. On the contrary, by combining regenerative farming practices with new carbon credit mechanisms, the industry and farm economy has caught up with the calls for action to improve natural ecosystems. At the same time, they create incentives to increase soil health and productivity. As agricultural biomass still represents the main renewable feedstock to produce bioplastics, it can contribute to food security by incentivising regenerative agricultural practices. This is the reason why EUBP supports the development of clearly defined and harmonised sustainability criteria[6] for sourcing of biomass, including local factors.

No competition between biomass use for food, feed, and for material use

The misconception that the use of biomass for materials may be detrimental to food security is flawed[5] and, according to RCI[7], distracts from the powerful causes of hunger in the world. According to the World Food Programme (WFP), in 2023, more than 300 million

[3] Primary agricultural biomass are crops like sugar and carbohydrate-rich plants.

[4] See publication of nova-institute (2013): „Food or non-food: Which agricultural feedstocks are best for industrial uses?“. https://renewable-carbon.eu/publications/product/nova-paper-2-on-bio-based-economy-food-or-non-food-which-agricultural-feedstocks-are-best-for-industrial-uses-%E2%88%92-full-version/

[5] Is there Enough Biomass to Defossilise the Chemicals and Derived Materials Sector by 2050?
The Bio-based Industries Consortium (BIC) and the Renewable Carbon Initiative (RCI) commissioned a study from the nova-Institute with the co-operation of EuroCARE Agricultural Policy Research and the Thünen Institute of Forestry (TI-WF). A Joint BIC and RCI Scientific Background Report Authors: Michael Carus, Olaf Porc, Christopher vom Berg (nova-Institute), Markus Kempen (EuroCare), Franziska Schier (TI-WF) and Julia Tandetzki (TI-WF) February 2025

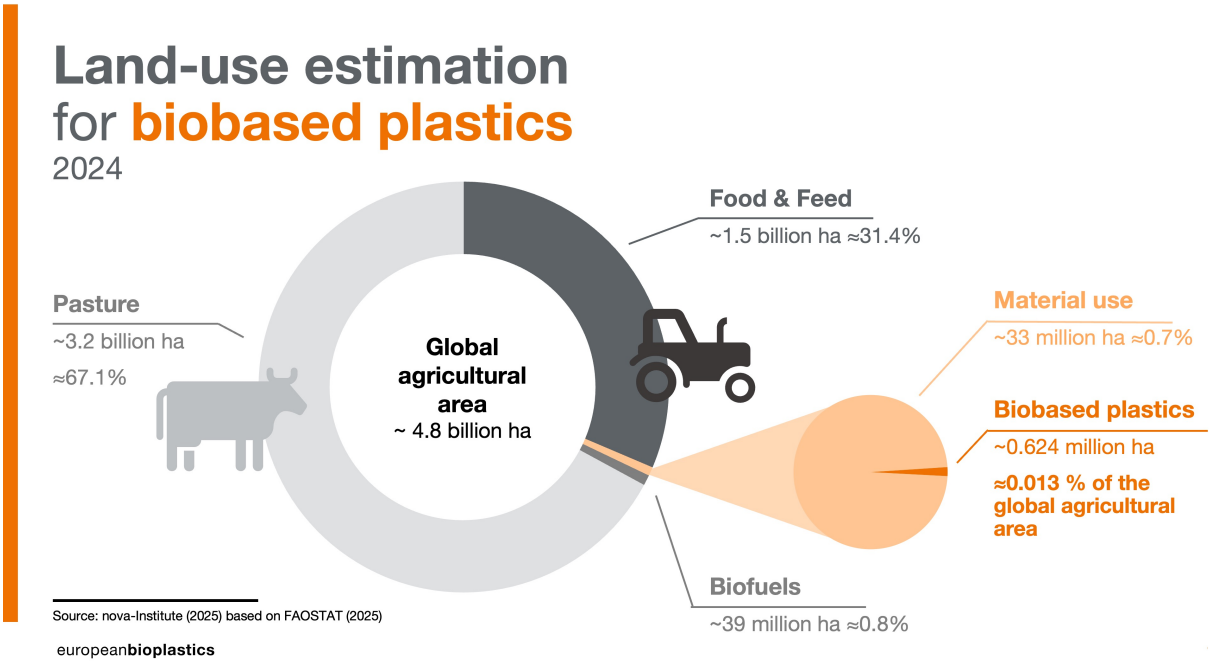
[6] According to PPWR Article 8§1 „By 12 February 2028, the Commission shall review the state of technological development and environmental performance of biobased plastic packaging, taking into consideration the sustainability criteria laid down in Article 29 of Directive (EU) 2018/2001 of the European Parliament and of the Council“

[7] Dammer, Carus, Porc, „The Use of Food and Feed Crops for Bio-based Materials and the Related Effects on Food Security – Recognising Potential Benefits“, RCI, June 2023; https://renewable-carbon.eu/news/the-use-of-food-and-feed-crops-for-bio-based-materials-and-the-related-effects-on-food-security-recognising-potential-benefits/

people faced acute hunger as a result of new and protracted conflicts, the global climate crisis, the economic aftershocks of the coronavirus pandemic, and food and energy price inflation[8].

In addition, according to RCI[7] there are multiple potential positive impacts of increased use of food and feed crops for chemicals and materials. These include:

- Achieving climate change mitigation by shifting away from fossil feedstocks.
- Improving land productivity by using high yield food and feed crops and making use of their co-products.
- Ensuring economic security for farmers via the option of selling stock to different markets (food, feed, biofuels, material industry).
- Ensuring market stability by increasing the global availability of food and feed crops, while reducing the risk of shortages and speculation peaks.
- Ensuring feed security with high-value protein-rich co-products of food and feed crops.
- Ensuring food security by increasing the overall availability of edible crops which can be used as emergency reserves and flexibly distributed in times of crisis[9].

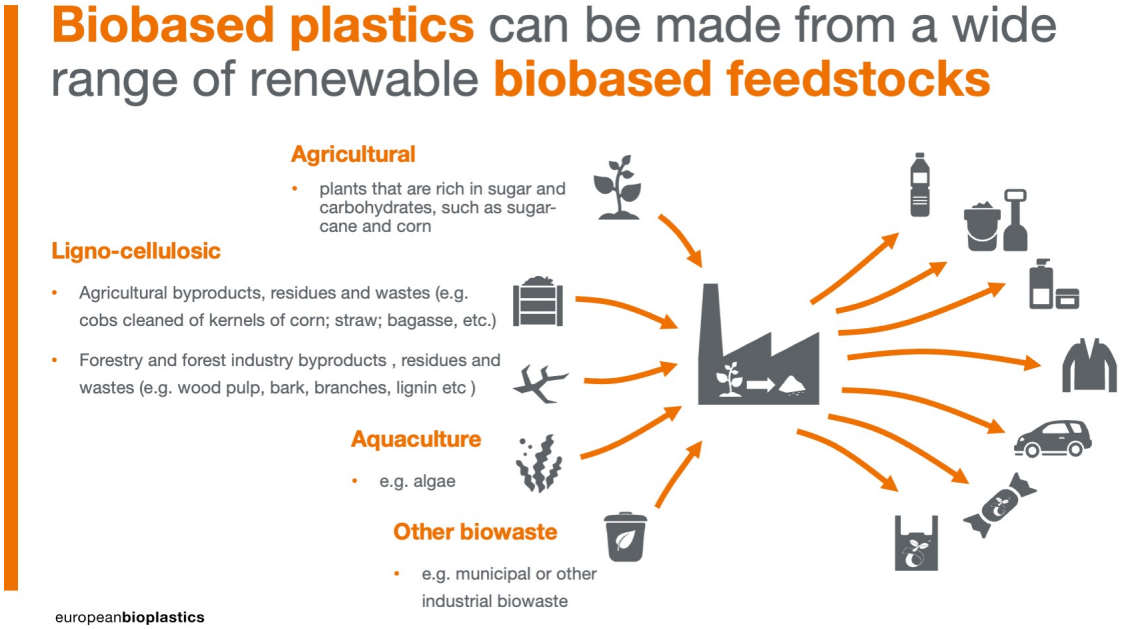


According to the nova-institute, the worldwide biomass demand in 2023 was 13.6 billion tonnes. Of this, only 0.023% was used for biobased polymers. This translates into a land area share of only 0.013% of global agricultural area.[10] The large majority of the global

[8] WFP Annual performance report for 2023, Foreword by the Executive Director
[9]"Extreme weather events, global pandemics and ongoing conflicts have showcased the fragility of the global food system, highlighting long-term systemic issues that weaken the food system. To address these long- and short-term challenges, building a more resilient food system is essential." According to the Economist Intelligence Unit's assessment tool: http://foodsecurityindex.eiu.com/.
[10] https://renewable-carbon.eu/publications/product/biomass-utilisation-worldwide-2024-png/

agricultural area is used to grow food and feed or used as pastures. The sheer difference shows that there is no competition between the use of biomass for food, feed, and for material use. Consequently, agricultural feedstock for industrial applications should not be discriminated against. In order to fulfil its growth potential, it is important that the bioplastics industry is ensured access to agricultural biomass now and in the future.

In addition, agricultural feedstock based bioplastics are an enabling technology that facilitates the increasing additional use of other feedstock sources.



Other sources of feedstock:

The bioplastics industry is increasing its use of other sources of biomass and exploring potential future sources with a view to the development of new, innovative materials in future.

A non-exhaustive list of examples of such sources may be:

- Ligno-cellulosic:
  - Agricultural byproducts, residues and wastes (e.g. cobs cleaned of kernels of corn; straw; bagasse, etc.)
  - Forestry and forest industry byproducts, residues and wastes (e.g. wood pulp, bark, branches, lignin etc)
- Aquaculture (e.g. Algae)
- Other biowaste (e.g. municipal or other industrial waste)

Europe needs a level playing field for products made from biomass

Industry needs to have a legal and regulatory framework that allows for the use or uptake of biomaterials in the same way as for bioenergy production.

Europe needs a level playing field for all biobased products to ensure the highest economic value creation for the whole value chain and to provide the strongest environmental benefits. A level playing field for the use of biomass in materials, compared to the use of biomass for energy, needs to be established.

At European level, many measures exist for using biomass for energy, such as mandates, quotas, tax benefits, etc. These incentives should at least be bestowed equally to all different industries using biomass. Currently, the bioenergy sector is promoted through different robust legislative measures, whereas the bioplastics industry lacks such support - a condition that distorts the effectiveness of biobased market segments. Equally strong incentives for all biomass applications would enable the actual implementation of the cascading principle.

The principle “aims to achieve the resource efficiency of biomass use by prioritising, wherever possible, the material use of biomass over its energy use, thus increasing the amount of biomass available within the system. Such an alignment is intended to ensure fair access to the biomass raw material market for the development of innovative, high value-added bio-based solutions and a sustainable circular bioeconomy”.

European Bioplastics calls for an equal treatment of all pillars of the bioeconomy and opposes political discrimination or preference of specific biobased industries.

Conclusion

The use of agricultural biomass for industrial applications, such as bioplastics and chemicals, drives the transition towards a more sustainable biobased economy. To realise the full potential of these materials, a level playing field is required, ensuring that biobased industries receive equal support and incentives as other sectors.

Contrary to the misconception that it competes with food production, as explained earlier and based on the RCI report[7], using agricultural biomass for bioplastics and chemicals can enhance food security. Increased production of agricultural feedstock for both food and industrial purposes can lead to improved land productivity, market stability, and economic security for farmers.

Furthermore, the use of agricultural feedstock for bioplastics and chemicals offers numerous environmental advantages. Biobased materials can replace fossil feedstocks, contributing to a significant reduction in greenhouse gas emissions and mitigating climate change – as mentioned earlier, one of the leading causes of hunger worldwide.

By supporting market demand generation, in addition to research and innovation in this sector, we can unlock new possibilities for the scale up of sustainable materials and processes, fostering a circular economy where biomass is efficiently utilised for both food and industrial applications.

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About European Bioplastics

European Bioplastics (EUBP) is the European association representing the interests of the bioplastics industry along the entire value chain. Its members produce, refine, and distribute bioplastics i.e. plastics that are biobased, biodegradable, or both. More information is available at www.european-bioplastics.org