

Mapping the European Soy Supply Chain

Embedded Soy in Animal Products Consumed in the EU27+UK

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January 2022

About this report

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This report was researched and written by Barbara Kuepper, with contributions from Manon Stravens. Correct citation of this document: Kuepper, B. and M. Stravens (2022, January), *Mapping the European Soy Supply Chain – Embedded Soy in Animal Products Consumed in the EU27+UK*, Amsterdam, The Netherlands: Profundo.

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Summary

Soy is used in the production of a wide range of products but is nonetheless hardly visible to European consumers. This research aims to provide the necessary underlying data to better understand the soy flows on the EU27+UK market, including basic data on soy production and trade worldwide, as well as detailed data on soy use in the consumption of animal products in 2020.

The global soybean harvest reached a volume of 340 million tonnes in the harvest season 2019/20. This corresponds with a total area of 123 million hectares. Over 80% of all soy produced globally originates from the United States, Brazil and Argentina combined, which are also the largest exporting countries. Globally, imports of soybeans, soybean meal and soy oil amounted to a combined 238 million tonnes. Largest importing countries/regions are China, the EU27+UK and other Asian countries.

Domestic soy production in the EU27+UK has shown considerable growth rates over recent years; however, it remains far too low to fulfil the demand for the high-quality protein crop. While domestic output reached 2.7 million tonnes in 2020, the total used soy volume including net imports amounted to 30.3 million tonnes of soybean meal, 1.8 million tonnes of soybeans and 2.7 million tonnes of soybean oil. The large volume of soybean meal as well as small volumes of beans and oil can be assigned to different categories of animal feed. Based on average content shares, the calculated embedded soy content per kg of animal product (retail weight) consumed in the EU27+UK is highest for broilers (956 grams) and pork (415 grams). Embedded soy shares in farmed fish and concentrated dairy products like cheese and milk powder are also high.

Based on these calculations, an average EU27+UK citizen consumes an estimated 61 kg of soy per year. With 55 kg, the largest share of soy products is embedded in the consumption of animal products like meat, dairy, eggs and farmed fish. The direct use of soybeans and soybean oil for food adds another 3.5 kg, while the consumption of soybean oil in industrial products like biodiesel amounts to an estimated 2.3 kg per capita.

Glossary of key terms

Carcass weight: The weight of an animal after being partially butchered. Average conversion factors are applied to calculate the → retail weight of meat products.

Compound feed: A mixture of different raw materials and supplements fed to farm animals.

Crushing ratio: The processing of soybeans results in the two main subproducts, meal and oil, where the crushing ratio describes the weight share of soybean meal and soybean oil resulting from the crushing of a certain volume of beans. The crush result can vary between 73% of soybean meal for high-protein meal and 80% for low-protein meal, depending on the inclusion of hulls. In this analysis, an average crushing ratio of 78.5% soybean meal and 18.5% soybean oil is applied. The remainder is accounted for by hulls and small amounts of other products.

Embedded soy: The soy footprint of an animal product based on the → soy used during its production. The concept of embedded soy allows to quantify the volume of soy linked to a certain product volume despite no physical soy being present in the end-product.

EU27+UK: The analysis is considering data for the 27 Member States of the European Union and the United Kingdom.

Home mixing: Mixing of feedstuffs on-farm including farm-grown and bought-in materials.

Protein content: The protein content of soybean meal differs depending on whether the hulls are included in the resulting meal (44% protein meal (low protein or 'low-pro')) or kept separate (48% protein meal (high protein or 'hi-pro')) as well as on the growing region.

Retail weight: Average conversion factors are applied to estimate the retail weight equivalent from → carcass weight. This includes, e.g., the removal of bone and fat.

Soy: In this research soy is used as a general term for soybeans and the products resulting from soybean crushing and processing, namely soybean meal and soybean oil. In the Harmonized System (HS), soybeans are traded under HS code 1201; soybean meal (also referred to as oil-cake, ground or in the form of pellets) under HS code 2304; and soybean oil under HS code 1507. Customs data suggests that soy protein concentrate (SPC) for feed use is mostly traded under HS code 2304, albeit in much smaller volumes than soybean meal. SPC may also show up under other, less specific HS codes.

Soy consumption: The embedded soy consumed by EU27+UK citizens in various animal products, including meat, dairy, eggs and farmed fish, as well as direct soy consumption in food and industrial products.

Soy content: The average share of physical soy in different types of animal feed.

Soy production: Soy cultivated and harvested in production countries.

Soy trade: Export and import of soy in the form of soybeans, soybean meal and soybean oil.

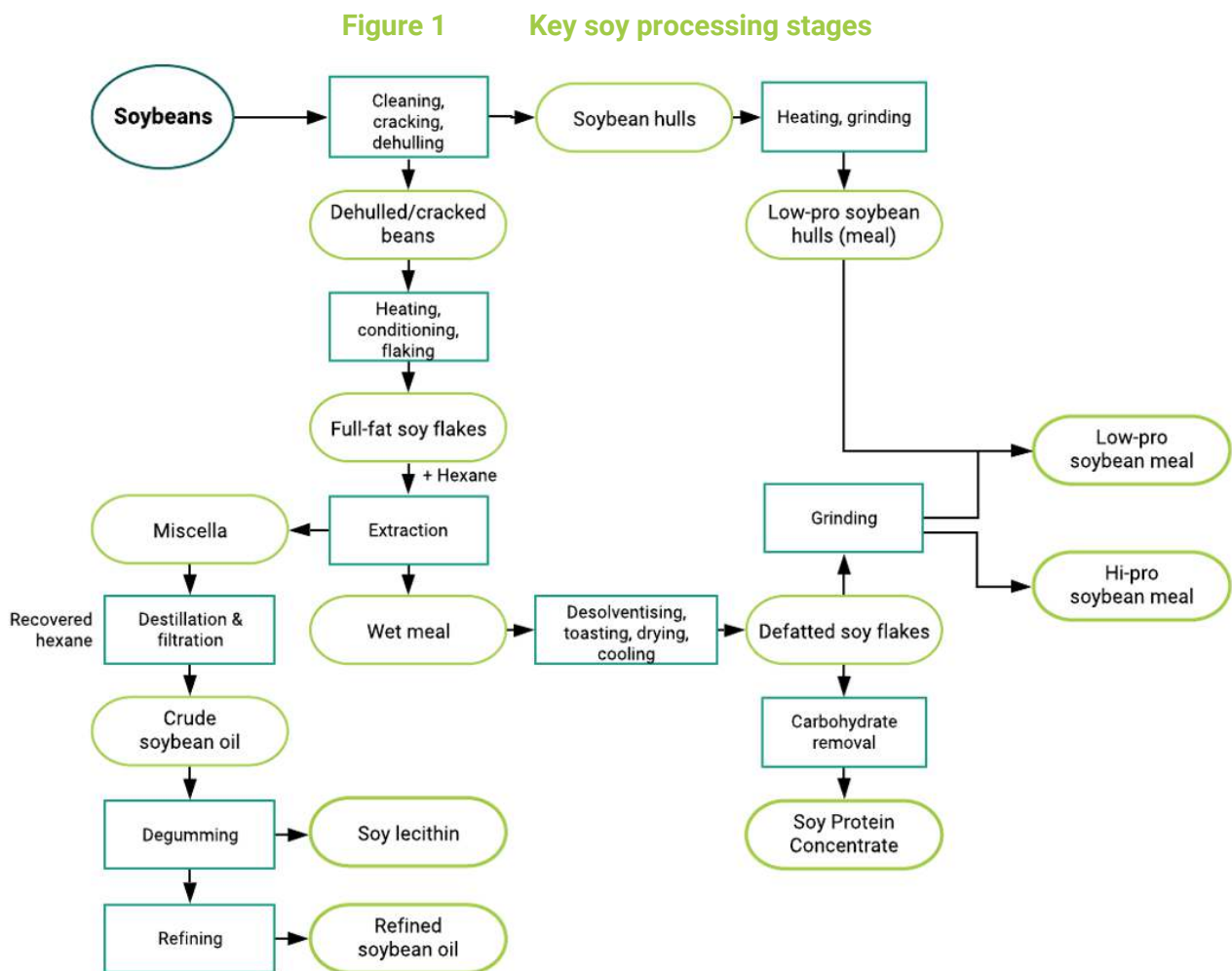
Soy use: The physical soy used in different types of animal feed.

Introduction

Soy is used in the production of a wide range of products but is nonetheless hardly visible to European consumers. Virtually all the soy meal resulting from the crushing process is used in animal feed. A small share of uncrushed beans (full fat soybeans) and of the soybean oil resulting from the crushing process are used in animal feed as well. Globally, most soybean oil is used as refined cooking oil, in margarines, dressings and for other food purposes, as well as in industrial and chemical purposes such as biodiesel, soaps, and fatty acids.¹ Uncrushed beans are also used for food products such as tofu or soy drinks.

In animal products, the soy is no longer physically present in the meat, dairy, or egg found in stores, despite millions of tonnes of soy products being fed to farm animals every year. Therefore, this research aims to map the distribution of soy use across different market segments in 2020 based on soy production, trade, and consumption data. Geographically, the current 27 member states of the European Union (EU27) plus the United Kingdom (UK) (EU27+UK) are the focus of the analysis.

Due to the incomplete data on feed composition for individual countries, the analysis must rely on several assumptions. The resulting estimates should therefore be seen as approximates rather than precise figures. The approach to calculating the use of soy in the production of animal feed, the resulting flow of soy into different animal product segments as well as other uses of soy products is explained in the text.



Source: Own elaborations, based on: Greenwood, W. and J. Kim (2021, April 10), "Shining a light on soybean meal quality", *FeedAdditive*, viewed in January 2022; U.S. Soybean Export Council (2015), *Manual of Quality Analysis for Soybean Products in the Feed Industry*.

When comparing the results with other studies as well as figures for previous years a couple of factors need to be kept in mind. The soy market, like all agricultural commodity markets, is highly volatile as it is affected by a broad range of influencing factors. These range from weather impacts on harvests and resulting surpluses or shortages in availability from one year to another, changes in demand as caused by the outbreak of African swine fever in China,² political developments like the US-China trade war, to the supply chain hick-ups and changes in demand because of the COVID-19 epidemic.³ A snapshot based on data for one specific year may be influenced by one or more of these factors when comparing with other years. Comparisons with other approaches to calculating soy use in specific products need to consider potential differences in the underlying methodology to calculate soy content in feedstuffs, data sources and geographic scope, among other factors.

1

Global soy production and trade

Global soybean production reached 340 million tonnes in 2019/20. More than 90% of this volume was crushed into the main products soybean meal (78.5%) and soybean oil (18.5%). The production and export of soy is dominated by the key producing countries, Brazil, the U.S., and Argentina. The most important destinations are China and the EU27+UK region.

1.1 Global soy production

The global soybean harvest reached a volume of 340 million tonnes in the marketing year 2019/20 (Table 1).^a This corresponds with a total area of 123 million hectares. Over 80% of soybeans globally are produced in Brazil, the United States and Argentina combined. The EU27+UK countries produced 2.6 million tonnes in 2019/20, less than 1% of the global total.

Soybeans are crushed in the country of origin as well as in importing countries. The EU27+UK countries accounted for around 5% of global soybean crushing in 2019/20.

Table 1 Soy production and crushing per country/region (2019/20)

Country / region	Area planted (1,000 ha)	Harvest of soybeans (1,000 t)	Share global soybean harvest (%)	Volume crushed (1,000 t)	Share global crushing volume (%)	Result of crushing (1,000 t)	
						Soybean meal	Soybean oil
Brazil	36,900	128,500	37.8%	46,742	15.0%	36,225	9,000
Argentina	16,700	48,800	14.4%	38,770	12.4%	30,240	7,700
Paraguay	3,500	10,250	3.0%	3,500	1.1%	2,645	665
Bolivia	1,358	2,829	0.8%	2,550	0.8%	2,000	473
Rest of Latin America	1,044	2,265	0.7%	1,340	0.4%	1,037	257
U.S.	30,327	96,667	28.4%	58,910	18.9%	46,358	11,299
Canada	2,271	6,145	1.8%	1,755	0.6%	1,366	320
EU27+UK	904	2,617	0.8%	16,275	5.2%	12,324	2,964
Ukraine	1,963	4,499	1.3%	1,850	0.6%	1,460	340

^a The marketing year in production data provided by the U.S. Department of Agriculture (USDA) begins on September 1 for soybeans, and on October 1 for soybean meal and soybean oil. The USDA provides detailed and recent overviews on the world production of agricultural commodities. It was chosen to use USDA on soybean production as e.g. the UN Food and Agriculture Organization (FAO) as another important global agricultural data provider at the time of writing only provides production data until 2019.

Country / region	Area planted (1,000 ha)	Harvest of soybeans (1,000 t)	Share global soybean harvest (%)	Volume crushed (1,000 t)	Share global crushing volume (%)	Result of crushing (1,000 t)	
						Soybean meal	Soybean oil
Russia	2,776	4,359	1.3%	4,650	1.5%	3,664	834
India	12,193	9,300	2.7%	8,400	2.7%	6,720	1,512
China	9,332	18,092	5.3%	91,500	29.3%	72,468	16,397
Indonesia	400	480	0.1%	-	0.0%	-	-
Japan	144	212	0.1%	2,460	0.8%	1,855	480
Vietnam	42	66	0.0%	1,250	0.4%	976	238
South Korea	58	105	0.0%	1,035	0.3%	815	183
Thailand	34	52	0.0%	2,610	0.8%	2,035	468
Rest of Asia & Oceania	391	588	0.2%	7,916	2.5%	6,193	1,452
South Africa	705	1,246	0.4%	1,100	0.4%	868	204
Nigeria	1,040	1,150	0.3%	870	0.3%	676	157
Rest of Sub-Saharan Africa	357	497	0.1%	305	0.1%	239	56
North Africa	9	25	0.0%	5,786	1.9%	4,508	1,066
Other countries	477	1,133	0.3%	12,906	4.1%	10,962	2,380
Total	122,893	339,885		312,480		245,634	58,543

Note: Volumes crushed are influenced by imports and exports of soybeans.

Source: USDA Foreign Agriculture Service (2021), "Production, supply and distribution online", viewed in November 2021.

1.2 Global soy trade

Global exports of soybeans, soybean meal and soybean oil amounted to a total of 245 million tonnes in 2019/20 (Table 2). The division between the two main traded products, soybeans and soybean meal, depends on a number of factors. In some producing countries the crushing before export is stimulated to increase domestic value adding or to use the resulting soybean oil for national biodiesel blending mandates.

Importing countries may prefer soybean imports as they have markets for both crushing products, like for example in China with its large edible oil and animal product sectors. Meanwhile, the EU imports large volumes of soybeans for crushing as well as soybean meal to fill the crop protein gap for its animal product sector.

In line with their role as top producers, Brazil, the United States, and Argentina are the leading exporters globally.

Table 2 Soy exports per country/region (2019/20)

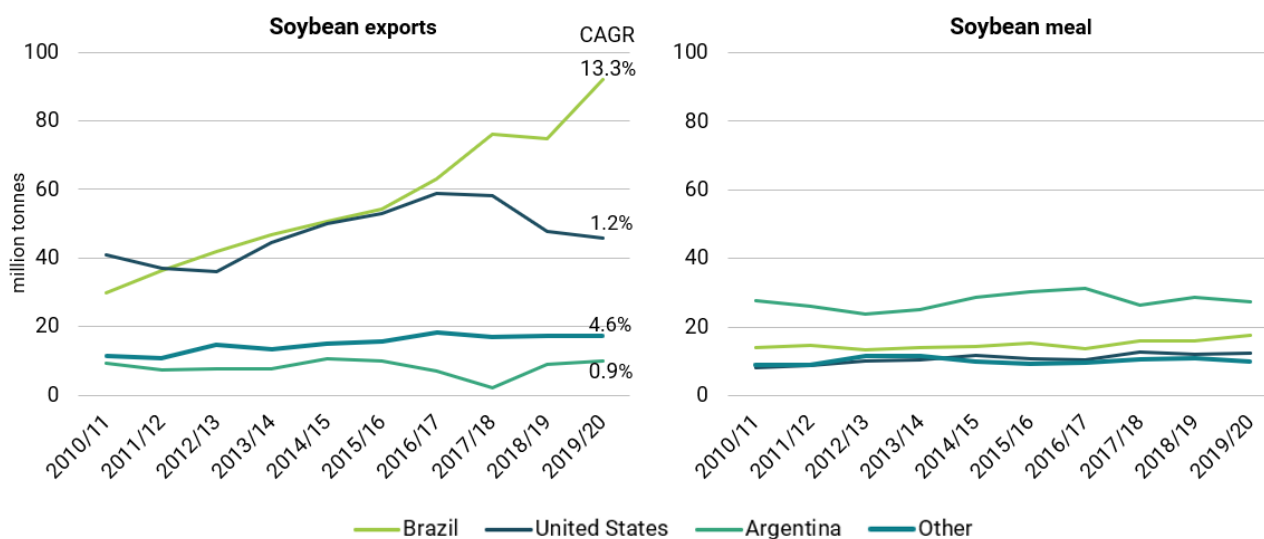
Exporting country / region	Export (1,000 tonnes)					
	Soybeans	Share total soybean exports (%)	Soybean meal	Share total soybean meal exports (%)	Soybean oil	Share total soybean oil exports (%)
Brazil	92,135	55.8%	17,499	25.8%	1,156	9.4%
Argentina	10,002	6.1%	27,461	40.6%	5,404	43.9%
Paraguay	6,619	4.0%	2,138	3.2%	631	5.1%
Bolivia	20	0.0%	1,723	2.5%	380	3.1%
Rest of Latin America	1,933	1.2%	15	0.0%	106	0.9%
United States	45,701	27.7%	12,550	18.5%	1,287	10.5%
Canada	3,907	2.4%	329	0.5%	144	1.2%
EU27+UK	256	0.2%	952	1.3%	951	7.7%
Ukraine	2,633	1.6%	724	1.1%	338	2.7%
Russia	1,186	0.7%	557	0.8%	612	5.0%
India	80	0.0%	886	1.3%	16	0.1%
China	90	0.1%	1,012	1.5%	155	1.3%
Indonesia	3	0.0%	-	0.0%	-	0.0%
Japan	-	0.0%	1	0.0%	1	0.0%
Vietnam	-	0.0%	110	0.2%	10	0.1%
South Korea	-	0.0%	44	0.1%	2	0.0%
Thailand	4	0.0%	47	0.1%	103	0.8%
Rest of Asia & Oceania	28	0.0%	78	0.1%	144	1.2%
South Africa	-	0.0%	106	0.2%	50	0.4%
Nigeria	7	0.0%	100	0.1%	-	0.0%
Rest of Sub-Saharan Africa	91	0.1%	120	0.2%	1	0.0%
North Africa	-	0.0%	38	0.1%	294	2.4%
Other countries	364	0.2%	1,227	1.8%	522	4.2%
Total	165,059		67,717		12,307	

Note: Difference in totals with Table 3 may be due to a) countries with minor volumes of imports and/or exports not always appearing in statistics but in totality creating a difference; and b) some exports and imports appearing in different marketing years.

Source: USDA Foreign Agriculture Service (2021), "Production, supply and distribution online", viewed in November 2021.

Brazil rapidly increased its absolute traded volumes as well as its share in global trade in recent years. While exports of soybean meal more or less stagnated during the ten year-period from 2010/11 to 2019/20, exports of unprocessed soybeans have experienced an ongoing and significant increase (Figure 2). Its compound annual growth rate (CAGR) in soybean exports of 13.3% during the analysed ten years is almost twice as high as the average global CAGR (6.8%).^b

Figure 2 Soybean and soybean meal exports by key producers (2010/11 to 2019/20)



Source: USDA Foreign Agriculture Service (2021), "Production, supply and distribution online", viewed in November 2021.

China is by far the largest importer of soy, and then almost exclusively in the form of soybeans. The country accounts for 60% of traded soybeans and 9% of traded soybean meal in 2019/20. Looking at the total traded volume of soy products, this represents a combined share of around 42% of all traded soy products. The EU27+UK is another important destination of soy imports, accounting for 10% of soybean imports, 30% of soybean meal imports and 6% of soybean oil imports, or a share of around 15% in total traded soy products (Table 3 and Figure 3). While China is a larger importer than the EU, *Trase* data shows though that the EU's relative deforestation impact linked to soy from Brazil was greater than China's. Over the period 2009 to 2018, EU imports of Brazilian soy on average led to 1.5 hectares of deforestation and conversion per 1,000 tonnes, compared to 0.75 hectares linked to Chinese imports from the country. A similar pattern has been observed for imports of Argentinian soy.⁴

^b The compound annual growth rate (CAGR) allows to calculate the annualized average rate of growth during a defined number of years, assuming growth takes place at an exponentially compounded rate.

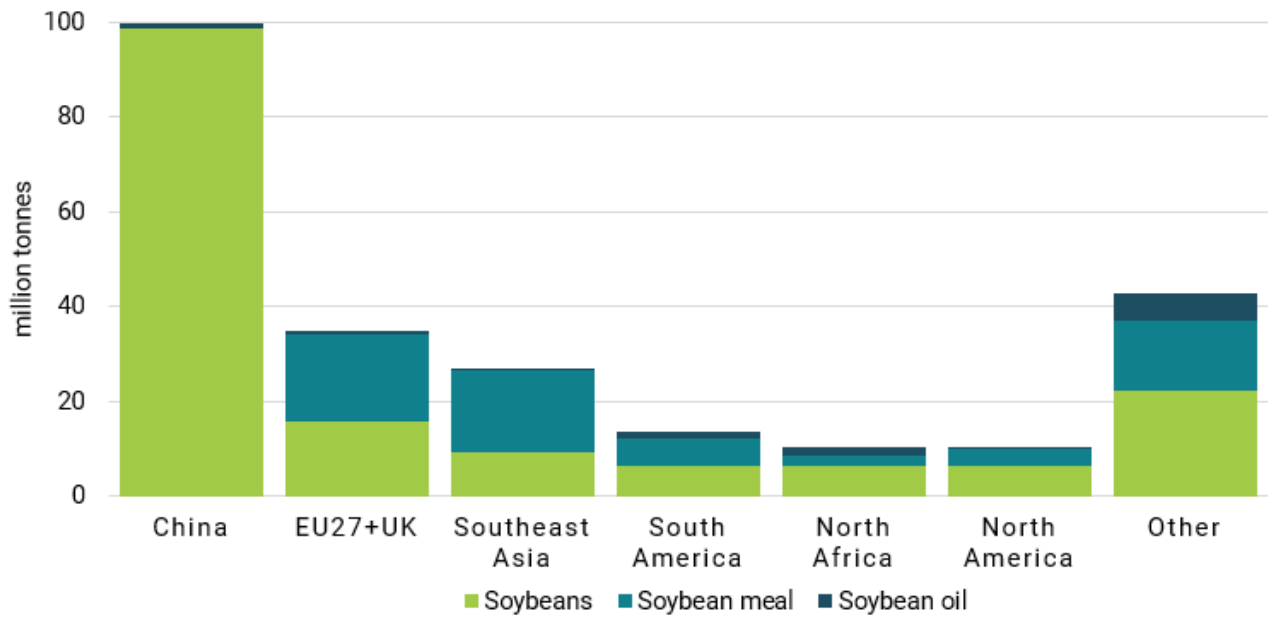
Table 3 Soy imports per country/region (2019/20)

Importing country / region	Soybeans		Soybean meal		Soybean oil		Total soy products share (%)
	1,000 tonnes	Share (%)	1,000 tonnes	Share (%)	1,000 tonnes	Share (%)	
Brazil	549	0.3%	10	0.0%	66	0.6%	0.3%
Argentina	4,882	3.0%	1	0.0%	0	0.0%	2.0%
Paraguay	10	0.0%	0	0.0%	6	0.1%	0.0%
Bolivia	6	0.0%	0	0.0%	8	0.1%	0.0%
Rest of Latin America	1,268	0.8%	7,089	11.4%	1,458	12.8%	4.1%
United States	419	0.3%	580	0.9%	145	1.3%	0.5%
Canada	263	0.2%	1,150	1.9%	27	0.2%	0.6%
EU27+UK	15,704	9.5%	18,464	29.8%	655	5.7%	14.6%
Ukraine	24	0.0%	4	0.0%	0	0.0%	0.0%
Russia	2,047	1.2%	288	0.5%	62	0.5%	1.0%
India	520	0.3%	23	0.0%	3,626	31.8%	1.7%
China	98,533	59.7%	51	0.1%	1,000	8.8%	41.8%
Indonesia	2,636	1.6%	5,043	8.1%	34	0.3%	3.2%
Japan	3,325	2.0%	1,858	3.0%	5	0.0%	2.2%
Vietnam	1,882	1.1%	5,090	8.2%	45	0.4%	2.9%
South Korea	1,291	0.8%	1,992	3.2%	402	3.5%	1.5%
Thailand	3,831	2.3%	2,854	4.6%	3	0.0%	2.8%
Rest of Asia & Oceania	8,701	5.3%	6,206	10.0%	1,055	9.3%	6.7%
South Africa	10	0.0%	481	0.8%	150	1.3%	0.3%
Nigeria	52	0.0%	0	0.0%	1	0.0%	0.0%
Rest of Sub-Saharan Africa	9	0.0%	97	0.2%	220	1.9%	0.1%
North Africa	6,176	3.7%	2,369	3.8%	1,790	15.7%	4.3%
Other countries	12,836	7.8%	8,321	13.4%	638	5.6%	9.1%
Total	164,974		61,971		11,396		100.0%

Note: Difference in totals with Table 2 may be due to a) countries with minor volumes of imports and/or exports not always appearing in statistics but in totality creating a difference; and b) some exports and imports appearing in different marketing years.

Source: USDA Foreign Agriculture Service, "Production, supply and distribution online", viewed in November 2021.

Figure 3 Regional distribution of soy imports (2019/20)



Source: USDA Foreign Agriculture Service, "Production, supply and distribution online", viewed in November 2021.

2

Soy production and use in EU27+UK

While output from domestic soy cultivation in the EU27+UK has increased in recent years, it remains much too small to satisfy the demand for high-quality crop proteins. In 2020, a total net volume of 1.8 million tonnes of soybeans, 30.3 million tonnes of soybean meal and 2.7 million tonnes of soybean oil were available for domestic use.

2.1 Soy production

Soy production in the EU27 is still small compared to global output but has shown significant growth in recent years. Output more than doubled during the last ten years, from 1.26 million tonnes in 2010 to 2.69 million tonnes in 2020. The top-5 producing countries – Italy, France, Romania, Croatia, and Austria - accounted for more than 80% of output in the EU in 2020 (Table 4). Production in the UK is too small to be reported in agricultural statistics.

Table 4 EU27+UK soy production (2020)

Country	Production (1,000 tonnes)	Share in EU27+UK production
Italy	965	35.8%
France	407	15.1%
Romania	334	12.4%
Croatia	266	9.9%
Austria	203	7.5%
Other	519	19.3%
Total	2,694	

Source: Eurostat (2021), "Crop production in national humidity", viewed in November 2021.

2.2 Imports of soybeans, soybean meal and soybean oil

Soybean, meal, and oil imports to the EU27+UK reached a combined 33.9 million tonnes in 2020 (Table 5). The top soy producing countries Brazil, Argentina, and the United States accounted for a combined 86% of these imports, Brazil alone for almost half. Soybean meal and soybeans are the main traded soy products. Soybean oil plays in comparison a much smaller role, and mostly comes from Central and Eastern European countries, including Ukraine, Russia, and Serbia. This can be explained with the demand for non-genetically modified (GM) soybean oil for food products.^c

^c In contrary to feed products, GM-ingredients in food products must be labelled as such in the EU.

Table 5 Soy imports to the EU27+UK (2020)

Country / region of origin	Soybeans		Soybean meal		Soybean oil		Total soy products share (%)
	1,000 tonnes	Share (%)	1,000 tonnes	Share (%)	1,000 tonnes	Share (%)	
Brazil	8,316	52.4%	7,843	44.7%	1	0.2%	48%
Argentina	121	0.8%	7,376	42.0%	2	0.5%	22%
United States	5,036	31.8%	407	2.3%	0	0.0%	16%
Canada	1,497	9.4%	164	0.9%	-	0.0%	5%
Ukraine	496	3.1%	177	1.0%	184	39.9%	3%
Paraguay*	96	0.6%	478	2.7%	54	11.8%	2%
Russia	0	0.0%	336	1.9%	51	11.2%	1%
China	19	0.1%	162	0.9%	0	0.0%	1%
India	14	0.1%	102	0.6%	0	0.0%	0%
Uruguay	12	0.1%	28	0.2%	-	0.0%	0%
Bolivia	-	0.0%	21	0.1%	-	0.0%	0%
Other countries	253	1.7%	456	2.8%	168	36.5%	3%
EU27+UK imports	15,860		17,551		461		
of which UK imports	783		1,549		18		7%

Note: Difference with Table 3 due to differing time periods;

*Some of Paraguay's soy exports may be included in data from Argentina, Brazil and Uruguay due to transshipment.

Source: Eurostat (2021), "International trade in goods - Detailed data", viewed in November 2021; UK Trade Info (2021), "Overseas trade data table", viewed in December 2021.

2.3 Exports of soybeans, soybean meal and soybean oil

Soy exports from the EU27+UK only account for a small share of total available soy from imports and production. In 2020, a total of 1.31 million tonnes of soybeans, soybean meal and soybean oil were exported to non-EU destinations (Table 6), with Morocco and Algeria as the most important trading partners, and soybean oil as the most important exported product.

Table 6 Soy exports from the EU27+UK (2020)

Country / region of destination	Export (1,000 tonnes)			
	Soybeans	Soybean meal	Soybean oil	Total
Morocco	0	5	247	253
Algeria	0	13	194	207
Switzerland	15	118	5	137
Russia	124	6	0	130
South Africa	0	-	105	105
Other	44	204	224	472
Total	183	346	775	1,304
of which UK exports	0.2	0.4	0.0	0.6

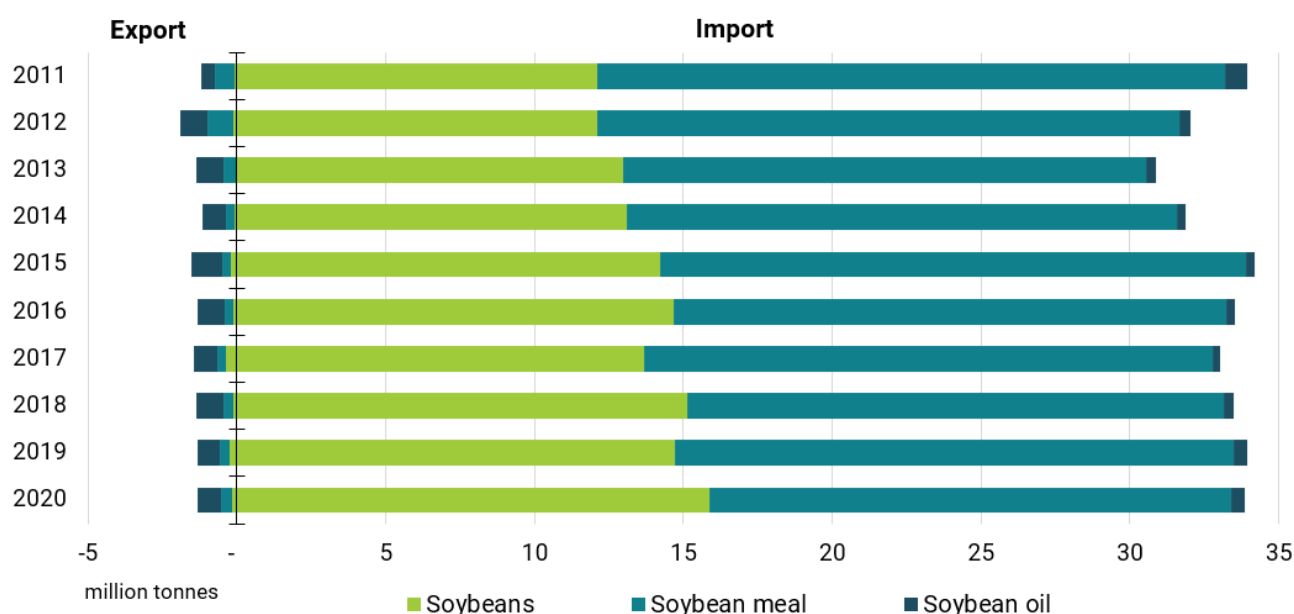
Note: Difference with Table 2 due to differing time periods.

Source: Eurostat (2021), "International trade in goods - Detailed data", viewed in November 2021; UK Trade Info (2021), "Overseas trade data table", viewed in December 2021.

Overall, the EU27+UK trade balance for the key soy products shows little changes over the ten years since 2011 (Figure 4). There has been a slight decrease in soybean meal and concurrent increase in soybean imports to the EU27+UK over the ten year-period to 2020. After the crushing of most of the soybeans with meal and oil as key products, the overall volume of soy products available for use does not suggest a sizable shift away from the predominantly South American soy imports to the region.

Exports of the key soy products to destinations outside the EU27+UK remained small, with soybean oil taking up a comparatively large share in exports since 2013.

Figure 4 Soy imports and exports EU27+UK (2011 to 2020)



Source: Eurostat (2021), "International trade in goods - Detailed data", viewed in November 2021; UK Trade Info (2021), "Overseas trade data table", viewed in December 2021.

2.4 Soy available for use in the EU27+UK countries

Summarising the results from sections 2.1, 2.2 and 2.3, Table 7 presents the total volumes of the main soy products – soybeans, soybean meal and soybean oil – that were available for use in the EU27+UK in 2020. With 17.6 million tonnes, soybean meal accounted for the largest volume, followed by uncrushed soybeans with 15.9 million tonnes. Imports of soybean oil are small at around 0.5 million tonnes. However, the crushing of a large share of the soybeans – both from imports and from regional production – results in an additional 3.1 million tonnes of oil, based on the average crushing outcome of 18.5% oil. Adding the 13.1 million tonnes of soybean meal resulting from the crushing of soybeans to net import volumes, a total of 30.3 million tonnes of soybean meal was available for use in feed in the EU27+UK market. With respectively 1.8 and 2.7 million tonnes, soybeans and soybean oil are used in much smaller volumes.

Table 7 Soy available for use in the EU27+UK (2020)

Soy products (1,000 tonnes)	Import	Domestic production	Crushing	Result of crushing	Export	Available for use in EU27+UK
Soybeans	15,860	2,694	16,665	-	183	1,846
Soybean meal	17,551		-	13,082	346	30,287
Soybean oil	461		-	3,083	782	2,746

Note: Differences in totals available for use due to changes in stocks and small losses during crushing.

Source: Eurostat (2021), "International trade in goods - Detailed data", viewed in November 2021; ISTA Mielke (2021), *Oil World Annual 2021*, Hamburg, Germany; ISTA Mielke; Eurostat (2021), "Crop production in national humidity", viewed in November 2021.

The following sections focus on the role of animal farming as a key destination of these soy products. Other uses such as direct processing into food products or in industrial products such as biodiesel are considered in Chapter 3.

2.5 Soy use in animal feed

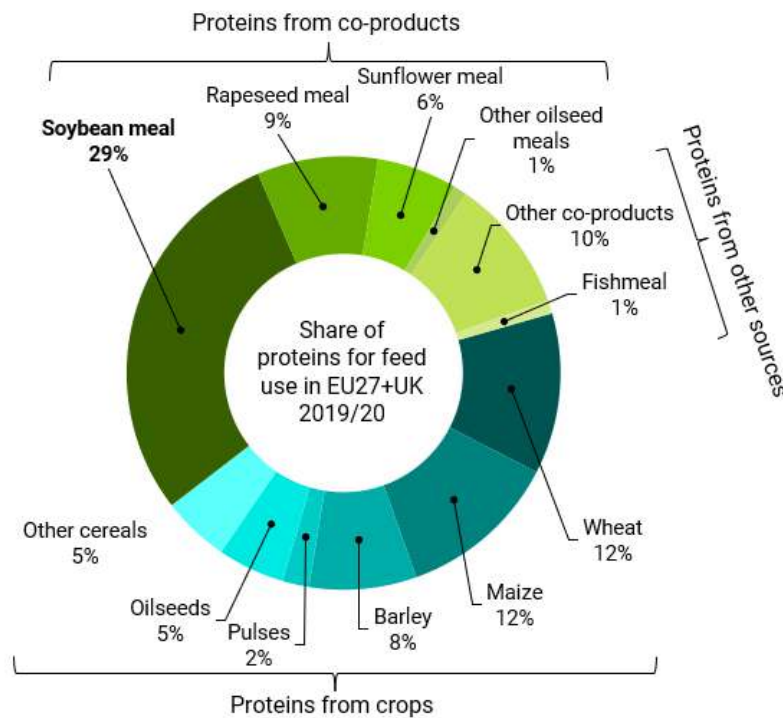
According to the European Compound Feed Manufacturers' Federation (FEFAC), the volume of industrial compound feed produced in the EU27+UK reached 164.86 million tonnes in 2020.⁵ This volume accounted for around 20% of the total feed consumed by farm animals in that year, while roughages accounted for 67% and on-farm feed materials for 13%.⁶

The privileged role of soybean meal as an ingredient in compound feed formulation is mainly due to its higher protein content in comparison to other crops, as well as its amino acid content and year-round availability.^{d,7} With roughage excluded,^e soybean meal has therefore become the most important individual protein source in the EU27+UK, supplying 29% of the crude protein for feed use in 2019/20 (Figure 5). However, the self-sufficiency rate for protein from soybean meal is low, with domestic production covering just 3% of demand in 2019/20.⁸ This crop protein gap in relation to the extensive EU27+UK animal product industry is leading to the observed strong dependence on soy imports.

^d Based on dry matter, soybean meal has an average protein share of 53%, compared to rapeseed meal with 40% and sunflower meal with 33%.

^e Roughage accounts for around 45% of protein supply in feed, based on protein equivalent.

Figure 5 Source materials for proteins for feed use in the EU27+UK (2019/20)



Note: Expressed in crude protein, excluding roughages.

Source: FEAC (2020), *From Farm to Table: 2020 Feed Statistics in Charts*, p. 34.

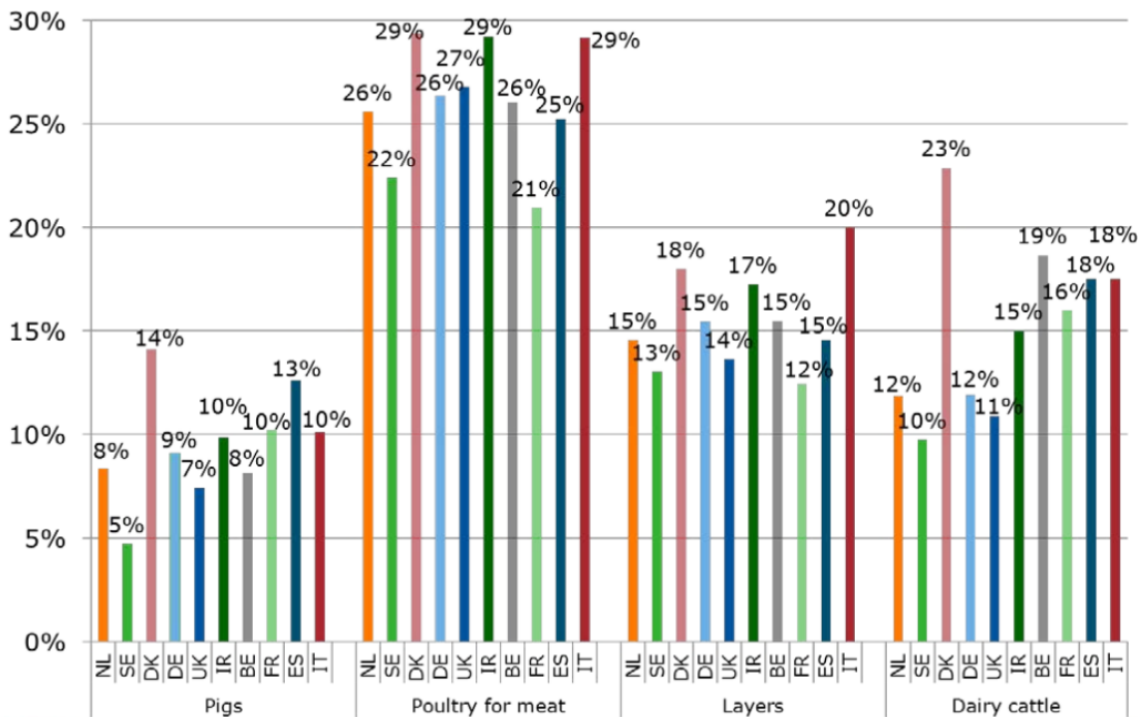
As the 2020 compound feed production figures are only provided per species but not further broken down per species (e.g., distinction between fattening and dairy cows for cattle feed or between broilers and layers for poultry feed), the relative division as reported by FEAC for 2017 was applied to the 2020 production volumes.⁹ Moreover, aquaculture feed production is not separately reported by FEAC. Therefore, its share in “other feed” was estimated based on European aquaculture feed production volumes published in the Alltech Global Feed Survey 2021.¹⁰

There is no other sizeable market for soybean meal than its use in feedstuffs. This refers notably to its inclusion as a high-quality crop protein source in compound feeds, as well as smaller volumes that are added in home-mixing on the farm. The composition of industrial compound feeds varies between certain margins on an annual basis, depending on availability and market prices. In the case of soybean meal, its content share may be somewhat higher or lower depending on the availability and price of other crop protein sources; however, as soybean meal is the most important high-quality crop protein these margins are limited.

While it is known that the share of soybean meal in compound feeds also shows differences between different European countries, it is difficult to access detailed figures across all countries and animal species. For this research, data on the soybean meal content in feeds for four key animal products across ten European countries collected by Hoste (2016) was used (Figure 6).^{f,11} In 2020, these countries accounted with around 81% for most of the industrial compound feed production in the EU27+UK as reported by FEAC.¹²

^f The ten countries covered are Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Spain, Sweden, the UK. No details on the role of soy protein concentrate (SPC) are included.

Figure 6 Estimated soybean meal content in compound feed in ten EU27+UK countries



Source: Hoste, R. (2016, September), *Soy Footprint of Animal Products in Europe – An Estimation*, Wageningen, Netherlands: Wageningen University & Research and IDH, p. 5.

Weighted averages based on the share of the ten countries in regional compound feed production were used to extrapolate the available data and estimate shares per type of feed on the EU27+UK level. As no figure for beef cattle could be drawn from the same report, an estimate for this share for the Dutch market was used as a proxy.¹³

Also in aquaculture feed, soy is an important protein source. It includes considerable shares of soy protein concentrate (SPC) as well as soybean meal.⁹ The composition differs between different aquaculture systems in Europe, with the main systems being freshwater, cold water marine and warm water marine production.^h First, the share of the three main aquaculture production systems for fish in the overall reported volume of aquaculture fish feed in the EU27+UK in 2020 was calculated based on FAO aquaculture production data.¹⁴ In a second step, average estimates for the inclusion of SPC and soybean meal in the different aquaculture feeds allowed to estimate the total volume of the soy products that was used for farmed fish in 2020.¹⁵ These calculations led to an estimated average content of 15% SPC and 10% soybean meal in the total aquaculture feed. Based on soybean industry conversion factors, SPC can be converted to soybean meal equivalent volume by applying a factor of 2.38.^{i, 16}

Smaller volumes of soybeans (roasted full-fat soybeans) and soybean oil are also added to feedstuffs. These volumes were estimated based on data for EU27+UK feed use of soybeans and soybean oil published by the U.S. Department of Agriculture (USDA) and distributed across different animal product sectors based on their shares in total feed use.¹⁷ For the relatively small volume of hulls resulting from the crushing of soybeans it is assumed that these are mixed into

⁹ In addition, small amounts of soybean oil are used in aquaculture feed.

^h Depending on the production system and geography, the share of SPC varies between approximately 5% and 30%, and the share of soybean meal between 5% and 20%.

ⁱ Based on soy conversion factors provided by the U.S. Soybean Export Council.

feeds to reduce the protein content. The relative soy share calculated for aquaculture feed is influenced by the applied conversion from SPC to soybean meal.

Applying the average shares of soy products to the feed production volumes reported by FEFAC for the EU27+UK in 2020 suggests a total use of soy products of 25.0 million tonnes, with soybean meal accounting for 23.4 million tonnes. However, trade statistics point to an approximately 6 million tonnes higher consumption of soybean meal in feedstuffs (Table 7). This divergence may be due to the use of soybean meal as a single feedstuff in on-farm mixing; higher average soybean meal shares in industrial compound feeds than suggested by the estimates; a lack of data on the share of SPC in animal diets; and some compound feed being produced by non-members of FEFAC. These factors fed into the corrected soybean meal content as provided in Table 8, which distributes the overall available volume of soybean meal as calculated in Table 7. Due to the lack of detailed data insights, it is not feasible to apply different corrections per species. These calculations lead to the conclusion that the average estimated soy content in feed in the EU27+UK is 19%. The soy content in feed differs between different types of feed, depending on the specific needs of the animals. Among farm animals, the estimated relative soy share in compound feeds is highest for broilers (34%), laying hens (21%), and dairy cows (19%).

Table 8 Estimated soy content in different feeds in the EU27+UK (2020)

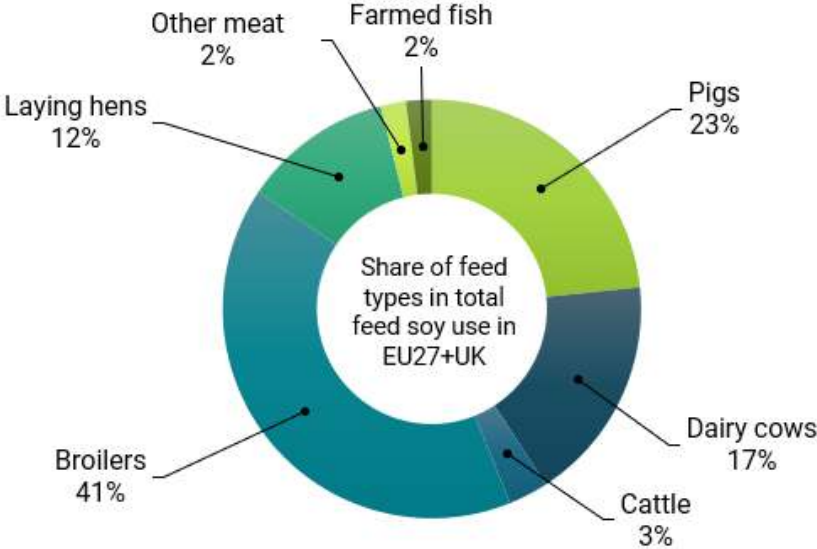
Type	FEFAC compound feed production (1,000 tonnes)	Average soybean meal content (%)	Soy product in feed (estimates, 1,000 tonnes)				Total soy products (1,000 tonnes)
			Soybean meal		Soybeans ^b	Soybean oil ^b	
			Low estimate	Corrected ^a			
Pigs	52,412	10.1%	5,317	6,928	509	17	7,454
Dairy cows	28,682	14.2%	4,064	5,296	278	10	5,584
Cattle ^c	19,980	3.0%	599	781	194	7	982
Broilers	37,615	25.6%	9,639	12,560	365	13	12,938
Laying hens	17,931	15.1%	2,711	3,532	174	6	3,712
Other meat ^d	6,885	6.2%	426	556	66	2	624
Farmed fish ^e	1,401	45.3%	634	634	-	0	635
Total	164,865		23,390	30,287	1,587	55	31,929

Notes: ^aIncluding estimates to correct for total soybean meal available for use in compound feeds and as single feedstuff in the EU27+UK; ^bEstimates for total use of soybeans and soybean oil in feed based on USDA data; ^cIncluding milk replacer and part of reported dairy feed attributable to young calves/old cows; ^dIncluding sheep, goat, horse, rabbit etc.; ^eFor aquaculture feed, estimated average share of 15% SPC and 10% soybean meal; SPC converted to soybean meal equivalent with a factor of 2.38.

Source: Own calculations, based on: FEFAC (2021, July), *Industrial compound feed production 1989-2020*; Alltech (2021), *Global Feed Survey*; Eurostat (2021), "International trade in goods - Detailed data"; Hoste, R. (2016, September), *Soy Footprint of Animal Products in Europe – An Estimation*, Wageningen, Netherlands: Wageningen University & Research and IDH, p. 5; Nantier, G. (2019, October), "Soja die je niet ziet", *Veetelt*, p. 20; FAO (2021), "FishstatJ - Global Aquaculture production statistics", viewed in December 2021; Alltech (2021), "Global Feed Survey 2021"; USDA Foreign Agricultural Service (2021), "Production, supply and distribution", viewed in December 2021.

With an estimated 32 million tonnes of soy products used in feed, the production of animal products accounted for around 90% of the total EU27+UK use of soy products (Table 7). Due to its comparatively high soy content and its role as the second biggest category in compound feed production, broiler feed accounted with an estimated 13 million tonnes or 41% for the largest share in the overall use of soy products in feeds in the EU27+UK in 2020. The pork sector accounted for a share of 23%, followed by dairy cows with 17% (Figure 7).

Figure 7 Shares of different animal products in total feed soy use in the EU27+UK (2020)



3

Embedded soy in animal products and consumption in EU27+UK

Due to the high share of domestic consumption of animal products, consequently also most of the soy embedded in these products is consumed in the EU27+UK. The 2020 per capita consumption of a range of different products was linked to an estimated embedded soy content of 61 kg, with animal products accounting for 90% of this soy consumption.

3.1 Consumption of animal products

The EU27+UK region is a large producer as well as consumer of animal products. Import volumes of meat and dairy are comparatively small. Exports are considerable for some products, notably pork with around 30% of production exported, and milk powder with an export share of around 25%, but domestic consumption is generally higher. This leads to the conclusion that most of the soy embedded in animal products produced in the EU27+UK is for own consumption. Table 9 provides an overview of the estimated production, net-export and consumption of meat, dairy, eggs, and farmed fish in the region.

Table 9 Production, net export, consumption of animal products in the EU27+UK (2020)

Product group	Production	Import	Export	Net-Export	Consumption
<i>Meat (1,000 tonnes carcass weight)</i>					
Beef & veal	6,822	291	746	454	6,368
Pork meat	23,031	44	7,364	7,320	15,711
Poultry meat	15,376	524	1,881	1,357	14,019
Other meat	796	165	59	-106	902
<i>Eggs & egg products (million eggs)</i>					
	125,982	1,108	4,962	3,854	122,127
<i>Dairy products (1,000 tonnes)^a</i>					
Consumption milk	30,333	11	1,056	1,045	29,288
Cream	2,806	2	201	199	2,607
Cheese	10,771	63	935	872	9,899
Butter & butter oil	2,488	4	236	233	2,255
Condensed milk	1,232	1	279	278	954
Milk powder	4,306	3	1,153	1,150	3,156
Yoghurt	8,137	4	79	75	8,061

Product group	Production	Import	Export	Net-Export	Consumption
Other dairy products	4,500	18	277	259	4,241
<i>Farmed fish (1,000 tonnes)</i>					
	742	1,081	361	-657	1,399

Notes: ^aNot considering whey and casein resulting from milk processing.

Source: Own calculations, based on: Eurostat, "Slaughtering in slaughterhouses - annual data", viewed in November 2021; Eurostat, "EU trade since 1995 by HS6", viewed in November 2021; DEFRA (2021), "UK slaughterings and production", viewed in November 2021; DEFRA (2021), "FSA, E&W Poultry Slaughterhouse Survey, DAERA and RESAS", viewed in November 2021; OECD Data (2018), "Meat consumption", viewed in November 2021; European Commission (2021, November 17), *EU Market Situation for Eggs*, p. 10; Egginfo (n.d.), "Egg sizes", viewed in November 2021; EggInfo (2021), "Industry data", viewed in November 2021; Eurostat (2021), "Milk and milk product statistics", viewed in November 2021; Eurostat (2021), "Cow's milk collection and products obtained", viewed in December 2021; UK Trade Info (2021), "Overseas trade data table", viewed in November 2021; FAO (2021), "FishstatJ - Global Aquaculture production statistics"; European Observatory for Fishery and Aquaculture Products (EUMOFA) (2021), *The EU Fish Market*, Brussels, Belgium: European Commission, p. 37; UK Commons Library (2021, November 16), "UK fisheries statistics", viewed in November 2021.

Table 10 shows the estimated per capita consumption of animal products in the EU27+UK. Based on a total population of 515 million,¹⁸ an EU27+UK-citizen on average roughly consumed 58 kg of pork, poultry, beef, and other meat (in retail weight), 237 eggs, 117 kg of various dairy products and 2 kg of farmed fish per year. This corresponds to a daily consumption of about 160 grams of meat, two-thirds of an egg, 320 grams of dairy products and 7 grams of farmed fish.

Table 10 Per capita consumption of animal products in the EU27+UK (2020)

Product (group)	Annual per capita consumption (in kg / number of eggs)
<i>Meat (retail weight)</i>	58.0
Beef & veal	8.7
Pork meat	23.8
Poultry meat	24.0
Other meat	1.5
<i>Eggs & egg products (number of eggs)</i>	237
<i>Dairy products (weight)</i>	117.5
Consumption milk	56.9
Cream	5.1
Cheese	19.2
Butter & butter oil	4.4
Condensed milk	1.9
Milk powder	6.1
Yoghurt	15.7
Other dairy products	8.2
<i>Farmed fish (retail weight)</i>	2.4

Note: Based on the following carcass weight to retail weight conversion factors: 0.7 for beef, 0.78 for pigmeat, and 0.88 for poultry and other meat (based on average sheep meat conversion), 0.9 for farmed fish.

Source: Input from Table 9; Eurostat (2020, July 10), *EU Population in 2020*; conversion rates from OECD (2021), "Meat consumption", OECD data, online: <https://data.oecd.org/agroutput/meat-consumption.htm>, viewed in November 2021; USDA Foreign Agriculture Service (1992, June), *Weights, Measures and Conversion Factors for Agricultural Commodities and their Products*, Washington: Agricultural Handbook Number 697, p. 38.

3.2 Consumption of embedded soy in the EU27+UK

Table 11 presents an overview on the estimated amount of soy needed for the EU27+UK consumption of animal products with embedded soy and other products in which soy is directly processed. In total, an estimated 31 million tonnes of soy products were required for domestic consumption, of which soybean meal accounted for 27 million tonnes or 86%.

Table 11 Soy consumption in the EU27+UK (2020)

Product (group)	Consumption (1,000 tonnes of meat/dairy/fish or million eggs)	Soy volume (1,000 tonnes)				Embedded soy products (gr/kg, gr/egg) ^a
		Soy- beans	Soybean meal	Soybean oil	Total	
<i>Meat (carcass weight)</i>	37,000	936	17,536	32	18,505	500
Beef & veal	6,368	181	729	6	916	144
Pork meat	15,711	347	4,726	12	5,085	324
Poultry meat	14,019	333	11,451	11	11,796	841
Other meat	902	75	629	3	707	784
<i>Eggs and egg products</i>	122,127	169	3,424	6	3,599	29
<i>Dairy products</i>	60,462	247	4,692	8	4,947	82
Consumption milk	29,288	49	926	2	976	33
Cream	2,607	4	84	0	88	34
Cheese	9,899	121	2,296	4	2,421	245
Butter & butter oil	2,255	5	101	0	106	47
Condensed milk	954	4	70	0	73	77
Milk powder	3,156	44	841	2	887	281
Yoghurt	8,061	14	259	0	273	34
Other dairy products	4,241	6	115	0	121	29
<i>Farmed fish</i>	1,399	-	1,196	1	1,197	856
<i>Sub-total animal products</i>		1,352	26,848	47	28,247	
<i>Other products</i>		258	-	2,691	2,950	
Food products		258	-	1,528	1,786	
Biodiesel		-	-	1,163	1,163	
Total consumption		1,610	26,848	2,738	31,197	

Note: ^aIn italics, average soy content across product groups; for meat and fish based on carcass weight.

Source: Own calculations based on Table 7, Table 8, Table 10; USDA Foreign Agriculture Service, "Production, supply and distribution online", viewed in November 2021; ISTA Mielke (2021), *Oil World Annual 2021*, Hamburg, Germany: ISTA Mielke.

The 2020 per capita consumption of a range of different products by the 515 million inhabitants of the EU27+UK was linked to an estimated embedded or direct soy content of 61 kg (Table 12). With 55 kg, the largest share of soy products is embedded in the consumption of animal products.

Table 12 Per capita soy consumption in the EU27+UK (2020)

Product (group)	Annual per capita consumption (in kg / number of eggs)	(Embedded) soy products (gr/kg, gr/egg)	Annual per capita consumption (embedded) soy (kg)
<i>Meat (retail weight)</i>			35.9
Beef & veal	8.7	206	1.8
Pork meat	23.8	415	9.9
Poultry meat	24.0	956	22.9
Other meat	1.5	891	1.4
<i>Eggs and egg products</i>			7.0
	237	29	7.0
<i>Dairy products</i>			9.6
Consumption milk	56.9	33	1.9
Cream	5.1	34	0.2
Cheese	19.2	245	4.7
Butter	4.4	47	0.2
Condensed milk	1.9	77	0.1
Milk powder	6.1	281	1.7
Yoghurt	15.7	34	0.5
Other dairy products	8.2	29	0.2
<i>Farmed fish (retail weight)</i>			2.3
	2.4	951	2.3
<i>Sub-total animal products</i>			54.9
<i>Other products</i>			5.7
Food products			3.5
Biodiesel			2.3
Total embedded soy consumption			60.6

Note: Difference in embedded soy content with Table 11 due to conversion to retail weight.

Source: Own calculations, input from Table 10, Table 11.

3.3 Embedded soy consumption per iconic product

Table 13 shows the estimated embedded soy consumption for several iconic animal products.^{j,19}

Table 13 Embedded soy consumption per iconic product in the EU27+UK in 2020

Product	Embedded soy (in gr)
Hamburger (100 gr of beef)	21
Pork meat (100 gr)	41
Pork sausage (50 gr) ^a	13
Chicken breast (100 gr)	96
Egg (55 gr)	29
Cheese (100 gr)	24
Glass of milk (200 ml)	7
Bowl of yoghurt (200 ml)	7
Salmon filet (100 gr) ^b	95

Note: ^aAssuming a weight of 50 grams for a pork sausage containing 65% of pork meat; ^bEstimated SPC content converted to soybean meal equivalent.

Source: Own calculations, input from Table 8, Table 9, Table 11.

^j While some animal products are linked to lower shares of embedded soy, this does not automatically imply an overall lower resource consumption but may be linked to large volumes of other crop ingredients and co-products consumed in feed.

References

- 1 Kuepper, B. and M. Riemersma (2019), *European Soy Monitor*, Amsterdam, Netherlands: IUCN Netherlands and IDH, p. 15.
- 2 *Bloomberg News* (8 March 2021), "Disease that wiped out millions of pigs is creeping back in Asia", online: <https://www.bloomberg.com/news/articles/2021-03-08/disease-that-wiped-out-millions-of-pigs-is-creeping-back-in-asia?sref=q8selhDd>, viewed in November 2021;
Gro Intelligence (2019, November 27), "How African Swine Fever in China is shaking up world trade flows, online: <https://gro-intelligence.com/insights/articles/how-african-swine-fever-in-china-is-shaking-up-world-trade-flows>, viewed in November 2021.
- 3 Patterson, W. (2020, Aug 21), "Chinese purchases of US soybeans pick up", *ING THINK Economic and Financial Analysis*, online: <https://think.ing.com/articles/chinese-purchases-of-us-soybeans-pick-up/>, viewed in November 2021;
Voorra, V. C. Larrea and S. Bermúdez (October 2020), *Global Market Report: Soybeans*, Sustainable Commodities Marketplace Series 2019, International Institute for Sustainable Development and State of Sustainability Initiatives, p.4.
- 4 Trase (2020, July), *Trase Yearbook 2020 – The State of Forest-Risk Supply Chains*, p. 5.
- 5 FEFAC (2021), *EU Industrial Compound Feed Production*, p. 3.
- 6 FEFAC (2020), *From Farm to Table: 2020 Feed Statistics in Charts*, p. 4.
- 7 European Commission (2018, November), *Report from the Commission to the Council and the European Parliament on the Development of Plant Proteins in Europe*, p. 3;
EIP Agri Focus Group (2014, April), *Protein Crops: Final Report*, p. 11.
- 8 FEFAC (2020), *From Farm to Table: 2020 Feed Statistics in Charts*, p. 33.
- 9 FEFAC (2018), *Industrial Compound Feed Production 1989-2017*.
- 10 Alltech (2021), *2021 Global Feed Survey*, p. 9.
- 11 Hoste, R. (2016, September), *Soy Footprint of Animal Products in Europe – An Estimation*, Wageningen, Netherlands: Wageningen University & Research and IDH, p. 5.
- 12 FEFAC (2021), *EU Industrial Compound Feed Production*, p. 13.
- 13 Nantier, G. (2019, October), "Soja die je niet ziet", *Veetelt*, p. 20..
- 14 FAO (2021), "FishstatJ - Global Aquaculture production statistics", viewed in December 2021;
Alltech (2021), "Global Feed Survey 2021", online: <https://www.alltech.com/2021-global-feed-survey/results?submissionGuid=e0d20127-3529-4443-83fc-353a7f20afb4>, viewed in January 2021.
- 15 Confidential industry data, available to Profundo.
- 16 U.S. Soybean Export Council (USSEC) (n.d.), "Conversion table", online: <https://ussec.org/resources/conversion-table/>, viewed in December 2021;
Rainforest Foundation Norway & Framtiden (2017), *From Brazilian Farms to Norwegian Tables*.
- 17 USDA Foreign Agriculture Service, "Production, supply and distribution online", online: <https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery>, viewed in November 2021
- 18 Eurostat (2020, July 10), EU Population in 2020.
- 19 *Feed & Additive* (2021), "FutureEUAqua and sustainable innovative tailor-made fish diets", online: <https://www.feedandadditive.com/futureeuaqua-and-sustainable-innovative-tailor-made-fish-diets/>, viewed in November 2021;
FAO (2021), "FishStatJ", viewed in November 2021.

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