Food & agribusiness specialists

FINAL REPORT

GM FEED RESEARCH SUPPORT

PREPARED FOR

CropLife Europe

Private & Confidential | 10th October 2024

Important Notices

IMPORTANT INFORMATION

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CropLife Europe

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GENERAL METHODOLOGY

Where relevant, information provided in this document has been sourced from published documents, primary research including where relevant and appropriate site visits and face-to-face interviews. In addition, information and statistics held by Farrelly Mitchell were also used alongside comprehensive industry and sector desktop analysis. Where possible we have referenced key information sources.

TERMS OF REFERENCE

This document is based on our engagement letter issued to:

Olivier De Matos, Director General, Crop Life Europe

Rue Guimard 9, 1040 Brussels, Belgium

And signed on:

10/01/2024

DOCUMENT STATUS

Please note that this document is the **Final Report**

Draft documents are subject to further review.

Abbreviations (1/2)

ANVISA	National Health Surveillance Agency (Brazil)
APHIS	Animal and Plant Health Inspection Service
Approx.	Approximately
BN	Billion
CAGR	Compound Annual Growth Rate
CAP	Common Agricultural Policy
CARC	Compound Annual Rate of Change
CNBS	National Council of Biosafety (Brazil)
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
CTNBio	National Technical Commission on Biosafety (Brazil)

DM	Dry Matter
DOC	Day Old Chick
Dom. Com.	Domestic Consumption
EC	European Commission
EFSA	European Food Safety Authority
EFSA	European Food Safety Authority
EGD	European Green Deal
ENGA	European Non-GMO Industry Association
EPA	Environmental Protection Agency
EPRS	European Parliamentary Research Service

Est.	Estimated
EU	European Union
EU Comm.	European Commission
Extra-EU Trade	Trade (imports/exports) between EU Member States and Third Party Countries
F&B	Food & Beverage
FAOSTAT	Food and Agriculture Organization Statistics
FDA	Food and Drug Administration
FEFAC	The European Feed Manufacturers' Federation
GDP	Gross Domestic Product
GEAC	Genetic Engineering Appraisal Committee

Abbreviations (2/2)

GMO	Genetically Modified Organism
GM	Genetically Modified
GTTAC	Gene Technology Technical Advisory Committee
Ha	Hectare
HE	Hatching Egg
Incl.	Including
Intra-EU Trade	Trade (imports/exports) between EU Member States
IP	Identity Preservation
ISAAA	International Service for the Acquisition of Agri-biotech Applications
KG	Kilogram

LHS	Left-Hand Side (axis)
MAPA	Ministry of Agriculture, Livestock and Supply (Brazil)
MJ	megaJoule
MMA	Ministry of the Environment (Brazil)
MN	Millions
MS	Member State
MT	Metric Tonne
NGTs	New Genomic Techniques
OGTR	Office of the Gene Technology Regulator
PNB	National Policy of Biosafety (Brazil)

RARMP	Risk Assessment and Risk Management Plan
RHS	Right-Hand Side (axis)
SMP	Skimmed Milk Powder
T/HA	Tonne per Hectare
USD	US Dollar
USDA	United States Department of Agriculture
USSEC	U.S. Soybean Export Council
Vol.	Volume
WMP	Whole Milk Powder
WWF	Worldwide Fund for Nature

Contents

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Project Overview

At week 4 following a 2-week mobilization period from engagement. Draft report to be delivered by the 19th of April

Overview of Project workstreams and objectives

	1	2	
PHASES	Baseline Assessment	Scenario Development	
OBJECTIVES	To analyze the current European GM feed policy environment and dependence	To assess the economic impact of a GM soyabean ban in the EU on the livestock, feed, dairy and meat manufacturing sectors	
DELIVERABLES	Draft Report	Final Report	Workshop Presentation

Scope Definitions

Project Focus

GM feed products (soybean focus)

Geographic Focus

European Union

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Report Outline (1/2)

Phase 1 established the baseline for examining the effects of a GM soybean ban on the feed value chain

Introduction

- The Client wishes to conduct market research to evaluate the direct and indirect costs of disrupted supply of imported GM soybean on the EU feed, livestock and dairy and meat manufacturing sectors.
- Farrelly Mitchell has been engaged by the client to carry out this work. The project is to be carried out over two phases:
  - **Phase 1:** A baseline assessment of the EU feed, livestock, meat and dairy industries; and
  - **Phase 2:** Based on the outputs of phase 1, develop scenarios to access the economic impacts of a supply disruption caused by a ban on imported GM soybean.
- The work in this report is the output of phase 1 of the project (baseline assessment).
- This report delves into the complexities of the EU's GMO policies, the pivotal role of soybean in the EU feed balance, the intricacies of the feed manufacturing sector, and the broader implications of global feed market dynamics on the EU's agricultural sector.

Regulatory Environment Assessment

- Section A looks at EU GMO regulation. The EU has established a comprehensive regulatory framework to govern GMOs. it aims to safeguard human and animal health and the environment.
- The authorization process for GM crops is notably rigorous, often taking five to six years, significantly longer other countries (Brazil, the USA, Australia). Within this stringent regulatory context, only a limited number of crops and transformation events have been approved, underscoring the EU's cautious approach towards GMOs.
- Despite this regulatory environment, the EU's agricultural sector remains heavily dependent on GM soybean imports, primarily due to its high protein content, essential for animal feed.

EU Feed Commodity Balances

- Section B looks at the EU feed balance. The feed market in the EU is characterized by a complex balance between domestic production and imports.
- Soybeans constitute a significant portion of the feed crude protein availability. its high protein efficiency and versatility make it an important feed material in animal nutrition.
- The EU's self-sufficiency in feed materials such as roughage and cereals contrasts sharply with its dependency on imported soybeans, highlighting a critical vulnerability in its supply chain.
- This dependency is further complicated by the limited production of non-GM soybeans globally and the concentration of GM soy production in a few countries.

Supply Chain Analysis

- A supply chain analysis is presented in Section C. The feed manufacturing sector in the EU, valued at approximately €69 billion, faces numerous challenges, including raw material cost volatility and the need for sustainable and efficient production practices.
- The sector's competitiveness hinges on the ability to navigate global supply dynamics, maintain robust supplier relationships, and innovate in product offerings and services.
- Moreover, the livestock industry, a significant consumer of feed, grapples with rising production costs, stringent welfare standards, and environmental pressures, emphasizing the critical role of feed costs in the sector's sustainability.
- Downstream manufacturing sectors are competitive, low margin, industries with either high or growing degrees of concentration.
- Raw materials costs account for high shares of production costs, making cost management important in maintaining market competitiveness.

Feed Crop Production in Key Supplier Countries

- Section D looks at global production of GM crops and EU GM import volumes. Overall, GM soybean accounts approx. 85% of global soybean production.
- Global soybean is concentrated in Brazil, USA and Argentina.
- These countries account for 80% of global production. GM soybean account for more than 95% of their combined output.
- These countries are also the EU's key suppliers. GM soybean and soybean meal account for +90% of the EU's soybean imports.

Global Availability & Price Dynamics

- Section E explores global feed market dynamics and the production, trade and availability of the key oilseeds and pulse crops that can be used as alternatives to soybean by the feed sector.
- Availability of crop-based alternatives to soybean in international markets is limited.
  Crop-based alternatives to soybean meal are often more expensive or have lower yield or incomparable nutritional profiles.
- These factors highlights the challenges of finding comparable substitutes for soybean meal for utilization in the feed.
- Global feed market dynamics further complicate the EU's position.
- With agri-food production needing to match the pace of population growth and changing dietary preferences, the EU faces the dual challenge of ensuring feed supply security and managing the environmental impact of its agricultural practices.
- Rapeseed meal and legumes are among the most substitutable and available alternatives; however, substitution depends on the target species and other considerations.
- The prospect of an EU ban on GM soybean imports highlights the delicate balance between regulatory aspirations, market realities, and the need for sustainable agricultural solutions.

Source: Farrelly Mitchell Research

Report Outline (2/2)

A soybean meal gap of 18 mn tonnes is identified, which would cost €15.7 bn to fill in the event of a GM ban

Scenario Development

- Section F explores the potential impacts of a GMO soybean ban in the EU based on phase 1 findings.
- It identifies a soybean meal supply gap of almost 18 mn in the event of a GM ban.
- This gap can be filled either by non-GMO soybean or using soybean substitutes. The analysis assumes that the lead time between the decision to ban GMOs and its implementation does not give farmers sufficient time shift production to non-GMO soybean.
- Therefore, the supply gap will need to be filled based on available volumes in the international market.
- A review of the international supply found potential to fill the supply gap with 6.8 mn tonnes of non-gm soybean and 10.9 mn tonnes of soybean substitutes.
- This increased demand pushes up the prices of non-gm soybean by 32% and soybean substitutes by 50% contributing to a €15.7 bn increase in feed costs.
- The analysis explores the impact of this increase in feed costs via three scenarios developed based on who will absorb the costs of the ban:

1) Scenario 1: Increased costs are fully absorbed by manufacturers;
2) Scenario 2: Increased costs are shared 50/50 between: manufacturers and suppliers; and
3) Scenario 3: Increased costs are fully passed on to final consumers.

- The poultry and pork manufacturing sectors are the most impacted across the three scenarios.
- Poultry manufacturing records negative operating margins in both scenario 1 and 2 and pork manufacturing margins negative in scenario 1.

EXECUTIVE SUMMARY

Report Summary (1/2)

The EU livestock sector drives rural livelihoods and economic growth but faces critical challenges

Introduction

The livestock sector is vital to the EU agricultural landscape, providing essential support to rural communities by creating jobs and sustaining livelihoods. It also plays a crucial role in driving the wider agrifood industry, particularly in food manufacturing, and contributes significantly to economic growth and food security across the region.

The livestock sector directly employs 6.2 million people across the EU, with a further 1.5 mn people employed indirectly via the feed, dairy and meat manufacturing sectors. Output from the livestock sector reached more than €200 bn in 2022, with an additional €86 bn worth of value add created by the feed, dairy and meat manufacturing sectors.

These industries, however, face significant competitive challenges and have undergone significant structural change over the last 20 years. Typically, margins are low, and scale is increasing required to compete in globalised markets.

Importance of GM Soybeans in EU

Feed costs represent the largest component of livestock production costs, accounting for approximately 60% of the value of the sectors output.

The European livestock value chain is critically dependent on imported genetically modified (GM) soybeans, relying on three GM-producing countries (Brazil, USA, Argentina) for over 90% of its soybean requirements.

Importance of GM Soybeans in EU (cont.)

- This makes the EU feed value chain highly vulnerable to any disruption, including the potential imposition of a GM-soybean ban. We estimate that a GM soybean ban would result in a €15.7 bn increase in EU feed cost.
- GM soybeans play a central role in supporting the sustainability and competitiveness of the EU's agricultural sector. Any move to restrict or ban these imports could have severe economic consequences, by driving up commercial feed costs by more than 20% and putting severe pressure on the viability of the EU's already strained livestock farming and manufacturing industries.
- Soybean is indispensable to the EU's feed supply due to its superior protein content, cost-efficiency, and flexibility across various livestock production systems. While soybean makes up only 2% of the total feed materials, it accounts for 17% of the crude protein available for livestock production and 55% of the EU's high and super protein feed materials.
- There is significant variation in soy usage in feed within the EU. Ranging from 20% of feed material usage in Slovenia to just 1% in Luxembourg. This variation relates to the dominant species and types of production systems in each country. Countries with high pig and poultry production typically use more soybean. In addition, countries with more intensive production systems also tend to use more soybean.
- A GM-soybean ban would have a substantial impact, creating a soybean meal supply gap of nearly 18 mn tonnes.

Implications of a GM Soybean Ban

- Attempts to fill this gap would drive up the cost of non-GM soybeans by 32 %, while the average cost **of** potential substitutes could rise by 50%.
- These price increases would add an estimated €15.7 billion to feed costs, a burden that would reverberate throughout the EU's livestock, dairy, and meat production sectors.
- The analysis models three scenarios for how the industry might absorb these increased costs:
  - Manufacturers absorbing the full cost
  - Shared cost between manufacturers and suppliers
  - Full cost passed on to consumers
- The consequences of these scenarios are stark, particularly for the poultry and pork sectors, where negative operating margins are projected under both cost-sharing and manufacturer-absorption models.
- The additional cost of the ban would likely lead to an increase in consumer prices, forcing consumers to shift their buying preferences towards cheaper alternatives, reducing the demand for EU produced meat products.
- This would further exacerbate the financial strain on an industry already dealing with rising input costs and competitive pressures. The EU's meat and dairy sectors, both essential to rural economies and the wider food supply chain, would face major disruptions.

Report Summary (2/2)

Policymakers must weigh the economic and food security risks of restricting GM soybean in the market

Policy Considerations & the Future of GM Soybeans in the EU

Critically, the viability of alternatives to GM soybeans is limited. While some substitutes, such as rapeseed meal and legumes offer potential, substitutes are constrained by lower availability, higher costs and/or less favourable nutritional profiles.

These factors underline the challenges of finding comparable replacements that meet the needs of the EU's high-protein livestock feed requirements.

From a policy perspective, any move towards banning GM soybean imports would conflict with several key EU objectives, including maintaining food security, supporting rural livelihoods, and enhancing the competitiveness of the EU's agri-food sector.

While the EU is committed to increasing domestic production of protein crops, this will be insufficient to meet the needs of the livestock sector in the event of a ban. The dependence on international supply for high-protein feed ingredients, particularly soybeans, will remain a critical factor for the foreseeable future.

Given the EU's ambition to lead in sustainability, it is essential that regulators carefully weigh the economic and social impacts of any decisions that could disrupt the feed supply chain.

A ban on GM soybeans would severely compromise the ability of the EU's livestock and feed industries to remain competitive, increasing costs for producers and consumers alike, while undermining rural economies.

Conclusion

For these reasons, maintaining access to GM soybeans is not only a matter of economic necessity but also one of safeguarding the EU's broader agricultural and environmental goals.

This report demonstrates that the feed value chain's reliance on GM soybeans cannot be replaced without significant, costly disruptions, making it clear that continued access to GM feed ingredients is essential for the sustainability and competitiveness of the EU agricultural sector.

Executive Summary: Key Findings (1/4)

Due to its reliance on imported GM soybean ingredients, the EU feed industry is highly exposed to a GM ban

Regulatory Framework

The EU has developed a comprehensive regulatory framework to govern the development and commercialization of genetically modified organisms (GMOs). However, the authorization process for transformation events is time-consuming, costly and uncertain. This means that the livestock, dairy and meat industries are already at a disadvantage to key competitors in the international market.

Authorized Crops

Soybean is one of five GM crops authorized for import. In the event of a GM ban, domestic producers and other international suppliers should be able to adapt and fill the gap for maize. However, the EU is highly reliant on imported soybean products from GM producing countries where GM soybean accounts for +90% of production.

Soybean's Share in the EU Feed Balance

Soybeans, despite comprising of just 2% of the 1.2 bn tonnes feed materials consumed in the EU, contributes to 17% of the EU's crude protein supply. It is the most important high protein feed material, accounting for 55% of the EU's supply of high and super protein feed materials.

Importance in Animal Nutrition

Soybean's versatility, high protein content and low cost means that soybean meal can be included across species and their production cycles. Soybean meal helps balance the amino acid profile in feed, improving feed efficiency, growth rates, and product quality. While there are alternatives to soybean, the potential of each is limited due to lower availability and factors that impact animal performance such as their overall nutritional profile, fiber content, digestibility/palatability and anti-nutritional factors

Dependance on Imports

The EU feed industry would be highly exposed if there were a ban on GM soybean. It is a net importer of both soybean and soybean alternatives (mainly GM soy products), with self-sufficiency rates of c10% and 77%, respectively. To fill the soybean gap, EU feed manufacturers will need to source from the international market. However, availability is limited, and buyers will be competing with other importing countries and industries for these materials. We can expect a sharp increase in the costs of non-gm soybean and alternatives in the international market.

Source: Farrelly Mitchell Research

Executive Summary: Key Findings (2/4)

The value chain is typically competitive, low margin and highly sensitive to rising raw material costs

Summary of Key Findings

Industrial Feed Industry	Compound feed is crucial to meeting the diverse nutritional needs across species and development stages. The EU industry processes 60% of available feed materials (excluding roughage) and is the main processor of soybean cake (+90%). The industry predominantly serves the pigs, cattle, and poultry sectors (94% of production). The industry is characterized by high competition and low margins. In 2022, the value of industry output increased but output volumes declined as demand fell due to rising feed costs. This indicates the industry's high exposure to rising raw material costs.
Livestock Industry	The industry is an important component of the EU agricultural sector (44% of output worth €211 bn). Feed costs account for 60% of the value of the production. The industry has gone through structural change over the last two decades, with significant declines in the number of holdings and employment in the sector While it remains fragmented, margins are tight and the need for scale is driving consolidation. The specialized nature of poultry and pig production mean that these sectors are particularly reliant on soybean feed materials. Any significant increase in feed costs is likely to accelerate the exodus of livestock farmers from the sector.
Dairy & Meat Manufacturing	The meat and dairy manufacturing sectors are particularly important subsector of the EU's food manufacturing – and are among the leading subsectors of food manufacturing across most Member States. Like the feed and livestock industries, margins are tight and the need for scale is driving consolidation. Raw material costs are key components in manufacturing costs (up to 75% of abattoir costs), underlining the importance of cost management in maintaining market competitiveness.
Production in Key Producer Countries	Approximately 90% of the +30 mn tonnes of soybean and soybean meal imported into the EU is GM. The EU is largely dependent on soybean imports from GM producers (Brazil, Argentina and the USA). These countries account for 80% of global soybean production. While non-GM production is limited in these countries, Brazil and the USA, in particular, have non-GM production capability and established systems for segregation. A favorable price environment would encourage an increase in the production of non-GM soybean.
Availability of Non-GM Soy & Soy Alternatives	The availability of GM-soybean alternatives is limited. Less than a third of the 52 mn tonnes of non-GM soybean that is produced globally is traded on international markets and just 38 million tonnes of the main soybean alternatives are traded globally (outside of EU trade). A ban on GM soybeans will likely lead to a sharp increase in the costs of these materials in the international market. However, higher prices will encourage sellers to divert more of their supply from domestic to the international markets.

Source: Farrelly Mitchell Research

Executive Summary: Key Findings (3/4)

The total cost of a GMO-soybean ban is estimated at €15.7 bn, increasing feed costs by up to 20%

Baseline

- Average supply of soybean cake equivalent, between 2018 and 2022 is 30.5 mn tonnes
- 2022 soybean demand of 21.8 mn tonnes is for the cattle, pigs, broilers and dairy sectors, which accounted for 80% of the total demand soybean cake equivalent in that year
- Average prices, between 2018 and 2022, for soybean cake equivalent are:
  - Produced in EU : 398 EUR/tonne
  - Imported : 440 EUR/tonne

Scenario Development (Ban implementation)

- In 2022 the total Non-GM soybean cake equivalent was 4 mn tonnes, leading to an initial supply gap of 17.7 mn tonnes
- The availability of non-gm soybean cake equivalent in the international market (excluding EU imports and production) in 2022, was 14 mn tonnes
  - Assuming the EU would be able to out-bid current buyers, by paying a premium for non-gm soybean in the international market
  - We assume a maximum of 6.8 mn tonnes could be purchased to decrease the supply gap
- The remaining supply gap of 10.9 mn tonnes of soybean cake equivalent would need to be bridged with potential substitutes:
  - 12 products were selected, based on suitability of replacement of soybean, and applied to 4 main sectors (Pork meat manufacturing, Chicken meat manufacturing, Dairy manufacturing, Cattle meat manufacturing)

Scenario Implications: Forecasted prices

- Forecasted prices were calculated for GM-soybean, Non-GM soybean and each of the 12 substitutes based on their individual supply-demand elasticities
- The prices for the Non-GM soy meal would be expected to increase, given the increased demand, driven by the GM soy meal ban:
  - Non-GM soy meal: 37.7%
  - Aggregate of substitutes: 49.6%
- The price for GM soy meal is expected to decrease by 13.0%, given the decreased demand, driven by the GM soy meal ban

Scenario Implications: Cost of GM-soybean ban

- The implication of the ban would lead to changes in the feed mixes for the various animal industries analysed:
  - The proposed substitutes already form part of the feed mix for the animals, however the quantities of each substitute would need to be altered so that the total quantities of protein consumed remains similar, when compared to the pre-ban feed mix
- By multiplying the new quantities of the Non-GM soybean cake equivalent and the substitutes by the forecasted prices and subtracting the total cost of the pre-ban feed mixes, we arrive at a ban cost of EUR 15.7 bn
- The cost of the ban is split between the 4 main industries based on their individual pre-and post-ban costs
- The individual costs of the ban, in each industry, was added to the operating costs and depending on the cost-sharing assumption (between manufacturers and customers) it was either added to revenue in full or partially.

Source: Farrelly Mitchell Research

Executive Summary: Key Findings (4/4)

The pork and chicken meat sectors would be the most severely affected sectors

Scenario 1: Costs of ban fully absorbed by the manufacturers	• Operating surplus margins drop for all 4 industries, with the cost of the ban not being absorbed by the pork and chicken meat manufacturing sectors
Scenario 2: Even cost-sharing between manufacturers & consumers	• Even with cost-sharing assumed, the chicken meat industry has a negative margin with the highest increase in output prices, resulting in the chicken meat industry being unable to absorb the cost of the ban • The price per unit of chicken meat increases by 7.1% • The prices per unit, for the other 3 industries, increase slightly, between 0.9%-4.1%
Scenario 3: Costs of ban fully transferred onto customers	• Output prices rise for all 4 industries, with the pork and chicken meat manufacturing being more severely affected: - Pork meat manufacturing: 8.1% - Chicken meat manufacturing: 15.9%
Overall	• A GM-soybean ban would most likely lead to an expected cost of at least EUR 15.7 bn • The consequences of the ban, given low availability of alternatives to soybean as suitable substitutes would be: - Increased input costs for the meat manufacturing industries, given premiums would need to be paid for Non-GM soybean and potential substitutes - Lower productivity (less units of meat for the same quantities of inputs), as there is no perfect substitute for soybean - Higher meat prices for the consumers, due to higher input costs and potentially lower volumes

Source: Farrelly Mitchell Research

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PHASE 1

BASELINE ASSESSMENT

SECTION A

REGULATORY ENVIRONMENT ASSESSMENT

GM Regulatory Environment: Overview

A comprehensive regulatory framework but the cumbersome authorization process stifles access to the market access

Introduction

- The European Union (EU) has developed a comprehensive regulatory framework to govern the development and commercialisation of genetically modified organisms (GMOs) aimed at ensuring the safety of human health, animal health, and the environment.
- EU law mandates that the GM crops (or their derivatives) consumed or produced in the EU must be produced from approved GM varieties (or transformation events).
- The authorisation process is time-consuming, costly and uncertain. The EU authorisation process takes approx. 5 to 6 years , compared to 1 to 2 years in Brazil, USA and Australia.
- To date, just 5 crops are authorised (cotton, maize, soybean, rapeseed and sugar beet) covering 133 transformation events (mainly focused on pest and herbicide resistance traits).
- Most GM crops consumed in the EU are imported and used in the feed market. GM crop cultivation in the EU, it is largely limited to Spain where a third of its maize production is GM.

REGULATORY LANDSCAPE

- The EU's GMO regulatory framework intersects with key EU policies such as the European Green Deal (EGD) and the Common Agricultural Policy (CAP), aiming to foster sustainability, biodiversity, and innovation within the agricultural sector.
- GMO legislation comprises directives and regulations addressing various aspects of GMO cultivation, release into the environment, food and feed safety, traceability, and labelling.
- Notably, recent amendments grant member states the authority to restrict or prohibit GMO cultivation within their territories, aligning with the EU's commitment to sustainability and biodiversity under the EGD.

REGULATORY CHALLENGES

- However, challenges persist within the existing regulatory framework. Authorization faces hurdles, including lengthy verification processes from EFSA, allied with difficulties in achieving a qualified majority decision among member states, leading to delays in approval.
- Moreover, efforts to reinforce public trust and streamline the approval process have fallen short, with increasing timelines for applications and limited improvements in public understanding.
- Furthermore, the regulatory burden poses barriers to innovation, particularly for small and mid-size companies, due to complex requirements and high financial costs associated with compliance.
- Standardised data requirements and methods may also compromise risk assessment approaches, hindering tailored assessments based on specific product characteristics.

Implications

- To address these challenges, stakeholders must collaborate to enhance transparency, streamline processes, and foster innovation while maintaining rigorous safety standards.
- This may involve refining the authorisation process, harmonising data requirements, and providing support mechanisms for smaller entities.
- Additionally, efforts to improve public engagement and understanding of GMO risk assessments are crucial for building trust and facilitating informed decision-making.
- Overall, navigating the regulatory environment for GMOs in the EU requires a balance between safety, sustainability, and innovation, ensuring that agricultural practices align with the broader objectives of the EU's policy landscape.
- In terms of this project and its focus on the feed market, only GM soybean (30 mn tonnes – soybean meal eqv.) and maize (6.5 mn tonnes) are imported in significant volumes.
- In the event of a GM ban, domestic producers and other international suppliers should be able to adapt and fill the gap for maize. However, this is not the case for soybeans due to limited EU production (c3% of its soybean feed requirement) and the concentration of international supply in GM producing countries

Source: Plan & Van Den Eede (2010), Garcia-Alonso et al (2022), Bruetschy (2019),Farrelly Mitchell Research

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Evolution of GMO Regulation in EU

A multifaceted regulatory framework underpinned by various regulations, directives and implementing acts

GMO Legislative Framework

- Since 2001, the EU has established and developed a legal framework to ensure the safe development and use of GMO biotechnology.
- The primary objectives of this framework are as follows:
  - Safeguarding human and animal health, as well as the environment, through the implementation of rigorous safety assessments at the EU level before any GMO is allowed in the market.
  - Establishing streamlined and time-limited procedures for the risk assessment and authorization of GMOs, with a focus on efficiency and transparency.
  - Mandating clear labeling of GMOs in the market to empower consumers and professionals (such as farmers and food feed chain operators) to make well-informed choices.
  - Ensuring the traceability of GMOs in the market
- The key building blocks of the framework include legislation regarding release into the environment, use in feed and food, traceability and labelling, potential for restricting or prohibiting the cultivation within MS territory and the contained use of GMOs.
- EU law mandates that food and feed products containing or derived from GM crops undergo an import authorization process.
- Despite ongoing reforms, the authorization process is typically lengthy, expensive, and unpredictable.
- The process can take up to six years from submission to final approval. EFSA The It can take up to 6 years
- In 2023, the EU Comm. proposed a revamp of EU rules on genetically modified organisms (GMOs), allowing certain crop plants modified through precise gene editing techniques (NGTS) to be exempt from GMO regulations.

Recent Developments

- The proposed changes aim to reflect the increased precision of new gene editing technologies, such as CRISPR.
- Under the proposal, plants modified using NGTs will not be subject to GMO regulations if the modifications are comparable to those achievable through conventional breeding.
- The proposal categorizes plants modified through NGTs into two categories.
- **Category I** includes plants with modifications comparable to conventional breeding, with a proposed limit of 20 modifications.
- This category is expected to accelerate the development of resilient, pest-resistant, high-yielding crops that require fewer pesticides.
- **Category II** encompasses plants with more than 20 modifications, which will continue to fall under GMO rules.

Evolution of GMO Regulation in EU: Key Legislation

Legislation	Legislation Scope
Directive 2001/18/EC	Addressed the intentional release of GMOs into the environment
Regulation 178/2002	Established the central regulatory framework. This regulation set up a centralized review system and introduced the EFSA as an independent scientific body responsible for conducting risk assessments for food and feed, including GM crops.
Regulation 1829/2003	Key regulation governing genetically modified food and feed products
Regulation 1830/2003	Addressed the traceability and labeling of genetically modified organisms, as well as the traceability of food and feed products derived from GMOs.
Regulation 1946/2003	Covered the transboundary movements of GMOs.
Directive 2009/41	Focused on the contained use of genetically modified micro-organisms.
Regulation 503/2013	Focus on strengthen the regulatory framework. The goal was to increase member states' trust in EFSA's assessments, enhance public trust, and streamline the approval process by providing clear requirements for applicants.
Directive 2015/412	Amendment of Directive 2001/18/EC. Granted Member States the authority to restrict or prohibit GMO cultivation within their territories.
Regulation 2019/1381	Focuses on transparency and sustainability of the EU risk assessment in the food chain

Source: Plan& Van Den Eede (2010), Farrelly Mitchell Research

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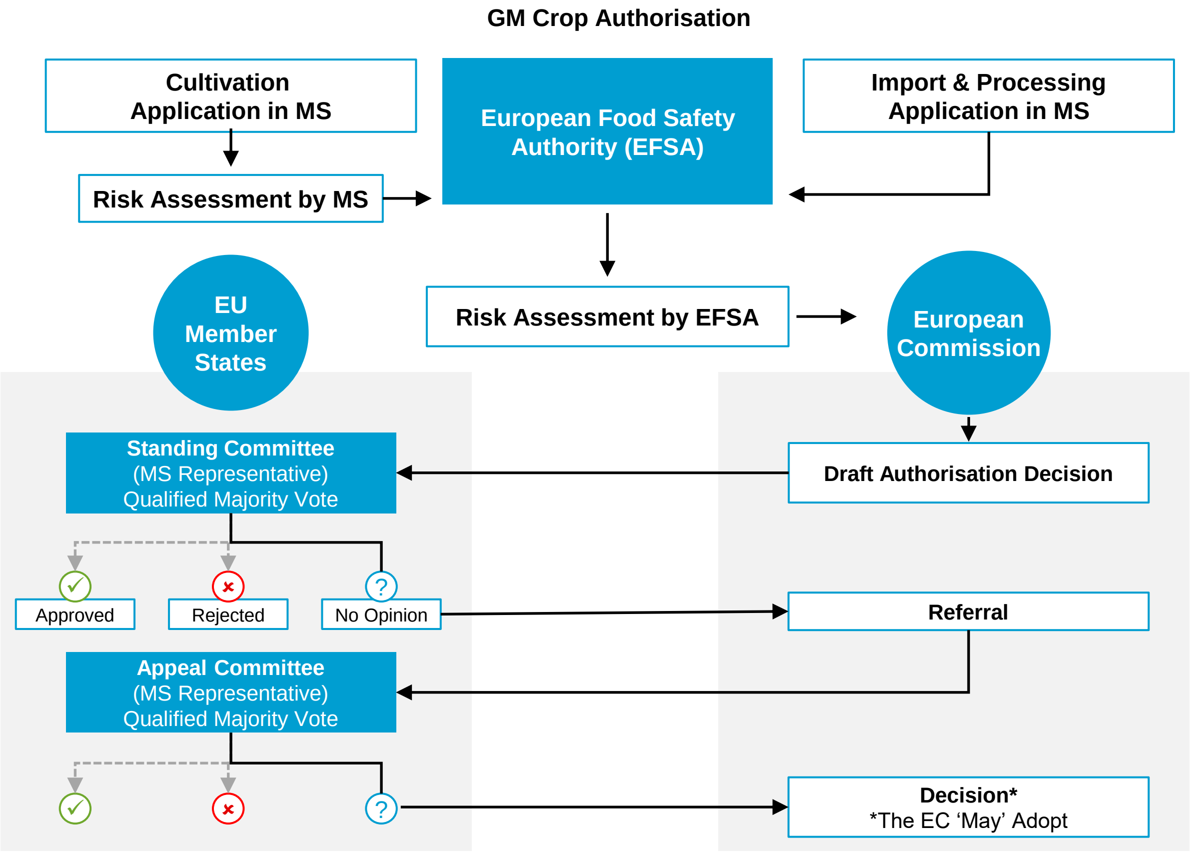
EU GM Authorisation

Just five crops authorized for import to date. The process is time-consuming, costly and uncertain[1]

GMO Authorisation Process[1]



Overview of GM Crops Authorized in the EU

Crop	 Cotton	 Maize	 Soybean	 Rapeseed	 Sugar Beet
Authorised Transformation Events	16	76	26	14	1
Key Traits/ Resistance Conferred	Herbicides (12); Pests (8)	Herbicides (65); Pest (50) Reproduction Control (18); Drought (3)	Herbicides (37); Pest (7) Reproduction Control (1); Other (7)	Herbicide (10); Reproduction Control (4)	Herbicide (1)
Authorised Biotechnology Company	BASF, Bayer, Corteva	BASF, Bayer, Syngenta, Corteva	BASF, Bayer, Syngenta, Corteva	BASF, Bayer, Corteva	KWS, Bayer

[1] The EU authorization process takes approx. 5 to 6 years , compared to 1 to 2 years in Brazil, USA and Australia
[2] For more details, see on the EU authorization process see appendix A.

Source: EU GMO Register, Mampuys, Farrelly Mitchell Research

EU Regulatory Framework Challenges

Extensive challenges exist with criticism notably directed at the implementing regulation 503/2013

Challenge	Details
Ineffectiveness in Streamlining Approval Process	• Regulation No 503/2013 aimed to streamline and shorten the review and approval process for GM crop applications by providing clearer requirements to applicants • Instead, the time taken for applications to go through EFSA's risk assessment has increased significantly. The timeline from submission to import authorization now takes almost 6 years.
Increased Data Requirements and Method Harmonization	• The implementation of a legally binding set of evaluation elements and test methods for genetically modified (GM) crop applications, as per the regulatory framework, introduces a challenge. • While the data requirements appear globally aligned, the methods mandated are specific to the European Union (EU). This EU-centric approach, coupled with continuous updates and reinterpretations of requirements, complicates the evaluation process • Additionally, it poses the risk of rendering previously compliant studies obsolete, as the evolving regulatory landscape may no longer align with past guidelines, thereby requiring applicants to adapt to the dynamic and region-specific nature of the EU's GM crop assessment framework.
Unchanged Member States Voting	• After receiving EFSA's opinion, EU member states vote on the EC's draft decision. However, reaching a qualified majority decision for authorization has been challenging due to disagreements among member states, often influenced by political and economic factors. • Member states with significant agri-food sectors may align with EFSA's opinions, while others may vote against or abstain for political reasons. This disagreement has hindered and contributed to the delays in the authorization process .
Failure to Reinforce Public Trust	• Another objective was to enhance public trust in the decision-making process and improve understanding of the risk analysis framework. • The regulation has not succeeded in reinforcing public trust or fostering a better understanding of the risk analysis framework among the general population.
Stifling Innovation and Financial Barriers	• The complex regulatory framework, including continuous updates and reinterpretations, poses challenges, particularly for small and mid-size companies. • Gaining a clear understanding of EU data requirements is difficult, and the estimated cost for GM food and feed approval ranges between €11 and €16.7 million. Many smaller entities lack the resources for such investments, stifling innovation in the development of GM crops tailored for local conditions
Compromised Risk Assessment Approaches	• Another objective was to enhance public trust in the decision-making process and improve. The regulation enforces standardized data requirements and methods, limiting the case-by-case approach. • Unlike other jurisdictions, the EU's approach requires an expanded set of mandatory studies irrespective of the specific crop, trait, or hazard. This deviates from the standard risk assessment principle of tailoring assessments based on the characteristics of each product..
Completeness Check Challenges for New Applicants	• The completeness check, a meticulous evaluation conducted by EFSA, presents challenges for new applicants, extending the approval process by over 15 months in certain cases • The stringent criteria, resource intensiveness, and the navigational learning curve within the complex regulatory framework contribute to delays, particularly for those unfamiliar with the intricacies of the application process

Source: Garcia-Alonso et al (2022), Bruetschy (2019)

Alignment of GM Crops with EU Policy Objectives

The use of GM crops align with numerous internal EU policy objectives

Alignment of GM Crops with EU Policy Objectives

Whether produced in the EU or abroad, GM crops can play a pivotal role in supporting the achievement of EU policy objectives around a range of issues including reducing its environmental footprint, increasing biodiversity, supporting social justice and promoting responsible innovation and resource usage.

European Green Deal[1]

- **Climate-Neutral Economy by 2050:** GM crops can contribute to sustainable agriculture by enhancing crop resilience, reducing the need for chemical inputs, and potentially sequestering carbon in soils..
- **Protecting Natural Capital:** GM crops engineered for improved pest resistance or drought tolerance can help protect natural ecosystems by reducing the reliance on chemical pesticides and minimizing water usage.
- **Fair and Prosperous Society:** The use of GM crops could enhance agricultural productivity, leading to economic growth and ensuring fair economic returns for farmers. This supports the EGD's vision of a fair and prosperous society.
- **Farm to Fork Strategy:** GM crops, if designed to be more resource-efficient and environmentally friendly, can contribute to the Farm to Fork Strategy's objectives of reducing the environmental and climate impact of primary production.

Food Security & CAP Reform

- **Enhanced Agricultural Productivity:** GMOs contribute to increased resistance to pests and diseases, leading to heightened productivity. This directly supports CAP's objective of sustaining farm viability and competitiveness, contributing to a more stable food supply and meeting the growing demand for food in the EU
- **Climate Resilience and Resource Efficiency:** The resilience of agriculture to climate change, facilitated by GMOs, helps prevent disruptions in food production, addressing key aspects of food security. Moreover, resource-efficient GMOs contribute to the sustainable use of agricultural inputs, ensuring the continued availability and accessibility of food resources. Thus directly supports the overarching goal of achieving food security in the European Union.
- **Eco-Schemes:** GM crops that align with eco-scheme practices, such as those promoting biodiversity, reduced chemical usage, and sustainable farming, can be integrated into CAP initiatives. For instance, GM crops designed to limit chemical nitrogen usage or enhance biodiversity could be eligible for eco-scheme incentives.
- **Reduction in Pesticide and Fertilizer Use:** GM crops with built-in pest resistance or nutrient-use efficiency traits can aid in achieving CAP targets for reducing pesticide and synthetic fertilizer use.
- **GHG Reduction Targets:** GM crops engineered to enhance carbon sequestration in soils or promote sustainable farming practices can support CAP's commitment to reducing greenhouse gas emissions.

Technology and Innovation

- **Promoting Responsible Innovation:** The pre-market authorization process, risk assessment, and enforcement measures reflect a commitment to responsible innovation in the field of biotechnology. This approach encourages the development and adoption of safe technologies while preventing potential risks.
- **Research and Development:** The EGD and CAP emphasize the importance of innovation in achieving environmental and sustainability goals. GMOs represent one avenue for agricultural innovation, aligning with the Green Deal's focus on research and development

[1] For more details, on the Green and CAP reform see appendix A.

Source: The European Commission's Directorate-General for Climate Action, The European Commission's Department for Agriculture and Rural Development Farrelly Mitchell Research

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Overview of GMO regulation in the Brazil

The GMO authorization process takes approximately two years.

GMO Policy

- The first Brazilian standard on GMOs was enacted in 1995, creating the National Technical Commission on Biosafety (CTNBio).
- In 2003, a new biosafety law (Law No. 11,105/2005) replaced the previous regulation, restructuring CTNBio and introducing the National Council of Biosafety (CNBS) and the National Policy of Biosafety (PNB).
- Decree No. 4,680/2003 emphasized the consumer's right to information about GMOs in food products
- Brazilian regulations on GMOs include laws, decrees, and resolutions issued by CTNBio.
- International agreements like the Cartagena Protocol on Biosafety and Codex Alimentarius standards influence domestic GMO regulations.
- CNBS and CTNBio are responsible for regulating and approving GMO activities, with CTNBio handling research and commercial use authorizations
- Despite Brazil's status as one of the largest GMO producers, controversies persist, especially regarding environmental and health concerns.
- The legislative branch considered a Bill of Law (No. 34/2015) to inform consumers about GMO presence in food products. The bill addresses criteria like detectability and excludes specific information from labels.
- Judicial actions have challenged aspects related to GMO approval and use, involving the Superior Court of Justice (STJ) and the Federal Supreme Court (STF).

GMO AUTHORISATION PROCESS

CTNBio Submission

- Legal entities submit applications to the National Technical Commission on Biosafety (CTNBio).

Authorization Request to CTNBio

- Applicants submit a comprehensive authorization request to CTNBio, including all relevant documentation.

CTNBio Evaluation

- CTNBio conducts a rigorous technical assessment, considering zoophytosanitary, human health, and environmental risks.
- Based on the assessment, CTNBio decides whether to approve or deny authorization for GMO research or commercial use.

Ministry Oversight

- Upon CTNBio's approval, the Ministry of Agriculture, Livestock and Supply (MAPA), the National Health Surveillance Agency (ANVISA), and the Ministry of the Environment (MMA) handle product registration and surveillance.

Monitoring and Compliance

- Ongoing oversight ensures compliance with biosafety regulations.
- Legal entities engaging in GMO-related activities must adhere to regulations, and violations may lead to penalties.

Judicial and Legislative Oversight

- The authorization process may face scrutiny and challenges within the judicial and legislative branches.
- Legal actions and discussions may arise, contributing to the ongoing evolution of GMO regulations

Source: Velini et al(2017), Granja & Advogados (2023), Farrelly Mitchell Research

Overview of GMO Regulation in the USA

The GMO authorization process takes approximately two years.

GMO Policy

- The Coordinated Framework for the Regulation of Biotechnology, instituted, in 1986 describes how the agencies work together to regulate GMOs.
- Depending on a product's characteristics, it falls under the jurisdiction of one or more of these agencies, with regulatory officials regularly communicating to exchange information.
- This framework ensures comprehensive regulation, emphasizing the safety of GMOs for human, animal, and environmental health. The agencies work together to promptly address safety and regulatory issues, fostering a unified and efficient approach to GMO oversight
- The authorization process is designed to ensure that GMOs undergo thorough safety assessments, with collaboration among federal agencies to cover various aspects such as food safety, environmental impact, and pesticide regulation
- Three agencies FDA (Food and Drug Administration), EPA (U.S. Environmental Protection Agency), USDA (U.S. Department of Agriculture) work together to regulate GMOs
- FDA: Regulates human and animal food, ensuring GMO safety.
- EPA: Regulates safety of substances protecting GMO plants.
- USDA: Animal and Plant Health Inspection Service (APHIS) sets regulations for GMO plant harmlessness.

GMO AUTHORISATION PROCESS

GMO Development and Submission	• Biotech companies create new GMOs (plants, animals, or microorganisms) and submit safety data to regulatory agencies for approval
FDA's Plant Biotechnology Consultation Program	• Developers of GMOs for human and animal food can voluntarily engage in the FDA's Plant Biotechnology Consultation Program. This program includes meetings with the FDA, submission of safety assessment data, and collaborative efforts to address identified issues..
FDA Evaluation	• The FDA evaluates the safety of the GMO for human and animal consumption, considering potential risks and benefits. • The evaluation process ensures that GMOs meet the same safety standards as other foods.
Issue Resolution	• If concerns or issues arise during the evaluation, the FDA collaborates with the GMO developer to address them. This may involve additional studies or data submission.
Public Disclosure	• Once the FDA is satisfied with the safety of the GMO, the consultation is considered complete. • Details of the consultation, including safety assessments and relevant information, are made public, promoting transparency.
EPA Oversight (for Pesticides)	• The EPA oversees GMOs that incorporate pesticides (plant-incorporated protectants) to ensure their safety for human health and the environment.
USDA (APHIS) Oversight	• The USDA, through it’s APHIS, sets regulations to prevent harm to other plants from GMOs.

Source: FDA, Farrelly Mitchell Research

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Overview of GMO regulation in the Australia

The GMO authorization process takes approximately one year.

GMO Policy

- New Zealand and Australia jointly regulate GMOs used as food primarily through the Food Standards Australia New Zealand Act. Each country has its own environmental regulator
- GMO regulation is governed by the Gene Technology Regulator under the Gene Technology Act 2000 and Gene Technology Regulations 2001, ensuring national consistency. The objective is to protect health and the environment by regulating GMO dealings. The Act defines gene technology broadly, excluding certain processes. It features a prohibition on unauthorized GMO dealings, monitoring provisions, a risk assessment process, expert committees, and a central GMO database.
- The regulatory approach relies on sound science, with the Office of the Gene Technology Regulator (OGTR) providing support through scientific advice, risk analyses, and collaboration with the Gene Technology Technical Advisory Committee (GTTAC). A Science Strategy aims to establish OGTR as regulatory science leaders, focusing on capacity enhancement, effective science application, collaboration, and stakeholder engagement.
- The regulatory process mandates a Risk Assessment and Risk Management Plan (RARMP) before licensing, especially for intentional GMO releases, with RARMPs published in the GMO Record. The Risk Analysis Framework guides risk analysis implementation, and reference documents address common issues in intentional GMO release applications.

GMO AUTHORISATION PROCESS

Application Submission	• Organizations or individuals seeking to deal with GMOs must submit an application to the OGTR. • The application includes detailed information about the GMO, its characteristics, the proposed dealings, and risk assessment and risk management plans
Risk Assessment	• The Gene Technology Act mandates a thorough risk assessment before any GMO is authorized. • The OGTR, in collaboration with the GTTAC and other experts, conducts a scientific risk analysis to evaluate the potential risks posed by the GMO.
Risk Management Plan	• Based on the risk assessment, the applicant must develop a RARMP that outlines measures to mitigate identified risks. • This is an integral part of the authorization process.
Public Consultation	• The OGTR may conduct a public consultation process to gather input from stakeholders, including the public, scientific community, and other interested parties. • Public input is considered in the decision-making process, contributing to transparency and accountability.
Decision-Making	• The Gene Technology Regulator, an independent statutory officeholder, makes the final decision on whether to grant authorization for the proposed GMO dealings. • The decision is based on the comprehensive risk analysis, the RARMP, and any public input received.
Licensing	• If the application is approved, a license is issued to the applicant, specifying the conditions and requirements for dealing with the GMO.
Monitoring and Enforcement	• The regulatory framework includes provisions for ongoing monitoring and enforcement to ensure compliance with the conditions outlined in the license. • The OGTR has the authority to take corrective actions or revoke a license if necessary.
Database of Approved GMOs	• The OGTR maintains a central, publicly available database that includes information about all approved GMOs in Australia.

Source: Office of the Gene Technology Regulator, Farrelly Mitchell Research

SECTION B

EU FEED COMMODITY BALANCES & IMPORTANCE OF SOYBEAN

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EU Feed Balance: Summary

Despite efforts to expand protein crop production, the EU is expected to remain dependent on imported soybean

Introduction

- Feed balances were developed at both an EU and at a EU country level for all feed crops. This involved:
  - Gathering trade and production data for the relevant countries to est. domestic usage; and
  - Estimating feed utilisation rates for each crop;
  - Developing feed balances that estimate the share of each crop of feed raw material supply.
- What we see is that roughage, cereals and co-products are typically the main feed materials used. However, their shares vary considerably across members.
- This largely relates to different production systems and to a lesser extent feed material availability in the different MS.

EU FEED BALANCE

- The EU feed balance averaged **1.22 bn tonnes** over the period **2017-2022.**
- Roughage accounted for **79%** of this, with cereals **(13%)** and oilseed and oilseed cake **(4%)** accounting for the bulk of the rest.
- In the case of soybeans, it accounts for **c2%** of feed material usage in the EU. However, due to its high protein content, its share of feed crude protein is **17%.**
- When we exclude roughage from the equation. The soybean's share of feed use increases to **11%** and its **29%** of crude protein supply.
- Across member states, soybean's share of crude protein supply ranges from **c5%** (in Luxembourg) to **49%** in Slovenia.
- The EU is largely self-sufficient in roughage and cereal production but is reliant on the international market for high protein crops (especially soybean).
- There has been a shift toward greater use of other co-products in feed over the last 15 years; soybean cake remains the most important high protein raw material source.
- Soybean accounts for **55%** of high and super protein feed materials used in the EU.

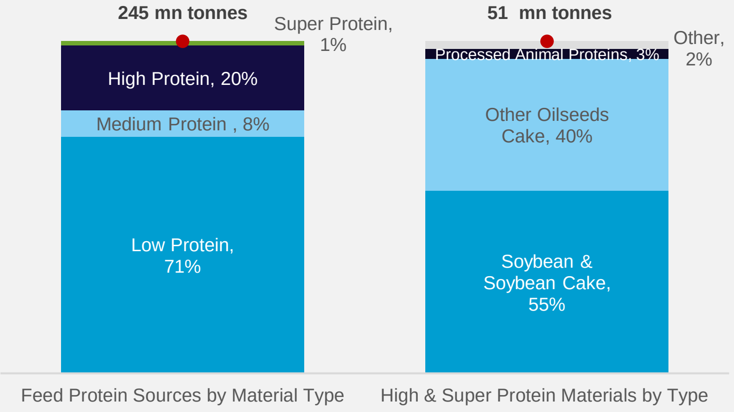
IMPORTANCE OF SOYBEAN

- Soybean's versatility, relatively low cost and high protein content means that soybean meal is included in feeds across species and their production cycles.
- It is a particularly important feed material when there is a high protein requirement:
  - Young and growing animals: Soybean meal is an excellent source of protein for poultry, piglets, calves, and other young livestock.
  - Lactating animals: Animals in lactation require more protein to support the production of milk.
- It is also an important feed material in that it can balance the amino acid profile of a feed ration ensuring that animals receive a more complete source of proteins.
- This in turn can support improved feed efficiency leading to optimised growth rates and enhanced product quality.
- Its low fibre content make it an important feed material for pigs and poultry, who struggle to break down fibre in their diets.
- Approx. **90%** of soybean feed consumption in the EU is via industrial feeds (compound feed), with the pig, dairy and poultry livestock sectors accounting for more than **80%** of use as a feed.
- Soybean inclusion rates (excluding roughage) range from **5%** for beef cattle to 34**%** in broilers.

Outlook

- The EU Commission is in the process of developing an EU protein strategy.
- While the successful implementation of the strategy may lead to greater production of protein crops, the impact will be limited, with the EU remaining largely dependent on soy imports.
- The EU's livestock and dairy and meat manufacturers are highly exposed to any ban in GM soy given:
  - Soybeans importance as a protein source – especially in intensive production systems;
  - That feed costs are the key cost component in livestock production systems;
  - That the EU is dependent on the international market for supply of soybean; and
  - That the vast majority of internationally traded soy is GM.

Breakdown of EU Feed Protein Sources by Material Type[1]



[1] Developed based on the EU Commission's Feed Commodity Balance for 2022/2023. Totals exclude roughage. The feed material types include low-protein (less than 15% protein content), medium-protein (15-30% protein content), high protein (30-50% protein content) and super protein materials (over 50% protein content). Other is broken down 50/50 between fish meal and starch industry super protein products (60-90%) within high and super protein material

Source: EU Commission Feed Balance Database, Farrelly Mitchell Research

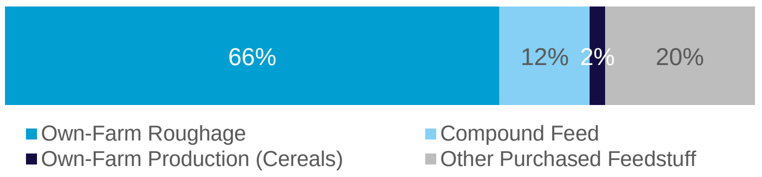
Feed Market Overview

Policies focused on securing stable and affordable feed supply to support food security and mitigate inflation

Overview

- Animal feed plays a crucial role in the health and productivity of the EU's livestock sector, representing the highest production cost for livestock farmers.
- The feed's quality, encompassing digestibility, nutrient content, and the absence of harmful substances, is essential for various species' growth and development.
- Key feed materials include roughage, cereals, oilseed meals/cake and other co-products.
- About 68% of the EU's animal feed originates from on-farm produced roughages and cereals and is supplemented by industrial compound feed (12%) and purchased feed materials.
- The EU is largely self-sufficient in roughage and cereal production but is reliant on the international market for high protein crops (especially soybean).
- Demand for cost-efficient animal products has led to an increased industry focus on optimization through new types of feed and greater nutrient recovery.

EU Feed Raw Material Supply by Source 2022



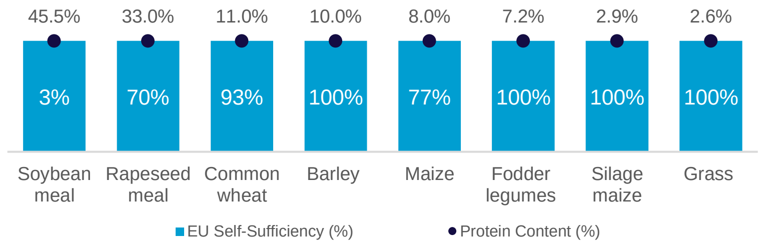
Importance of Compound Feed

- Compound feed is crucial to meeting diverse nutritional needs across species and development stages.
- It primarily consists of cereals, oilseed co-products and other co-products tailored to specific nutritional requirements.
- The industrial feed sector processes 60% of the EU's available feed commodities (excluding roughage) and is the majority processor of soybean cake (+90% of available supply).
- Compound feed costs accounts for a significant portion of production costs (e.g. 62% and 40% of the farm gate value of poultry and pig production value).
- These costs ultimately affect the availability and affordability of meat, eggs and dairy products for EU consumers.

EU Policy Drivers

- Production costs in the livestock sector have risen faster than producer prices over the past two decades.
- This has been compounded by a series of recent crises which has affected the availability of animal feedstuffs and resulted in a spike in feed raw material, producer and consumer prices.
- Among the challenges the EU faces is its deficit in protein crop production, the impact COVID-19, global disruptions caused by weather extremes, and the war in Ukraine.
- EU policies aim to secure stable and affordable animal feed supply, addressing food security and mitigating inflation pressures.

EU Domestic Supply of Feed Crops & Other Feedstuff 2022



EU's Proposed Actions to Address its Protein Deficit

- EU policy is focused on reducing reliance on imported proteins to boost livestock market competitiveness, ensuring affordable food, and stabilizing feed prices to counter inflation.
- The EU Commission is in the process of developing a protein strategy. It is expected to focus on the 4 actions listed below.
- While the successful implementation of the strategy may lead to greater production of protein crops, the impact will be limited, with the EU remaining largely dependent on soy imports.[1]

Increasing Production of Protein Crops (Oilseeds & Pulses)	Diversifying Feed Sources (Insects, Algae, Microbes)	Changing Consumption Patterns (Shift away from Animal Proteins)	Increasing Feed Efficiency (Use of tech to optimise available resources)

[1] The EU Commission acknowledges this. In its EU Agricultural Outlook Report 2023-2035, it forecasts that imports will account for 37% of uncrushed oilseeds and 40% of oilseed meal/cake use in the EU in 2035, compared to a for 41% import dependency for both oilseeds and oilseed meal/cake in 2023.

Source: Eurostat. EU Commission, EPRS, FAOSTAT, FEFAC, Farrelly Mitchell Research

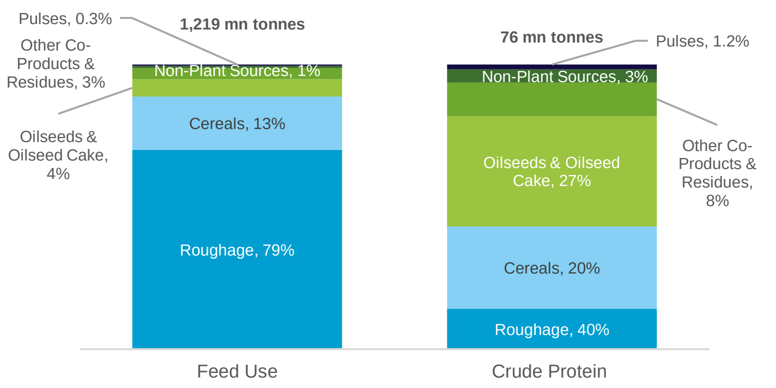
EU Feed Commodity Balance (1/3)

Feed consumption est. at 1.2 bn tonnes, equating to 76 mn tonnes of crude protein.

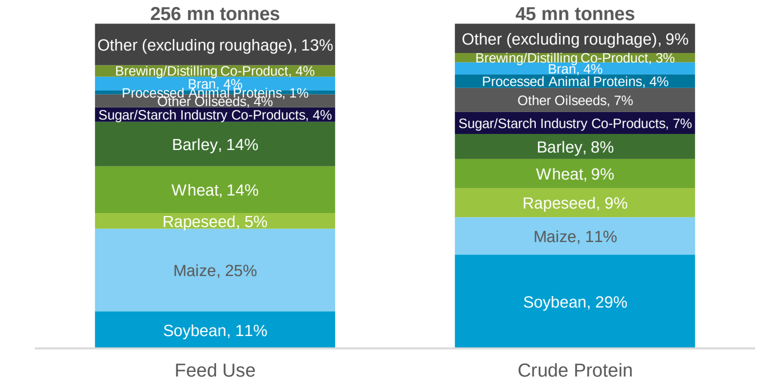
Overview

- Five EU countries account for 64% of feed consumption and a similar proportion of soybean use in feed.[1]
- While roughage holds a 79% share of feed materials, its low protein content means it accounts for just 40% of available crude protein.[2]
- The importance of roughage in diets varies by production system, species and species production cycle.
- Oilseeds are the second most important crude protein source, accounting for 27% of available crude protein available.
- Soybean is the most important oilseed raw material source (56% and 64% of oilseeds feed materials and crude protein).
- There is limited interchangeability between the proteins from different plant sources due to their different amino acid compositions.
- Soybean meal and other high–protein content feed materials are highly valued from an animal nutrition perspective as they contain the ideal amino acid profile for feed formulations.
- While there has been a shift toward greater use of other co-products in feed over the last 15 years; soybean cake remains the most important high protein raw material source.
- Soybean accounts for 11% and 29% of feed raw materials and crude protein (excluding roughage).
- There is significant variation across countries, with soybean's share in crude protein ranging from just 4% (in Luxemburg to 49% in Slovenia).

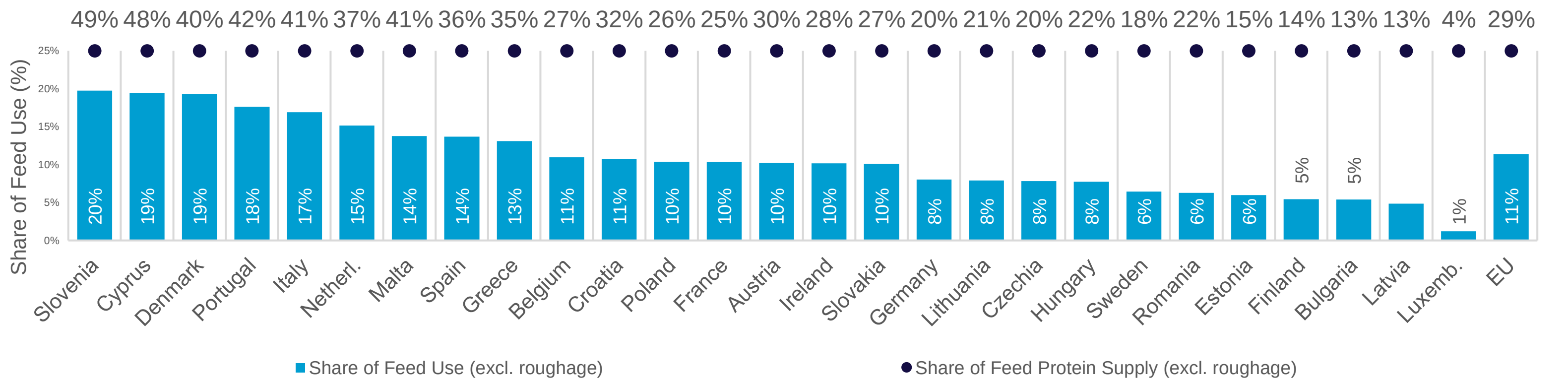
Feed Use & Crude Protein by Broad Feed Category[3]



Feed Use & Crude Protein by Feed Type (excl. roughage)



Soybean Share of Feed Use & Feed Protein Supply by Country



1 France, Germany, Italy, Spain and Poland
2 Roughage has an average crude protein content of 3.1%. It include pasture grazing (grasses), fodder legumes, cereal silage and other fodder crops.
3 Oilseed feed use is estimated based on oilseed cake equivalent.

Source: FAOSTAT, EU Commission Feed Balance Database, Farrelly Mitchell Research

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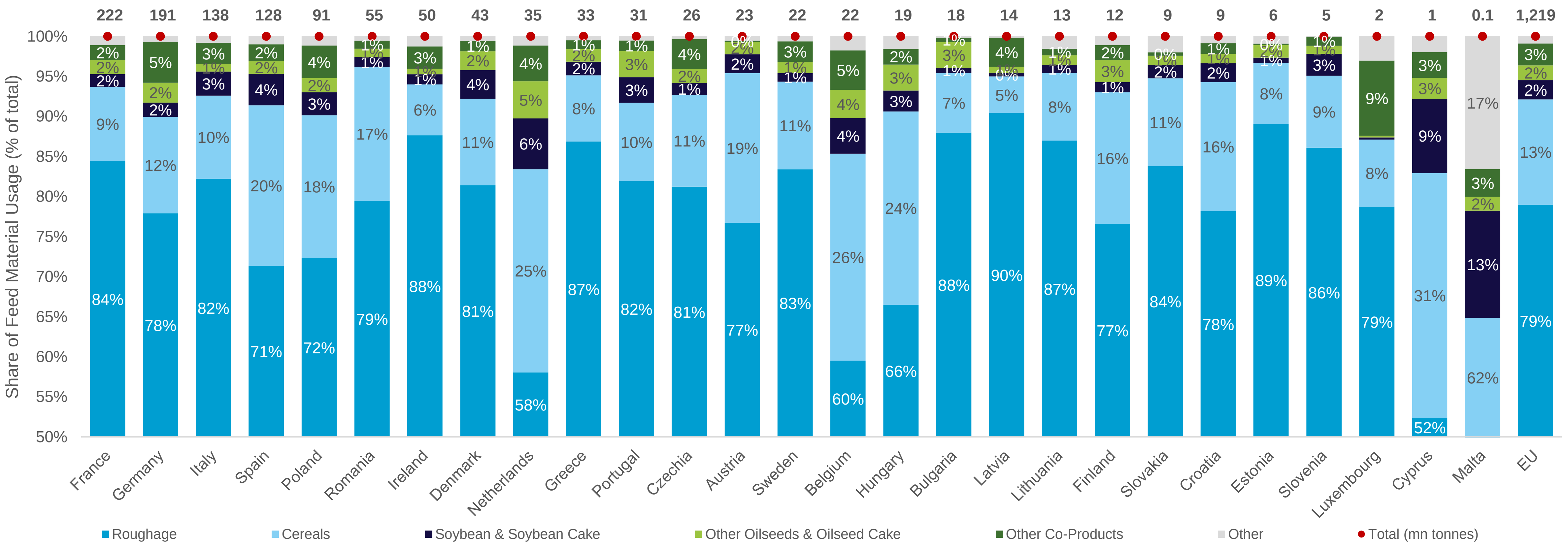
EU Feed Commodity Balance (2/3)[1]

While soybeans and meal account for just 2% of the EU's 1.2 bn tonnes of feed raw material…

Estimated Feed Raw Material Use by Country (million tonnes)[2]



[1] See appendix B for detailed breakdown of production and trade of feed raw materials

[2] Average annual feed use over the period 2017-2022. Oilseeds use is estimated based on an oilseed cake equivalent. Other includes pulses and non-plant sources e.g. whey powder, milk, animal meals etc.

Source: Eurostat Database, EU Feed Balance Database, FAOSTAT, Farrelly Mitchell Research

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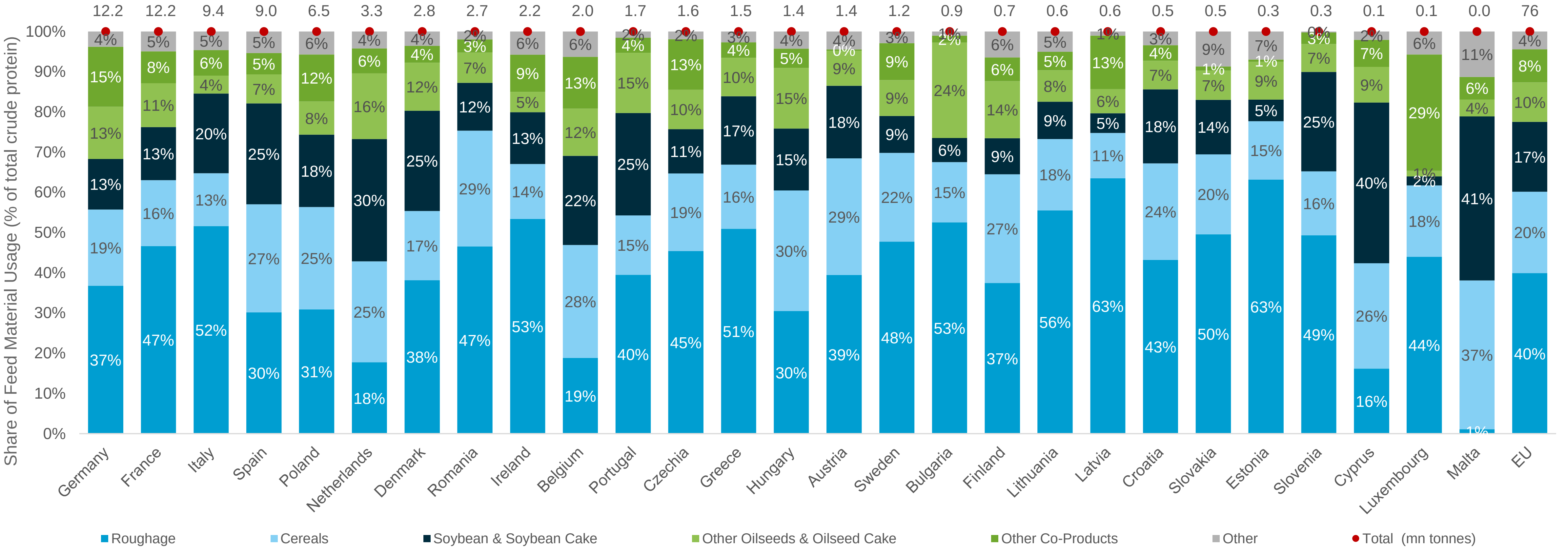
EU Feed Commodity Balance (3/3)

…it accounts for 17% of crude protein supply and is a highly valued protein source due to its nutritional profile

Estimated Crude Protein Consumption by Feed Raw Material & Country (million tonnes) [1]



[1] Average annual feed use over the period 2017-2022. Oilseeds use is estimated based on an oilseed cake equivalent. Other includes pulses and non-plant sources e.g. whey powder, milk, animal meals etc.

Source: Eurostat Database, EU Feed Balance Database, FAOSTAT, Farrelly Mitchell Research

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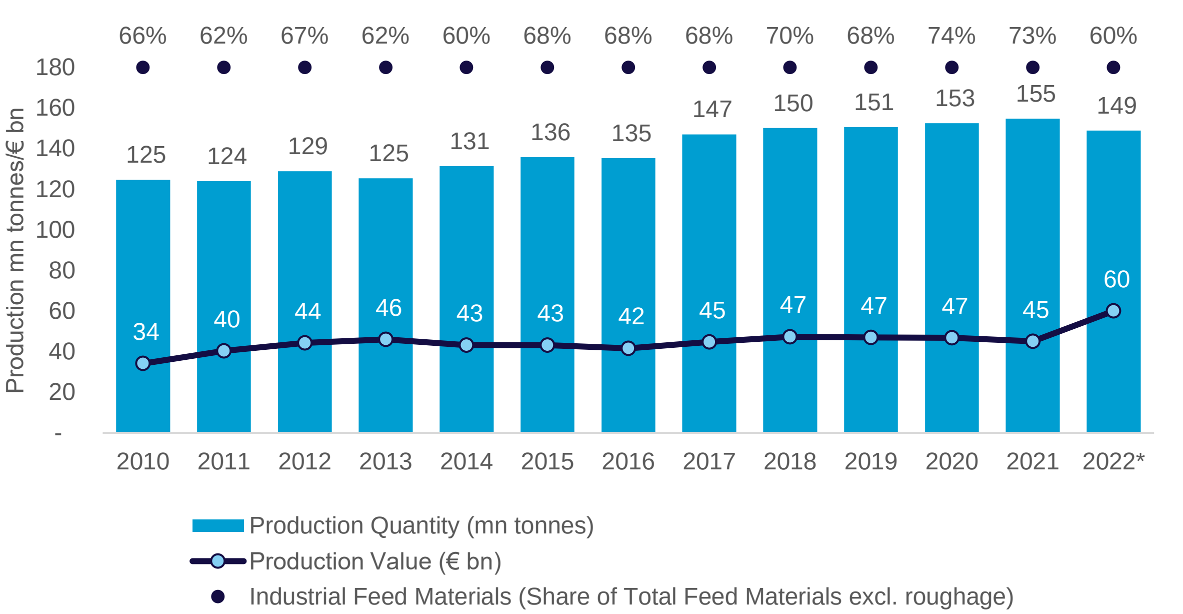
Industrial Feed Manufacturing

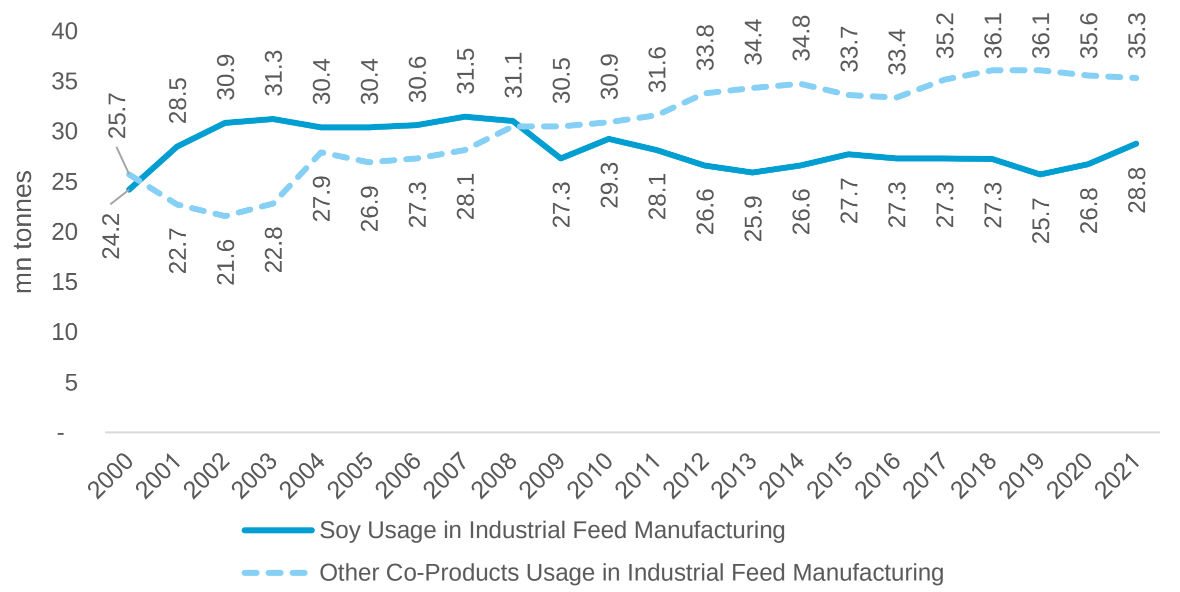
The EU's feed manufacturing industry processes between 60% and 74% of available feed materials

Value of Volume of Industrial Feed Manufacturing 2010-2022[1]



- Output from the industrial feed industrial followed a general upward trajectory over the period 2010-2022 but high raw material costs resulted in a declined in the volume of output in 2022.
- Total output reached 149 mn tonnes in 2022 (a 3.7% decline on the previous year, while the value of output increased by 33% to more than €60 bn.
- The industrial feed sector processes approx. 60% of the EU's available feed commodities (excluding roughage) and is the majority processor of soybean cake (+90% of available supply).

Usage of Soy & Other Co-Products in EU Industrial Feed 2000-2021



- While soybean usage in industrial feed manufacturing has increased since 2000, its share of co-product usage in industrial feed has declined from a high of 59% in 2002 to 45% in 2022.
- Other co-products increased their share of feed raw materials mainly due to increased availability of rapeseed and sunflower seed meal as the EU almost doubled production driven by its EU's biofuel policy.[2]
- However, remains the most important high protein content feed source, accounting for over 50% of the EU's supply of "high and super pro." protein source.[3]

[1]2022 is estimated.
[2]Other co-products include other oilseed cake, mainly rapeseed and sunflower seed, and other residues and co-products from food and beverage manufacturing. Recent data indicates that production of other oilseeds and usage in feed manufacturing is stagnating.
[3] "High-pro" is a feed raw material with 30-50% protein content. Super-pro": is a feed material with over 50% protein content

Source: Eurostat Database. FEFAC, Farrelly Mitchell Research

Importance of Soybean Meal

Appropriate inclusion rates in feed rations can help optimize growth, production and reproductive performance

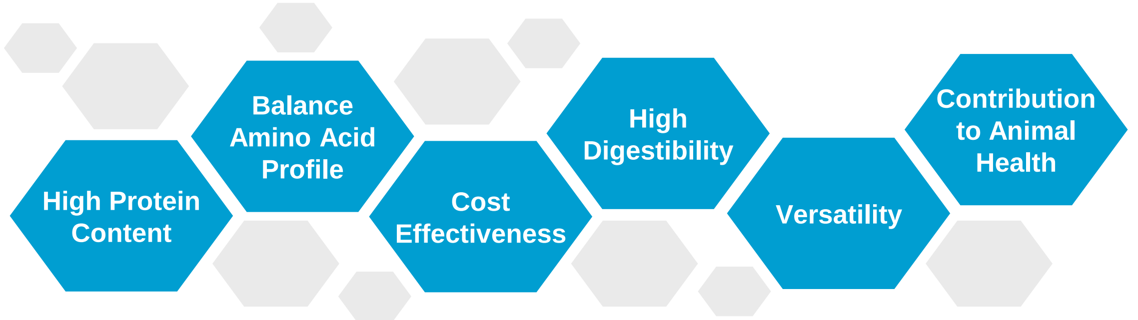
Importance of Soybean Meal in Feed Rations

- Its versatility and high protein content means that soybean meal can be included across species and their production cycles.
- Inclusion rates may need adjustment based on the animal's growth stage, health status, and production goals.
- Soybean inclusion is particularly valuable at addressing the following:

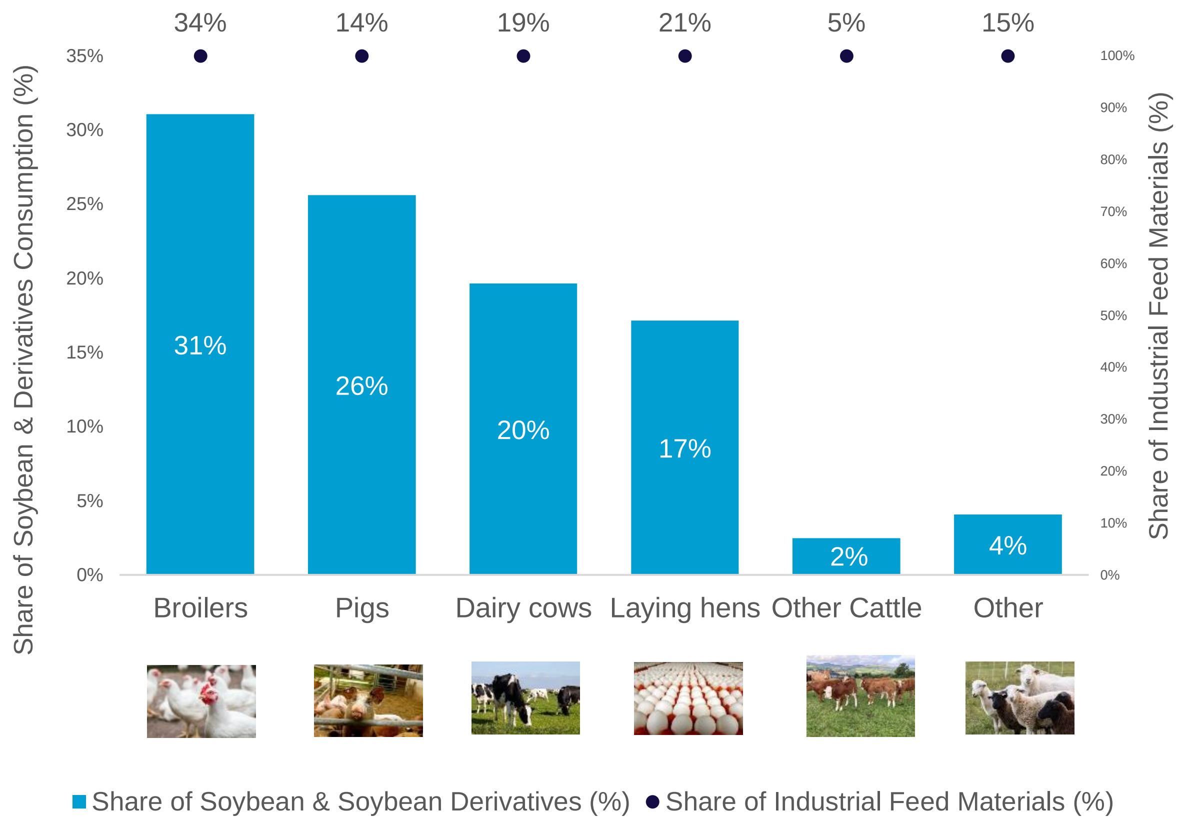
High Protein Requirement	Amino Acid Supplementation	Improving Feed Efficiency
Young & Growing Animals; Lactating Animals	Balancing the amino acid profile of the feed	Optimizing Growth Rates; Enhancing Product Quality

- As monogastric animals (pigs/poultry) can struggle to breakdown fibres, soybean meal high protein and low fibre content make it particularly suitable to their needs.

Key Characteristics of Soybean Meal as an Animal Feed



Soybean Usage & Share of Feed Material Usage by Production Type (Dry Matter)



Source: WWF 2022, Various, Farrelly Mitchell Research

Soybean Alternatives: Overview of Key Findings

Suitability varies across feed materials and species. Where materials are suitable, they may partially or fully replace soybean

FACTORS INFLUENCING THE USE OF SOYBEAN ALTERNATIVES IN EU

Nutritional Composition:
- Protein Content
- Fat Content
- Fiber Content
- Carbohydrate Composition

Digestibility and Absorption:
- Protein Digestibility
- Energy Digestibility
- Nutrient Absorption

Anti-nutritional Factors:
- Presence of Toxic Compounds (e.g., alkaloids, gossypol, glucosinolates)
- Levels of Anti-nutritional Factors (e.g., tannins, phytates)

Palatability and Acceptance:
- Animal Preference
- Results from Feeding Trials

Performance and Productivity:
- Growth Performance
- Production Metrics (e.g., milk yield, egg production)

Cost and Economic Feasibility:
- Cost-effectiveness
- Feed Conversion Efficiency

Processing and Feeding Methods:
- Effectiveness of Processing Techniques
- Recommended Feeding Practices

Health and Well-being:
- Digestive Health
- Overall Animal Health

Environmental Impact:
- Considerations for Sustainability

KEY DISCOVERIES FROM STUDIES ASSESSING THE SUBSTITUTION OF SOYBEAN MEAL

- Complete replacement of traditional protein sources in broiler diets with novel ingredients such as pea, fava bean, and blue narrow-leaf lupin is viable, although each source has specific nutritional characteristics and considerations (Koivunen 2016).
- Moderate inclusion levels of sunflower meal did not negatively impact broiler performance. Sunflower meal can partially replace soybean meal without adverse effects on performance or carcass quality (Amerah et al, 2015).
- Full replacement of soybean meal with dehulled-micronized fava beans at 31% of the diet had no adverse effect on broiler growth performance and meat quality (Laudadio 2011).

- Diets containing rapeseed meal, pea seeds, flaxseeds, and lupin seeds exhibit similar nutrient digestibility and energy value to diets with soybean, suggesting potential for replacing soybean (Zagorakis et al, 2018).
- For growing beef heifers, crossbred (250 kg), cottonseed meal can effectively serve as a protein supplement, specifically as a substitute for soybean meal, as indicated by the study, where replacing up to 100% of soybean meal as the sole supplement at a rate of 1 kg/d showed no significant difference in average daily gain (ADG) ranging from 542 to 570 g/d (Barros et al., 2011)

- Feed formulations incorporating high levels of peas or beans do not necessarily affect growth performance if diets are balanced with synthetic amino acid supplements.
- Replacement of soybean meal with rapeseed meal or pea seeds does not negatively impact diet nutrient digestibility.
- Pea seeds and rapeseed meal can be effectively used as feedstuff materials for growing-finishing pigs without compromising pork quality (Sonta et al, 2021).

Methodology For Rating Suitability of Feed Materials as Alternatives to Soybean

The viability of replacing soybean with alternative feeds is assessed in the next two pages based on nutritional composition, digestibility, palatability and productivity and performance. Suitability is classified into three tiers:

Limited potential to replace soybean (typically <25%). This might be due to lower nutritional values and poor performance outcomes, anti-nutritional factors or because of regulatory constraints.	Moderate potential to replace soybean (typically =<50%). Limitations in the degree to which this material is substitutable with soybean may relate to nutritional and/or anti-nutritional factors that can impact animal performance. The use of this material must be supplemented with other feed materials.	High potential to replace soybean. Depending production cycle, there may be some limitations in the degree of substitutability and/or further feed material supplementation required to ensure comparable animal performance. These can generally be overcome via feed formulation.

Source: Farrelly Mitchell Research, Feedipedia, Feedinamics, Various

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Soybean Alternatives: Feed Materials Review (1/2)

Appropriateness of usage depends on availability, cost, nutritional requirements and desired outcomes

	Planted Based Meals						**Pulses**		
Ingredient	Sovbean 	Rapeseed 	Sunflower 	Cottonseed 	Oil palm 	Olives Residue 	Peas 	Blue Lupins 	Broad/Fava Beans 
Nutrition									
Protein Content (% Dry Matter)	45	38	32	47	17	12.3	24	34	29
Fibre Content (% Dry Matter)	4.4	4.4	28	13	39	21.4	6	16	9.1
Lysine (% of protein)[1]	6.2	6.2	4	4	3	0.9	7	5	6.2
Energy (MJ/kg DM)	19.7	19.3	19.4	20	16.7	18.3	18.3	20.3	18.7
Suitability[2]									
Ruminant	High	High	High	Moderate	Moderate	Low/Limited	High	High	High
Pigs	High	High	Low/Limited	Moderate	Low/Limited	Low/Limited	Moderate	High	High
Broilers	High	Moderate	Moderate	Moderate	Low/Limited	Low/Limited	Moderate	Moderate	Moderate

High · Moderate · Low/Limited

Source: Farrelly Mitchell Research, Feedipedia, Feedinamics

[1] Lysine is particularly important in assessing the overall nutritional quality of proteins and their ability to meet essential amino acid requirements. It is important as its availability can determine the overall quality of the protein, due to its efficiency in supporting protein synthesis and meeting the body's amino acid needs and the crucial role it plays in various physiological processes (including growth, tissue repair and immune functions).

[2] The viability of the soybean alternative protein is assessed based on criteria such as nutritional composition, digestibility, palatability and productivity and performance. Following the assessment, the suitability is classified into three tiers (limited, moderate and high suitability)

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Soybean Alternatives: Feed Materials Review (2/2)

Appropriateness of usage depends on availability, cost, nutritional requirements and desired outcomes

	Fodder Legumes	Cereal Grains & Other Co-Products					Animal based Meals	
Ingredient	Lucerne (Alfalfa) 	Distiller's Grains (Corn) 	Brewer's Grain (Barley) 	Wheat Bran 	Corn Gluten Meal 	Beet Molasses 	Processed Animal Protein 	Insects Meals[1] 
Nutrition								
Protein Cont. (% Dry Matter)	18	30	26	17	67	14	55	42
Fibre Content (% Dry Matter)	29	8	16	10	1	0	NA	9
Lysine (% of protein) [2]	5	3	3	4	2	2	5	6
Energy (MJ/kg DM)	18.0	21.4	19.7	18.9	23.1	15.5	17.7	21.7
Suitability[3]								
Ruminant	Moderate	High	Moderate	Low/Limited	Moderate	Low/Limited	Low/Limited	Low/Limited
Pigs	Low/Limited	Moderate	Moderate	Low/Limited	Moderate	Low/Limited	Moderate	Moderate
Broilers	Low/Limited	Moderate	Low/Limited	Low/Limited	Low/Limited	Low/Limited	Moderate	High

High   Moderate   Low/Limited

Source: Farrelly Mitchell Research, Feedipedia, Feedinamics

[1]Insect meal pertains specifically to the larvae of the Black Soldier Fly

[2] Lysine is particularly important in assessing the overall nutritional quality of proteins and their ability to meet essential amino acid requirements. It is important as its availability can determine the overall quality of the protein, due to its efficiency in supporting protein synthesis and meeting the body's amino acid needs and the crucial role it plays in various physiological processes (including growth, tissue repair and immune functions).

[3] The viability of the soybean alternative protein is assessed based on criteria such as nutritional composition, digestibility, palatability and productivity and performance. Following the assessment, the suitability is classified into three tiers (limited, moderate and high suitability)

Soybean Alternatives: Benefits & Limitations

While alternative materials can potentially replace soybean meal in the EU, they each have their limitations

Sunflower

- ✓ Cost Effective
- ✓ No Antinutritional Factors
- ✓ Lower Phytic Acid
- ✓ Reduced Goitrogenic And Oestrogenic Substances
- ✗ Variable Nutrient Composition
- ✗ Lower Protein Content
- ✗ High Fibre Content
- ✗ Amino Acid Imbalance
- ✗ Palatability
- ✗ Variability

Canola Meal

- ✓ Lower Antinutritional Factors
- ✓ Improved Phosphorous Availability
- ✓ Higher B-vitamin Content
- ✓ Reduced GM Concerns
- ✗ Lower Protein Content
- ✗ B-vitamin Content
- ✗ Ruminant Digestibility
- ✗ Lower Palatability

Peas

- ✓ Lower Antinutritional Factors
- ✓ Enhanced Digestibility
- ✓ Improved Palatability
- ✓ Reduced Variability
- ✓ Lower Environmental Impact
- ✗ Variable Nutrient Composition
- ✗ Lower Protein Content
- ✗ Imbalanced Amino Acid Profile
- ✗ Potential Digestibility Issues

Faba Beans

- ✓ Reduced Antinutritional Factors
- ✓ Enhanced Phyate And Mineral Availabity
- ✓ Decreased Digestive Issues
- ✓ Cost Effective
- ✗ Variability In Composition
- ✗ Processing Requirements
- ✗ Potential Palatability Issues
- ✗ Nutrient Density
- ✗ Market Availability And Pricing

Insect Meal

- ✓ Sustainability
- ✓ Nutritional Quality
- ✓ Reduced Import Dependency
- ✓ Organic Waste Utilization
- ✓ Increased Local Production
- ✓ Feed Formulation Versatility
- ✓ Economic Viability
- ✗ Nutritional Composition Variability
- ✗ Amino Acid Imbalance
- ✗ Antinutritional Factors
- ✗ Regulatory Approval & Market Acceptance
- ✗ Production Scalability & Cost-effectiveness

Cottonseed

- ✓ Cost-effective
- ✓ Improved Phosphorous Availability
- ✓ Lower Antinutritional Factors
- ✗ Presence Of Gossypol Content
- ✗ Palatability Issues
- ✗ Nutritional Imbalance Eg Low Levels of Lysine
- ✗ Phytate Content
- ✗ Potential Allergenicity

Corn Distillers Grain

- ✓ Rich Energy Content
- ✓ Higher Dietary Fiber
- ✓ Higher Mineral Leves
- ✓ Higher Environmental Impact
- ✓ Cost-effective
- ✗ Nutritional Variation
- ✗ Lower Protein Content
- ✗ Reduced Palatability
- ✗ Digestibility Issues
- ✗ Antinutritional Factors
- ✗ Storage And Handling Challenges

Rapeseed

- ✓ Reduced Digestive Issues
- ✓ Reduced Anti-nutritional Factors
- ✓ Higher Energy Content
- ✓ Balanced Amino Acid Profile
- ✓ More Available And Cost Effective
- ✗ Antinutritional Factors
- ✗ Bitter Taste Hence Affecting Palatability
- ✗ Limited Amino Acid Profile
- ✗ Storage Stability

Oil Palm

- ✓ High Digestibility
- ✓ High Palatability
- ✓ Cost Effective
- ✓ Integration Potential
- ✓ High Nutritional Attributes Especially Energy And Fiber
- ✗ Lower Protein Content
- ✗ Presence Of Anti Nutritional Factors
- ✗ Imbalanced Amino Acid Profile
- ✗ High Fiber Content

Lupin

- ✓ High Protein Content
- ✓ Favourable Amino Acid Profile
- ✓ Low Antinutritional Factors
- ✓ Environmentally Sustainable
- ✓ Regional Adaptability
- ✓ Cost Effectiveness
- ✗ Antinutritional Factors
- ✗ Bitterness
- ✗ Variable Nutrient Composition
- ✗ Potential Allergenicity
- ✗ Digestibility Issues In Monogastric Animals

Fish Meal

- ✓ High Crude Protein Content
- ✓ High Digestibility
- ✓ High Amino Acid Profile
- ✗ High Cost
- ✗ Sustainability Concerns
- ✗ Contaminants Such As Heavy Metals
- ✗ Anti-nutritional Factors
- ✗ Regulatory Restrictions
- ✗ Storage And Handling Challenges

Olive Residue

- ✓ Higher Sustainability
- ✓ Improved Meat Quality
- ✓ Potential Cost Saving
- ✗ Variable Nutrient Composition
- ✗ Nutrition Deficiencies
- ✗ Lower Digestibility
- ✗ Lower Palatability
- ✗ Safety Concerns (Including toxins)

✓ Benefits of Soybean Alternatives over Soybean Meal ✗ Limitations from the Use of Soybean Alternatives

Source: Farrelly Mitchell Research, Feedipedia, Feedinamics

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SECTION C

SUPPLY CHAIN ANALYSIS

Return to Executive Summary

Overview of Supply Chain

Value chain actors operate in a low margin environment, with scale required to compete in a globalized market

Feed Manufacturing

- EU livestock farmers costs reached €122 bn in 2022 (c60% of the value of output at the farm gate).
- Approx. 70% of feed costs relate to feed materials and industrial feeds purchased in the market, with the remainder relating to materials produced on farm.
- In 2022, the EU's industrial feed industry generated 149 million tonnes of feed, valued at approximately €69 billion.
- Despite a growing output value, volumes decreased due to elevated raw material costs.
- Over the past decade, the industry has seen an average annual growth of 1.5% in value and 3.4% in volume, with significant growth in value occurring since 2020.
- The industry predominantly serves pigs, cattle, and poultry, accounting for 94% of production, focusing mainly on pig fattening, dairy cows, and broilers.
- It processes about 60% of the EU's feed commodities (excluding roughage) and is the main processor of soybean cake (+90%).
- Characterized by high competition and low margins, feed manufacturers must navigate a volatile market for raw materials, making supplier relationships and procurement strategies crucial for success.
- The challenge of product differentiation necessitates a balance between price competitiveness, innovation, and service enhancement.
- There is an increasing focus on safety, sustainability, efficiency, and productivity within the industry.
- Despite its fragmentation, the European sector is consolidating, with major players expanding through mergers and acquisitions, aiming to become total feed solution providers.

Livestock Industry

- The livestock farming sector is an important component of the EU's agricultural sector. It accounts for 44% of the EU's agricultural outputs (€211 bn in 2023).
- The sector employs 6.2 mn people. In addition, the sector supports indirect employment via associated industries (e.g. 1.4 mn people are employed in dairy and meat manufacturing alone).
- It also supports regional cohesion and efforts to prevent depopulations in many parts of the EU were the potential for income generation from other activities is low.
- Most livestock holdings in the EU are small in scale, typically employing two people. The industry has gone through structural change over the last two decades, with significant declines in:
  - The number of livestock holdings (down -42% since 2010);
  - The number of people employed in the sector (down -45% since 2010 ; and
  - To a lesser extent - the EU livestock herd (ruminants and pigs down -5% over ten years).
- Generally, margins are tight across the sector and producers need scale to be able to compete in a globalised market particularly in pig and poultry sectors which are highly intensive and specialised.
- This has resulted in increased consolidation, with many livestock farmers leaving the industry.
- Other challenges, include rising production costs, increasingly stringent welfare standards and pressure to reduce environmental impacts.
- Any significant increase in feed costs are likely to accelerate the exodus of livestock farmers from the sector.

Dairy & Meat Manufacturing

- The EU's meat and dairy manufacturing sectors are critical components of the food manufacturing industry, significantly impacting most Member States.
- Together, these industries:
  - Employ around 1.4 million individuals; and
  - Generate a combined output of €372 billion, with a value add of €76 billion.
- Despite tight margins, with gross operating surpluses between 5% and 6%, these sectors exhibit a significant economic footprint.
- In dairy, industry concentration rates (C4) are high, ranging from 30% to 98% across member states.
- Dairy manufacturing is robust, producing over 55 million tonnes annually, with the faster-growing segment being higher-value processed products, despite fresh dairy dominating 70% of output.
- The meat sector produced 43 million tonnes in 2022, with poultry output driving growth (1.6% CAGR since 2012), while output growth from other segments remain subdued.
- Consolidation is also a trend in the meat industry, with larger firms processing multiple species and the top five EU meat processors holding 20% of the market share.
- Key challenges for industry operators include product differentiation, delivering superior products, maintaining close relationships with customers and suppliers, and fostering product innovation.
- The industry operates on low margins, focusing on economies of scale and throughput intensification.
- Strategic supply chain partnerships and exceptional procurement are essential (raw materials constitute 75% of abattoir costs), underlining the importance of cost management in maintaining market competitiveness.

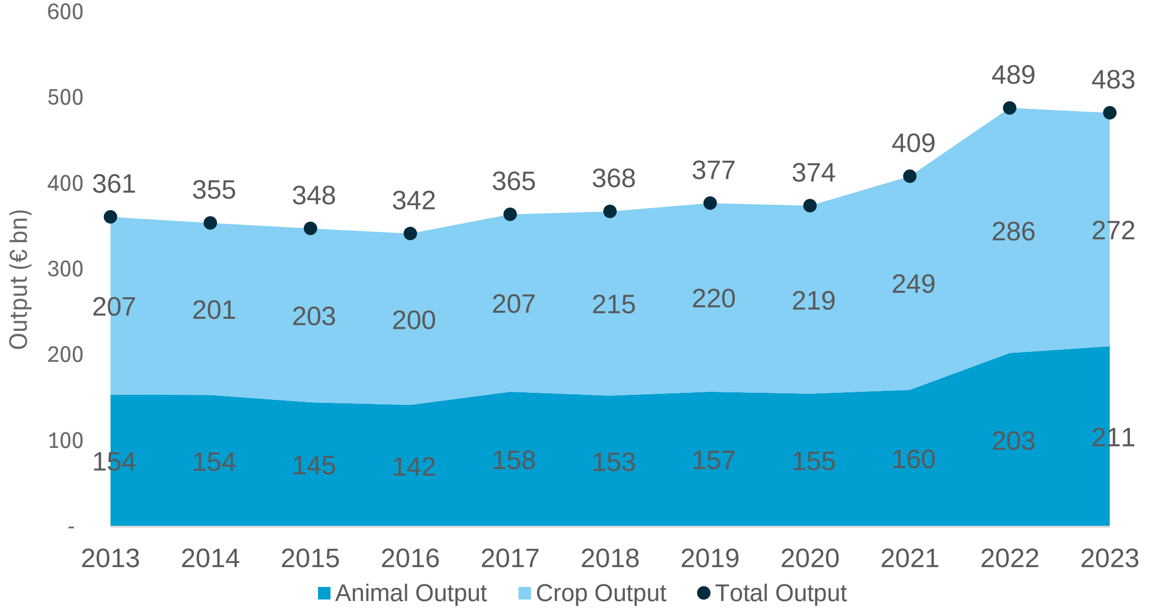
Source: Eurostat Database,EPRS Farrelly Mitchell Research

Return to Executive Summary

EU-27 Agriculture

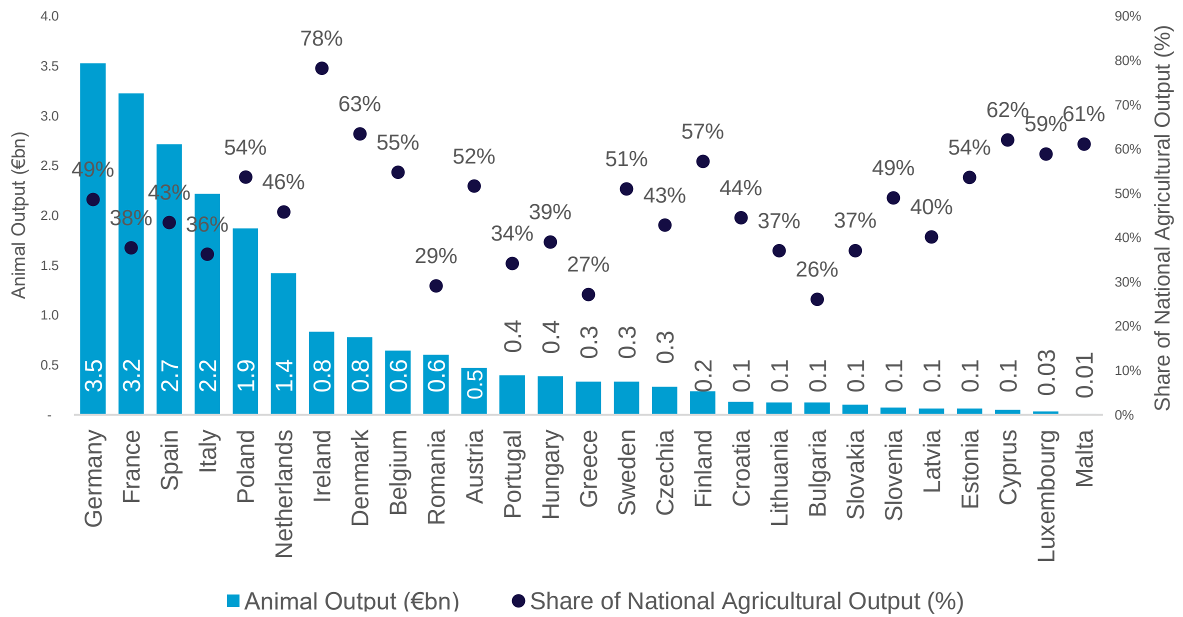
Almost 100% of live animals for slaughter and raw milk produced is processed by the EU's F&B manufacturer

The Value of EU-27 Agricultural Output by Type 2013-2023 (€bn)



- Output from EU agriculture grew at a 2.9% CAGR to reach $483 bn in 2023. Agriculture accounts for just 1.5% of the EU's GDP but is an important component of the economy.
- It is the primary source of nutrition for EU consumers and a provider of raw materials to other industries (particularly F&B manufacturing) and of direct and indirect employment and incomes.
- An est. 70% of EU primary production is used as an input in the local F&B manufacturing sector.
- This share varies by raw material, with almost 100% live animals produced for slaughter and raw milk production in the EU processed by the EU's F&B manufacturing industry.

Breakdown of Animal Output by Country 2023 (€bn)



- Animal output (from livestock and poultry farming) accounts for 44% of EU agricultural output, reaching 211 bn in 2023.
- Since 2013, growth in animal output has outpaced growth in crop output (3.2% vs 2.8% CAGR).
- Animal output accounted for 44% of EU agricultural output in 2023. Its importance varies across the EU, ranging from 26% of agricultural output in Bulgaria to 78% in Ireland.
- Animal output is relatively concentrated, with 5 countries accounting for 64% of the EU's animal output.

Source: Eurostat, Farrelly Mitchell Research

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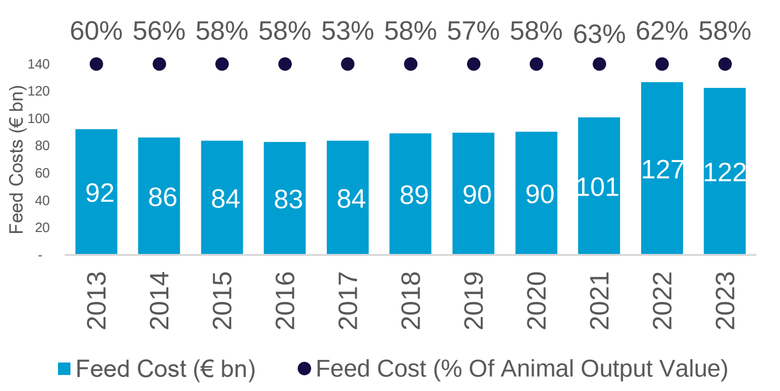
EU-27 Livestock Industry (1/2)

Industry margins are tight and any large increase in feed costs may accelerate industry restructuring

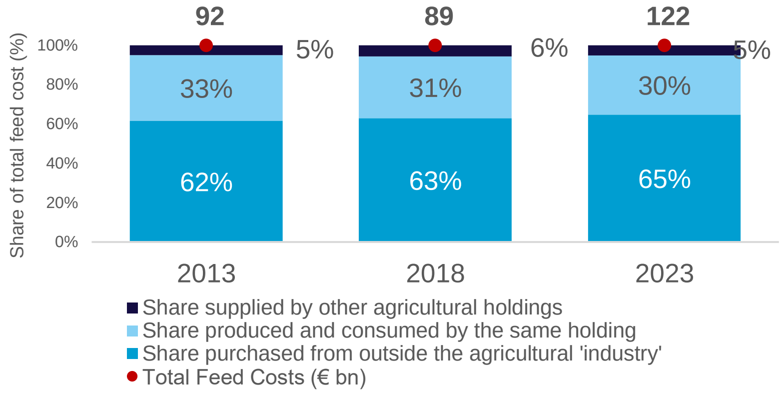
Overview

- The EU livestock industry has undergone significant structural change over the last two decade.
- Most livestock holdings are small operations, typically employing two people.
- Margins are tight and the number of holdings, livestock and people employed in the sector are largely in decline.
- Producers have been able to maintain or increase output levels due to productivity gains.
- There has been a move toward greater consolidation across subsectors as producer need scale to be able to compete in a globalized market.
- EU feedstuff costs reached € 122 bn in 2023 and are the main production cost of livestock farmers.
- Since 2013, feed costs as a proportion of EU farm animal output (production value) ranged between 53% and 63%.
- Approx. 70% of feed costs relate to feed materials and industrial feeds purchased in the market (most of this industrial feed), with the remainder relating to materials produced on farm.
- Since 2021, a boom in global feed commodities prices saw the EU feed price index increase by c50%.
- While prices remain high but there was some softening in 2023. However, the outlook is uncertain due to the war in Ukraine and other macro-factors.
- Any significant increase in feed costs are likely to accelerate the exodus of livestock farmers from the sector

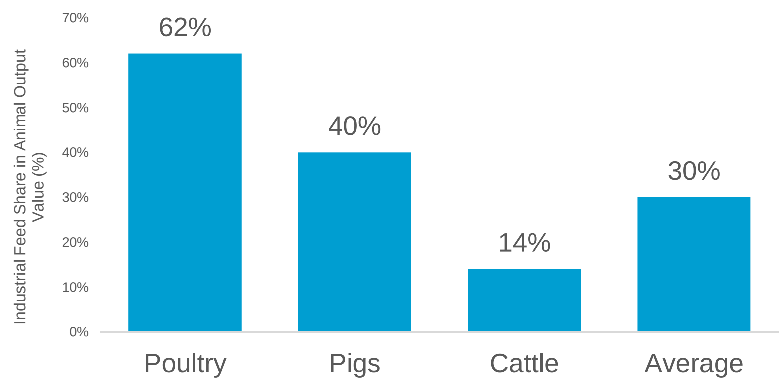
EU Feed Costs & Feed Costs as a Share of Output 2013-2023



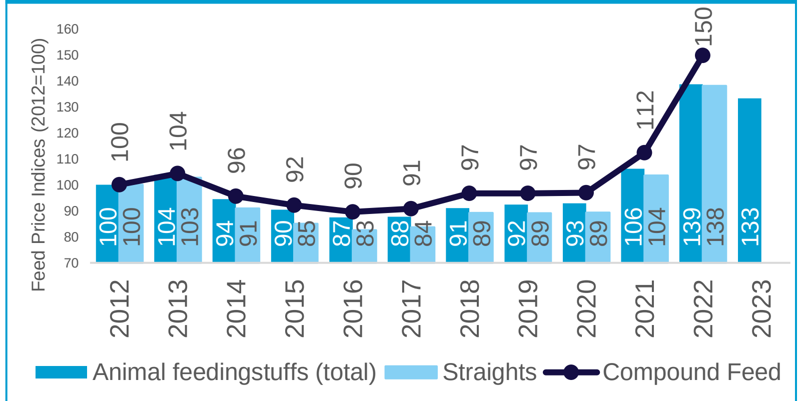
Share of EU Feed Costs by Source 2013-2023



Share of Industrial Feed in Animal Output Value 2021 (%)



Feed Input Price Index 2012-2023 (Nominal, Base = 2012)

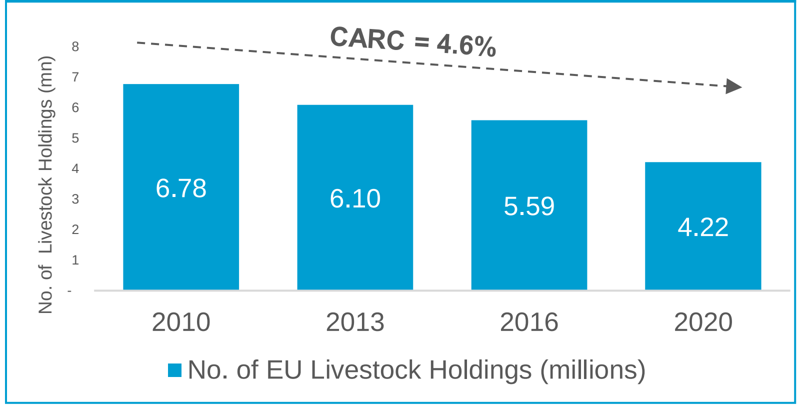


Source: Eurostat Database. EU Commission Feed Balance Database, FEFAC, Farrelly Mitchell Research

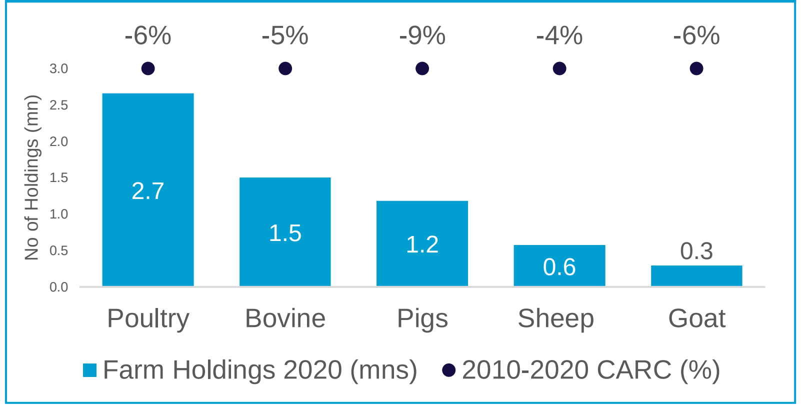
EU-27 Livestock Industry (2/2)

While the animal output has been growing, the number of livestock holdings and livestock are largely in decline

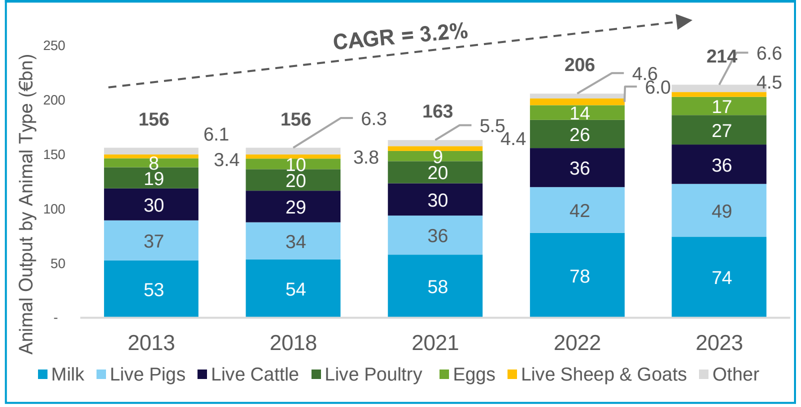
Evolution of No. of Livestock Holdings 2010-2020 (mn)



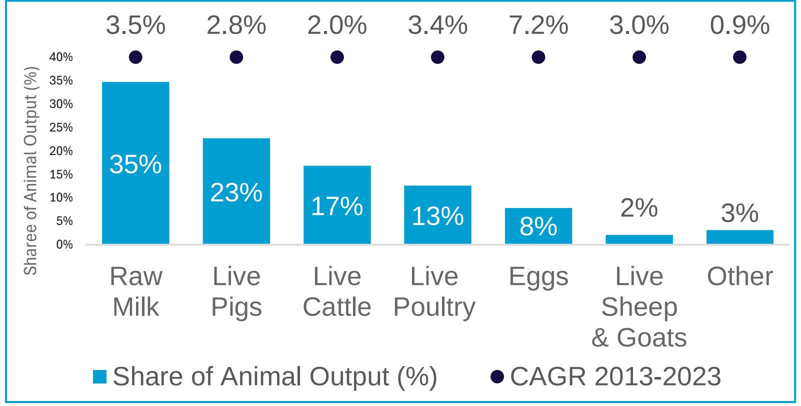
No. of Holdings with Select Livestock Species (millions)[1]



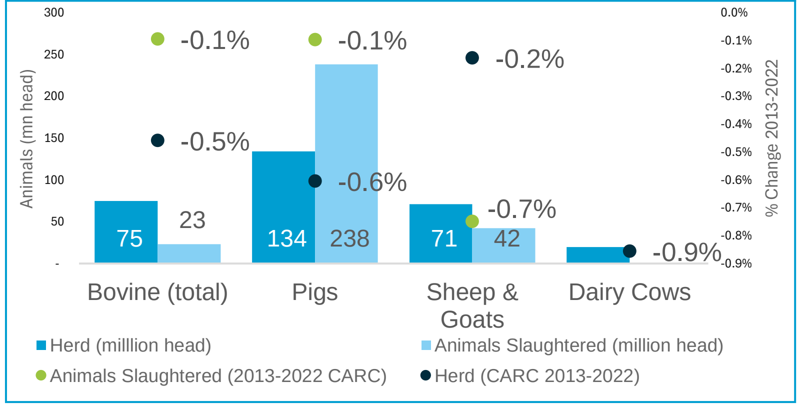
Farm Animal Output by Type 2013-2023 (€ bn)



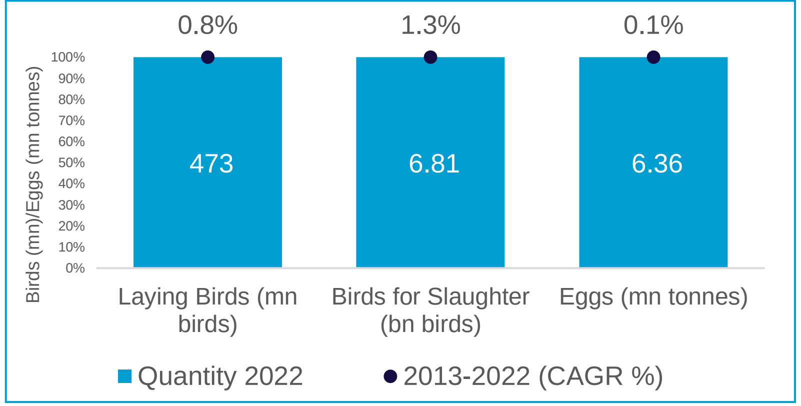
Farm Animal Output by Type 2023 (Share of Total Value)



Livestock Herd & Producing Animals by Type 2022



Poultry Production by Type 2022



[1] Number of holdings that keep the specified animals. The combined total of the referenced animals is higher than the total EU livestock holdings due to high presence of mixed livestock farm holdings.

Source: Eurostat. EU Commission, Farrelly Mitchell Research

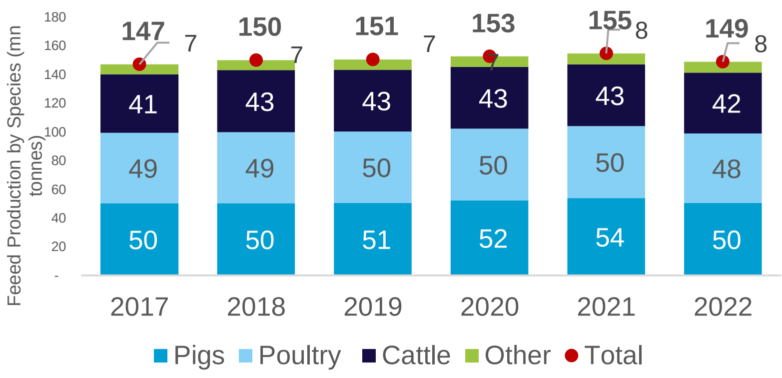
EU-27 Industrial Feed Production

The industrial feed industry sector processes c90% of the EU's available soybean cake

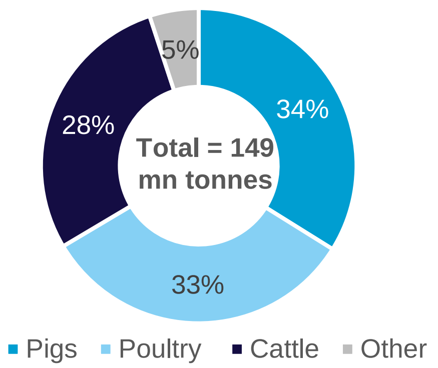
Overview

- The EU industrial feed industry produced 149 mn tonnes of industrial feed in 2022, worth approx. €60 billion.
- While the value of output continued to grow, industrial feed market volumes declined in 2022, with a further decline est. for 2023 (due to high raw material costs).
- Five producers account for 64% of EU production.[1] Output quantity declined in 3 of this 5 but mostly increased elsewhere.
- Pigs, cattle and poultry are the key species; with pig fattening, dairy cows and broiler the most important feed types.
- There is significant variation in production across countries, for example, 68% of production in Ireland is for cattle, whilst cattle feed accounts for just 3% of production in Romania.

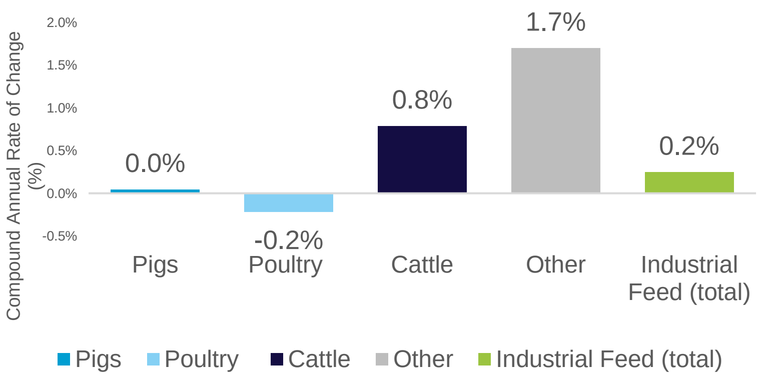
Industrial Feed Production 2017-2022 (mn tonnes)



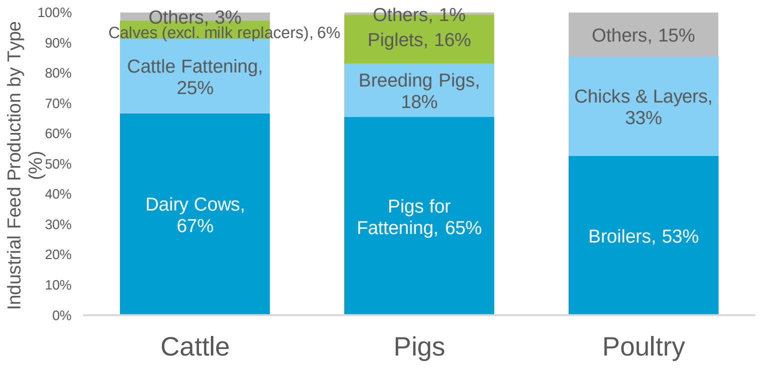
Industrial Feed Production by Species 2022 (% of Total)



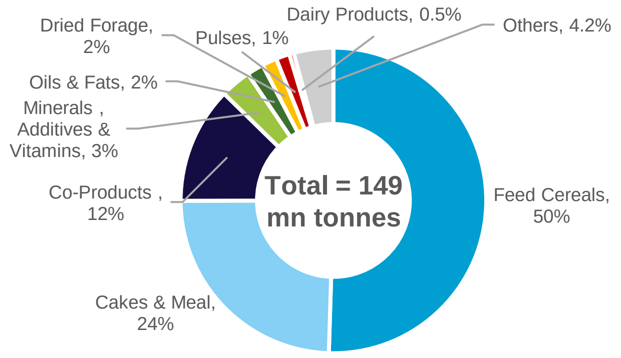
Change in Production Volume 2017-2022 (% CARC)



Industrial Feed Production by Species Production Type



Industrial Feed Raw Materials by Type 2022 (% of total)



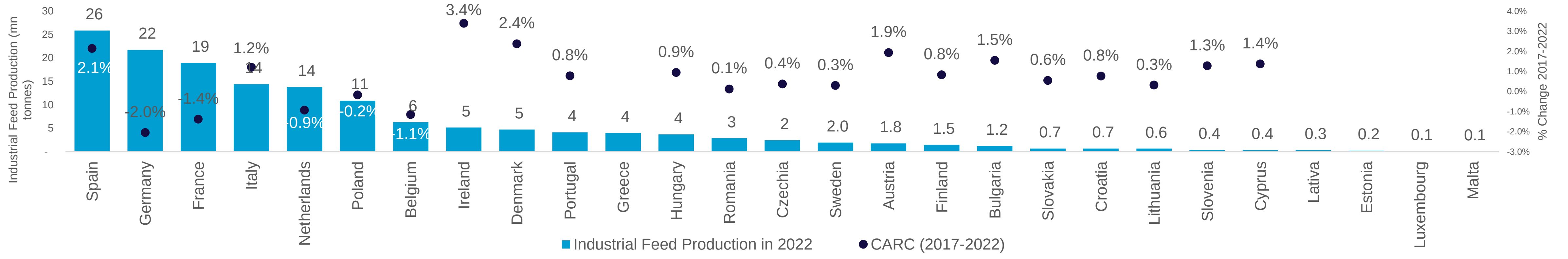
[1]Spain, Germany, France, Italy and the Netherlands

Source: FEFAC, Farrelly Mitchell Research

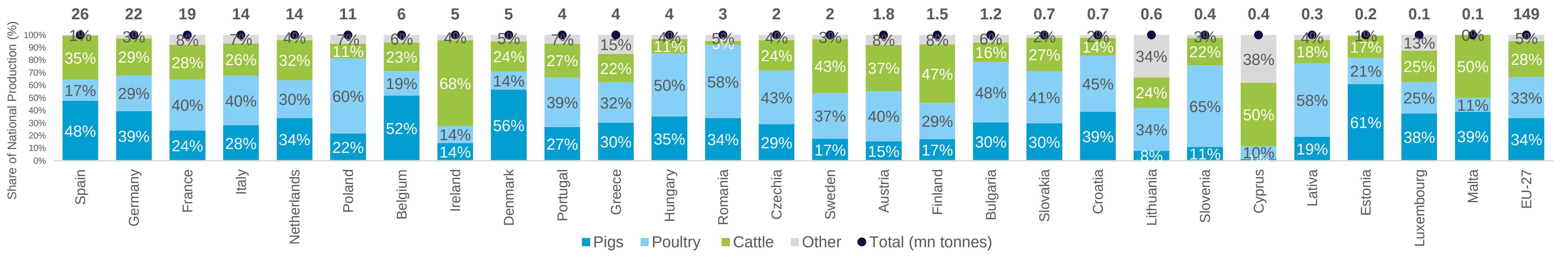
EU-27 Industrial Feed Production

Five producers account for 64% of EU production. Output declined in 3 of the 5 but mostly increased elsewhere

Industrial Feed Production Volume & Change in Production Volume by Country (2017-2022)[1]



Breakdown of Industrial Feed Production Volumes by Country & Species 2022



[1] Historical data is not available for Latvia, Estonia, Malta, Luxembourg and Greece

Source: Eurostat Database, EU Commission Feed Balance Database, FAOSTAT, Farrelly Mitchell Research

Dairy Value Chain

Feed cost are the key production cost and the key determinant of profitability at farm level

Industry Overview

- The dairy industry arguably the most important component of the EU agrifood industry. Raw milk accounts for 35% of EU farm animal output and dairy manufacturing accounts for 16% of EU food manufacturing output.
- Combined output form these sectors grew at a 3.3% CAGR over 2012-2022 to reached €232 bn. Dairy manufacture accounted for 2/3rds of this output.
- The introduction of milk quotas in the 1980s saw EU raw milk production stagnate, however, since quota reform (in 2009) and abolition (2015) the industries output has been growing a 1.1% CAGR.
- EU farmers produced c154 mn tonnes of raw cow's milk in 2022, this is processed by dairy manufacturers into approx. 54 mn tonnes of dairy products.[1]
- Approx. 65% of the EU's raw milk production is produced in 5 countries (Germany, France, Poland, Netherlands and Italy).
- Fresh dairy products account for almost 70% of dairy manufacturing output in volume terms. Fresh dairy output has stagnated (mainly due to slower sales of drinking milk, 60% of fresh dairy output).
- Production of other fresh and processed dairy products have largely been growing (1.1% CAGR).[2]
- The EU is the largest exporter of dairy products in the world (exports are particularly focused on dairy ingredients and other processed dairy products especially cheese). Most fresh product is consumed domestically (c5% of production is exported).

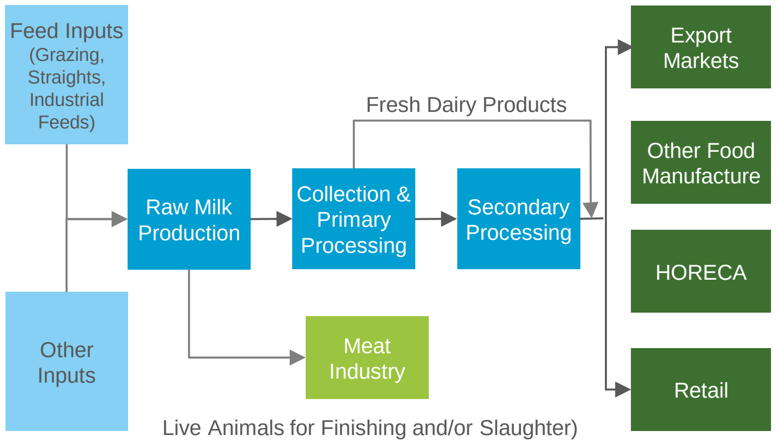
Farm Level Dynamics

- The EU dairy sector includes some 470,000 dairy farms. It is heterogeneous with significant variation in production systems, farm scale, climate and product focus.
- The sector has undergone several structural changes, including
  - A very large reduction in the number of dairy farms (except for Ireland, Cyrus and Romania);
  - A general increase in the average dairy farm size (but a relatively small change in the total dairy land area); and
  - A long-term decline in dairy cow numbers and offsetting increase in dairy cow yields.
- Dairy production systems ranges from to low-input extensive pasture systems (common in the EU's Dairy Belt) to high-input intensive confinement systems (common in Southern Europe and the Nordic countries).[3]
- Dairy production is more profitable in the Dairy Belt. However, profitability can be undermined if farm gate prices don't increase in line with increased input costs.
- In 2018, a drought in Ireland undermined grass growing conditions and increased farmer reliance on purchased feed, resulting in a c40% decline in average net margins per litre.
- Feed costs account for 50% of EU dairy farm production costs (broken down 70/30 between purchased and farm grown feed).
- Feed cost fluctuations (along with changes in energy and fertilizer costs) are the key drivers of change in production costs
- Income support payments are key to maintaining the viability of EU dairy farms ((averaging 40% of dairy farm income).

Dairy Processing

- There are some 13,000 dairy processors in the EU, employing more than 400,000 people.
- However, the industry is highly concentrated at processor level across most of the EU. Industry concentration rates (C4) ranging from 30% to 98% across member states.[4]
- Gross operating surpluses averaged 7% in 2021 and ranged from 4% (in Sweden, France and Austria) to 13% in Ireland.
- The industry exported 25 mn tonnes of dairy products in 2022 (worth €68 bn). 30% of export value is to 3rd party countries (mainly cheese and milk and whey powders, +70% of value).

Simplified Commercial Value Chain for Raw Milk



[1] In addition to raw milk, the dairy farming sector also supplies calves and unproductive animals to beef sector.
[2] Fresh dairy products include drinking milk, buttermilk, cream for direct consumption, acidified milk and other fresh dairy products. Processed dairy products include milk powders (whole and skimmed), whey powder, cheese and butter.
[3] The Dairy Belt stretches across north and northwestern Europe from the Baltic States, through to Poland and Germany, into northern France and across to Ireland. This region is particularly favourable for dairy production due mild temperatures and ample rainfall contributing to good grass growth conditions over a long grass growing season.
[4] The concentration ratio expresses the share of activity in a sector represented by a specific number of firms e.g. a C4 ratio indicates the percentage of the sector represented by the top 4 firms. Concentration rates are highest in the Scandinavian countries, the Netherlands, Ireland, Croatia, Cyprus and Slovenia (+80%).

Source: EPRS, Eurostat Database, Farrelly Mitchell Research

Pork Value Chain (1/2)

There has been a tightening of margins driven by increased input costs and lower carcass prices

Industry Overview

- The EU pig meat sector is a significant component of the EU's agricultural landscape, contributing nearly half of the total meat production within the EU.
- In 2022, more than 238 mn pigs were slaughtered (22.3 mm tonnes c.w.e), more than twice the volume of the beef sector.
- Germany, Spain, and France are the primary contributors to EU pig meat production, collectively accounting for over half of the total output.
- Germany and Spain lead the pack, with Germany contributing 23% and Spain contributing 19% of the EU's total pig production.
- France follows closely behind, contributing 9% of the total production.
- Other significant producers include Poland, Denmark, the Netherlands, Italy and Belgium.
- Lower domestic demand resulted in relatively flat sector output over the period 2017-2022, however, export volumes grew at a 2.6% CAGR.
- The EU stands as the world's top exporter of pig meat products. The EU exported almost 4 mn tonnes in 2022 (18% of output), worth more than €10 bn.
- It holds an 30% share of global trade. Its main competitors include the USA, Brazil, and Canada.
- China is the EU's largest market, but substantial volumes also target the UK, Japan, and S. Korea.
- Exports peaked in 2020 (4.9 mn tonnes), largely fueled by heightened demand from China .However, volumes have declined since then.
- This decline is largely due to lower availability due to a declines in production across the major producer countries due to the spread of African swine fever and high input and regulatory compliance costs leading to EU exports being less competitive on international markets.

Farm Level Dynamics

- The pig farming sector in the EU exhibits significant diversity in methods and farm sizes among and within member states, however, output is concentrated on larger specialist farms.
- Output from the sector grew at a 2.8% CAGR over the period 2013-2023 to reached €49 bm , 23% of farm animal output.
- There are almost 1.2 mn farms with pigs in the EU, however, these farms vary in size and production scale, ranging from small family-owned farms to large-scale commercial enterprises.
- The main production region in the EU is an area that extends from Denmark through northern Germany and into the Netherlands and Belgium. In additional, there are high concentrations of production in parts of France, Spain and Poland.
- Approx. 83% of production is concentrated in 137,900 specialist pig farms that employ more than 300,000 people.
- Within this segment there are c46,000 specialist farms with annual output above €100,000 who account for the bulk of live pigs.
- Since 2010, there has been considerable consolidation at farm level, with decline in most types of farms (59% decline in all holdings with pigs) and sharp increase in average herd size.
- Between 2010-2020, average herd size in specialist pig farms increasing from 338 to 866 pigs.
- While there is a great deal of specialization in the industry (breeding and finishing of pigs are often conducted in separate facilities) there are lower levels of vertical integration compared to poultry.
- Denmark boasts the most developed integrated production system.
- In Spain, the industry is highly intensive with vertically integrated companies controlling pork production; providing farmers with inputs and purchasing outputs on a contract basis.

Farm Level Dynamics (Cont.)

- Additionally, slaughterhouses and meat processing companies often exhibit high levels of integration in Spain.
- The sector utilizes diverse feed sources to meet pigs' nutritional needs throughout the production cycle.
- Conventional production systems often depend purchased feeds from outside the farm (industrial feeds account for the bulk of feed costs).
- Feed costs typically account for c60% of production costs in the EU, however, soaring feed prices in 2022 saw this increase to c70%
- Soy accounts for c10% of feed materials used in the sector.
- There has been a tightening of margins driven by increased input costs and lower carcass prices (lower domestic and international demand).
- In addition, the intensive nature of production means the sector faces numerous issues around animal welfare and pollution.
- The sector is already tightly regulated, with the regulatory burden expected to increase as the EU implements measures to achieve its policy objectives under the Green Deal.

Meat Manufacturing

- According to Eurostat, the value of EU slaughtering and processing sector production grew at a 2.2.% CAGR over the period 2012-2022 to reach €57 bn.
- Like the rest of the meat manufacturing industry, margins are low and there is a drive for scale, automation and standardization (the largest slaughterhouses can process +7 mn animal a year).
- The industry is highly consolidated, with the top 3 pork companies in capability of processing 30% pf the EU market's needs
- Major players typically slaughter and process the meat themselves.

Source:, Eurostat Database, EPRS, Farrelly Mitchell Research

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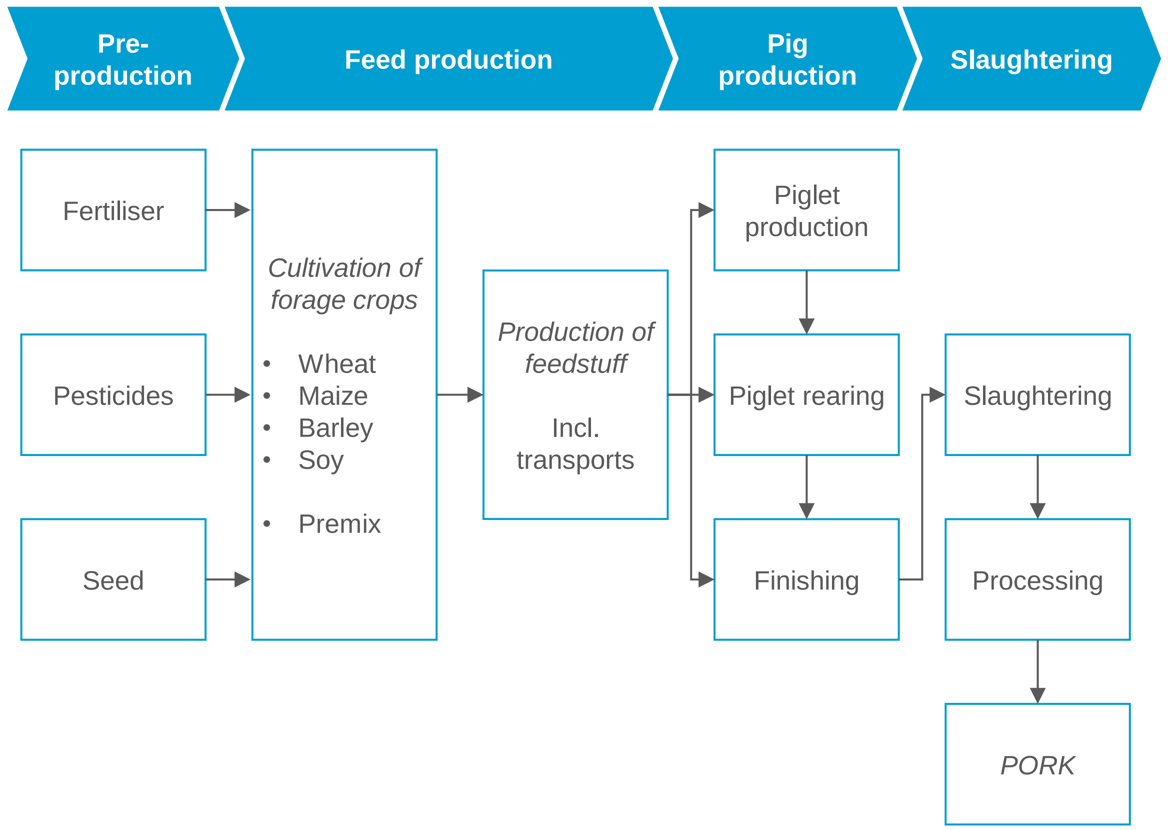
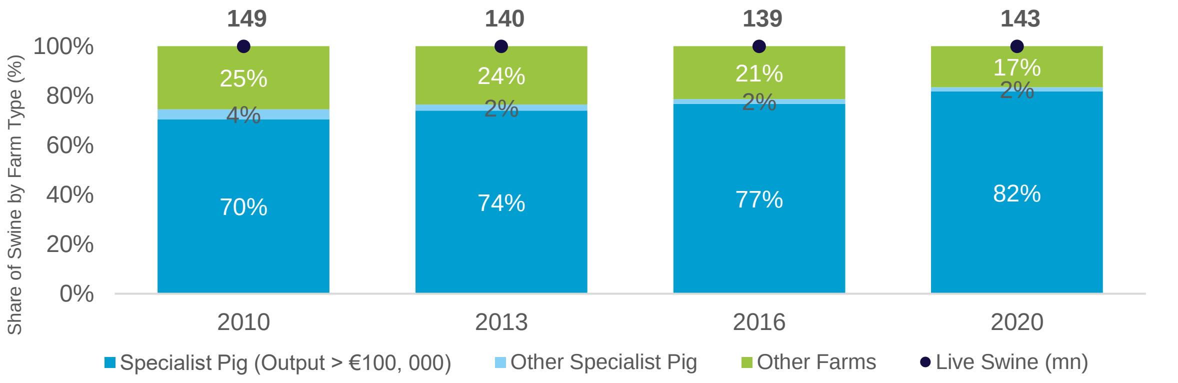
Pork Value Chain (2/2)

Farm production and returns are increasing concentrated in larger specialised pig farms

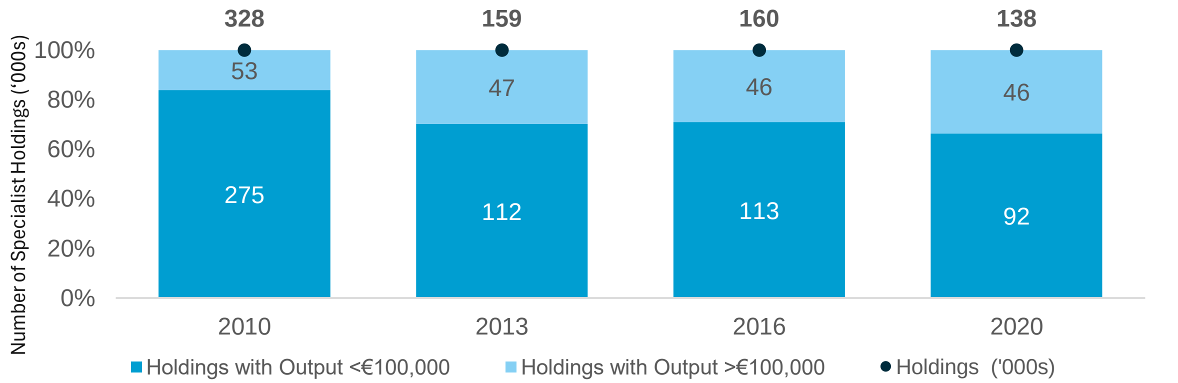
Simplified Pork Beef Value Chain



Distribution of EU Live Swine by Farm Type 2010 to 2020



Distribution of Number of Specialist Pig Holding by Annual Output 2010 to 2020



Source: Eurostat Database, Farrelly Mitchell Research

Broiler Value Chain

The broiler value chain is highly specialised. Margins are highly sensitive to rising production costs

Overview of EU Poultry Industry

- The poultry industry is one of the most important within the EU agri-food sector. The sector has shown robust long-term growth, driven by increased domestic and international sales.
- Commercial poultry value chains (especially broiler and table egg production) are highly intensive and among the most sophisticated in the EU agri-food sector.
- Each stage of production, from production of genetic stock through to poultry slaughter (or table egg production), is highly delineated, with different production units involved at each stage of the value chain. This delineation helps drive efficiencies and provides enhanced biosecurity.
- Revenues at farm level increased at a 4.6% CAGR over the 10-year period from 2013 to 2023 to reach almost €42 billion. In addition, poultry slaughterhouses had revenues of €38 bn in 2021.[1]
- Live birds represent +60% of farm output (mainly for slaughter), with eggs accounting for the rest.
- Poultry meat is the second most produced and consumed meat in the EU, with EU poultry slaughterhouse processing some 13.3 mn tonnes of meat in 2021 (worth €38 bn).[1]

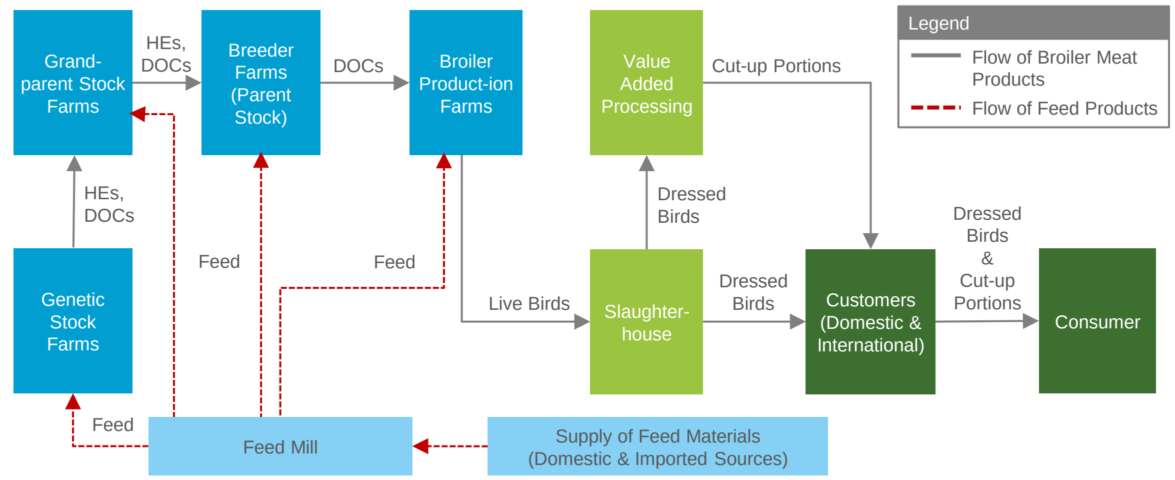
Broiler Value Chain

- The broiler industry is the most important component within the poultry meat industry, accounting for 82% of EU poultry meat production in volume terms (carcass weight equivalent).
- Genetic selection has contributed to a 400% increase in broiler growth rates since the 1950s.
- A small number of companies control the global market for genetic stock. The main suppliers of broiler genetic stock in the EU are Aviagen, Cobb-Vantress and Lohmann Breeders.
- These supply parent and grandparent stock to broiler breeder farms across the EU, who in turn produce fertilized hatching eggs (HEs) which are incubated and hatched at hatcheries.
- DOCs or HEs are then transported to broiler production farms where they are grown to a target weight over a period of between 35 to 45 days. At the end of the production cycle, broilers are sent to slaughter.
- Five countries (Poland, Spain, France, Italy and Germany) account for 2/3rd of EU production.

Industry Structure & Competitiveness

- Large scale, intensive production systems account for 90% of EU broiler production, with c50,000 birds on a typical commercial farm holding.
- There is stiff internal EU competition, while in international markets EU processors compete with lower cost producers in Brazil and the USA.
- Significant restructuring and consolidation has taken place as the EU industry seeks to achieve the benefits of scale. A small number of processors dominate production in most EU countries.[2]
- Integrated broiler production models, where a single company controls several or all links in the value chain (either through direct ownership or contracting with growers), are common throughout Europe and are the dominant production model in most of the key producing countries.[3]

Simplified Commercial Broiler Value Chain[4]



[1] Latest available data
[2] Poultry International estimates that five EU headquartered companies slaughter the equivalent to c30% of the EU's total poultry slaughterings in 2021. The five companies are LDC Group, Plukon Food Group, Gruppo Verones, PHW Group and Amadori. Note that these companies also have processing facilities outside the EU.
[3] Integrated production models are dominant in France, Germany, Spain , Italy and Austria. While production tends to be non-integrated in Poland, the Netherlands, Belgium, Finland and Sweden. In non-integrated production systems, the different links in the chain are independent companies trading on the market. This means that breeders and growers buy feed and birds at their own risk and are directly exposed to market fluctuations.
[4] HE = Hatching eggs; DOC = Day old chicks

Source: Eurostat Database, EPRS, Farrelly Mitchell Research

EU Beef Value Chain (1/2)

Among the least profitable sectors in EU agriculture and highly reliant on income supports to maintain profitability

Industry Overview

- The EU is the 3rd largest producer of beef in the world, after Brazil and the USA. It slaughtered some 23.3 mn head of cattle in 2022, producing 6.7 mn tonnes of meat.
- Beef production in the EU sources animals from the specialist cattle fattening, dairy and mixed livestock farming sectors.
- Notably, about two thirds of beef and veal production in the EU is soured from the dairy sector, meaning ongoing structural changes in the dairy sector impact beef supply.
- Beef production has been slowly declining since 2017 (-0.7% CARC), mainly due to tighter supply due to restructuring in the dairy sector. [2]
- Five countries accounted for 2/3rd of EU beef production in 2022.
- The EU market consumed some 6.5 mn tonnes of beef. The consumption of beef within the EU also experienced a slight decrease, due to falling per capita consumption.
- This trend is expected to continue, influenced partly by higher meat and food prices leading consumers to opt for cheaper animal proteins.
- The EU exported some 538,000 MT of beef and imported 356,000 MT in 2022. It also exported almost 1 mn live cattle.
- The EU's total exports (beef and live cattle) were worth more than €4 bn. Major trading partners for EU beef include the United Kingdom, Israel, Ghana, the Philippines, and Bosnia-Herzegovina.
- Its main competitors in international markets are Brazil, the USA, India, Australia and New Zealand.
- With global population growth and increased incomes, especially in developing countries, the global meat, including beef, demand is set to grow (an additional 3.4 mn tonnes of meat will be traded by 2031).
- This offers EU beef producers a chance to tap into new markets globally, leveraging the EU's renowned food production standards. However, in order to do so, it is an imperative that they maintain their price competitiveness.

Farm Level Dynamics

- The EU beef farming sector has significant variation in its distribution, farm size, farm structure and productivity, economic profitability and income.
- These differences are driven by climate, pasture availability and the historical developments leading to different livestock practices and farm characteristics.
- In 2020, approx. 1.5 m farms had raised cattle. Most cattle are held on specialist dairy farms or specialist cattle rearing and fattening farms (75% of 77 mn cattle).
- The number of farm holdings with cattle has been in general decline, while average cattle herd size increased from 31 to 51 cattle over the period 2010-2020.
- There is significant variation in average herd size within countries and across farm types, ranging from just 5 cattle in Romania to 270 cattle per holding in Cyprus. In specialist cattle fattening/rearing, the average cattle herd size ranges from just 13 cattle in Slovenia to 214 in the Netherlands.
- Returns per farm and per animal vary significantly across countries. Average returns per farm in specialist rearing fattening farms in 2020 was €46,500 and ranged from €7,700 in Malta to €169,000 in the Netherlands.
- In late February 2024, the average market price for EU cattle was €460, with average prices across countries ranging from €208 in Hungary to €512 in Italy.
- In general, beef sector farm incomes are amongst the lowest of the EU agricultural system and EU beef farming is of marginal profitability at best. Without direct income supports, most beef farmers would experience negative incomes.

Farm Level Dynamics (cont.)

- Smallholders are particularly vulnerable and have limited resources to invest in productivity improvements and increasing output.
- Average feed costs in fattening farms range from 30% to 46% of the farmgate carcass price. While feed costs shares are lower than in broiler and pig production, they remain significant and leave farmers exposed to rising feed prices.

Beef Processing

- The beef processing sector encompasses slaughterhouses and processors of value-added meat products.
- Beef processing revenues in 2022 were more than €35 bn. Approx. 4,650 establishments operate in the sector, employing nearly 133,000 people.
- The industry is low margin and characterised by a drive for economies of scale and throughput intensification.
- The industry is consolidating, driven by local and international acquisitions. Larger players typically process a variety of species, with the top 5 EU meat processors accounting for 20% of share of the EU meat market.
- The level of consolidation varies by country e.g. in Ireland, 3 processing groups control almost 2/3rds of cattle throughput.
- The beef sector in general faces a range of challenges around issues such as increased regulatory requirements, animal welfare and environmental impacts, origin and authenticity and the nutritional benefits and quality of meat.
- In addition, both the EU and international markets are becoming increasing globalized, with EU beef producers and processors facing increasing competitive pressure from low-cost production locations (particularly from Brazil).

[1] France, Germany, Italy, Spain and Ireland

Source: Farrelly Mitchell Research, EPRS

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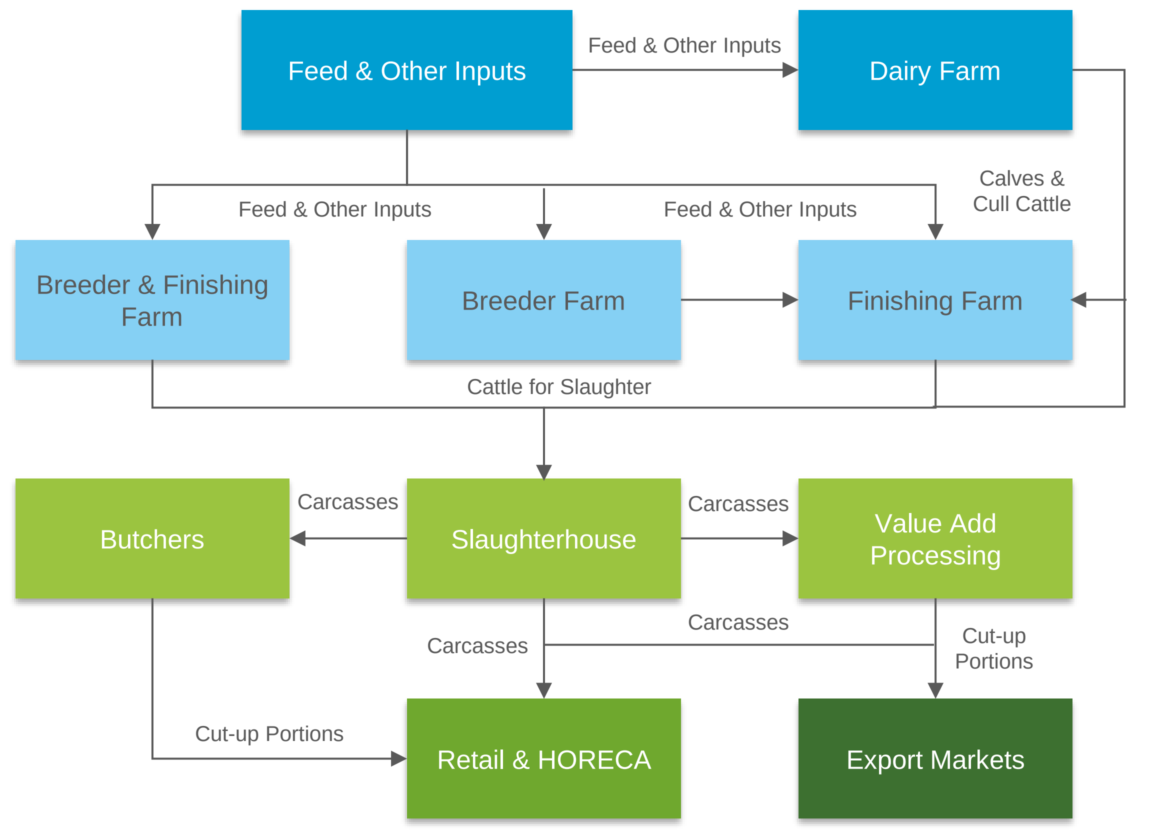
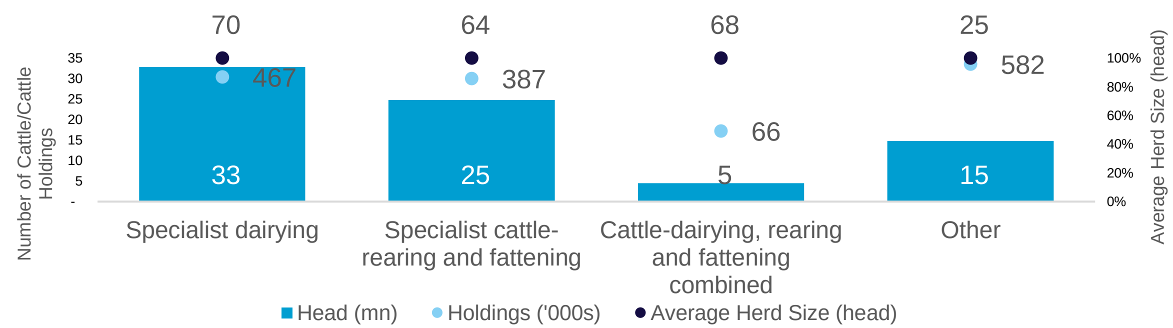
EU Beef Value Chain (2/2)

The number of farm holdings with cattle declined by 41% from 2.5 mn to 1.5 mn holdings over 2010-2020

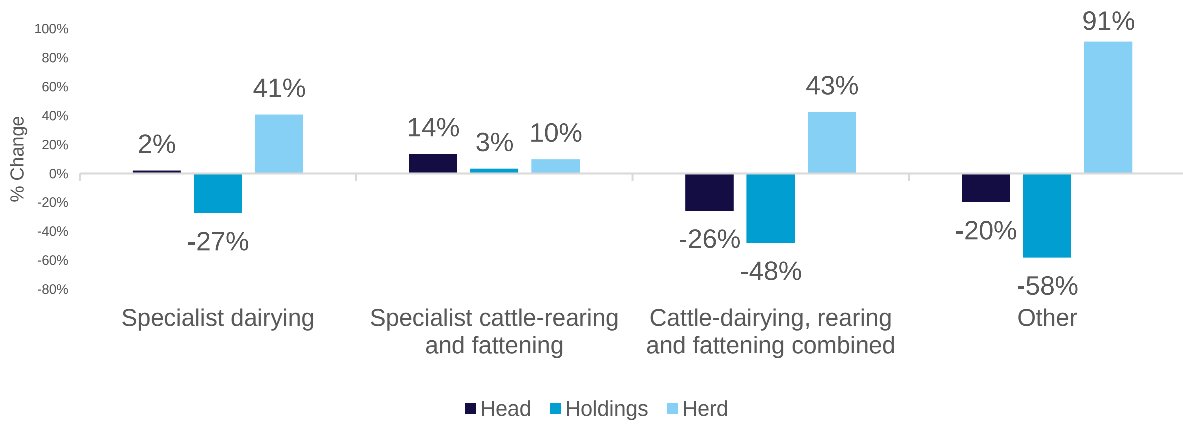
Simplified EU Beef Value Chain



Number of Cattle, Holdings & Average Herd Size by Farm Type in 2020



Change in Number of Cattle, Holdings & Average Herd Size by Farm Type 2010-2020

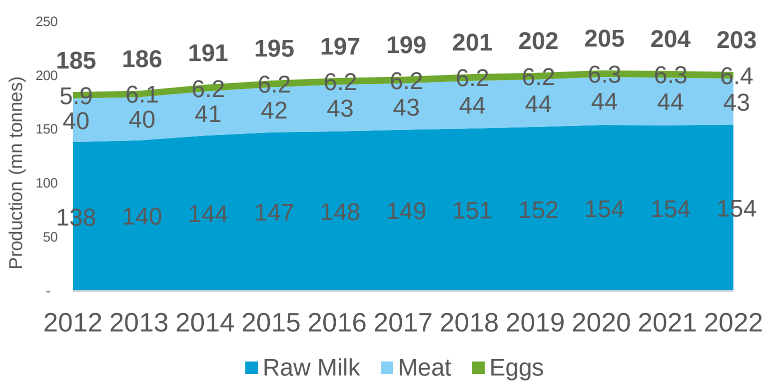


Source: Eurostat Database, Farrelly Mitchell Research

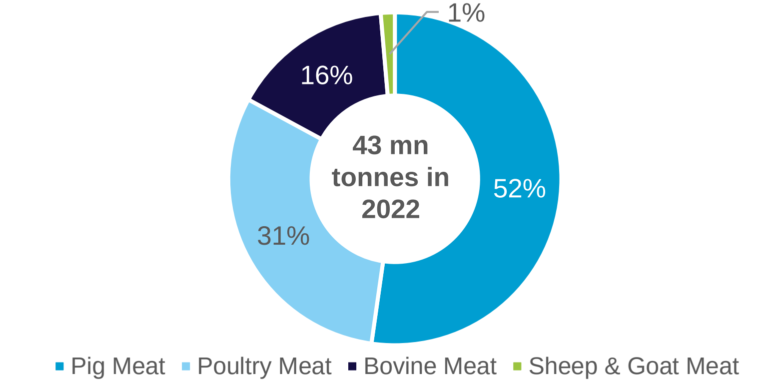
EU Animal Products Production

Production reached 203 mn tonnes in 2022 (1% CAGR), with raw milk accounting for 76% of the total produced

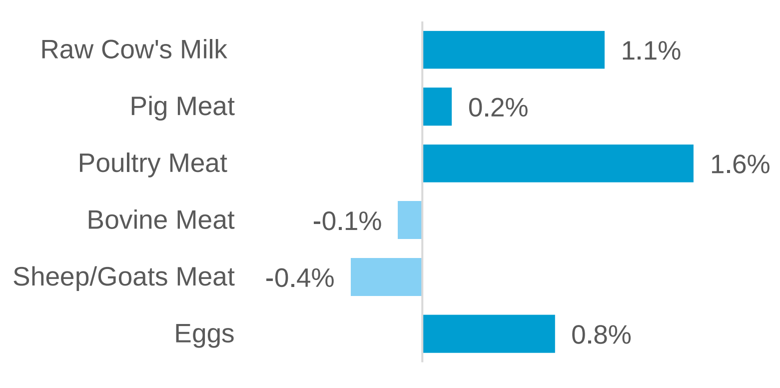
EU Animal Products Production 2012-2022 (mn tonne)



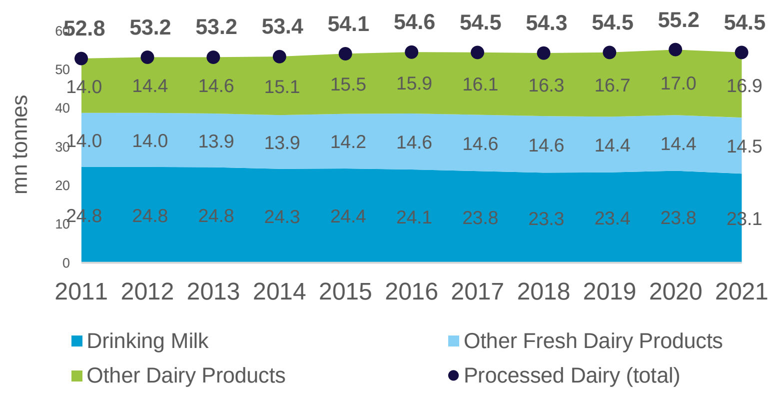
Breakdown of Meat Production by Type 2022 (%)



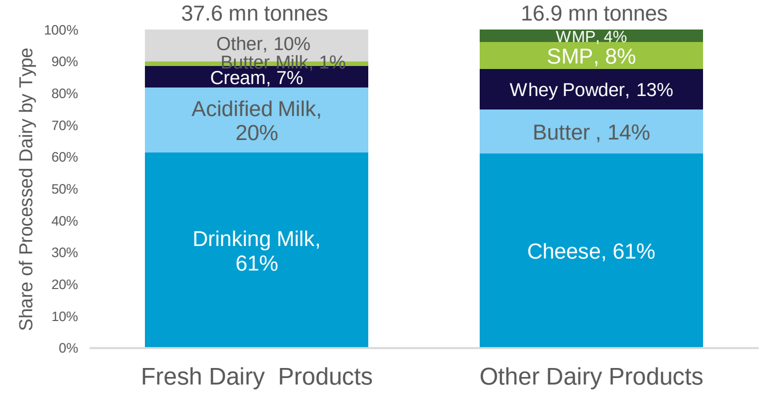
Volume Output Change by Product (2012-2022 % CARC)



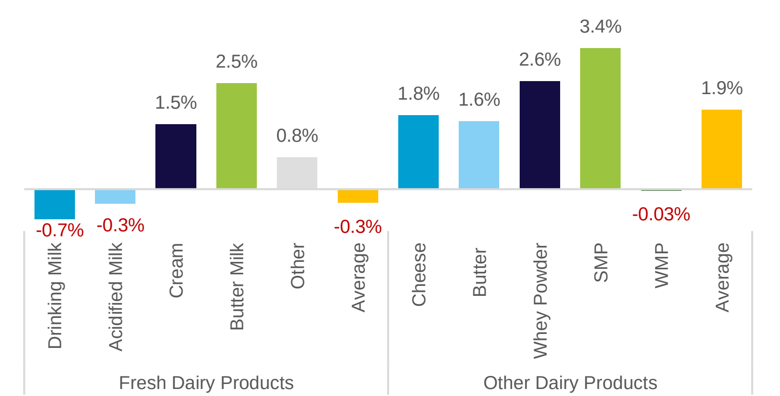
Processed Dairy Production by Type 2011-2021 (mn tonnes)



Breakdown of Processed Dairy by Type 2022 (%)



Volume Output Change by Dairy Product (CARC: 2011-2021)



[1] WMP = Whole Milk Powder; SMP = Skimmed Milk Powder

Source: Eurostat Database, Farrelly Mitchell Research

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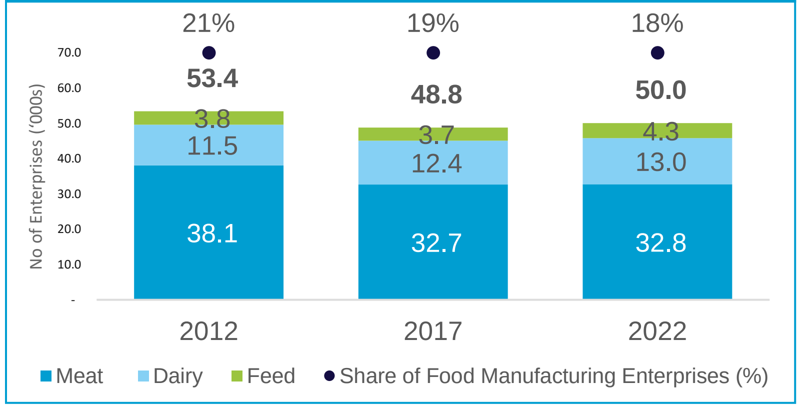
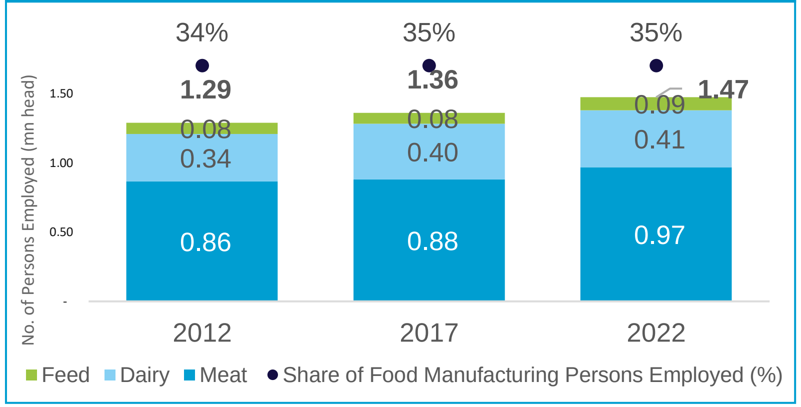
EU Feed & Animal Product Manufacturing: Key Economic Indicators[1]

These sectors' output reached €441 bn in 2022. They account for 40% of EU food manufacturing's value add

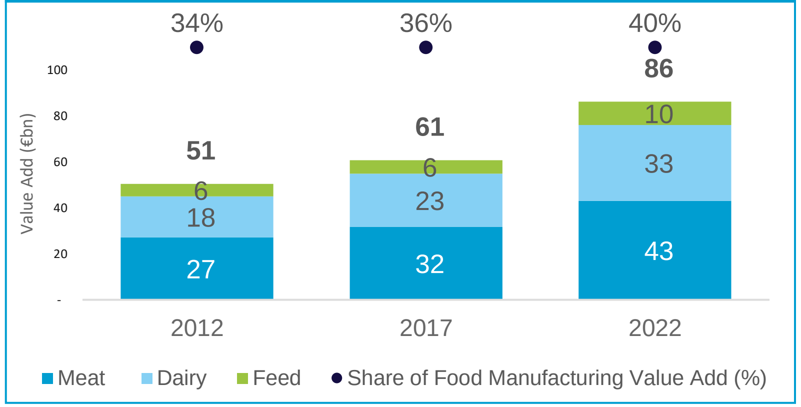
No. of Enterprise by Sector 2012-2022 ('000s)



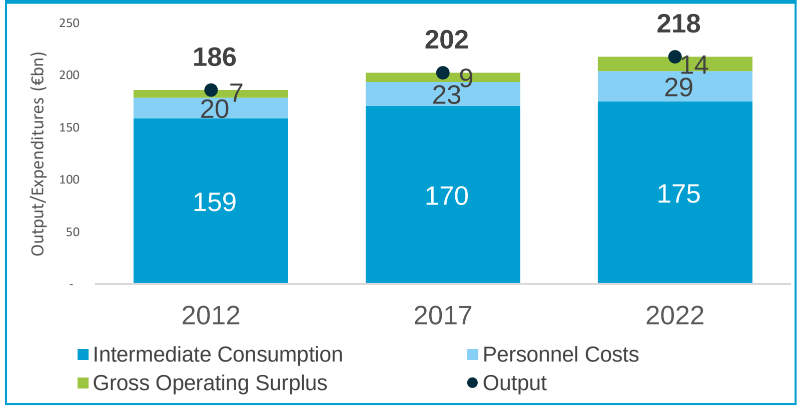
No. of Persons Employed by Sector 2012-2022 (mn people)



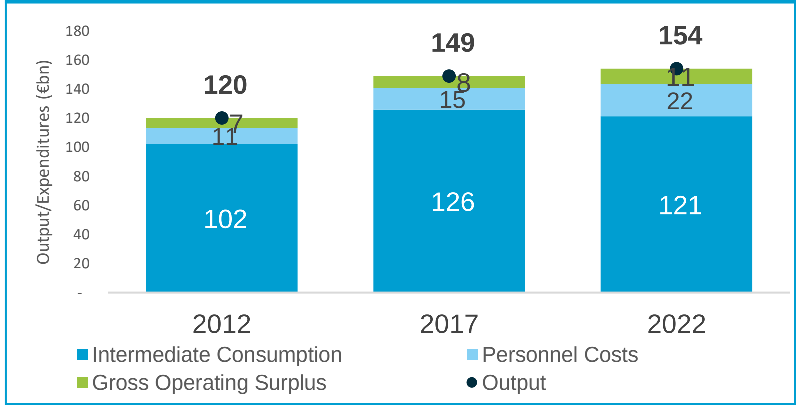
Value Add by Sector 2012-2022 (€ bn)



Meat Manufacturing Output & Current Expenditures (€bn)



Dairy Manufacturing Output & Current Expenditures (€bn)



Feed Manufacturing Output & Current Expenditures (€bn)

[1]. At the time of writing, published data for feed manufacturing in 2022 is not available. The feed manufacturing data provided here for 2022 is estimated by Farrelly Mitchell

Source: Eurostat Database, Farrelly Mitchell Research

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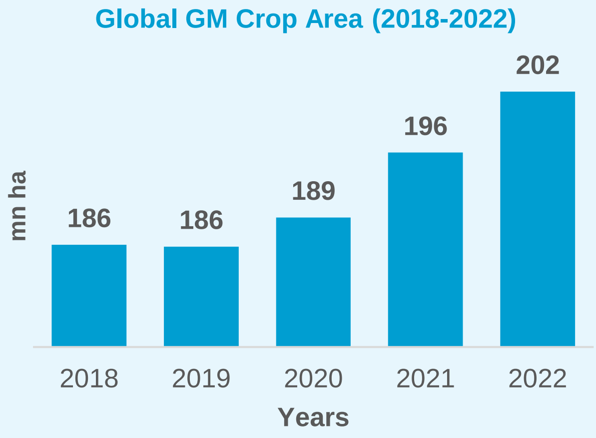
SECTION D

ASSESSMENT OF PRODUCTION IN KEY SUPPLIER COUNTRIES

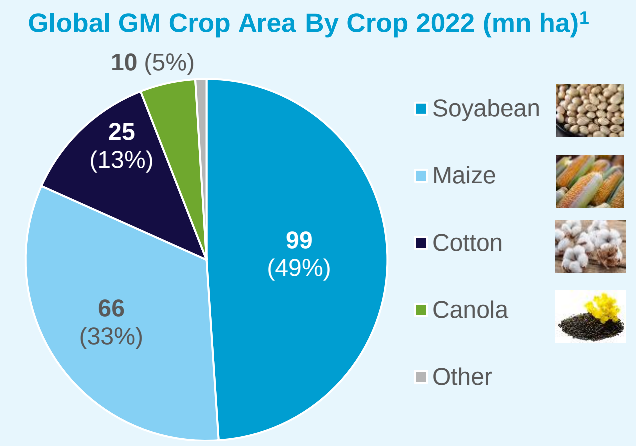
Global Overview: GM Crop Production

Global area of GMO crops planted has increased steadily in the last five years with soyabean accounting for 49% of total area

Introduction

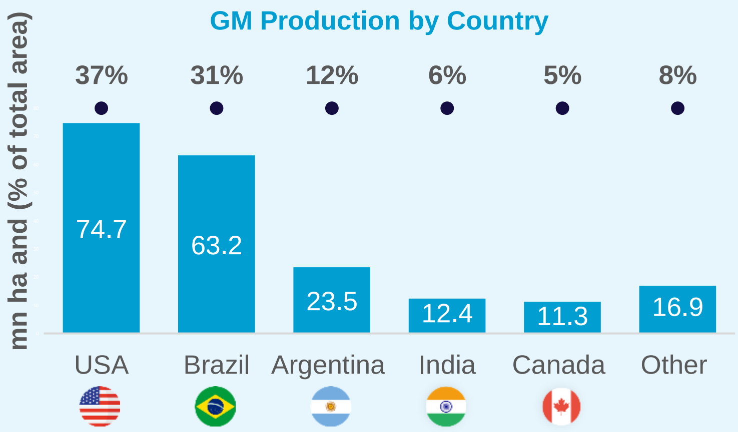


- In 2022 the global area under GM crops was 202 million hectares (mn ha). This accounts for approximately 19% of total global arable land (1,038 mn ha).
- The area under GM crops increased 2.6% in 2022 compared to 2021. The long terms growth rate of production areas was 2.7% (CAGR) over the period 2012-2022.
- Production is concentrated in a small number of countries (27) who cultivate a range of 11 different GM crops.

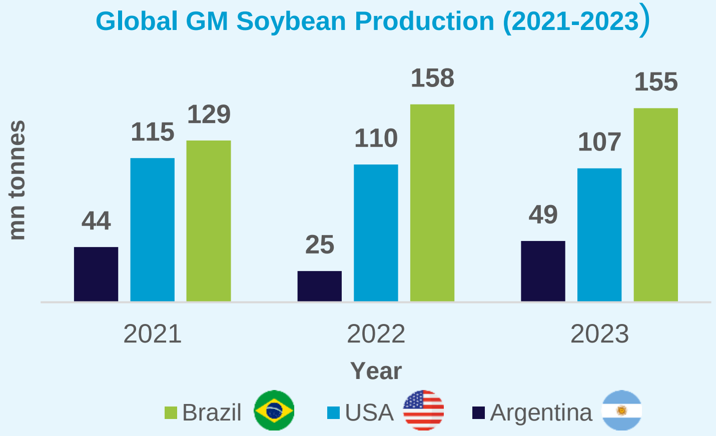


- Soyabean is the most widely planted GM crop at 98.9 Mha or 49% of total area.
- This is a breakdown of global GM crop area for 2022. Maize and cotton are the most important GM crops after soybeans.
- Growth in the area under GM maize and cottonseed, at 3.3% and 7.9% outpaced growth in GM soyabean are in 2022 (compared to 2021).

Production Area by Country



- The USA, Brazil and Argentina have the largest land areas under GM cultivation.
- The USA's GM crop area is dominated by soyabean (33.6 Mha) and maize (33.3).
- The same can be seen for Brazil and Argentina, with soyabean and maize accounting for almost 100% of GM land area.



- Brazil, the U.S and Argentina account for over 90% of global GM production of soybean.
- GM soybean accounts for 99% of total soybean produced in Brazil and Argentina and 95% in the U.S.

[1] Other includes alfalfa (1.1 mn ha), sugar beet (0.5 mn ha), sugarcane (0.1 mn ha), Wheat (0.1 mn ha), brinjal (0.03 mn ha) and rice (0.02 mn ha).
[2] Other is a contribution of Paraguay (3.7 Mha), South Africa (3.2 Mha), China (2.9%), Pakistan (1.7 Mha), Austalia (1.5 Mha).
[3] 27 EU member states are included in 52 total countries that authorise the importation of GMO soyabean.
There are several facilitating factors that contribute to the uptake pathways of GM crops. They include economic (improved yield and crop quality),political (government pressure and influence of associations and co-ops and cultural (increase in prevalence of GM crops globally).

Source: USDA, AgBio Investor, Farrelly Mitchell Research

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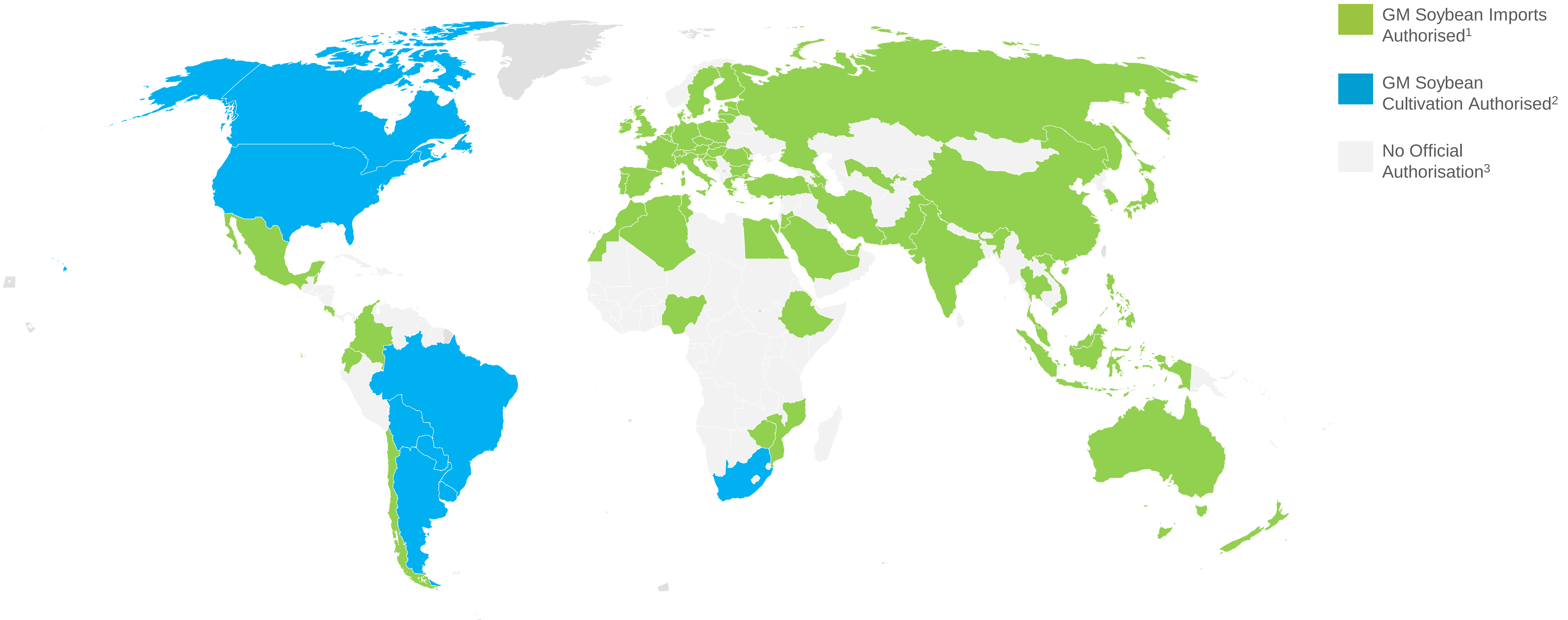
Countries That Grow and Import GM Soybean

China is by far the largest import market for uncrushed GM soybean accounting for over 60% of the global market



[1] 8 countries have authorised the production of GM soybean (Argentina, Bolivia, Brazil, Canada, Paraguay, South Africa, United States and Uruguay).
[2] 65 countries have officially authorised the importation of GM soybean (this includes the 8 producing countries above and the 27 EU member countries).
[3] Another 75 countries have not officially authorised the importation of GM soybean. However, based on trade data, it is most likely that they import GM soybean. This might be for a variety of reasons including the absence of regulation or due to illicit trade.

Source: FAOSTAT, ISAAA, GEAC, AgBio Investor, Farrelly Mitchell Research

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Supplier Challenges In Segregating GM and Non-GM Crops

Cross contamination, traceability and adequate education and skill training are the major supply chain challenges associated with producing and processing GMO and non-GMO crops

CHALLENGE		IMPLICATIONS: Import restrictions or ban:	Possible farmer reaction:	Impact on export market:
• Achieving 100% segregation is challenging due to the potential for cross-contamination during various stages of production, storage, and transportation. • In the EU the threshold for unapproved GMOs in feed is 0.1%.	**Cross Contamination**	• Mixing can compromise the integrity and trust of non-GMO crops resulting in market rejection or legal repercussions for the exporter. • Substituting GM soy with non-GM soy would lead to an increase in feed costs e.g. stakeholder research indicates that a ban would lead to compound feed costs increasing by more than 10% for the EU livestock sector.[1]	• Farmers could face reduced export market access for GM crops turning to non-GM cultivation. • Shifting to non-GM crop production takes several planting seasons .	• An EU ban on GM soybean would likely result in decline in the price of GM soybeans and an increase in non-GM soybeans • Cross contamination could lead to integrity issues with non-GM supply and negatively impact non-GM prices in the international market supply (due to bans or embargos).
• Establishing and maintaining traceability of GM and non-GM crops throughout the supply chain requires comprehensive documentation and integrated tracking systems.	**Traceability and Documentation**	• A significant cost and administrative burden to ensure accurate labeling and documentation to ensures regulatory requirements are met and increase transparency of supply. • Lack of traceability and documentation may prompt regulatory bodies of importing countries to implement stricter measures to ensure the accurate labeling and segregation of GM and non-GM crops.	• Farmers in developing countries may need to invest or seek funding for record keeping systems. This may reduce profit returns and make growing a more complexed process.	• Investments in barcoding, RFID, and blockchain could help improve crop traceability. • Suppliers who adopt best practice may be able to achieve premium prices for exports and access a larger market
• Both farmers and supply chain personnel (e.g. in transportation and processing facilities) need specialised training to understand and implement the protocols for segregating GM and non-GM crops effectively.	**Educational and Training Needs**	• Insufficient training can lead to errors when producing or processing, heightening the risk of cross-contamination. This could result in penalties and import bans of crops.	• Training programmes and agricultural extension services should be made available to farmers and supply chain actors on good practices in crop segregation.	• More skilled producers and processors of GMO and non-GMO crops reduce operational waste and lower the probability of cross contamination. • Quality assured crops may attract a higher price on the global market.

[1] Estimated in a submission to the EU by FEFAC, FEDIOL and COCERAL to the EU commission

Source: IFOAM EU Group, Farrelly Mitchell Research

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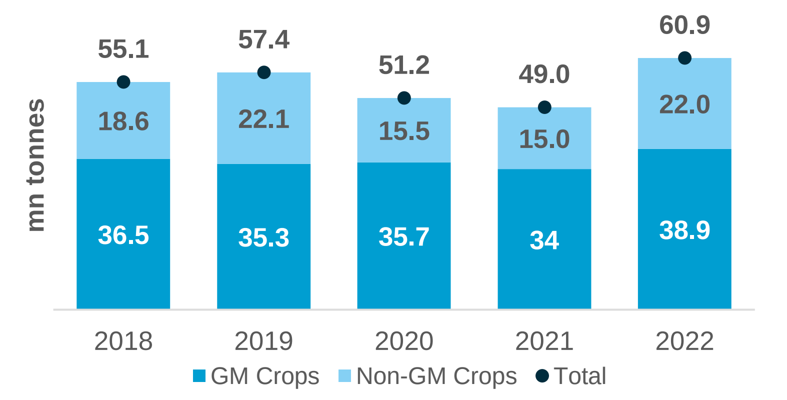
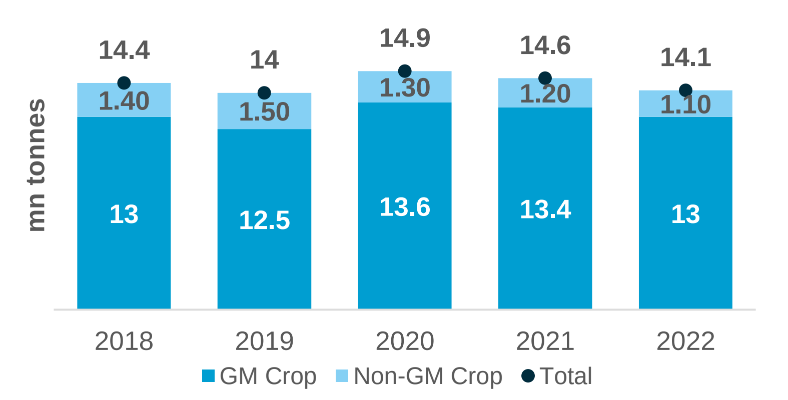
EU GM Crop Imports (1/2)

Soybean and soybean cake account +70% of the EU's 39 mn tonnes of GM feed commodity imports

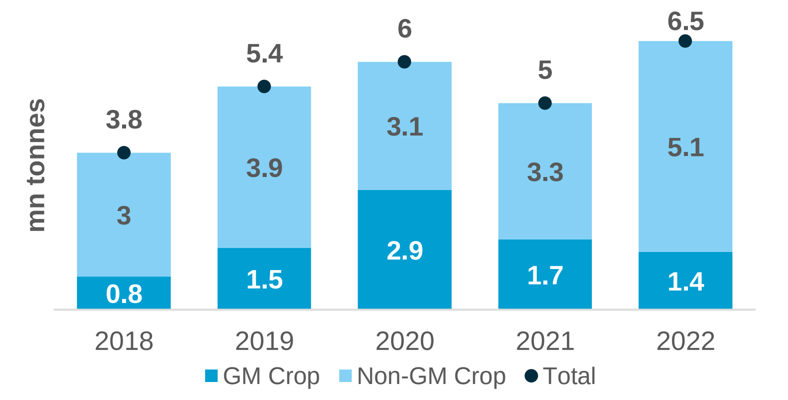
EU GM vs Non-GM Imports (All Authorized Crops) 2018-22[1]



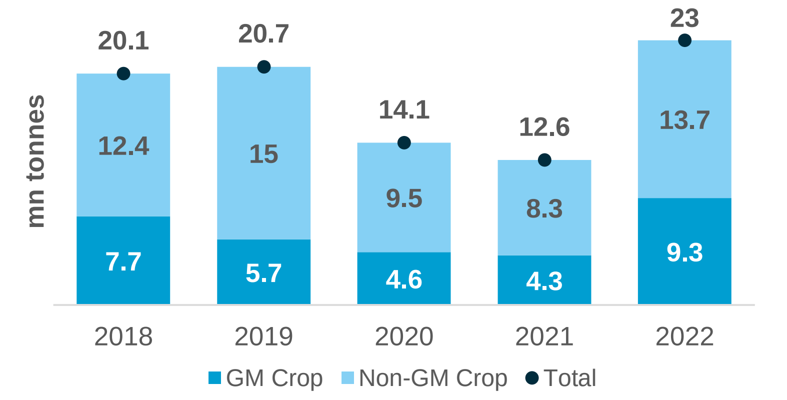
EU GM Vs. Non-GM Uncrushed Soybean Imports 2018-2022



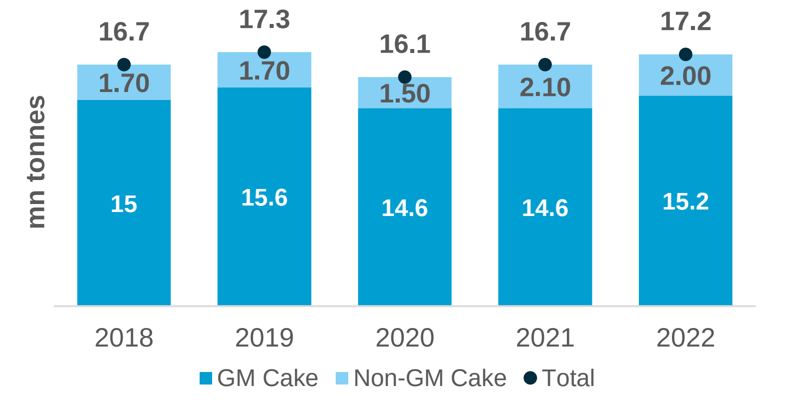
EU GM Vs. Non-GM Uncrushed Rapeseed Imports 2018-22



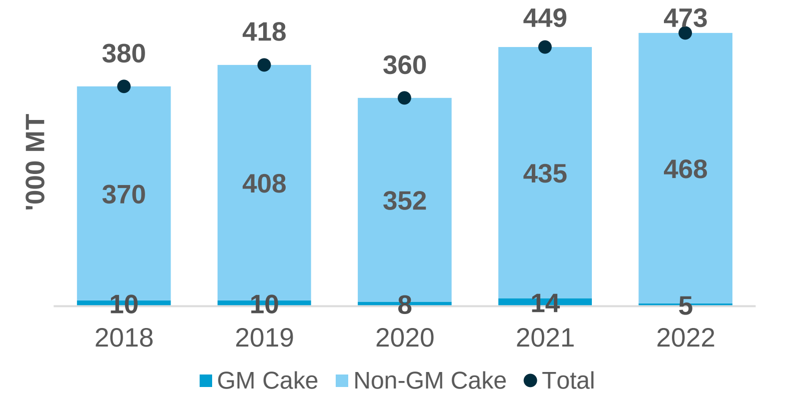
Maize Imports Into The EU: Total vs GMO 2018-2022



EU GM Vs. Non-GM Soybean Cake Imports 2018-2022



EU GM Vs. Non-GM Rapeseed Cake Imports 2018-2022



[1] Includes maize, soybean, rapeseed and soybean and rapeseed cake. EU imports of other GM crops by the feed industry is limited.

Source: USDA, FAOSTAT, AgBio Investor, ISAAA, GEAC, Farrelly Mitchell Research

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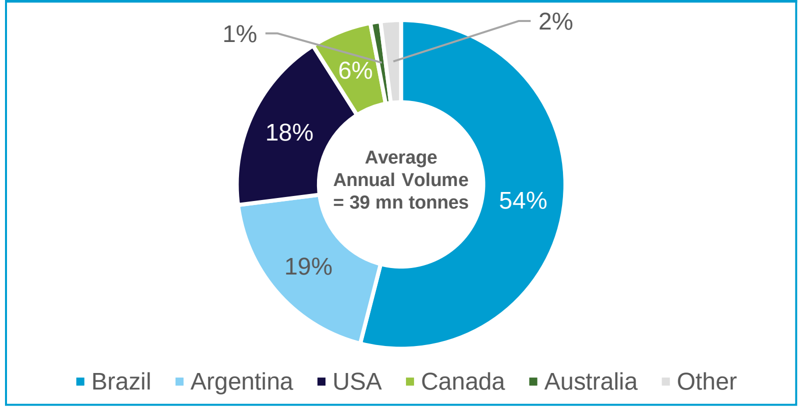
Return to Executive Summary

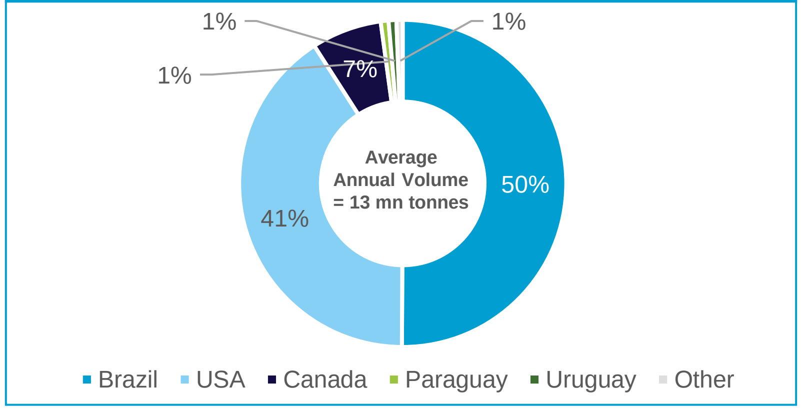
EU GM Crop Imports (2/2)[1]

Brazil, Argentina and USA supply more than +90% of both GM feed crops and GM soybean and soybean cake

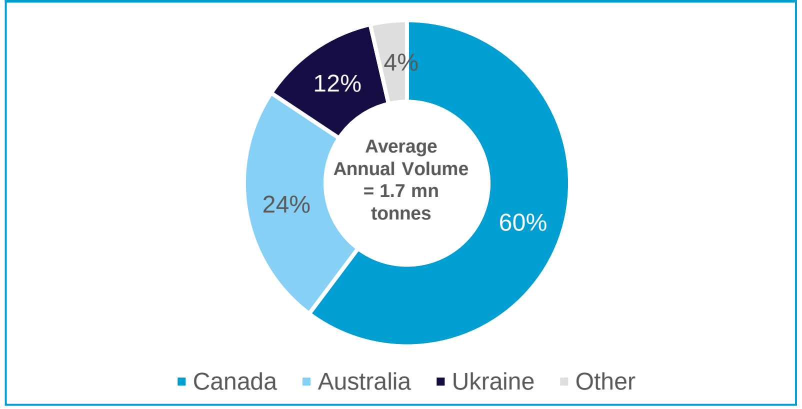
Average EU GM Feed Crop Imports by Origin Country



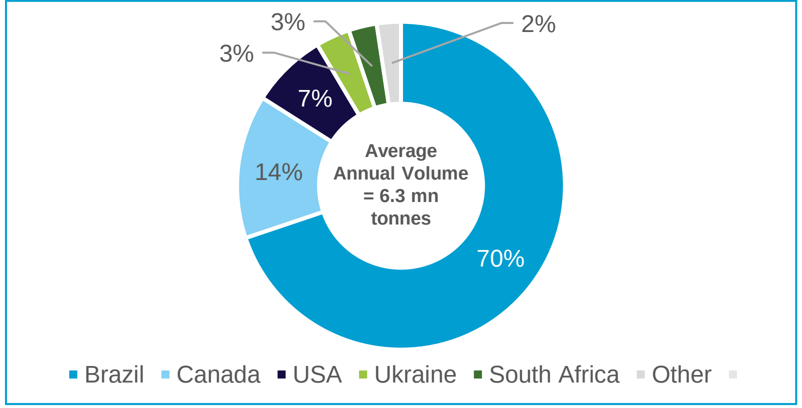
Average EU GM Soybean Imports by Origin Country



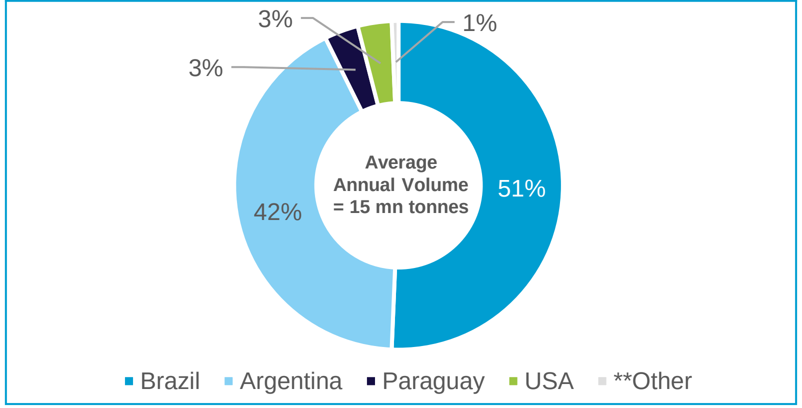
Average EU GM Rapeseed Imports by Origin Country



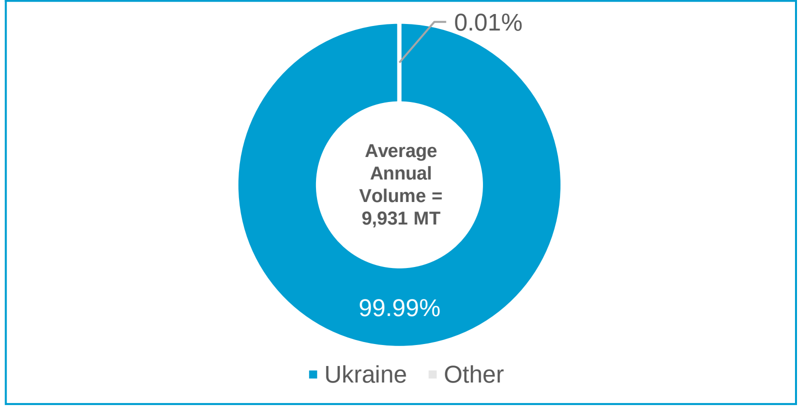
Average EU GM Maize Crop Imports by Origin Country



Average EU GMO Soybean Cake Imports by Origin Country



Average EU GM Rapeseed Cake Imports by Origin Country



[1] Average Annual import volumes over the period 2018-2022.

Source: USDA, FAOSTAT, ISAAA, and Farrelly Mitchell Research

Key GM Soybean Suppliers: Brazil

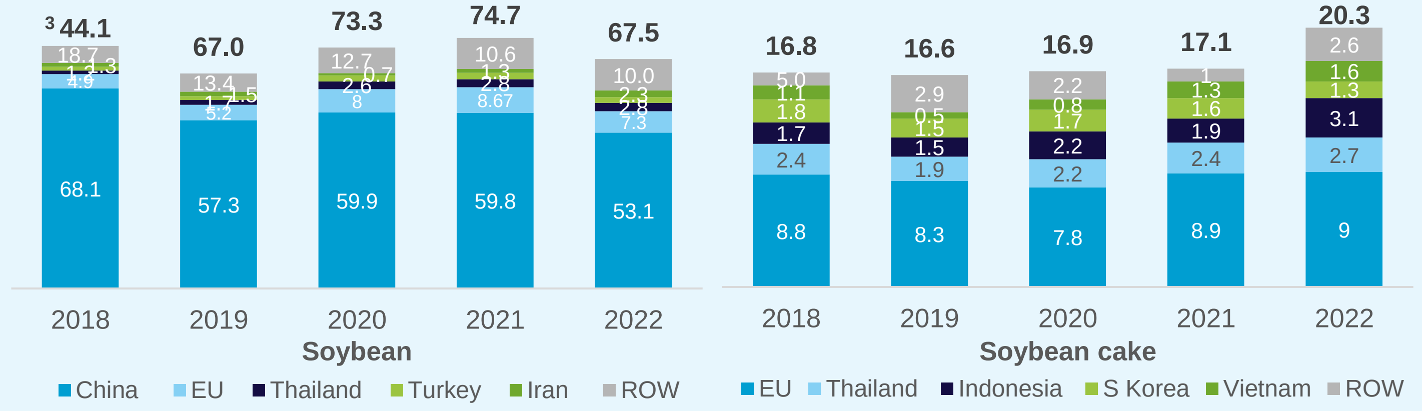
The EU is the second largest import market of Brazilian GM soybean and the largest importer of GM soybean cake

Overview and Soybean and Cake Exports

Overview :

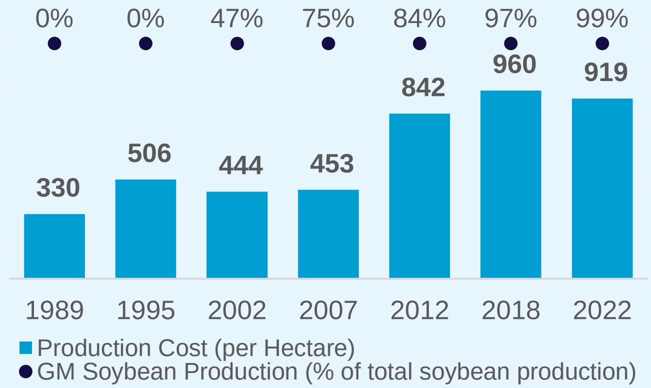
- Brazil is the largest producer of GM soybean in the world. In 2023[1] Brazil grew 155 million tonnes of GM soybean. Like the USA, Brazil mainly adopts soybean seeds varieties that possess herbicide tolerance, primarily glyphosate.
- In recent years non-GM soybean production has increased, driven by higher GM seed costs (and rising production costs in general), the increasing availability of new non-GM seed varieties which have closed the technology gap between GM and Non-GM and the availability of price premiums for non-GM soybean on international markets.
- In 2023/2024, it is expected that Brazil will produce c4 mb tons of non-GMO beans, almost twice the volume harvested last year was harvested.

GM Soybean & Soybean Cake Exports by Destination 2018-2022 (mn tonnes)[2]



GM Soybean Cost of Production, Challenges and New Technology

Evolution of Production Costs 1989-2022 (USD)



- Brazil introduced GM soybean in 1998.
- Brazilian cost of production per acre was 20% lower than US on average for 2021/2022. Largely because of lower land and capital costs in Brazil.
- Production cost per hectare increased at 4.2% CAGR over to 1999-2022 compared to a 3.9%% increase in the US over the same period.
- While seed costs tripled and fertilizer and chemical cost more than doubled, there was no significant change in their proportion shares of overall production costs.

Challenges in the Brazil Soybean Production:

- **Mass Deforestation and biodiversity loss:** The constant expansion of soybean harvesting area has led to deforestation and loss of biodiversity. In 2022, it is estimated that soy fed cattle farming led to the deforestation of 9,494 km² of vegetation. Between 2008 and 2019, one-fifth of the total deforestation in Brazil took place in soy farms.
- **Export market heavily reliant on China:** Like the US the Brazilain export GM soybean market is hugely reliant the Chinese market. Trade disputes or political decisions could leave the Brazil exposed. In 2022 Brazil exported 68 mn tonnes of GM soybean to China which accounts for over 85% of total uncrushed soybean exports.

NEW Technology:

- Between 10% to 15% of Brazil's soybean area will be sowed with Bayer's genetically modified biotech seed Intacta2 Xtend in the 2023/24 season.

[1] Brazil produced 158 and 129 million tonnes in 2022 and 2021, respectively. 99% of all soybean grown in Brazil are GM.
[2] The data in the graph illustrates Brazilian exports for GM soybean and cake from 2018 to 2022. The graph also illustrates the top 5 import markets for the Brazil (2018-2022).
[3] "Intacta2 Xtend" seed is designed with traits to strengthen resistance to the main caterpillars that attack the crop, such as Helicoverpa and Spodoptera, and the major glyphosate and dicamba herbicides.

Source: FAOSTAT, USDA, Farrelly Mitchell Research

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Non GM Production & Segregation: Brazil

Bulk supply of GM soy to the EU may require investment in improving the effectiveness of existing certification systems

Overview

- In Brazil, there are established systems for segregating genetically modified (GM) soybeans from non-GM soybeans. .
- Brazil has implemented certification schemes and labeling requirements to differentiate between GM and non-GM soybeans. These systems aim to track the production, processing, and distribution of non-GMO soybeans from cultivation through to export.
- However, their effectiveness is influenced by various challenges and limitations which could hinder Brazil's ability to switch a portion of its production to non-GM and supply the EU without major hiccups.

Market Dynamics

Brazilian growers are highly responsive to changes in soybean prices. Skyrocketing premiums for Non-GM soybean the previous season led to a significant increase in Brazil production in the 2022/2023 season, production is estimated to have doubled to c4 mn tonnes of in 2022/2023 with approx. 75% of this traceable.

However, orders from the EU, est. at **1.7 mn tonnes**, were significantly below production, leading to a decline in prices with Brazilian non-GM production expected to decline by a third in the 2023/2024 season.

Surpluses of non-GMO soybeans poses a challenge for producers, with erratic demand causing price fluctuations and production disruptions. Thus, suppliers must manage this surplus while ensuring segregation to meet market demands without impacting prices or market stability. Brazilian farmers are likely to maintain Non-GM soy production only with the following market conditons:

- A strong long-term commitments on the side of buyers to source from Brazil;
- Stable and fair premiums;
- Increased transparency in the sector; and
- Clear communication between the partners.

Traceability Challenges

- New measures such as the EU's legislation deforestation free products are increasing pressure to meet buyer requirement.
- This burden along with production surpluses are leading to more farmers selling their production outside of the non-GM chain. This can undermine prices and, when non-GMO soybeans are sold along with non-traceable product through markets without certified traceability schemes (e.g. Brazil's recent diversion to the Chicago market), compromises applied traceability standards. This diversion can raise uncertainties about the origin and production practices of non-GMO crops, underscoring the difficulty in ensuring traceability outside of certified schemes.

Logistical Challenges

- Despite efforts to establish segregation systems, challenges exist in maintaining strict segregation throughout the supply chain. The widespread cultivation of GM soybeans in Brazil makes it difficult to prevent cross-contamination during transportation, storage, and handling.

Source: ENGA, Donau Soja, & Proterra. (2024). Report Farrelly Mitchell Research

Key GM Soybean Suppliers: USA

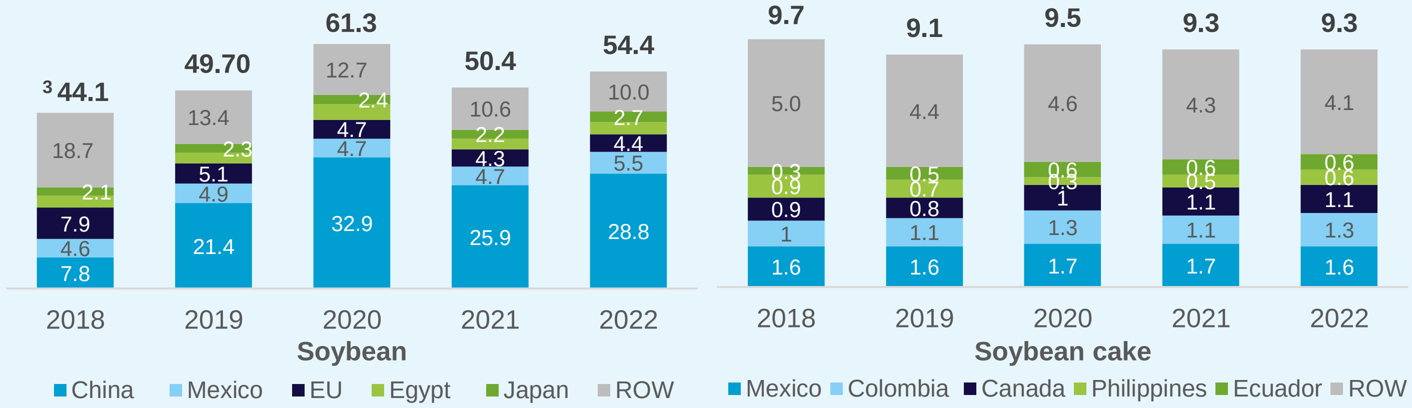
The US is the second largest exports of GM soybean globally and sent 2.6 billion USD worth of GM soybean to the EU in 2022

Overview and Soybean and Cake Exports

Overview :

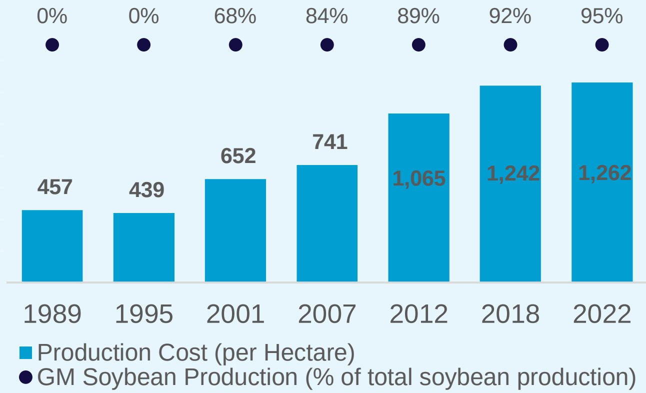
- The US is the second largest producer of GM soybean globally. In 2023, the US produced 107 mn tonnes[1] of GM soybean.
- Over 70% GM soy grown is used for animal feed predominantly poultry and livestock and 5% is utilised as soybean oil (biodiesel).
- The remaining 25% of production is used as ingredients for human consumption (lecithin, emulsifiers, and proteins) in processed foods.
- Almost all GM varieties possess only herbicide tolerance. Primarily glyphosate but also herbicides such as glufosinate, and dicamba.
- Glyphosate-tolerant varieties allow farmers to apply glyphosate to kill weeds without harming the soybean plant.

GM Soybean & Soybean Cake Exports by Destination 2018-2022 (mn tonnes)[2]



GM Soybean Cost of Production, Challenges and New Technology

Evolution of Production Costs 1989-2022 (USD)



- The US authorised the cultivation of GM soybean in 1996. Since then, GM soybean has become widespread (95% of all soybean grown in the US).
- This contributed to increased yields but also increased costs per ha.
- Production costs increased by 187% between 1995 and 2022.
- The biggest cost increases were for capital recovery of machinery and equipment.
- Seed costs tripled and fertilizer and chemical costs more than doubled but there was no significant change in their proportion shares of overall production costs.

Challenges in the US supply chain:

- **Weed resistance**: Over time, populations of some weed species have evolved a resistance to glyphosate.
- This has led to the use of different herbicides to treat weeds in soybean fields, as a result new soybean seed types resistant to these herbicides, such as dicamba have also increased.
- **Export market heavily reliant on China:** The US export GM soybean market is hugely reliant the Chinese market. They import 5 times the quantity of soybean compared to the 2nd largest Mexico. Trade disputes or political decisions could leave the US export market exposed.

NEW Technology:

- **Gene editing ([4]CRISPR):** This new technology could potentially replace transgenics. Scientists can modify the existing genetic structure of the targeted organism. This method is described as easier, more efficient way to modify soybeans to have the qualities that can benefit farmers and the general population.

[1] Total soybean production in 2023 was 113 million tonnes with GM accounting for 95% (113 * 95% = 107 million tonnes).
[2] The data in the graph illustrates US exports for GM soybean and cake from 2018 to 2022. The graph also illustrates the top 5 import markets for the US (2018-2022).
[3] Total export quantity.
[4] CRISPR- Clustered Regularly Interspaced Short Palindromic Repeats.

Source: FAOSTAT, USDA and Farrelly Mitchell Research

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Non-GM Production & Segregation: United States

Robust traceability systems play a vital role in upholding the integrity of non-GMO soybeans in the US market

Overview

- In the U.S., segregation of GM and non-GM soy involves regulatory oversight by agencies like the USDA, FDA, and EPA, along with industry IP programs, certification initiatives such as the Non-GMO Project, supply chain management practices such, testing protocols, and voluntary labeling efforts. However, there are several challenges related to the strict segregation of GMO and non-GMO crops in the United States.

Market Dynamics

- The area planted with non-GM soybean has been in decline over recent years (down 22% since 2017). Non-GMO growers planted approximately 1.70 mn hectares in 2023, compared to 1.78 mn hectares in 2022.
- In 2023, non-GMO growers planted approximately 50,605 acres out of a base of 99,243 acres, accounting for **51% of total planted acres.**
- In **2022, 44%** of soybeans planted were non-GMO feed-grade, increasing to **47% in 2023**, but have now decreased to **36% in 2024**.

Factors Contributing to Declining Non-GMO Soy Production

1. **Commodity Prices**: High commodity soybean prices have been a key factor contributing to the decline in non-GMO soy production as premiums don't track parallel to soybeans prices (e.g. substantial increases in soybean commodity prices in 2021 and 2022 (+48% and +18%) were not reflected in non-GM soybean prices (+4% and +13%).
2. **Yield Lag and Premium Levels**: Farmers perceive a yield lag compared to GM soybean and insufficient premium levels discouraging non-GMO soybean cultivation.
3. **Agronomic Challenges:** Yield and weed control issues further deter farmers from cultivating non-GM soybeans.
4. **Disruptions in Shipping and Freight Costs:** Issues with shipping and freight costs also impact non-GMO soy production.

Due to lower premiums, few purchasers of non-GMO soybeans opt for non-GMO feed-grade soybeans, with only **28%** purchasing them, and less than half of those are identity preserved **(44%)**. All non-GMO feed-grade soybeans purchased are exported outside of the US

Contracting Challenges

In the USA, most non-GMO soybeans are acquired through contracts, but recent spikes in soybean futures prices have posed challenges. The rise in futures prices, alongside high basis levels and reduced demand due to economic factors, has made it increasingly difficult to secure contracts for non-GMO soybeans

Supply Chain Management

Despite the implementation of identity preservation (IP) programs and certification/verification programs, ensuring the strict segregation of GMO and non-GMO crops throughout the supply chain requires rigorous documentation, testing, and physical segregation. Any lapses in these systems could lead to contamination and compromise the integrity of non-GMO products.

International Trade Considerations

Exporters in the USA face challenges aligning with diverse regulatory standards and consumer preferences regarding GMO and non-GMO commodities in various international markets. This highlights the necessity for stringent testing and sampling procedures to guarantee that non-GMO crops designated for export comply with the strict regulations, especially in light of the new EU law addressing deforestation concerns.

Source: USSEC. (2022), Farrelly Mitchell Research

Key GM Soybean Suppliers: Argentina

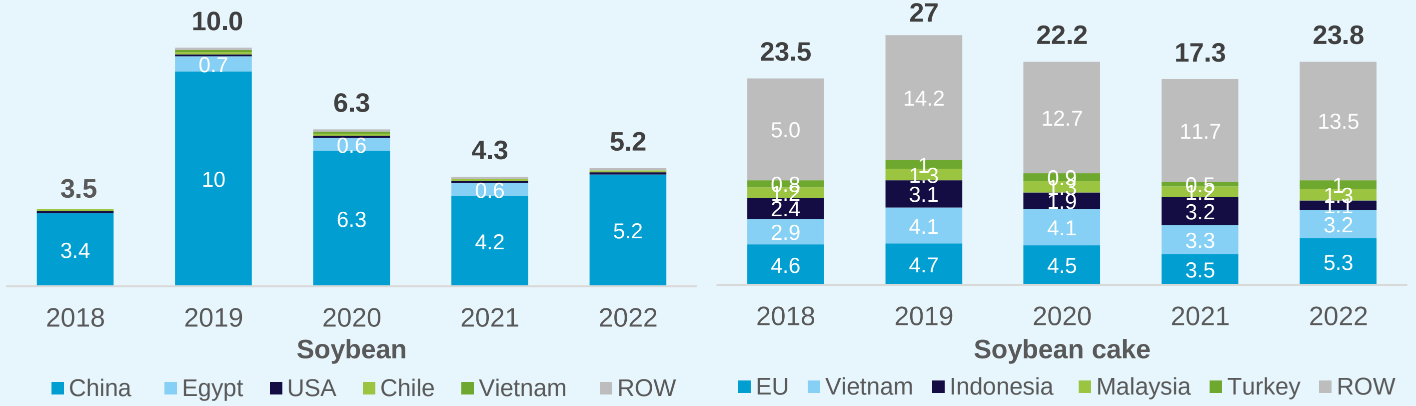
The EU is the largest import market for Argentinian GM soybean cake. In 2022 4.6 million tonnes of cake was exported to the EU

Overview and Soybean and Cake Exports

Overview :

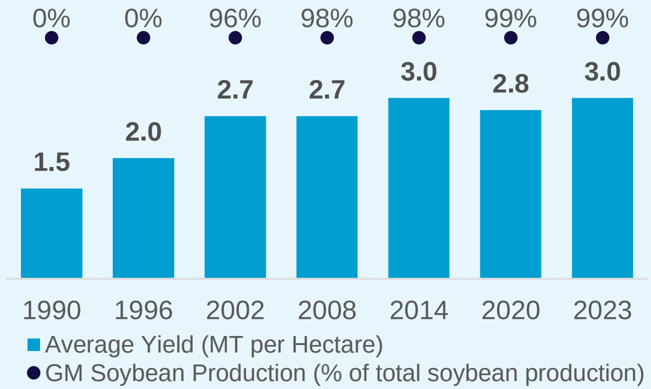
- Argentina is the third largest producer of GM soybean in the world. In 2023, it produced 49 million tonnes of GM soybean.
- All GM varieties possess herbicide tolerance. Primarily glyphosate but also herbicides such as glufosinate, and dicamba similar to the US and Brazil.
- Approx. 16% of soybeans are exported as whole uncrushed beans while the remaining 84% are crushed and mostly exported as meal or oil. Around 12% of soybean meal is consumed by the domestic feed sector

GM Soybean & Soybean Cake Exports by Destination 2018-2022 (mn tonnes)[2]



GM Soybean Cost of Production, Challenges and New Technology

Evolution of Yield per Hectare 1990-2022 (USD)



- The increase in the adoption of GM soybean across Argentina has led to an increase in yield per ha.
- From 1990 (0% GM soybean) to 2023 (99% GM soybean) yield per ha has doubled from 1.5 t/ha to 3.0 t/ha.

Challenges in the US supply chain:

- **Mass Deforestation and soil degradation:** Like Brazil, Argentina' ever expanding soybean sector has had negative consequences in terms of deforestation (ablet to a signicantly lesser extent). From 2012-2016, 277,000 ha of forest area was lost with soybean area expansion being a major contributor.
- **High inflation and tax affecting soybean export price and quantities:** [4]In 2022 inflation rose to over 100% and government taxes of 33% were placed on soybean. These factors, along with a prolonged drought and early frost, contributed to a sharp decline in production in 2022. Argentina had it lowest soybean and meal export volumes since 1996.

NEW Technology:

- **Stacked Gene:** Argentina is the worlds second largest adopter to Brazil of stacked gene tech. for soybean [3]. This hybrid plant expresses both insect resistance and herbicide tolerance genes derived from two parent plants. This makes the plant more robust and decreases potential yield losses because of pests and diseases

[1] Like Brazil and the US soybean production is dominated by GM seed varieties with 99% of all soybean being genetically altered.
[2] The data in the graph illustrates Argentina's exports for GM soybean and cake from 2018 to 2022. The graph also illustrates the top 5 import markets for the Argentina (2018-2022).
[3] Gene stacking refers to the process of combining two or more genes of interest into a single plant.
[4] In 2022/2023 Argentina exported 1 million tonnes of whole soybean which was the lowest quantity since 1996.

Source: FAOSTAT, Farrelly Mitchell Research

Non-GM Production & Segregation: Argentina

Established systems for segregating in place but would need systematic investment for expanded non-GM exports

Overview

- Argentina has established systems for segregating genetically modified (GM) and non-GM soybeans, although not as comprehensive as in some other nations.
- Various certification schemes (including Book & Claim, Area Mass Balance, Mass Balance, and Identity Preserved), are employed to ensure the segregation.
- These systems are essential for meeting the demands of buyers that prefer non-GM products, particularly in regions such as Europe and Asia.
- Measures employed include certified non-GM seed production, field management practices to prevent cross-contamination, careful harvesting and transportation practices, dedicated storage and processing facilities, and robust traceability and documentation systems.
- While efforts have been made to strengthen these systems in recent years, ongoing improvements are needed to ensure compliance throughout the supply chain.
- While Argentina has the agricultural capacity to produce non-GMO soybeans and potentially supply the EU, several factors complicate this transition.

Market Demand and Price Differentials

- Approx. 99% of soybean production is GM. Demand for non-GM soybeans is driven by consumer preferences, especially in regions like the EU.
- However, despite the higher selling price of non-GM soybeans, their adoption remains limited to a small group of passionate producers.
- Non-GMO soybeans require more intricate management, increasing production costs such as labor and input costs.
- Farmers must carefully weigh the potential benefits of higher prices against the increased production costs associated with non-GM soybeans. The government does not provide incentives to offset higher production costs.
- While there is potential for increased profitability, the fluctuating price premium may not always provide sufficient incentive for farmers to switch from genetically modified to non-GM

Investment

A large-scale transition to non-GM soybean production for the EU market would necessitate sufficient investment in infrastructure in Argentina and an expanded certification programme. Additionally, Argentina may need to invest in upgrading storage, transportation, and processing facilities to handle non-GMO soybeans separately and prevent cross-contamination with GM varieties

Regulatory Compliance

Ensuring compliance with EU market needs would be complicated by the high volumes of soybeans imported from other GM producers and processed for export by Argentina. A pivot to non-GM supply would require buy-in and cooperation with Argentina's internation partners. Argentina would need to ensure compliance across the supply chain. This involves maintaining detailed records of production practices, verifying GM and deforestation-free status, and obtaining necessary certifications to demonstrate compliance. Regulatory compliance adds administrative burdens and costs to the production and export process.

Government Support and Policy

The lack of explicit government support or policy favoring non-GMO soybean production hinders production in Argentina. Without incentives or subsidies to offset the higher production costs of non-GMO varieties, farmers are reluctant to make the switch.

Source: Farrelly Mitchell Research

SECTION E

GLOBAL AVAILABILITY & PRICE DYNAMICS

Section Overview (1/2)

A review of global dynamics and the production and availability of the alternative oilseeds and pulse feed crops

Overview

- This section of the report reviews global feed market dynamics and production, trade and availability of the key oilseeds and pulse crops that can be used as alternatives for to soybean in animal production.
- The various crop-based alternatives to soybean meal are often more expensive or have lower protein content and yields. This highlights the challenges of finding comparable substitutes for soybean meal for utilisation in the feed and livestock industries.
- In terms of global availability of alternative oilseed meals and pulses, less than 38 mn tonnes are traded internationally outside of the EU.1 Pulses (48%), rapeseed cake (21%) and pam kernel cake (18%) account for a combined 87% of this availability.
- Primary production within the EU is also limited (c 46 mn tonnes). Rapeseed (42%), Olives (22%) and sunflower (20%) account for 84% of EU production. Pulses accounted for an additional 15% of production.
- Most of this is already consumed in the EU.

Global Feed Dynamics

- Feed prices are the key input costs in the livestock industry and drive costs all along the value chain.
- World feed crop production and utilization are finely balanced. Thus, local shocks can have an international impacts on feed commodity prices.
- Agri-food production needs to keep pace with population growth, increased urbanization, affluence and changes in diet. The challenge is further complicated by:
  - The increasing complexity of agribusiness value chains;
  - Competing demands of the biofuels, food and feed industries on global agriculture; and
  - The potential negative impacts of climate change on weather patterns and crop production.
- These issues will likely encourage the long-term appreciation of feed prices unless anticipated the productivity improvements of a second “green revolution” are achieved.
- An EU ban on GM soybean imports will result in a shock to global markets, driving up the cost of non-GM soybean and alternative feed materials.
- In addition, at least initially, it is likely that costs of production will decline in countries with continued access to GM soybean.

Global Oilseed and Pulse Production & Trade

- Global production of oilseed and pulse crops reached almost 1.3 bn in 2022 (broken down 89/11 between oilseeds and pulses).
- Palm oil fruit and soybean account for more than 60% of this production and soybean and soybean meal making up 70% of global trade. Asia is the leading importing region for all commodities considered except rapeseed and sunflower seeds and their cakes (more than half of which is imported by EU countries).

SOYBEAN

- Soybean production account for 27% of global production of oilseeds and pulses (349 mn tonnes). Soybean production is mainly concentrated in the Americas. Three countries dominate the global market (Brazil, USA and Argentina), with a +80% share of global production and trade.
- The vast majority (+90%) of their production is GM. Global production of non-GM soybean has been declining, with GM making up most production outside the EU, China, India and Russia.
- We estimate that 85% of global production and +90% of trade is GM. Production of non-GM fell to 53 mn tonnes, with international traded volumes falling to 8 mn tonnes of soybean and 10 mn tonnes of cake.
- Global trade of soybean trade grew to 158 mn tonnes in 2022, with trade in soybean cake reaching 70 mn tonnes. China is the main importers of soybean (60% of traded volumes), while the EU is the main importer of soybean cake (33%).

OTHER OILSEEDS & PULSES

- Oil palm fruit accounts for 41% of global production of other oilseeds. While production is substantial, international trade of palm oil fruit and palm kernel cake is limited.
- This is also true to varying degrees for most other oilseeds. These are typically processed domestically, with their primary products consumed as food or used as raw materials in other manufacturing sector.
- While Europe dominates sunflower production and Europe and North America are the major rapeseed growing regions. Production of oil palm fruit, pulses and other oilseeds is concentrated in Asia.
- The EU has a 4% share of global production of pulses and other oilseed crops (c39.2 mn tonnes), with rapeseed, sunflower seed and olives making up c99% of its production.
- Approx. 96 mm tonnes of these crops (including their cake) are traded internationally. Rapeseed (47%), pulses (22%) and sunflower seed (18%) account for the bulk of trade volumes.[2]

[1].Global availability here refers to internationally traded volumes in 2022 excluding EU import volumes (whether traded internally or imported from 3rd party trade partners).
[2] The breakdown of share of trade for rapeseed and sunflower seed includes their cake.

Source: FAOSTAT, Farrelly Mitchell Research

Section Overview (2/2)

Limited availability of crop-based alternatives. They are typically more expensive or have lower protein or yields

Overview of Key Indicators for Soybean Meal and Potentiall Alternatives

Crop Type	Feed Material	Typical Protein Content (DM %)	Global Average Yield (MT/Ha)	Global Average Export Price (USD/MT)	Global Availability (mn tonnes)[2]	EU Primary Production (mn tonnes)
Oilseeds	Soyabean Cake	45%	2.6	511	49.0	2.5
	Rape or Colza Seed Cake	38%	2.2	377	8.0	19.4
	Sunflower Seed Cake	32%	1.9	287	0.5	9.3
	Palm Kernel Cake	17%	14.1	187	6.7	n/a
	Cottonseed cake	47%	2.2	259	0.6	0.1
	Copra Cake	23%	5.6	215	0.7	n/a
	Groundnut Cake	52%	1.8	469	0.2	n/a
	Linseed Cake	34%	0.9	453	0.1	0.4
	Other Oilseed Cake	10%	1.1	434	2.9	10.3[3]
Pulses[1]	Peas	24%	1.5	611	7.5	2.7
	Beans	29%	1.5	893	6.0	2.5
	Other Pulses	25%	1.1	848	4.9	1.6

[1] Pulses includes various green and dry beans and peas. Global production and trade of other pulses is largely made up of lentils, but also include lupins and vetches and other pulses.
[2]Global availability refers to internationally traded volumes in 2022 excluding EU import volumes (whether traded internally or imported from 3rd party trade partners).
[3]Mainly olive production (c10 mn tonnes produced in the EU in 2022).

Source: FAOSTAT, Feedpedia, Farrelly Mitchell Research

Global Feed Market Dynamics

An EU ban on GM soybean imports will likely drive up the cost of feed materials for EU buyers

Overview

- Feed prices are the key input costs in the livestock industry and drive costs all along the value chain. They can account for +70% of livestock production costs.
- World feed crop production and utilization are finely balanced. Thus, local events – such as drought in Argentina; war in Ukraine, floods in Canada; export bans by India; or panic buying by importers seeking to restock their grain reserves – can have international impact on feed commodity prices.
- Agri-food production needs to keep pace with population growth, increased urbanization, affluence and changes in diet.
- With the global population expected to reach 9.7 billion by 2050, significant investment will be required across the agribusiness supply chain to meet a projected 30% increase in global food demand.
- The challenge is further complicated by:
  - The increasing complexity of agribusiness value chains;
  - Competing demands of the biofuels industry on global food and agriculture; and
  - The potential negative impacts of climate change on weather patterns and crop production.
- These issues will likely encourage the long-term appreciation of feed prices unless anticipated the productivity improvements of a second "green revolution" are achieved.

Key Drivers

- A number of interconnected drivers and feedback loops are influencing world feed prices.
- It is the nature of soft commodities to show cyclical behaviour, because supply decisions must be made well in advance of the sale of the commodity at market.
- The effect of this lag has long been understood - producers respond to higher food prices by planning to increase supply. However, planting, harvesting and breeding takes time and the supply that is eventually drawn forth forces prices down. Hence, the old adage, "the best remedy for high food prices is high food prices".
- World agrifood food markets are now more complex. Burgeoning demand for food from the world's developing and emerging economies is occurring at a time when uncertainties on the supply side have increased because of growing use of biofuels, global warming and rising water scarcity.

Feedback Loops & Increased Interconnectivity

- Feedback loops have become more powerful. The demand-supply balance for food has become a very complex equation.
- With limited available arable land, productivity improvement along with improved sustainability is crucial to meeting rising food demand.
- The interconnectivity of biofuels and crop prices has seen the feed prices move very much in tandem with oil prices. Land scarcity and food shortages also drive-up prices.
- Energy price volatility significantly impacts the outlook for feed prices and scarcity. Fuel prices directly correlates with cereal commodity prices. Oil has a dual effect on cereal commodity prices, first as an input in farm operations and secondly as an alternate indicator for biofuel demand, which is met by the utilisation of competing food and feed production resources.

Impact & Outlook

- Much of the feed commodity boom of 2008 was due to the rapidly rising costs of fuel during that year. This saw most agri-food commodities reach historic highs before easing due to a crash in global economies. The dramatic increase in oil prices and the war in Ukraine over the last 3 years has led to a significant increase in the global cereal and oilseed prices since 2020.
- This increased volatility and a general upwards trajectory is common to all major agri-food food categories including agri-inputs, meat; dairy; cereals; edible oil and sugar. It appears that the world market will be characterized by increased volatility over the coming years. Net importers are particularly vulnerable to commodity price volatility.
- Feed purchasers compete with other purchasers (e.g. food processers) for cereals and oilseeds. While proportions vary by crop/by-product, it is estimated that feed accounts for around 49% of the total utilization..
- Only 17% of these commodities are traded internationally, however, it is this portion that sets prices in the market. Over the next ten years, the volume of these products traded internationally is expected to outpace production volume. This indicates future price appreciation unless bumper global harvests are achieved.
- An EU ban on GM soybean imports will result in a shock to global markets, driving up the cost of non-GM soybean and alternative feed materials. In addition, at least initially, it is likely that costs of production will decline in countries with continued access to GM soybean.

Source: FAOSTAT, Farrelly Mitchell Research

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Global Dynamics & Prices

Feed and livestock product prices are closely correlated to each other and move in tandem with oil prices

Drivers of Global Feed Prices

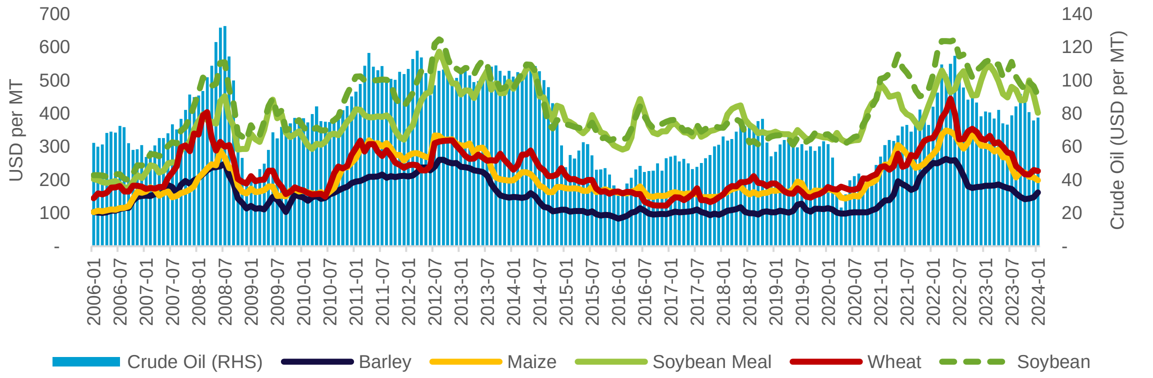
Feed Back Loops
- Increased speculation and hoarding
- Increased trade protectionism
- Rising correlation with oil prices

Key Demand Drivers
- Population and income growth, especially Asia
- Shifting diets; higher calorie intake
- Diverting food commodities for biofuel production

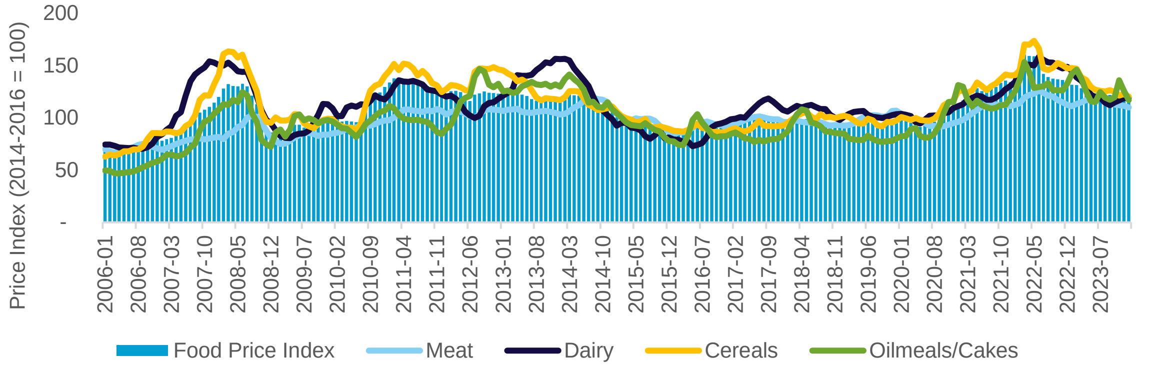
Key Supply Drivers
- Further productivity improvements
- Availability of additional land
- Availability of water
- Diverting land for biofuel

Uncertainties
- A severe El Nino or La Nina event
- Climate change
- Oil prices
- US dollar

Benchmark Monthly International Feed Commodity Prices 2006-2024



FAO Monthly Food Price Index & Feed & Livestock Product Components 2006-2024



Source: FAOSTAT, IMF, Farrelly Mitchell Research

FARRELLY MITCHELL

Agrifood Value Chain Challenges and Risks

The industry faces a range of macro and operational challenges and risks

Market Volatility	**Complex Supply Chains**	**Innovation/R&D Investment**
Volatile FX Rates	**Global Warming**	**Increasing Regulation**
High CAPEX & OPEX	**Fickle Consumer**	**Perishability**
Water Scarcity	**Retailer Dominance**	**Specialist Skills & Knowledge**

Source: Farrelly Mitchell Research

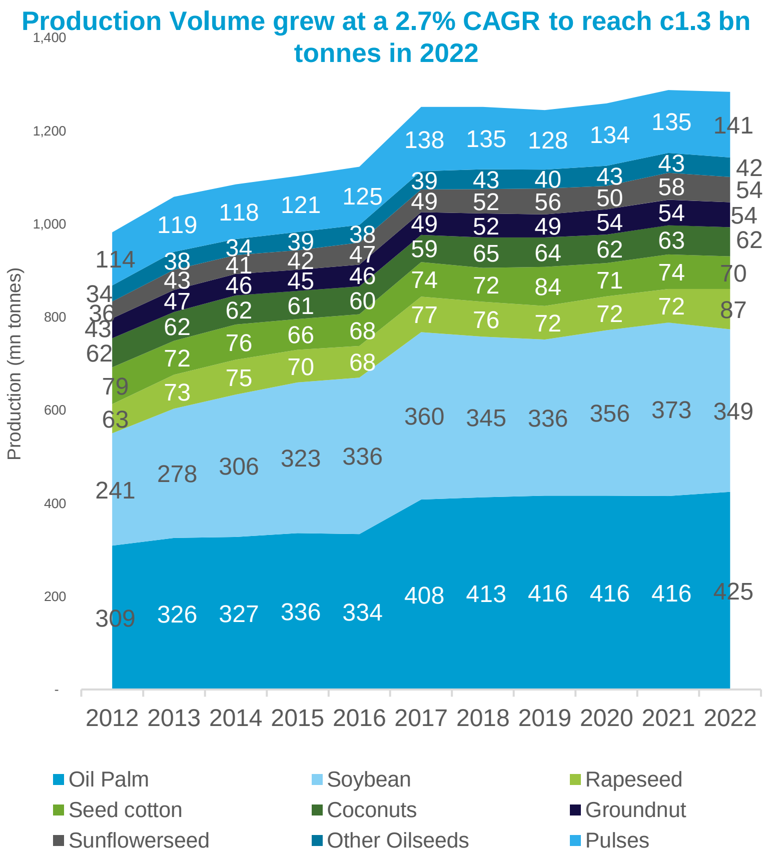
Global Protein Crop Production & Trade (1/2)[1]

Almost 1.3 bn tonnes produced in 2022, with oil palm and soybean accounting for 60% of global production

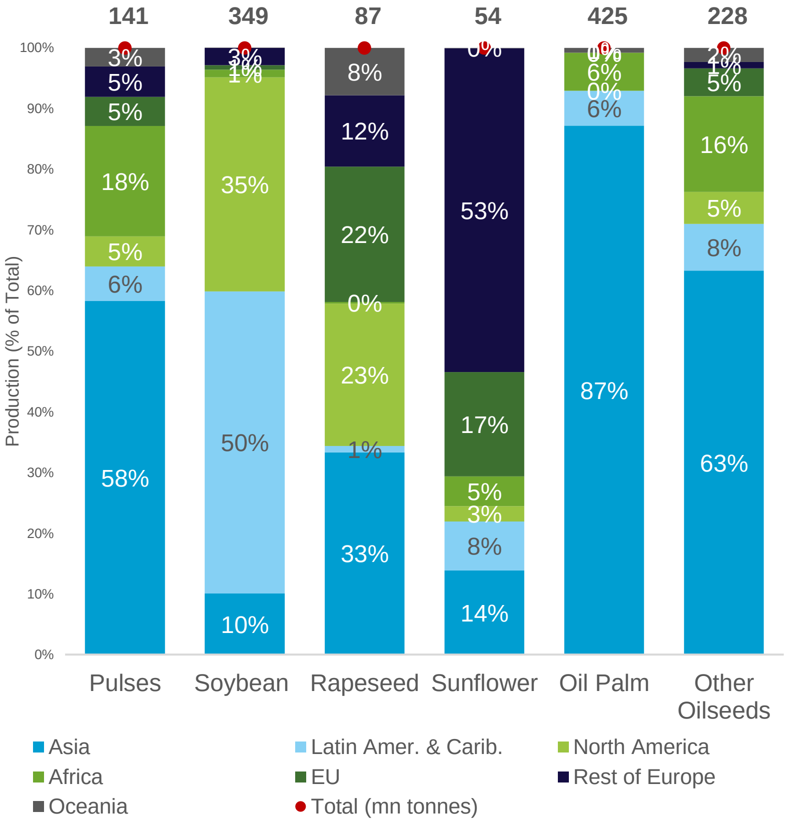
Overview

- Global production of oilseed and pulse crops reached almost 1.3 bn in 2022 (oilseed = 89% of production).
- Oil palm fruit and soybean are key crops, with production of 425 mn tonnes and 349 mn tonnes.
- Production of palm oil fruit, soybean, rapeseed and sunflower seed all grew above the global average (2.7% CAGR) over the period, with average growth rates between 3.2% and 4.1%.
- Pulse production increased at a 2.1% CAGR to reach 141 mn tonnes, broken down 49%/44%/8% between peas, beans and other pulses (mainly lentils).
- Europe dominates sunflower production, while Europe and North America are the major rapeseed growing regions.
- While soybean production is mainly concentrated in the Americas; while pulse, palm oil fruit and other oilseed production is concentrated in Asia.
- The EU's has a 4% share of global production of these crops (c48.5 mn tonnes), with rapeseed, sunflower seed and olives making up c80% of its production.
- Approx. 323 mm tonnes of these crops (including cake) are traded internationally, with soybean and soybean cake making up 70% of traded volumes, followed by rapeseed and rapeseed cake (11%) and pulses (6% of total).
- Demand is strongest from Asia (59% of imports). The Asia region is the leading importer for all commodities except rapeseed and sunflower seeds and their cakes.

Production of Oilseed & Pulse Crops 2012-2022 (mn tonnes)[1]



Production of Oilseed & Pulses by Region 2022



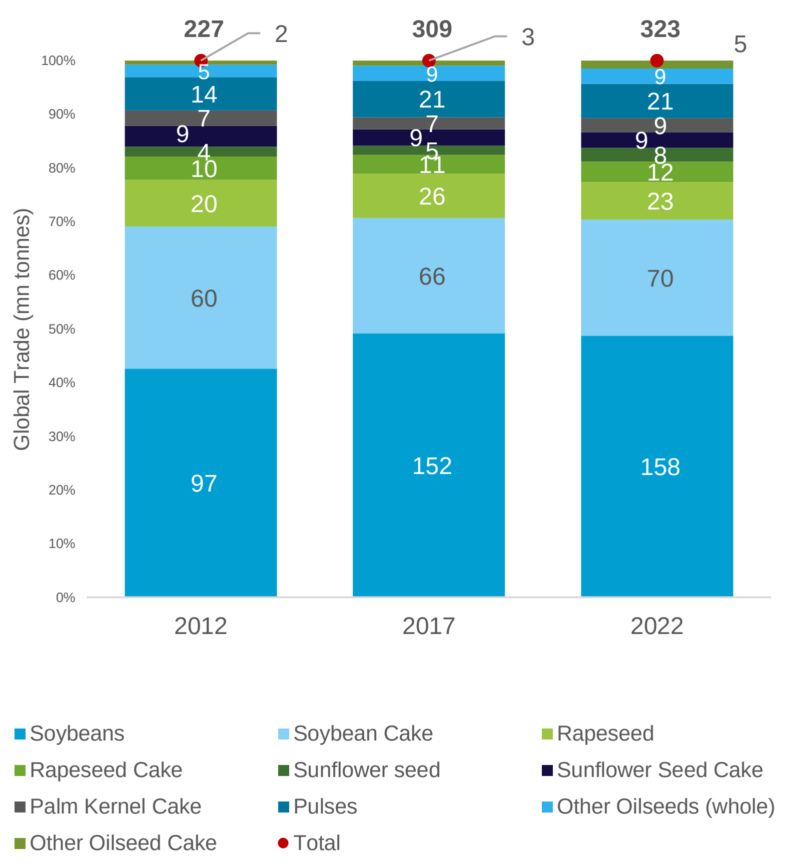
[1] See appendix C for detailed breakdown of global exports and export prices by origin for the oilseeds and pulses
[2] Pulses includes various green and dry beans and peas, lentils, lupins and vetches and other pulses

Source: FAOSTAT, Farrelly Mitchell Research

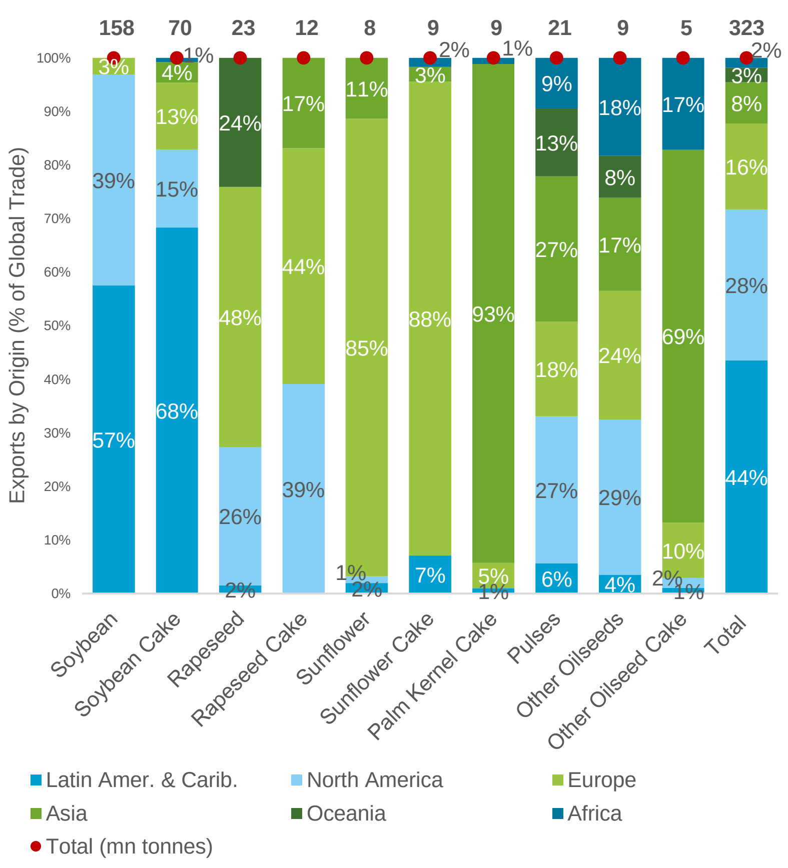
Global Protein Crop Production & Trade (1/2)

The Americas account for 72% of exports volumes, with Asia and Europe the key importing regions

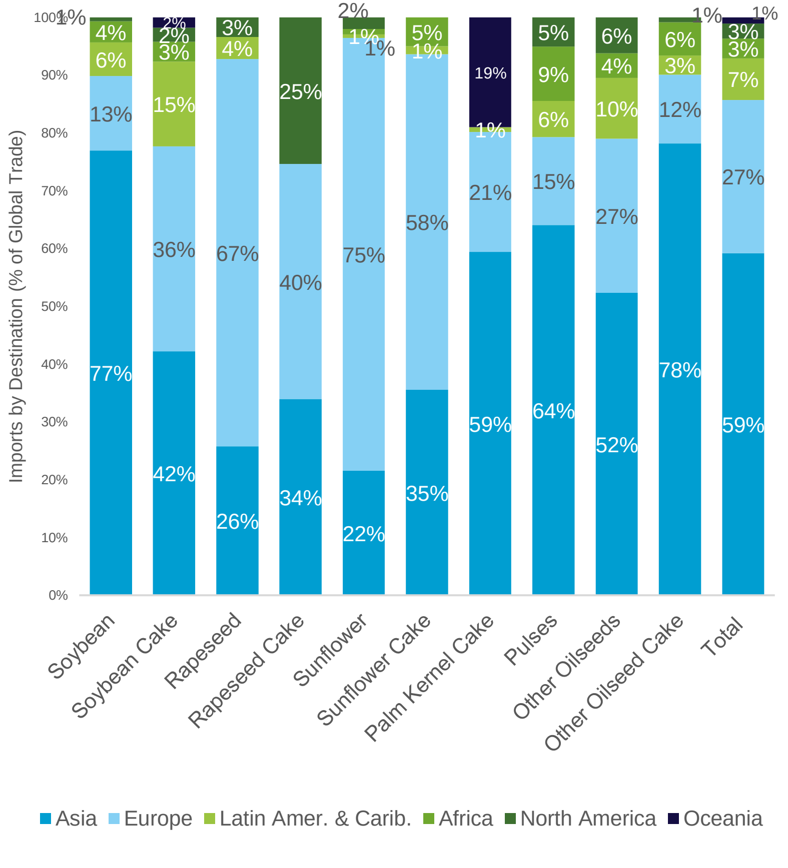
Breakdown of Global Trade by Commodity 2012-2022



Breakdown of Global Exports by Commodity & Region 2022



Breakdown of Global Imports by Commodity & Region 2022



[1] Pulses includes various green and dry beans and peas, lentils, lupins and vetches and other pulses

Source: FAOSTAT, Farrelly Mitchell Research

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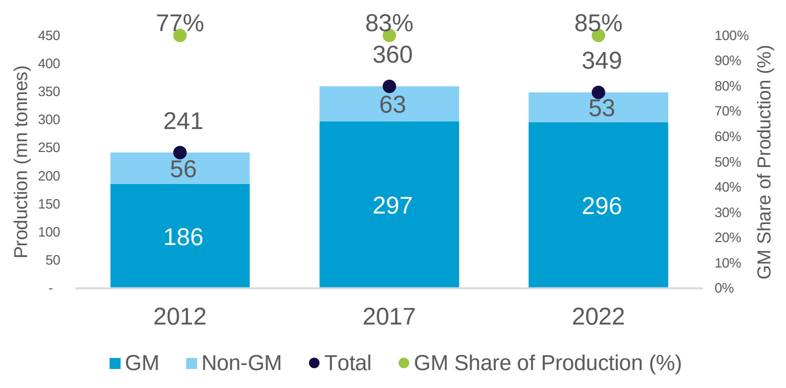
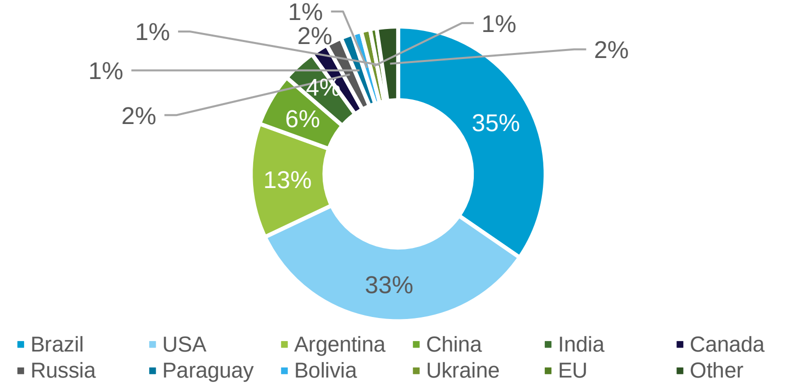
Global Production & Trade: Soybean (1/2)

Approx 85% of soybean production is GM, with GM growers holding a significant yield advantage

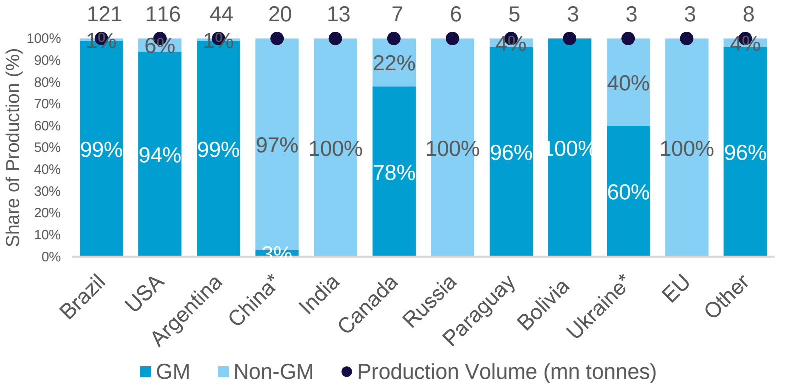
Global Soybean Production 2012-2022 (mn tonnes)



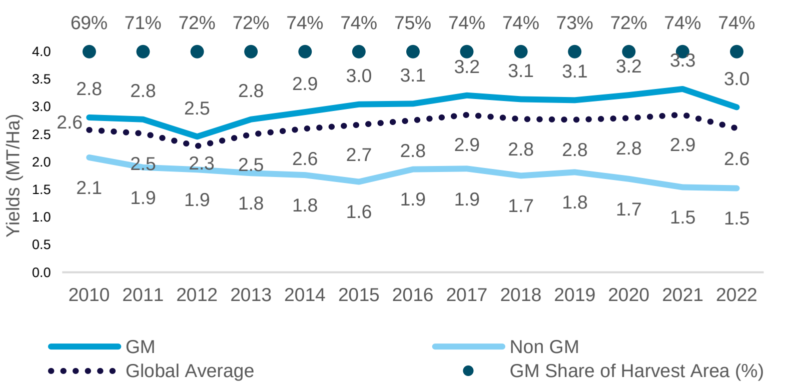
Breakdown of Soybean Production by Country



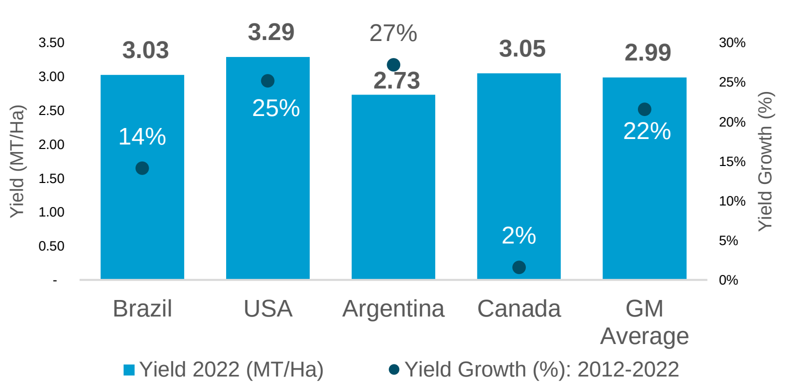
Share of GM Soybean in Production by Key Producer[1]



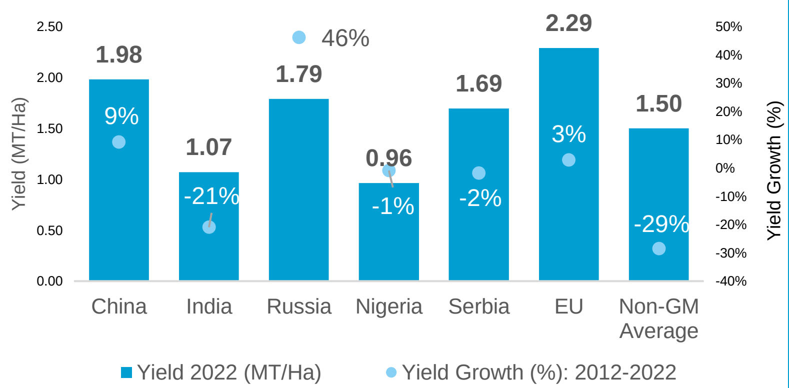
Average Global Soybean Yields: GM vs Non-GM (MT/Ha)



Average GM Soybean Yields by Key Producer (MT/Ha)



Average Non-GM Soybean Yields by Key Producer (MT/Ha)



[1] China has recently approved expanded commercial cultivation of GM soybean varieties. Industry sources believe that market penetration of GM soybean cultivation could reach 85% over the next five year. While GM soybean cultivation is not authorized in the Ukraine, however, the USDA's foreign agricultural service believes that between 60%-70% of soybean production is cultivated using gm seed varieties.

Source: USDA, FAOSTAT, AgBio Investor, ISAAA, Farrelly Mitchell Research

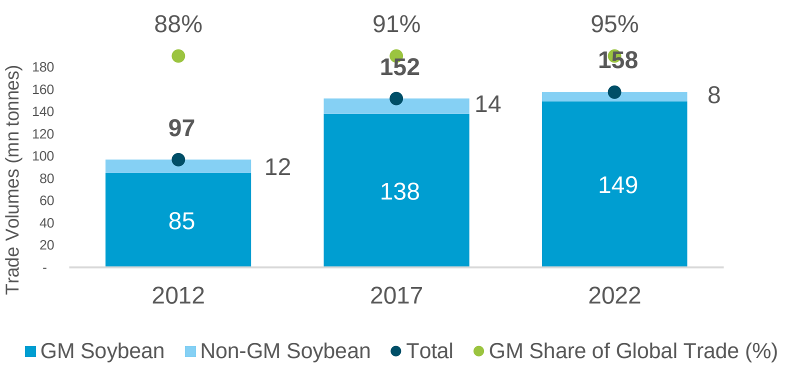
Global Production & Trade: Soybean (2/2)

While production is concentrated in the Americas; China and the EU are the main importer

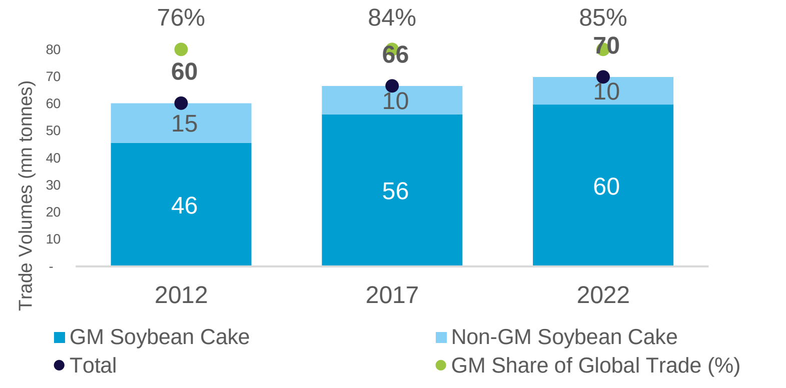
Overview

- More than 80% of global production of soybean is concentrated in three countries ((Brazil, USA and Argentina).
- These countries also dominate global trade, accounting for 89% of soybean and 77% of soybean cake exports.
- Production in these countries is largely GM (94% to 99%) as is most production outside of China, Russia and the EU.
- Typically, average yields are in GM producing countries are twice that of non-GM producers.
- Global trade of soybean reached 158 mn tonnes in 2022, with soybean cake trade reaching 70 mn tonnes (growing at 5% and 2% CAGRs over the period 2012-2022, respectively.
- While production is concentrated in the Americas, China and the EU are the main importers.
- China mainly imports whole uncrushed soybean for internal processing, while the EU imports both whole soybean and cake.
- The Netherlands, Spain, Germany, France Poland and Italy are the major EU importers.1
- Other significant importers of soybean include Mexico, Japan and Egypt, while southeast Asian countries and the UK are the main other importers of soybean cake.
- Global production of non-GM soybean is estimated at 53 mn tonnes in 2022 (mostly produced in China and India).
- We estimate that just 18 mn tonnes of non-GM soybean and soybean cake were traded in 2022.

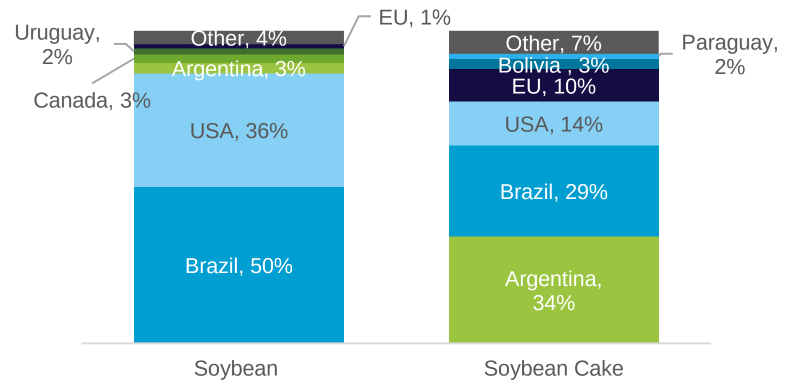
GM vs Non-GM Soybean Trade Volume (mn tonnes)



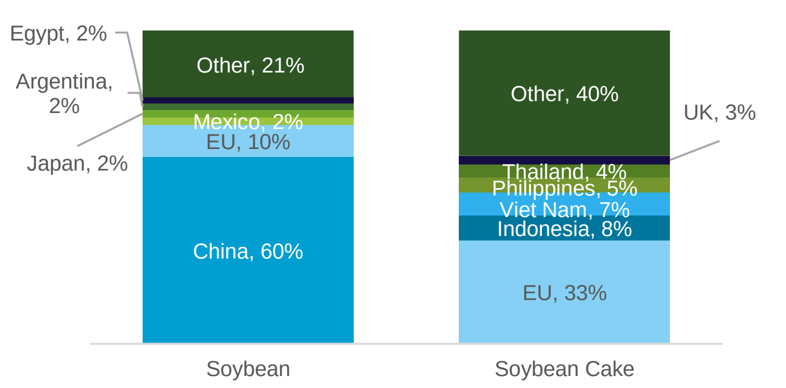
GM vs Non-GM Soybean Meal Trade Volume (mn tonnes)



Breakdown of Share of Export Volumes by Exporter[1]



Breakdown of Share of Import Volumes by Importer



[1] EU exports include exports of domestic production, re-export of imports and export of cake crushed from imported soybean. The Netherlands is major importer, processor and re-exporter of soybean and soybean meal. It imported 4 mn tonnes of soybean and almost 3 mn tonnes of soybean cake in 2022

Source: FAOSTAT, AgBio Investor, ISAAA, Farrelly Mitchell Research

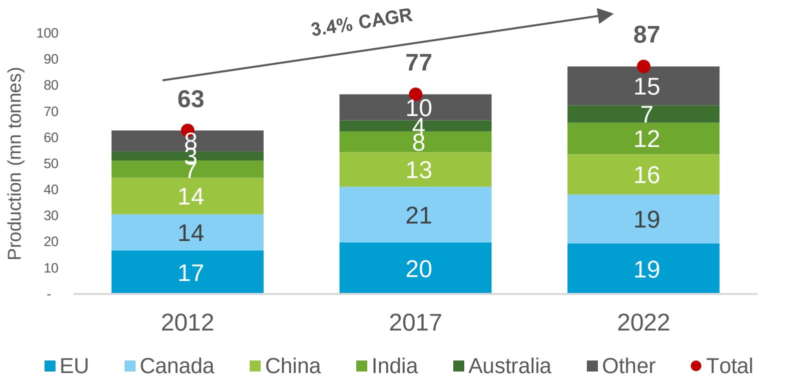
Global Production & Trade: Rapeseed & Sunflower Seed

The EU accounts for 20% of global production and 55% of global import volumes of sunflower and rapeseed

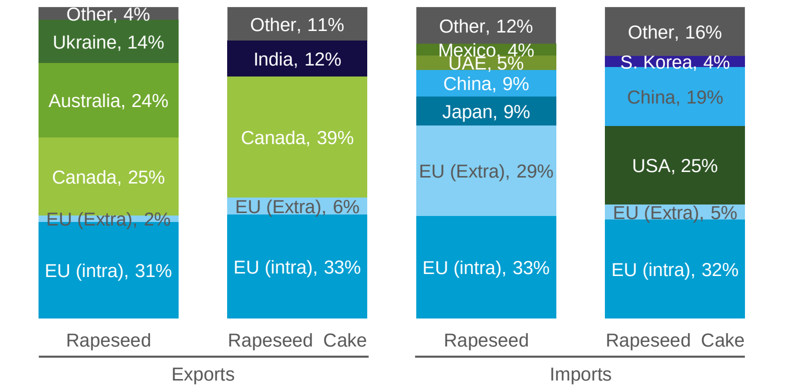
Overview

- Global production of rapeseed reached 87 mn tonnes in 2022.
- The top 5 producers account for 83% of global production, with more than half of this produced in the EU and Canada.
- Production growth was strongest in India, Australia and the other segment – with 6%-7% CAGRs over 2012-2022.
- Global exports of rapeseed reached 22.6 mn tonnes (1.3% CAGR) and rapeseed cake 12.3 mn tonnes (2.4% CAGR).
- The EU and Canada account for more than half of exports of rapeseed and almost 80% of rapeseed cake exports.
- The bulk of the EU's c5 mn tonnes of exports target internal EU markets, it also imported more than 6.5 mn tonne of rapeseed and 0.5 mn tonnes of rapeseed cake form outside the EU in 2022.
- Other major importers include countries in East and Southeast Asia, the USA, the UAE and Mexico.
- Global sunflower seed production reached 54 mn tonnes in 2022, with 81% of production concentrated in five countries.
- Increased production in Russia (8% CAGR) has been the key driver of growth in global production since 2012.
- In 2022, global export reached 8.3 mn tonnes of sunflowers seed (6.9% CAGR) and 9.3 mn tonnes of cake (0.5% CAGR).
- The EU and Ukraine are the key exporters (+70%). However, most of the EU's exports are for internal markets.
- More than half of global trade volumes are directed to EU markets.

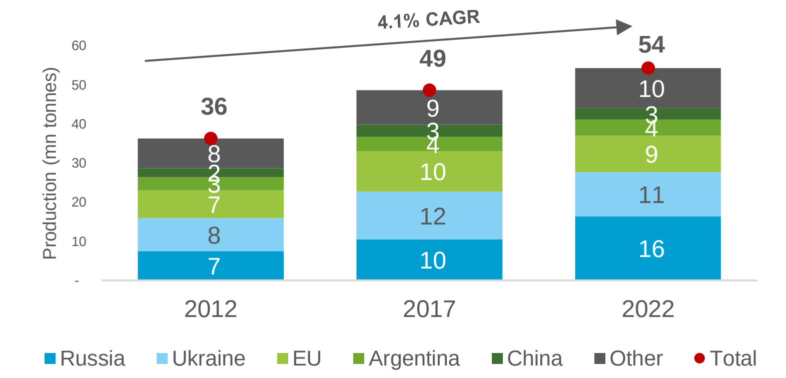
Rapeseed Production by Producer (mn tonnes)[1]



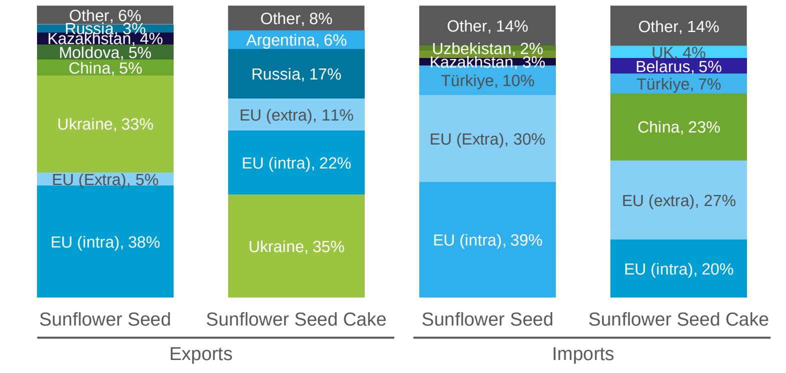
Breakdown of Rapeseed Trade by Country 2022 (% of total)[1]



Sunflower Seed Production by Country (mn tonnes)



Breakdown of Sunflower Trade by Country 2022 (% of total)



[1] Include colza seeds and cake

Source: FAOSTAT, Farrelly Mitchell Research

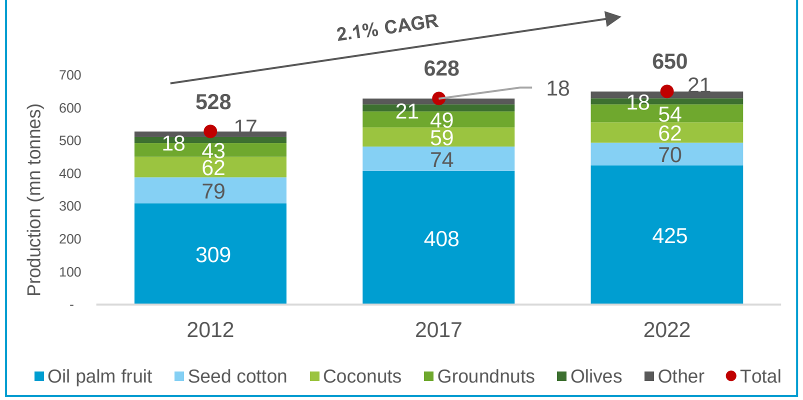
Global Production & Trade: Other Oilseeds

International trade of other oilseed cake is limited. Palm kernel cake accounting for +50% of available supply

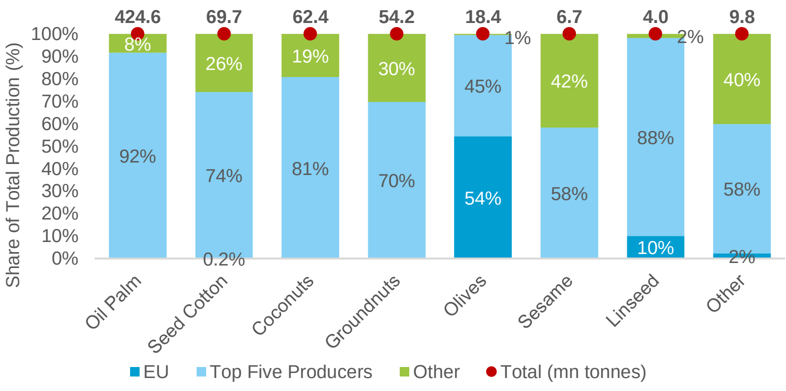
Overview

- Global production of other oilseeds reached some 650 mn tonnes, growing at a 2.1% CAGR over the period 2012-2022.
- Palm fruit accounted for 65% of production. Cotton, coconuts, groundnuts and olives made up the bulk of the rest.
- Production of other oilseeds is limited in the EU (10.8 mn tonnes), apart from olives (10 mn tonnes) and linseed (c400,000 MT).
- Production of palm oil fruit and coconut is concentrated in Asia; cotton in the China, India, the US and Brazil; groundnuts in Asia, Africa and the USA; sesame in Asia and Africa and linseed in Russia, Asia and Canada.
- Global trade is limited, just 9 mn tonnes of while oilseed crops and 16 mn tonnes of other oilseed cake were traded in 2022.
- Most other oilseed crops are processed domestically, with their primary products consumed as food or used as raw materials in other manufacturing sector.
- Palm oil kernel cake accounted for more than half of globally traded cake from other oilseeds in 2022, with the EU importing 17% of globally traded (mainly via the Netherlands).
- The EU accounted for 6.8% of global exports, with most of this (93%) traded within the block – mainly cake from palm kernel, olives, linseed and cotton and mis. flours and meals.
- In total, the EU imported 1.54 mn tonnes of other oilseed cake from outside the region.
- Palm kernel cake accounted 97% of this extra EU imports.

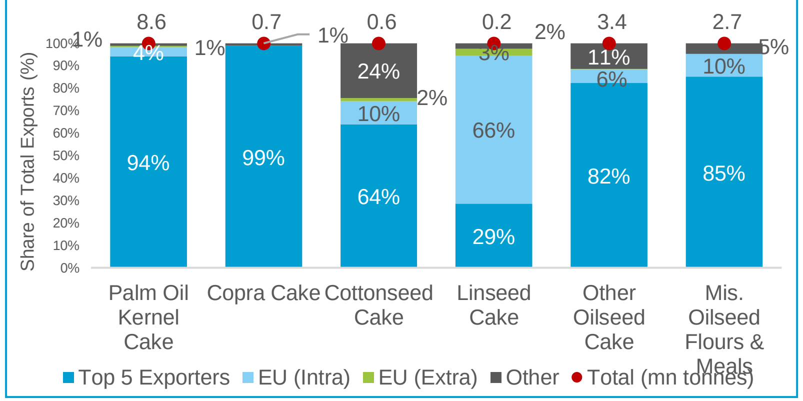
Global Production of Other Oilseed by Producer Type 2022[1]



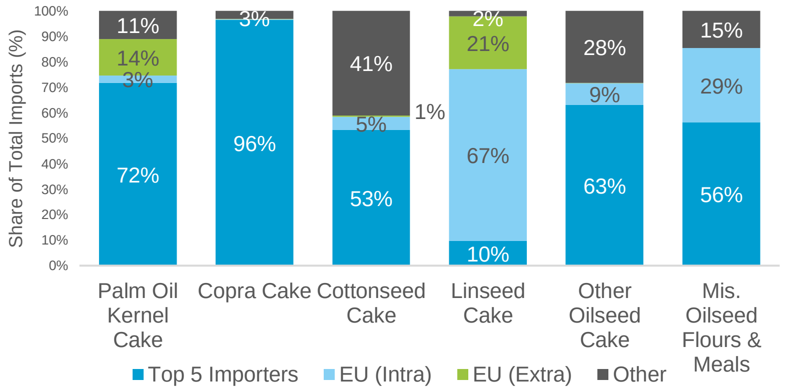
Breakdown of Other Oilseed Production by Origin 2022



Breakdown of Other Oilseed Cake Exports by Origin 2022



Breakdown of Other Oilseed Cake Imports by Country 2022



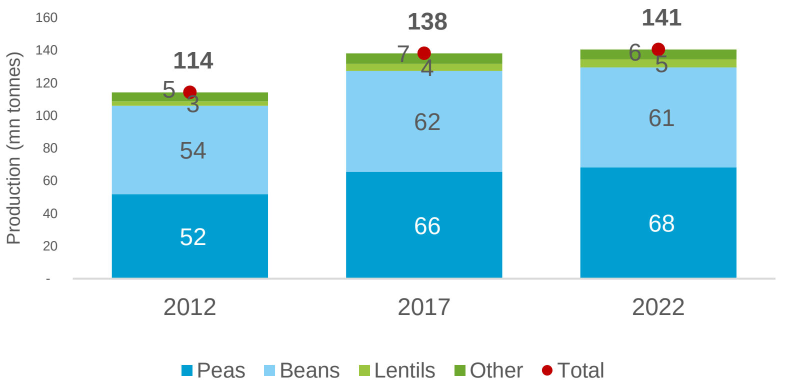
[1] In a limited number of cases, EU countries are among the top 5 global producers, importers and/or exporters of oilseeds or oilseed cake e.g. Greece is among the top 5 cotton producers and Spain and Italy are among the top 5 olive producers. However, in the analysis above, EU countries are excluded from the top 5 and considered separately as a single EU unit.

Source: FAOSTAT, Farrelly Mitchell Research

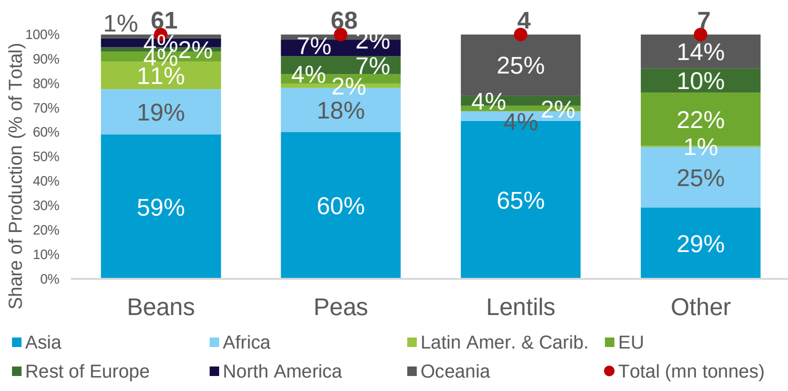
Global Production & Trade: Pulses

Approx 21 mn tonnes of pulse traded internationally. The EU accounts for 9% of exports and 18% of imports

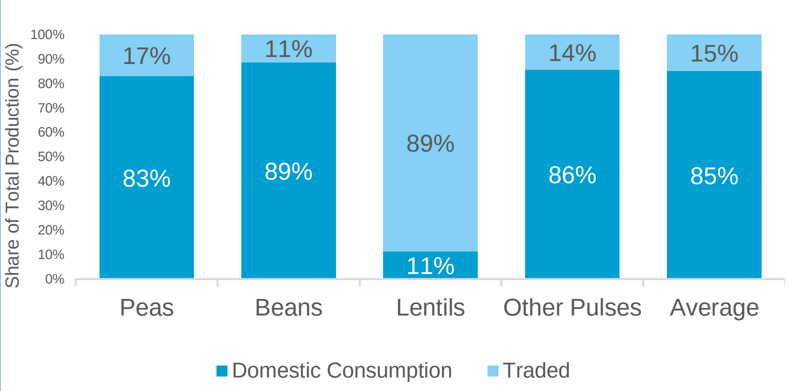
Global Production of Pulse by Type (mn tonnes)



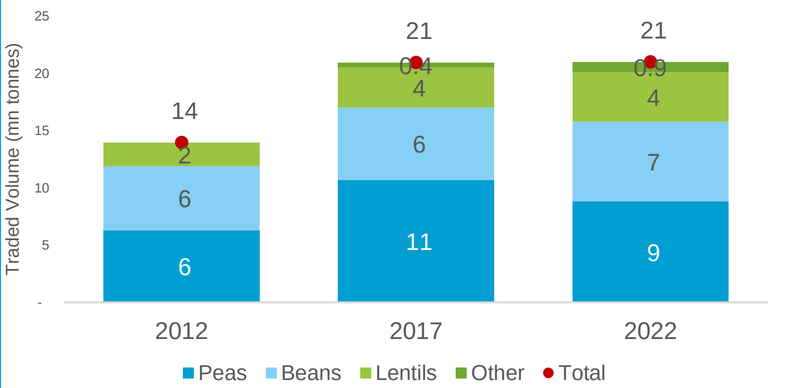
Global Production of Pulses by Type & Region 2022



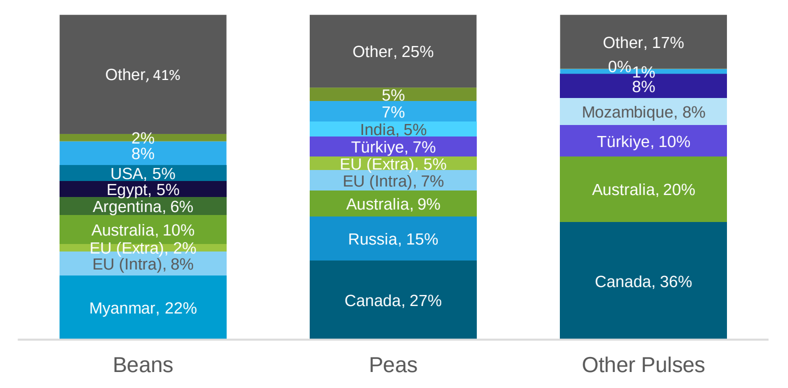
Breakdown of Pulses in 2022: Dom. Com. vs. Traded Vol.



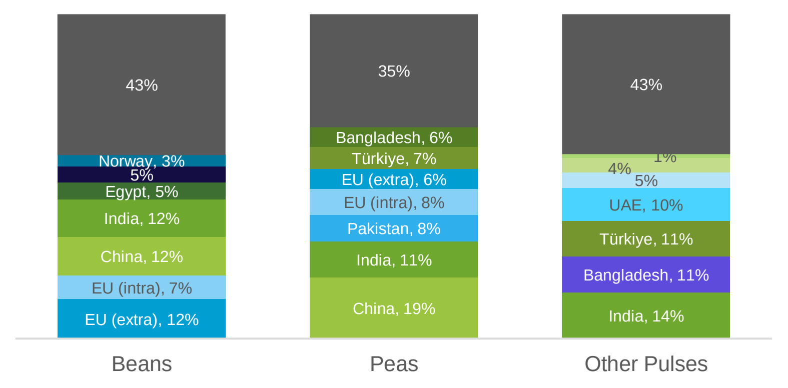
Globally Traded Volumes by Pulse Type (mn tonnes)



Breakdown of Top Pulse Exporters by Crop



Breakdown of Top Ten Importers by Crop



[1] Average Annual import volumes over the period 2018-2022
[2] Oilseed imports volumes are given in oilseed cake equivalent

Source: FAOSTAT, Farrelly Mitchell Research

SECTION F

PHASE 2: SCENARIO DEVELOPMENT

STRUCTURE, METHODOLOGY & ASSUMPTIONS

Structure for Scenario 1: Strict Ban on GMO Soya Bean

Key focus on the feed manufacturing, livestock and dairy and meat manufacturing sectors

A - Baseline

- Historic supply of **whole soybean** and **soybean cake**:
  - Quantities breakdown between **production** and **imports**
  - Quantities and percentage (%) breakdown between **GM** and **Non-GM** *(not available)*
- Historic demand of **whole soybean** and **soybean cake**:
  - Quantities breakdown between **pigs, dairy cows, cattle, broilers, laying hens and farmed fish**
- Historic price for **whole soybean** and **soybean cake**:
  - Production vs Imports
  - GM vs Non-GMO *(not available)*

B - Scenario Development (Ban implementation)

- New supply of **whole soybean** and **soybean cake**:
  - EU non-GM soya bean and soya meal production expansion, in hectares and quantities produced
  - Increase in imported quantities of non-GM soya bean and soya meal *(If it is possible)*
- Demand of **whole soybean** and **soybean cake**:
  - Determine the gap, in quantities, to be filled between soya bean and soya meal required, compared to quantities supplied
- Determine the **substitutes** required to fill the supply gap, in each sector:
  - Quantities of each substitute for **feed manufacturing**, **livestock**, **dairy**, **meat manufacturing**
- Supply and demand for each substitute

C - Scenario Implications

- Price impact on GM vs non-GM **whole soybean** and **soybean cake,** worldwide
  - Comparing baseline and scenario prices
- Total cost impact on EU **pigs, cattle, broilers and dairy sectors:**
  - Total demand of baseline **whole soybean** and **soybean cake,** in sectors mentioned above
  - Total demand of scenario **non-GM whole soybean**, **non-GM soybean cake** and substitutes
  - The difference between the two bullet points above will be the estimated annual cost of the ban, if nothing else changes
- Impact of the cost of the ban on the EU **pigs, cattle, broilers and dairy sectors:**
  - Revenue, operating costs and operating surplus differentiated between baseline and scenario – *assuming the cost of the ban is:*
    - *Absorbed by manufacturers*
    - *Shared between manufacturers & customers*
    - *Passed onto the customers*
  - Price increase per unit, for each of the sectors, for the final consumers

Methodology & Data Sources

Methodology

Step 1 – Identifying the Supply Gap

- Review of EU and global soybean and soybean meal production and trade
- Estimate of quantities consumed by the feed industry by species
- Estimate of EU imports of GM soybean and soybean meal
- Identification of base case availability (volumes) and unit costs
- Breakdown of soybean consumption by industry (Pigs, cattle, broilers and dairy)

Step 2 – Estimation of Global Non-GM Soybean Availability

- Estimation of global non-GM soybean production by country
- Estimation of global non-GM soybean and soybean meal trade by country
- Identification of benchmark unit values of non-gm soybean and soybean meal in 2022

Step 4 – Identification of Most Suitable Soybean Substitutes by Species

- Review of literature on soybean substitution
- Evaluation of most suitable substitutes based on nutritional composition, digestibility, palatability and animal performance
- Determine rate of substitution of substitutes when compared to soybean, according to species

Step 3 – Estimation of Global Availability of Soybean Substitutes

- Review of global production and trade of soybean substitutes
- Identification of base case availability (volumes) and unit costs

Step 5 – Allocation of Alternatives to GM Soybean Alternatives by Species

- Allocation of non-gm soybean and soybean alternatives to species based on the following criteria:
  - Total allocation of each feed material does not exceed 50% of available international supply (excluding EU trade and feed materials from gmo crops)
  - The total allocation to each species provided protein content equivalent to soybean meal
  - The suitability of each feed alternative for each species and achieving a balance between availability and suitability across species.
  - Where possible, lower priced alternatives were prioritised over higher priced feed materials.
  - No allocation of a feed material in cases were there may be regulatory restrictions.

Step 6 – Estimation of the Costs of Ban

- Estimation of the price elasticity of EU imports of Non-GM soybean and soybean substitutes based average annual extra-EU imports volumes and values over the period 2012-2022
- Application of price elasticities to new demand volumes of feed materials to determine post-ban prices per unit of feed materials
- Estimation of the total costs of the ban across the species, based on estimated volumes and prices

Step 7 – Estimation of Ban Impact on Manufacturers

- Identification of base case costs, revenues and operating surpluses for dairy, beef, broiler and pork manufacturing
- Application of additional costs to base case and determination of revenues and operating surpluses based on ability to pass on additional costs to other parts of the value chain actors, covering three scenarios:
  - 100% of additional costs are absorbed by manufacturers
  - Additional costs are shared evenly (50/50) between manufacturers and their suppliers
  - 100% of additional costs are passed on to consumers

Key Data Sources

FAOSTAT | EU Commission Feed Protein Balances | Eurostat | AgbioInvestor | CLAL | Feedipedia | Kuepper B, Stravens M (2022)

Key Assumptions

Parameter	Assumption
Estimates of GM and Non-GM soybean trade	As there is limited data available on the breakdown of GM and Non-GM soybean trade. It is assumed that proportion of GM-soybean to Non-GM soybean exports is the same as the proportional breakdown of their production of GM and Non-GM soybean.
Pre-ban cost of non-gm soybean	Assumption that the average price of EU soybean meal sourced on the Bologna exchange in 2022 represents a good benchmark for EU Non-GM soybean meal import prices in 2022.
Implementation of GM ban decision	The analysis assumes that the lead time between the decision to ban GMOs and its implementation does not give farmers sufficient time to shift production to Non-GM soybean. Therefore, the supply gap must be filled by sourcing Non-GM soybean in the international market
Suitability of soybean substitutes	A review of scientific papers was carried out to determine the most suitable soybean substitutes by species. The assessment of suitability looked at suitability in terms of nutritional composition, digestibility, palatability and animal performance. The suitability of each feed material for consumption by species was rated. The allocation of substitutes to species was determined with a view to striking a balance between suitability across species and availability in the international market.
Rate of substitution for gm soybean alternatives	Assume 1:1 substitution in terms of protein content.
Impact of changes in feed recipes on animal performance	Assumption is that there is no change in productivity, given that the supply gap is filled at recommended replacement rates (GM soybean to substitute).
Additional costs related to usage of subsitutes	Assumption that the additional cost of using soybean subsitutes (e.g. increased use of additives/supplements, additional preparation costs etc.) are offset by the reduction in usage of other materials (e.g. cereal grains) in the feed formulation.
Availability of required alternatives	Assumption is that substitutes would need to be imported, since local production would not be sufficient to satisfy increased demand and local farmers would not have sufficient time to expand production. The second assumption is that not more than 50% of global available supply would be purchased.
Changes in prices of alternatives	Assumption that the additional demand for gm soybean alternatives leads to increased unit prices. The increase is determined by calculating the price elasticity of EU imports of the specific feed materials over the period 2012-2022.
Margins in meat manufacturing	Margin for meat manufacturing is 5%, assumed to be equal for the pork, cattle and chicken manufacturing industry, since further segmentation is not available from Eurostat.
Allocation ban costs across manufacturing	Cost of ban was allocated to each industry based on the quantities of the GM soybean substitutes needed to replace the GM-soybean in each of the industries.
Manufacturing output	Each scenarios assumes that manufacturing output remains the same despite the increase in costs.
Financial impact of the ban on the feed value chain	Three scenarios are developed based on the absorption of the costs of the ban (i) fully absorbed by manufacturers, (ii) evenly shared (50/50) between manufacturers and suppliers and (iii) fully passed on to customers.
Financial impact of the ban on other value chains	Not considered beyond increased prices in the international market.

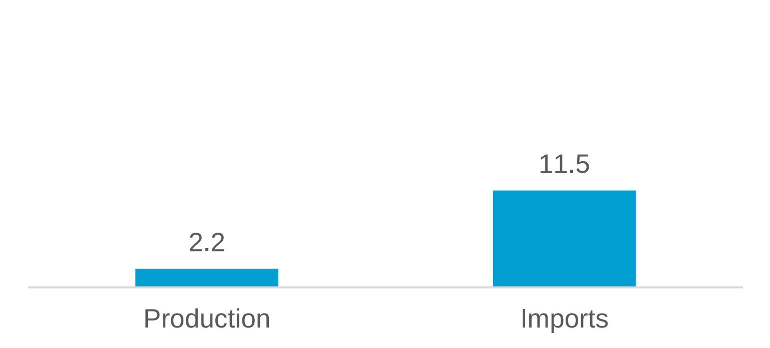
A - BASELINE

Average EU Soybean Supply between 2018-2022

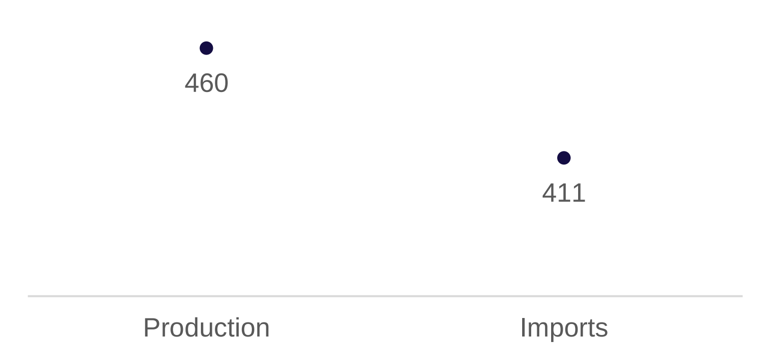
Total average soybean supply is 30.5 mn tonnes

Whole Soybean[1,2]

Average Supply (mn tonnes)

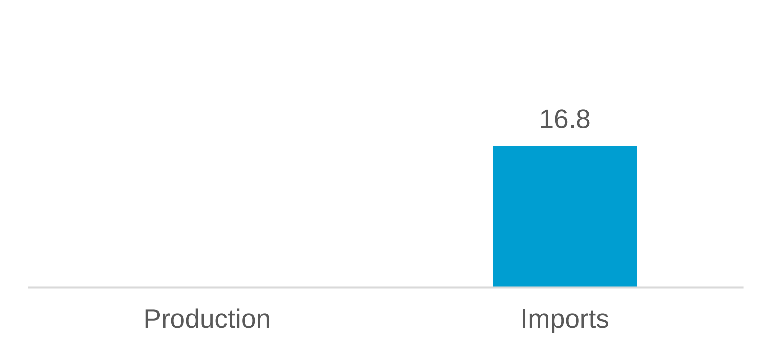


Average Prices (€/tonne)

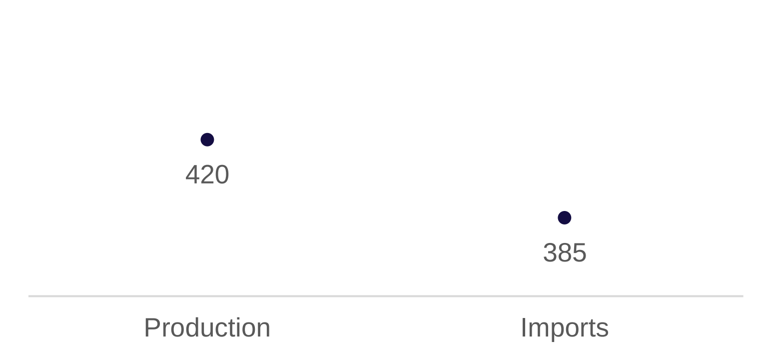


Soybean Cake[2]

Average Supply (mn tonnes)

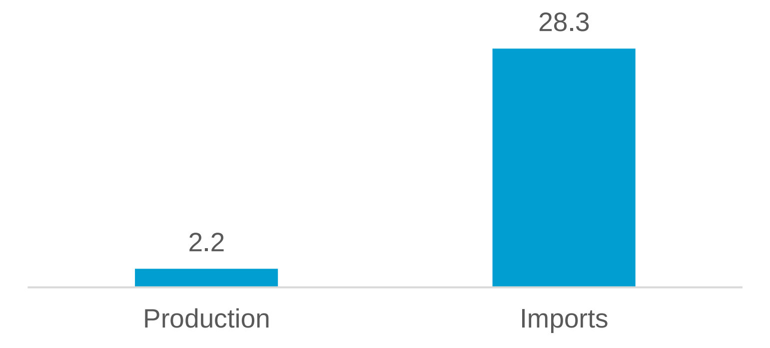


Average Prices (€/tonne)

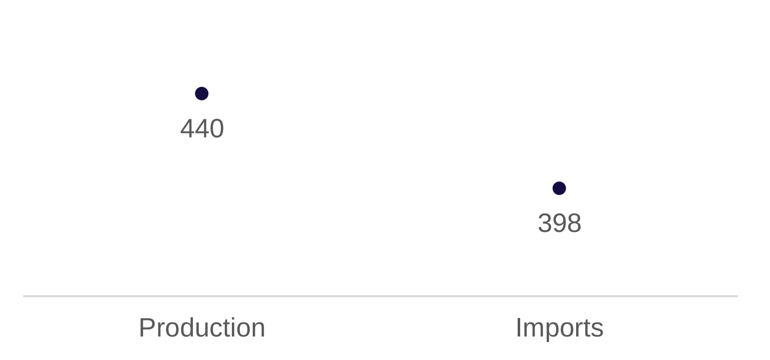


Aggregate[1]

Average Supply (mn tonnes)



Average Prices (€/tonne)



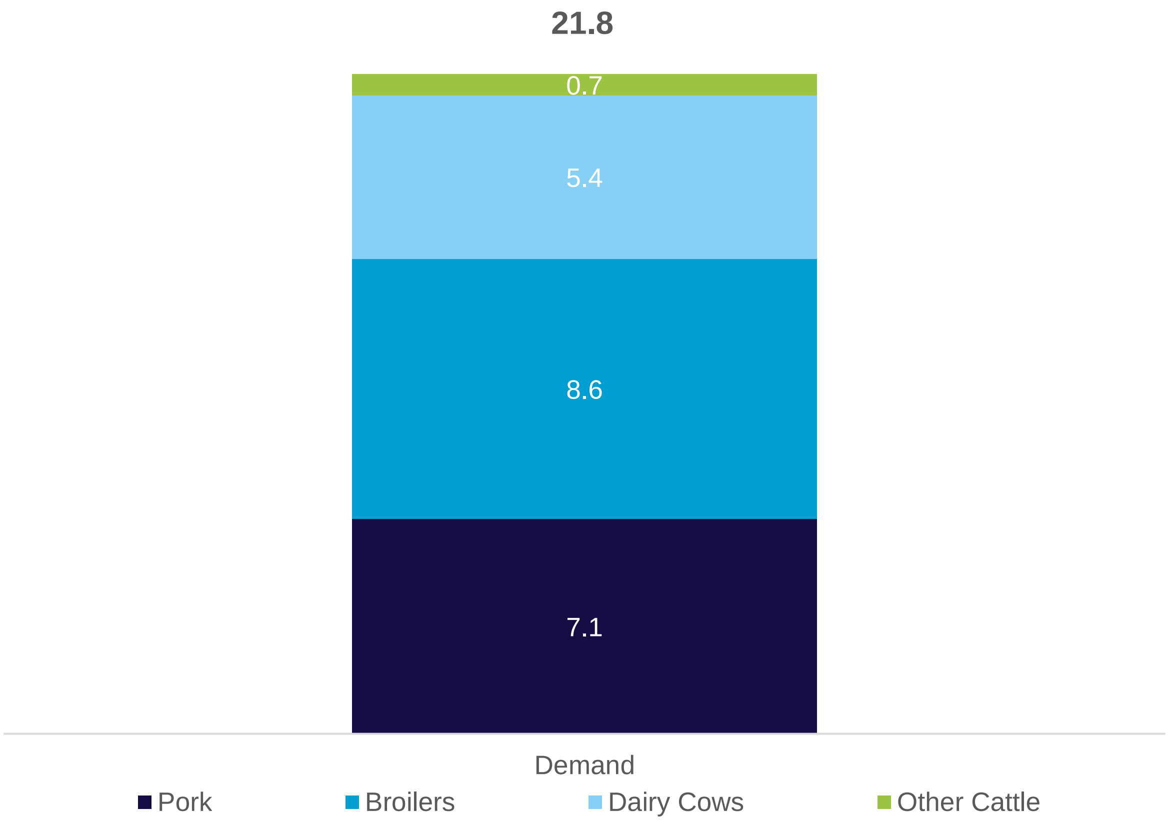
[1]Soyabean quantity is given in cake equivalent, with the calculation based on an extraction rate of 80.1%
[2]To avoid double counting, all wholesale soybean is taken as cake equivalent, which is why the production of soybean cake is 0

Source: Farrelly Mitchell, EU Comm. DG Agri (EU Feed Protein Balance Sheet 2023), FAOSTAT, CLAL.it

EU Soybean Demand[1]

Approx. 21.8 mn tonnes of soybean is needed to met demand from the cattle, pigs, broilers sectors in 2022

(mn tonnes of soybean cake equivalent)



[1]Soyabean quantity is given in cake equivalent, with the calculation based on an extraction rate of 80.1%

Source: Farrelly Mitchell, EU Comm. DG Agri (EU Feed, Protein, Crop & Livestock Balance Sheets 2023), Kuepper, B. and M. Stravens 2022, FAOSTAT

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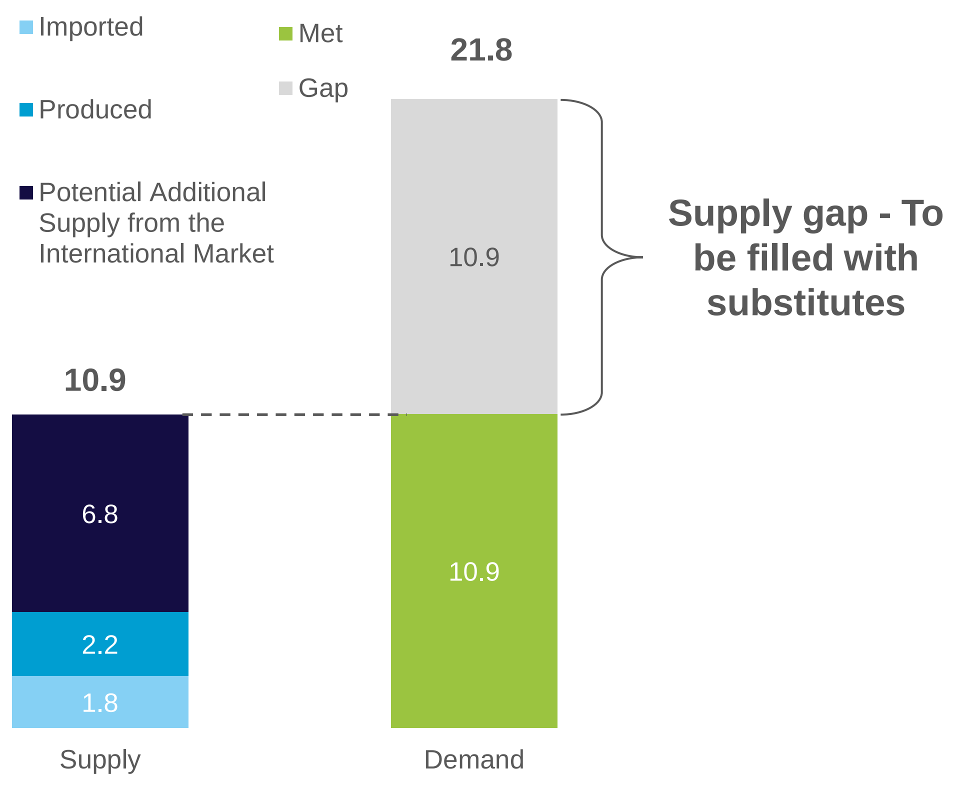
B - SCENARIO DEVELOPMENT (BAN IMPLEMENTATION)

Return to Executive Summary

Supply Gap[1]

50% of the supply gap can be filled with Non-GM soybean

Supply Gap & Breakdown Potential Sources of Non-GM Soybean (mn tonnes)



- 2022 Non-GM soybean cake equivalent supplied in the EU:
  - 2.2 mn tonnes was produced
  - 1.8 mn tonnes was imported
- World Market Supply (excluding GM & EU Imports) of soybean cake equivalent in 2022 was 14.0 mn tonnes
  - Of which 6.8 mn tonnes (48.6%)3 is assumed to potentially be imported
  - Resulting in total imported quantities of 8.6 mn tonnes

Notes

Non-GMO Trade Data Sources

- There is limited published data on the international trade of non-gmo products. Therefore, in phase 1, Farrelly Mitchell estimated EU import volumes and global export volumes based on FAO trade and production data and estimates of the proportion of non-GMO production volume in producer countries based on various sources including ISAAA and AgBio Investor. It was assumed that exporters of soybean products exported non-gmo products in line with non-gmo's proportion of that countries production.

Available in International Market

- Available in the international market refers to the portion of internationally traded non-gmo soybean (excluding EU trade volumes) in 2022 that the EU could potentially source in the international market. It assumes that the EU buyers could conceivably source 50% of internationally traded volume by outbidding buyers from other countries (mainly East Asian countries). It also assumes that as the price of non-gm increases, producers will divert more of their non-gmo output from domestic to the international markets.
- In 2022, global non-gmo production (excluding EU production) is estimated at 50 mn tonnes. Key producers include China (39% of total), India (26%), USA (14%), Russia (12%), Canada (3%), Brazil (2%), Ukraine (2%).

Opportunities for Increased Production

- As evidenced by the increases in production of non-gmo soybean in Brazil and the EU since 2022, there is potential for greater cultivation of non-gmo soybean both within the EU and globally if the prices are favourable.
- However, the analysis is focused on a point in time (base year 2022) and assumes that the timing of the decision to ban GMO soybean does not give farmers sufficient time shift production to non-GMO soybean.
- We believe that a favourable price environment could see the EU non-gmo soybean demand gap filled **within a time frame of 1 to 3 years.**

[1]Soyabean quantity is given in cake equivalent, with the calculation based on an extraction rate of 80.1%
[2]EU Non-GM soybean production would likely increase, however the assumption is that the increase in quantities would be immaterial, given limited land area availability and high competition amongst the various crops (these are crops that would be more profitable to produce than Non-GM soybean)
[3]Assumed that the EU would not be able to purchase more than 50% of the available Non-GM soybean in the international market. The value could be attainable if the EU were to purchase the product at a premium, when compared to other regions.

Source: Farrelly Mitchell, EU Comm. DG Agri (EU Feed Protein Balance Sheet 2023), FAOSTAT

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Substitutes required to fill the supply gap (1/2)

12 potential substitutes selected and allocated according to availability and replacement effectiveness

	Soybean needed[1]	Soybean available (Prorated)	Sunflower	Rapeseed	Peas, dry	Broad beans and horse beans, dry	Pig Meal	Poultry Meal	Cake of palm kernel	Groundnut	Linseed	Gluten feed and meal	Brewing or distilling dregs and waste	Fish Meal
Pork	7.1	3.5		0.9	1.0			0.7	1.5		0.4	0.3	0.3	
Broilers	8.6	4.8	1.2	0.9			0.3			0.7		0.6		0.1
Dairy cows	5.4	2.4	1.7			0.6			1.8			0.3	0.4	
Cattle	0.7	0.2			0.8									
Total demand	**21.8**	**10.9**	**2.9**	**1.8**	**1.8**	**0.6**	**0.3**	**0.7**	**3.4**	**0.7**	**0.4**	**1.3**	**0.7**	**0.1**
Apportioned Non-GM Soy Existing Supply	4.0		6.0	4.4	4.9	1.1	1.3	1.5	6.7	1.9	0.7	3.1	1.3	3.2
Additional Non-GM Soy intl. mkt.	6.8													
Total supply	**10.9**	**0.0**	**6.0**	**4.4**	**4.9**	**1.1**	**1.3**	**1.5**	**6.7**	**1.9**	**0.7**	**3.1**	**1.3**	**3.2**
International Supply Surplus	**10.9**		**3.1**	**2.7**	**3.0**	**0.5**	**0.9**	**0.8**	**3.3**	**1.2**	**0.3**	**1.8**	**0.6**	**3.1**

- The methodology for selecting potential substitutes was based on a review of the scientific papers to determine the most suitable soybean substitutes by species in phase 1. Unprocessed cereal grains and other low protein crops were not considered as they are sources of energy and starch rather than of protein in animal nutrition.
- The assessment of suitability looked at suitability in terms of nutritional composition, digestibility, palatability and animal performance.
- Replacement quantities were allocated based on the following criteria:
  - Total allocation of each feed material does not exceed 50% of available international supply (excluding EU trade and feed materials from GMO crops)[2]
  - The total allocation to each species provided protein content equivalent to soybean meal (45%)
  - The suitability of each feed alternative for each species and achieving a balance between availability and suitability across species.
  - Where possible, lower priced alternatives were prioritised over higher priced feed materials.
  - No allocation of a feed material in cases were there may be regulatory restrictions.

[1]Soyabean and other oilseed quantities are given in cake equivalent
[2] Assumed that the EU would not be able to purchase more than 50% of the available products in the international market. The value could be attainable if the EU were to purchase the products at a premium, when compared to other regions.

Source: Farrelly Mitchell, EU Comm. DG Agri (EU Feed Protein Balance Sheet 2023), FAOSTAT

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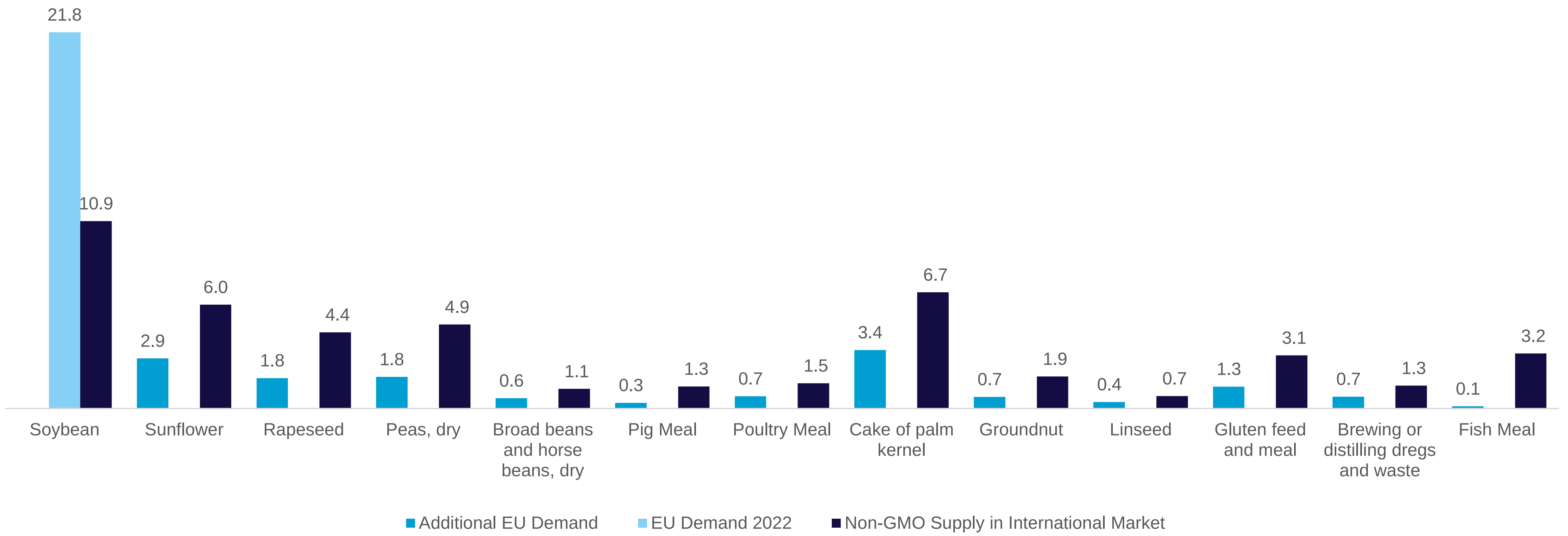
Substitutes required to fill the supply gap (2/2)

Predicted global supply and demand for each substitute after factoring in the ban

Availability of Substitutes in the International Market & Post-Ban Additional EU Demand (mn tonnes)[1]



[1]Available supply in the international market excludes EU imports and GMO feed materials. Soyabean quantity is given in cake equivalent, with the calculation based on an extraction rate of 80.1%

Source: Farrelly Mitchell, FAOSTAT

C - SCENARIO IMPLICATIONS

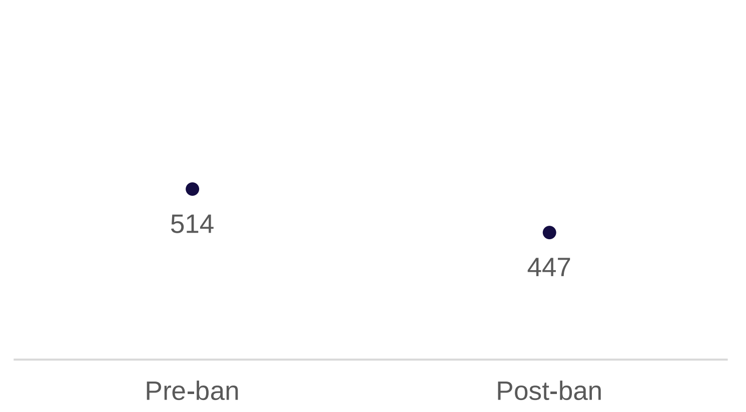
Price impact for pre-ban & post-ban scenarios

Changes in prices are based on the price elasticity of demand of EU imports of the relevant feed materials

Pre-and-Post Ban Average Prices (€/tonne)

GM soy meal

13.0% decrease



Non-GM soy meal

31.7% increase

Substitutes[1]

49.6% increase

- Pre-ban soybean meal and substitute prices are based on the average EU import price for feed materials sourced from outside the EU in 2022 (source from the FAO). Non-GM Soybean meal prices are the average price of EU soybeans sourced on the Bologna exchange in 2022, a benchmark price for non-GM soybean (sourced from CLAL).
- Post-ban prices were developed using price elasticity of demand ratios for the various soybean and alterative feed materials. Price elasticities were calculated based average annual responsiveness of extra EU import volumes to price changes over the period 2012-2022.
- The prices for the Non-GM soy meal and the substitutes are expected to increase, given the increased demand, driven by the GM soy meal ban
- The price for GM soy meal is expected to decrease, given the decreased demand, driven by the GM soy meal ban

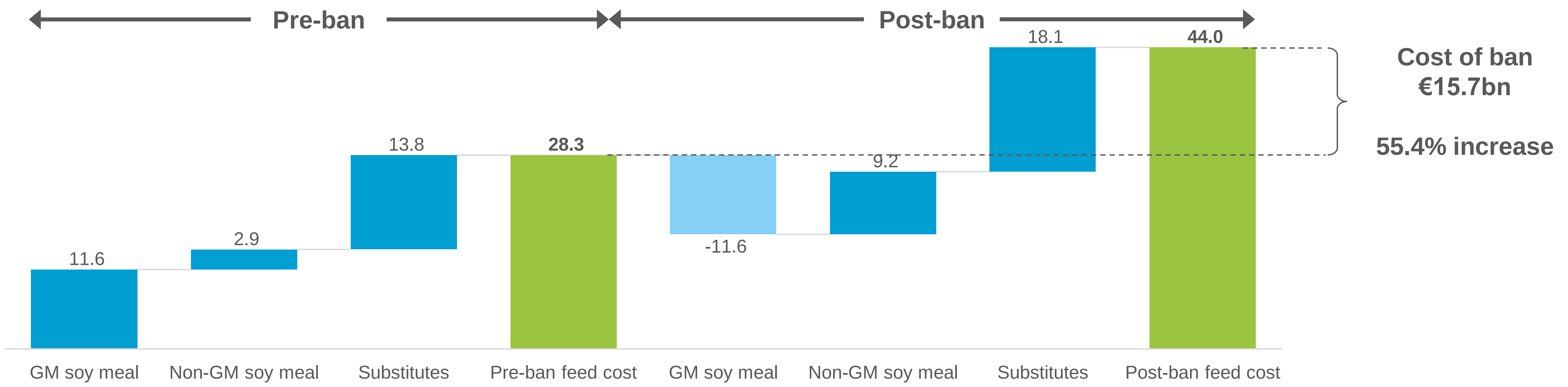
Note: Pre-ban data is for year 2022 (most recent data available)
1. Average price of all 12 substitutes

Source: Farrelly Mitchell, CLAL, FAOSTAT

Total costs for pre-ban & post-ban scenarios

The change in costs of post-ban substitutes is higher than the cost saving from the reduction in GM-soy meal

Impact of Ban on Feed Costs (€ bn)



- Total pre- and post-ban costs are for the following sectors: a) Pork meat manufacturing, b) Chicken meat manufacturing, c) Dairy manufacturing, d) Cattle meat manufacturing, e) Chicken eggs production, e) Other meats manufacturing, f) Farmed fish manufacturing
- The substitutes1 are comprised of products that are already included in the pre-ban feed mix for the animals, which would increase in quantities, to replace the lack of protein from the ban on GM-soybean
- The total cost of ban would be allocated to the following industries: a) Pork meat manufacturing, b) Chicken meat manufacturing, c) Dairy manufacturing, d) Cattle meat manufacturing, given they account for 80% of soybean cake consumption

Note: Pre-ban data is for year 2022 (most recent data available)
1. Substitutes include the 12 products mentioned in the table on slide 16

Source: Farrelly Mitchell, CLAL, ICH Brazil, FAOSTAT

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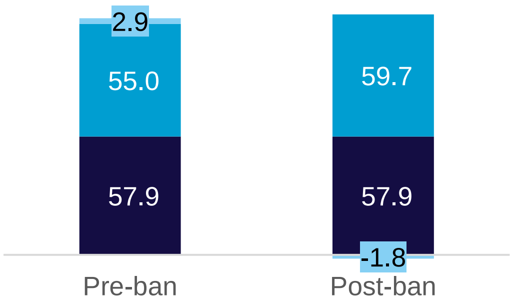
Scenario 1: Costs of ban fully absorbed by the manufacturers

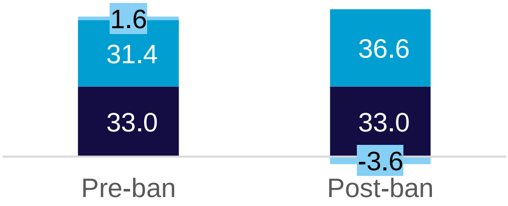
Operating surplus margins drop for all 4 industries, with the cost of the ban not being absorbed by the pork and chicken manufacturing sectors

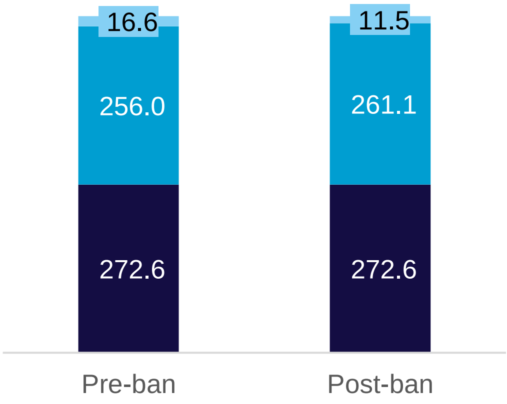
Impact of Ban on Meat & Dairy Manufacturing Sectors (€ bn)

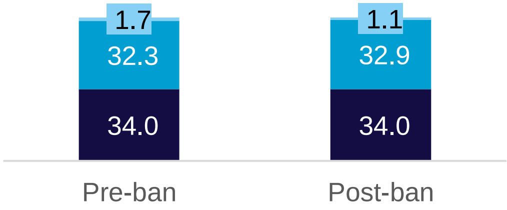
	Pork meat manufacturing	Chicken meat manufacturing	Dairy manufacturing[4]	Cattle meat manufacturing
Cost of ban[1]	€4.7bn	€5.3bn	€5.1bn	€0.7bn
Margin	5.0%[2] → (3.1%)	5.0%[2] → (10.9%)	6.1% → 4.2%	5.0%[2] → 3.1%
€/tonne[3]	2,599 → 2,599	2,528 → 2,528	1,767 → 1,767	5,061 → 5,061
% change	0.0%	0.0%	0.0%	0.0%

Total €15.7bn









■ Revenue ■ Costs ■ Operating surplus

Note: Pre-ban data is for year 2022 (most recent data available)
1. Cost of ban was allocated to each industry based on the quantities of the substitutes used to replace the GM-soybean for each of the industries
2. Margin for meat manufacturing is 5%, assumed to be equal for the pork, cattle and chicken manufacturing industry, since further segmentation is not available according to the data extracted from Eurostat
3. Assuming the output quantities do not change
4. Dairy products include milk, cheese, ice cream and yoghurt, given there is no segmentation available just for milk

Source: Farrelly Mitchell, Eurostat (Manufactured Goods Statistics, National Acounts-Prices, Structural Business Statistics, Economic Accounts for Farming), EU Comm. DG Agri (EU Crop & Livestock Balance Sheet 2023),FAOSTAT

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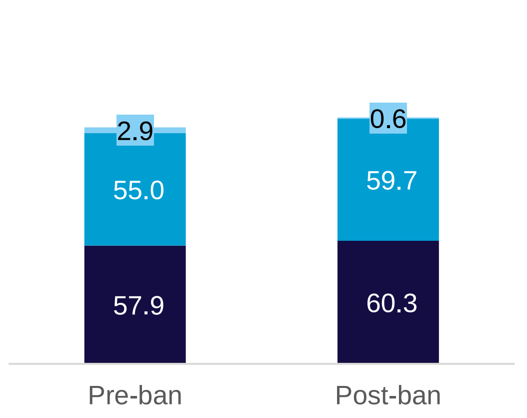
Scenario 2: Even cost-sharing between manufacturers & consumers

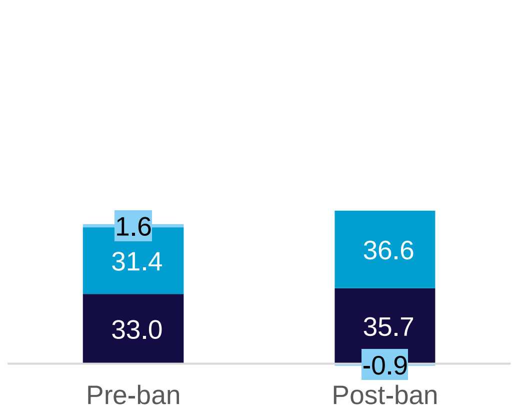
Even with cost-sharing assumed, the chicken meat industry has a negative margin with the highest increase in output prices, resulting in the chicken meat industry being unable to absorb the cost of the ban

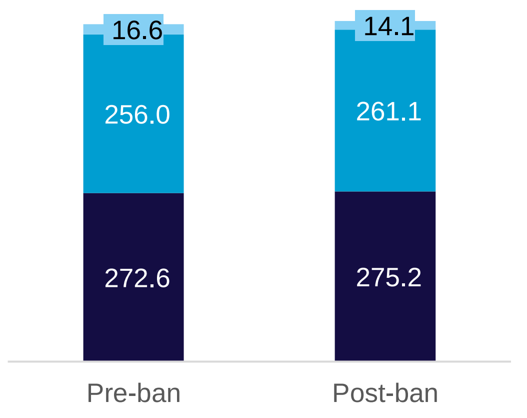
Impact of Ban on Meat & Dairy Manufacturing Sectors (€ bn)

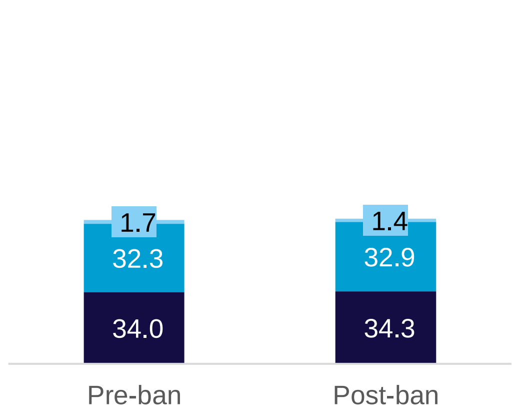
	Pork meat manufacturing	Chicken meat manufacturing	Dairy manufacturing[4]	Cattle meat manufacturing
Cost of ban[1]	€4.7bn	€5.3bn	€5.1bn	€0.7bn
Margin	5.0%[2] → 0.9%	5.0%[2] → (2.7%)	6.1% → 5.1%	5.0%[2] → 4.0%
€/tonne[3]	2,599 → 2,705	2,528 → 2,728	1,767 → 1,783	5,061 → 5,110
% change	4.1%	7.9%	0.9%	1.0%

Total €15.7bn









■ Revenue ■ Costs ■ Operating surplus

Note: Pre-ban data is for year 2022 (most recent data available)
1. Cost of ban was allocated to each industry based on the quantities of the substitutes used to replace the GM-soybean for each of the industries
2. Margin for meat manufacturing is 5%, assumed to be equal for the pork, cattle and chicken manufacturing industry, since further segmentation is not available according to the data extracted from Eurostat
3. Assuming the output quantities do not change
4. Dairy products include milk, cheese, ice cream and yoghurt, given there is no segmentation available just for milk

Source: Farrelly Mitchell, Eurostat (Manufactured Goods Statistics, National Acounts-Prices, Structural Business Statistics, Economic Accounts for Farming), EU Comm. DG Agri (EU Crop & Livestock Balance Sheet 2023),FAOSTAT

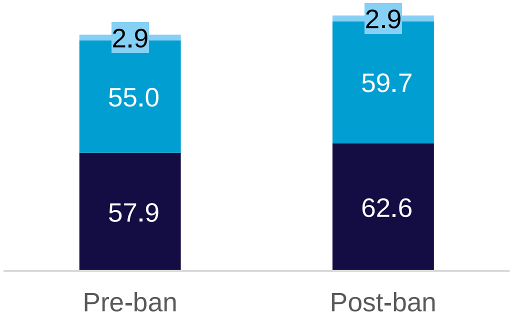
Scenario 3: Costs of ban fully transferred onto customers

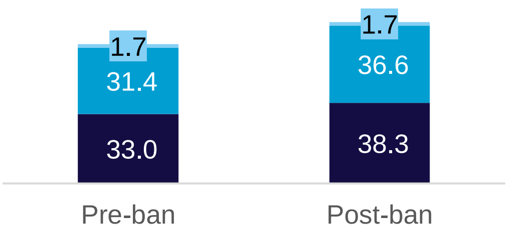
Output prices rise for all 4 industries, with the pork and chicken meat manufacturing being more severely affected

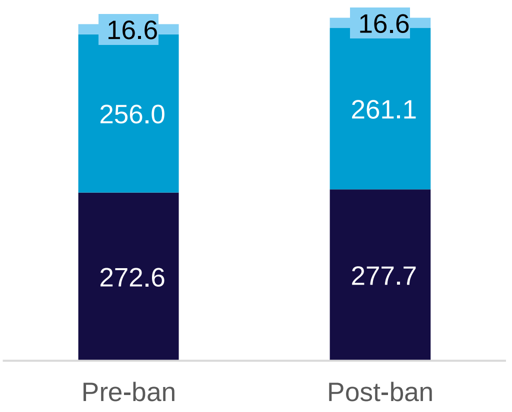
Impact of Ban on Meat & Dairy Manufacturing Sectors (€ bn)

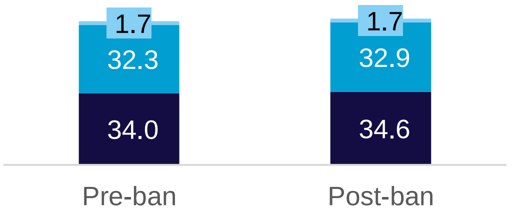
	Pork meat manufacturing	Chicken meat manufacturing	Dairy manufacturing[4]	Cattle meat manufacturing
Cost of ban[1]	€4.7bn	€5.3bn	€5.1bn	€0.7bn
Margin	5.0%[2] → 4.6%	5.0%[2] → 4.3%	6.1% → 6.0%	5.0%[2] → 4.9%
€/tonne[3]	2,599 → 2,810	2,528 → 2,929	1,767 → 1,800	5,061 → 5,159
% change	8.1%	15.9%	1.9%	1.9%

Total €15.7bn









■ Revenue ■ Costs ■ Operating surplus

Note: Pre-ban data is for year 2022 (most recent data available)
1. Cost of ban was allocated to each industry based on the quantities of the substitutes used to replace the GM-soybean for each of the industries
2. Margin for meat manufacturing is 5%, assumed to be equal for the pork, cattle and chicken manufacturing industry, since further segmentation is not available according to the data extracted from Eurostat
3. Assuming the output quantities do not change
4. Dairy products include milk, cheese, ice cream and yoghurt, given there is no segmentation available just for milk

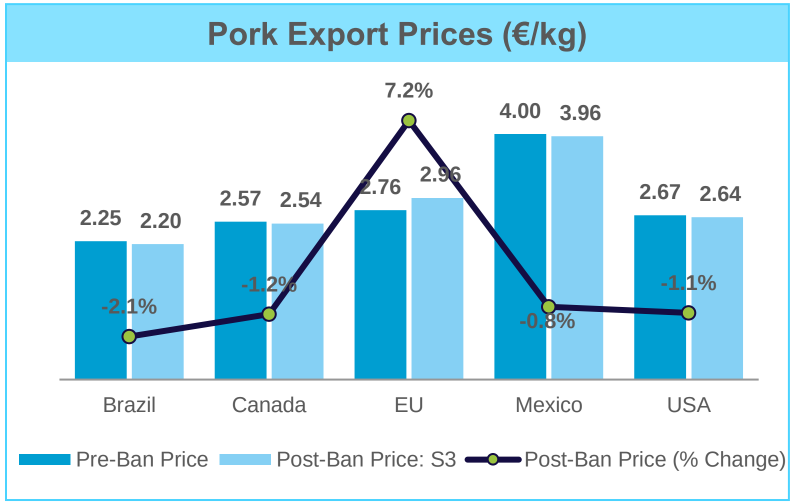
Source: Farrelly Mitchell, Eurostat (Manufactured Goods Statistics, National Acounts-Prices, Structural Business Statistics, Economic Accounts for Farming), EU Comm. DG Agri (EU Crop & Livestock Balance Sheet 2023),FAOSTAT

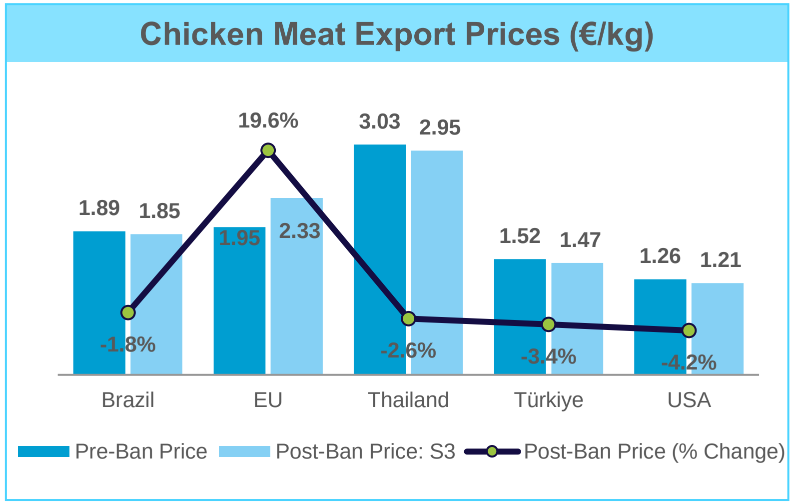
FARRELLY MITCHELL

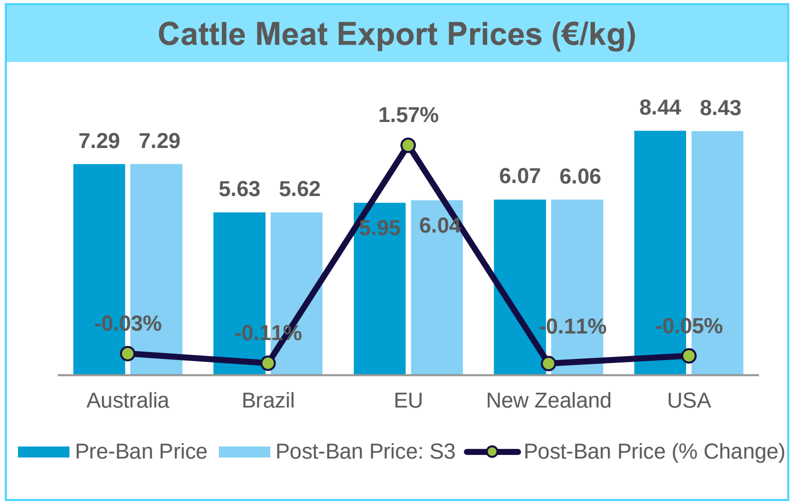
International Competitiveness: Meat Industry

A GM-soybean ban has potential to further erode the international competitiveness of EU chicken meat and pork

Pre-and-Post Ban Average Export Prices (€/tonne)[1]







- Based on 2022 data, the EU has a slight relative price advantage in international markets (97%) for beef compared to the global average but operates at a slight disadvantage for both chicken meat and pork, 104% and 107%, respectively. A gm-soybean ban has potential to further erode the international competitiveness of EU meat products.
- The analysis above compares estimates of average pre-and-post-ban EU meat export prices with those of key competitors in the international market. These are the key exporters in the international market and, including the EU, account for between 50% (beef) and 68% (chicken) of international traded volumes.
- While the EU can expect a relative decline in competitiveness across meat types, chicken meat and pork export prices are the most impacted.
- Beef prices remain below those of each of key competitors (except Brazil). In contrast, chicken meat and pork export prices are already above most of the key competitors and are estimated to increase by a further 20% and pork by 7%.
- These increases have substantial potential to undermine demand for EU pork and chicken meat, considering the cost competitiveness of these sectors at a global level and their profile as low-cost protein sources.

1. The post-ban analysis is based on scenario 3, with manufacturers fully passing on increased costs to customers. The analysis estimates soybean inclusion rates in feed by species in competitor countries based on published estimates and industry standard practices. The contribution of changes in soybean costs to changes in meat export prices is then calculated based on costs plus method i.e. adding/subtracting the mark-up or down in the soybean price to the post-ban meat price. Note that the analysis focuses on soybean and assumes that it is the key protein supplement used in feed materials across competitor countries

Source: Farrelly Mitchell, USDA Foreign Agricultural Service, UN Comtrade, Alltech, FAOSTAT, Soybean Meal Info Centre

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APPENDICES

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APPENDIX A

POLICY & REGULATORY LANDSCAPE

EU Authorisation Process for GMOs

Guidelines' target draft decision within 1 year. However, in reality, full authorization can take up to 6 years

Overview of the Authorization Process

Submission of Application:

- The applicant applies to the national competent authority of a Member State. The application includes include relevant details including food designation and specification, transformation event(s) used, method of production, and studies demonstrating compliance with safety criteria

Verification and Assessment by Authority:

- The national competent authority acknowledges receipt of the application in writing within 14 days and informs the applicant, specifying the date of receipt.
- Without delay, the authority informs the European Food Safety Authority (EFSA) and makes the application and any supplementary information available to the EFSA.
- The EFSA verifies the submitted particulars and documents. The EFSA examines whether the food complies with safety criteria (human health, animal health, and/or the environment), may mislead the consumer and differs from the food it is intended to replace (to an extent that its would be nutritionally disadvantageous).
- Supplementary information may be requested from the applicant

Opinion of the EFSA:

- The EFSA provides its opinion within six months from the receipt of a valid application, with a potential extension for supplementary information.
- The opinion considers safety assessments, environmental risk assessments, and validation of detection methods. The opinion, along with a supporting report, is submitted to the EU Commission, Member States, and the applicant. If consulted, opinions of competent authorities are also included.

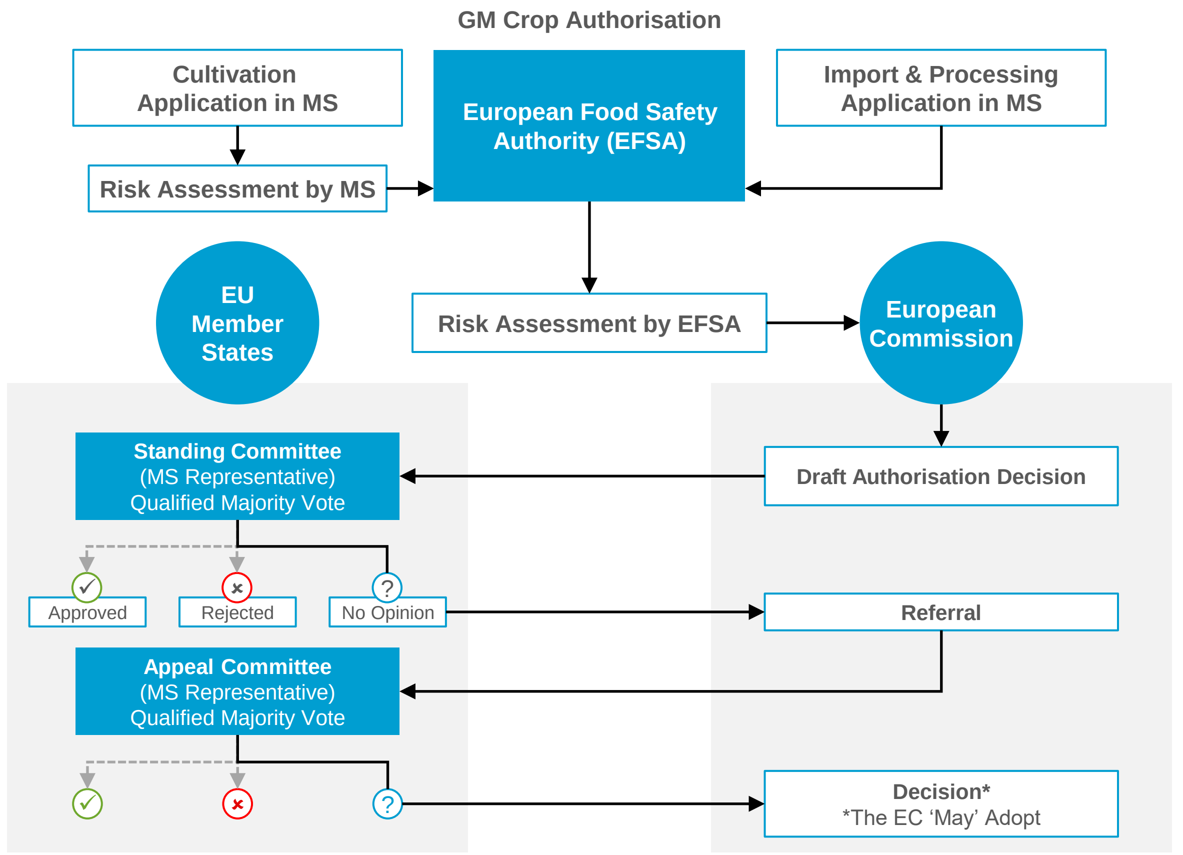
Draft Decision by the European Commission:

- Within three months of receiving the opinion of the EFSA, the Commission presents a draft decision to the EU Standing Committee, composed of representatives from Member States
- The draft considers the EFSA's opinion, relevant provisions of Community law, and other legitimate factors. If the draft decision deviates from the EFSA's opinion, the Commission provides an explanation.

Authorization or Rejection:

- A final decision is adopted, and the decision is communicated to the applicant
- f a qualified majority is not achieved, the matter is referred to the Appeal Committee.
- If there is still no agreement, the Commission makes the final decision

GMO Authorisation process



The Commission is assisted by the Standing Committee on the Food Chain and Animal Health, set up by Article 58 of Regulation (EC) No 178/2002, hereinafter referred to as the 'Committee

*A qualified majority is a specific voting threshold in decision-making processes in the EU where. a certain percentage of votes, typically determined by a specified proportion of member states or voting weights, is required for a proposal to be approved or rejected

Source: EU GMO Crop Register, Mampuys, Farrelly Mitchell Research

Overview of Green Deal & CAP Reforms

Policy emphasizes food security, sustainability and technology inclusion

The European Green Deal 2030 (EGD)

- The European Green Deal (EGD) is the EU's transformative growth strategy adopted in 2019. Its overarching objective is to transform the EU into a fair and prosperous society with a modern, resource-efficient, and competitive economy.
- The key goals include achieving climate neutrality by 2050 and decoupling economic growth from resource use.
- The EGD aims to protect, conserve, and enhance the EU's natural capital while ensuring the health and well-being of citizens.
- Some key elements and objectives of the EGD include:
  - **Climate Neutrality:** The primary goal is to make the EU a climate-neutral block by 2050.
  - **Pollution Reduction:** Protecting human life, animals, and plants by cutting pollution.
  - **Innovation Leadership:** Assisting companies in becoming world leaders in clean products and technologies.
  - **Inclusive Transition:** Ensuring a just and inclusive transition to a sustainable economy.
  - **Initiatives:** The EGD has led to key initiatives such as the Farm to Fork Strategy, the EU Circular Economy Action Plan, and the EU Biodiversity Strategy for 2030.
  - **Farm to Fork Strategy:** A cornerstone of the EGD, aiming to accelerate the transition to a sustainable food system, with targets to reduce environmental and climate impact.
  - **CAP Alignment:** The EGD aligns with the Common Agricultural Policy (CAP) to support a just transition and make food systems sustainable.

Common Agricultural Policy (CAP): 2023-2027 Reforms

- The CAP is a the EU's main policy tool for agriculture and rural development. The most recent revisions aims to accelerate the transition to environmentally friendly farming practices and ensure a fairer distribution of funding.
- The key objectives of the CAP during this period focus on guiding policies and measures for a more sustainable and equitable agricultural sector in the European Union. These include:
  - **Climate Action:** Promoting environmentally sustainable farming practices and contributing to climate goals. The reforms supports the European Green Deal by incorporating higher green ambition and introducing enhanced conditionality for beneficiaries;
  - **Biodiversity:** Supporting measures that enhance and protect biodiversity in agri. landscapes;
  - **Sustainable Resource Management:** Encouraging responsible use and management of natural resources, including soil and water. Specific measures in the fruit and vegetables sector allocate at least 15% of expenditure towards the environment;
  - **Circular Economy:** Promoting practices that align with the principles of a circular economy within the agricultural sector;
  - **Social Inclusion and Vitality:** Addressing social issues, promoting inclusivity, and supporting the vitality of rural communities;
  - **Farm Viability:** Ensuring the economic viability and competitiveness of farms, especially smaller and medium-sized ones;
  - **Innovation and Knowledge Transfer:** Supporting research, innovation and the dissemination of knowledge within the agricultural sector.
  - **Young Farmers:** Facilitating the entry of young farmers into the agricultural sector and providing support for their development.
  - **High-Quality Food Production:** Promoting the production of high-quality and safe food for consumers.
  - **Resilience and Crisis Management:** Enhancing the resilience of the agricultural sector and establishing measures for crisis management in times of need.

Source: European, Commission Department For Agriculture And Rural Development ,The European Commission's Directorate-General for Climate Action, Farrelly Mitchell Research

APPENDIX B

EU RAW MATERIAL SUPPLY

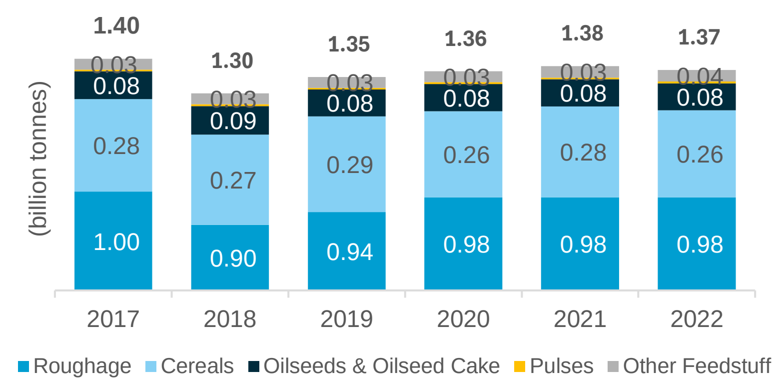
EU Raw Material Supply (1/3)

Total available feed raw materials in the EU is estimated at 1.37 bn tonnes (90% of which is used as feed)

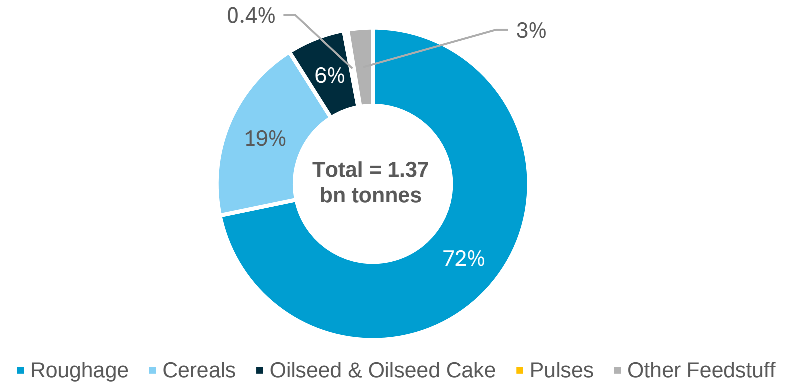
Overview

- Total available raw materials in the EU is estimated at 1.37 mn tonnes in 2022 (with 1.23 mn tonnes of this used as feed).
- Roughage accounts for 72% of these materials, with cereals 19%) and oilseeds (6%) accounting for the bulk of the rest.
- The livestock and feed sectors compete with other industries for raw materials (particularly the F&B processing and biofuels), while also offering an outlet for the valorisation of co-products and residues from these industries.
- Approx. 58% of cereals, 67% of oilseeds and oilseed cake and 69% of pulses available are consumed as feed.
- The EU is self-sufficient in the production of cereals. Despite rapid growth in protein crop production since 2000s, it relies on imports to supplement production of oilseeds and pulses.
- There is a significant supply gap for oilseed and oilseed cake; 43% of uncrushed oilseed is imported and 72% of oilseed cake is either imported as cake or derived from imported oilseeds.
- The gap is most acute for soybean and soybean cake where imports account for 86% of (uncrushed) soybean supply.
- In addition, 98% of available soybean cake is either imported as cake or derived from imported soybeans.
- Brazil (38%) and the USA (33%) are the EU's key suppliers of uncrushed soybean, while Brazil (33%) and Argentina (29%) are the key suppliers of imported soybean cake.
- Most soybean production (94% to 99%) in these countries is from GM seeds.

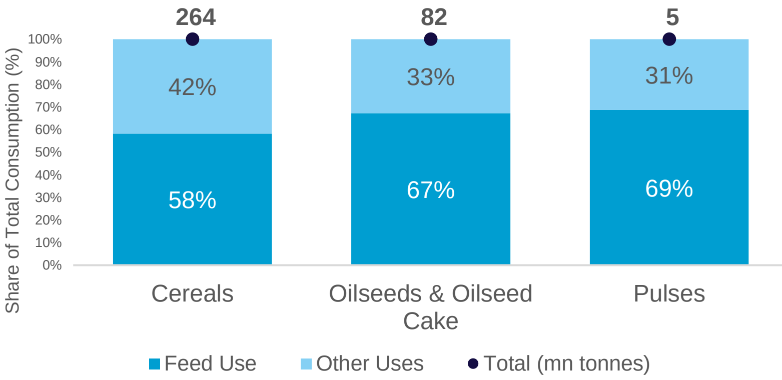
EU Domestic Supply of Crops & Other Feedstuff 2017-2022[1]



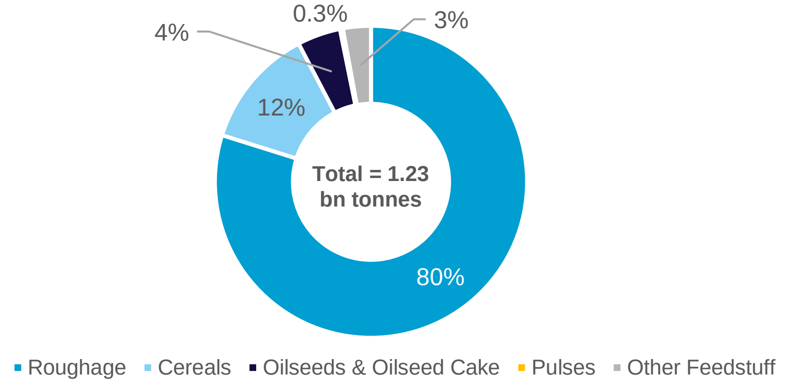
EU Domestic Supply of Feed Crops & Other Feedstuff 2022



Utilization Rates Across Commodity Categories 2022



EU Feed Raw Material Consumption by Type 2022[2]



[1] Roughage includes pasture grazing (grasses), fodder legumes, cereal silage and other fodder crops. Other feedstuff includes non-oilseed co-products (including bran and residues from the sugar, starch and brewing/distilling industries) and non-plant sources (e.g. processed animal proteins, whey and milk powder and food waste).

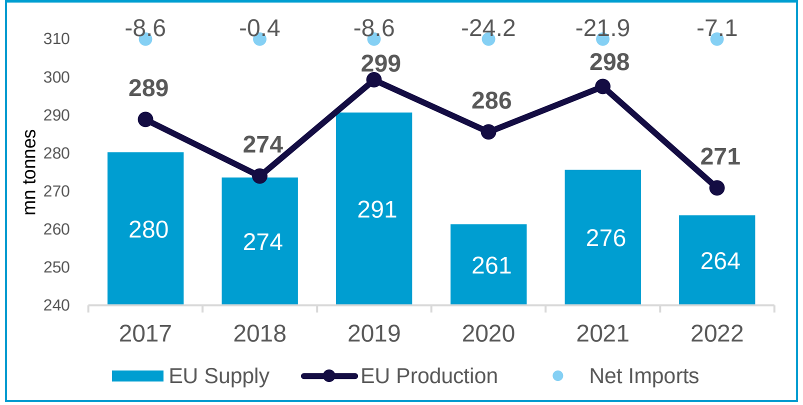
[2] Oilseeds feed use is estimated based on an oilseed cake equivalent basis

Source: Eurostat Database. EU Commission, FAOSTAT, Farrelly Mitchell Research

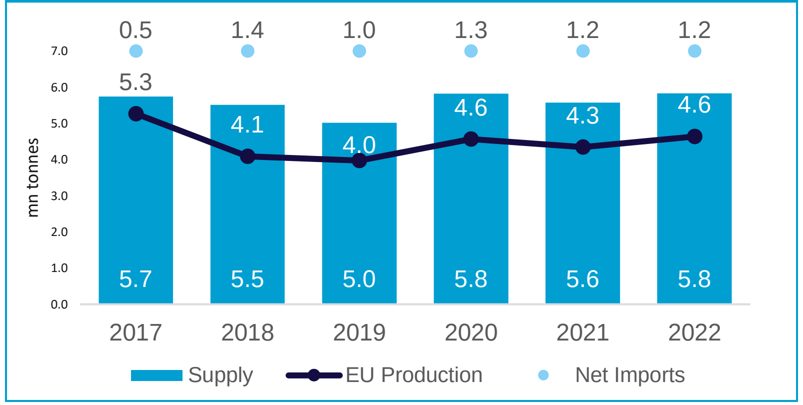
EU Raw Material Supply (2/3)

The EU is self-sufficient in cereals but relies on imports to supplement production of oilseeds and pulse

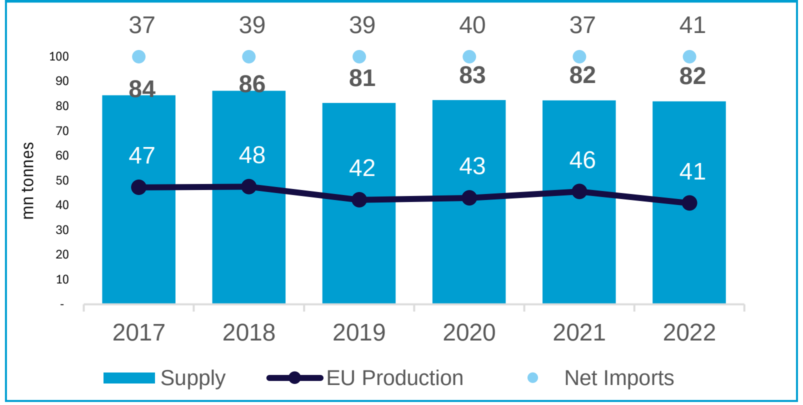
Cereal Supply in the EU 2017 to 2022 (mn tonnes)



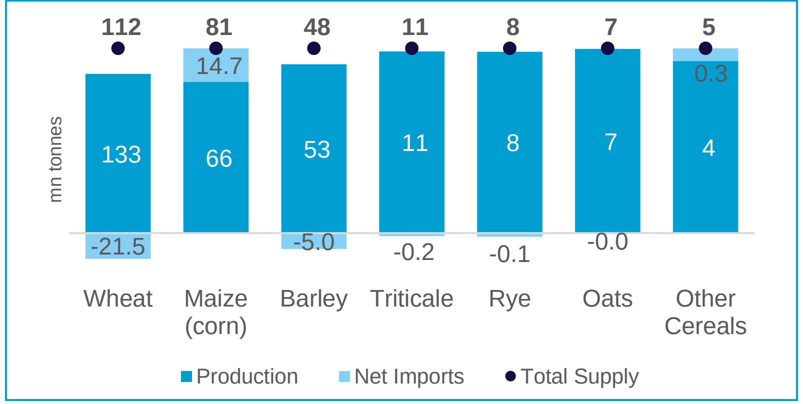
Pulse Supply in the EU 2017 to 2022 (mn tonnes)



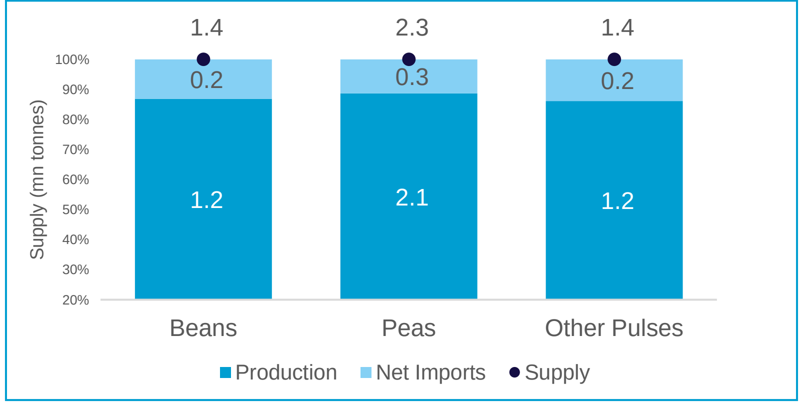
Oilseed Supply in the EU 2017 to 2022 (mn tonnes)[1]



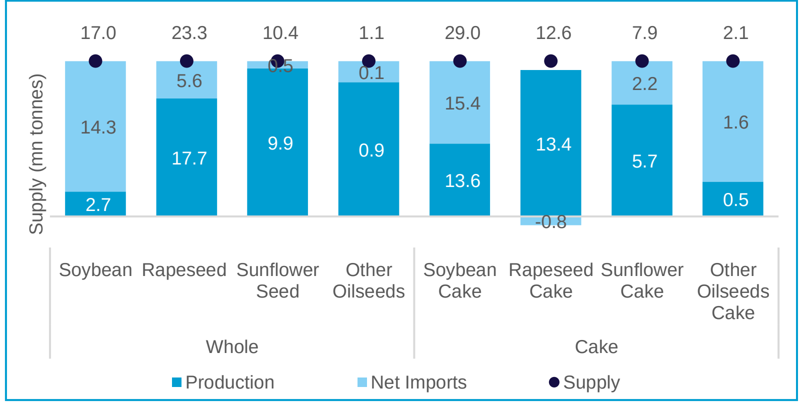
Cereal Supply Balance by Type: Average Annual



Pulse Supply in the EU 2017 to 2022 (mn tonnes)



Oilseed Supply Balance by Type: Average Annual[2]



[1] Includes both oilseeds and oilseed cake
[2] Oilseed cake production estimates are for EU processing of imported and domestically produced whole oilseeds

Source: Eurostat. EU Feed Balance Database, FAOSTAT,, Farrelly Mitchell Research

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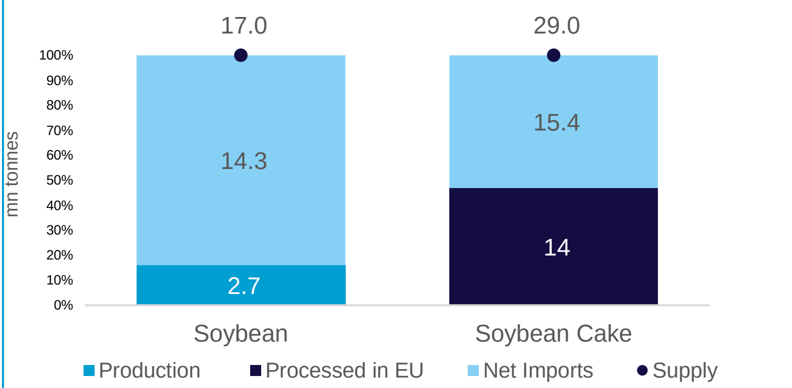
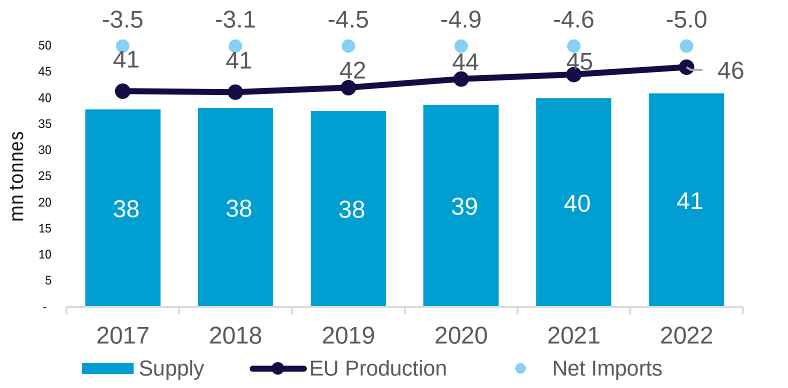
EU Raw Material Supply (3/3)

An acute soybean cake supply gap with +90% of supply imported as cake or crushed from imported soybeans

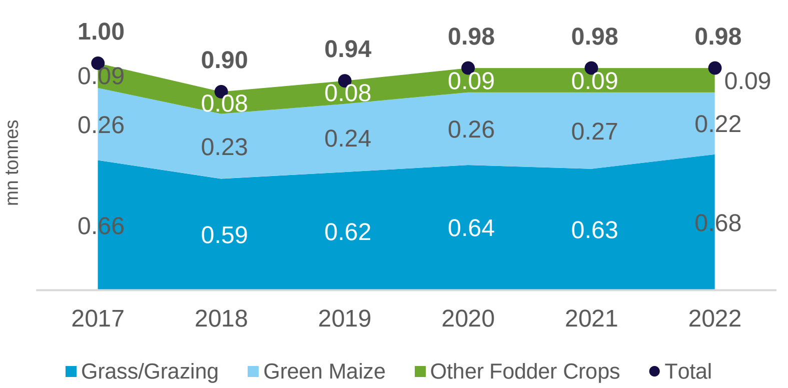
Soybean & Soybean Cake Supply Balance: Average Annual



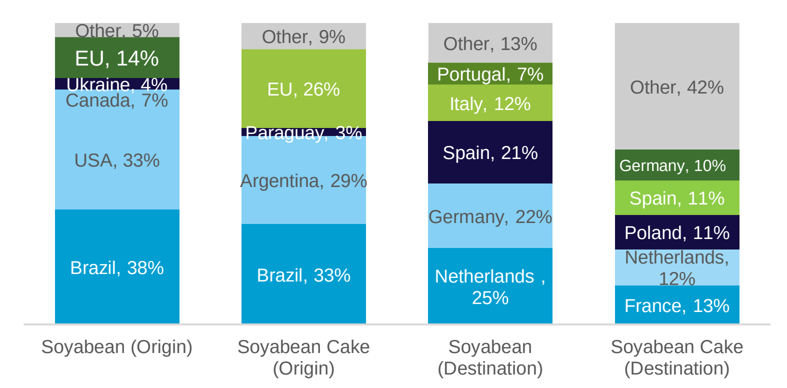
EU Supply of Other Feedstuff 2017-2022 (mn tonnes)[1]



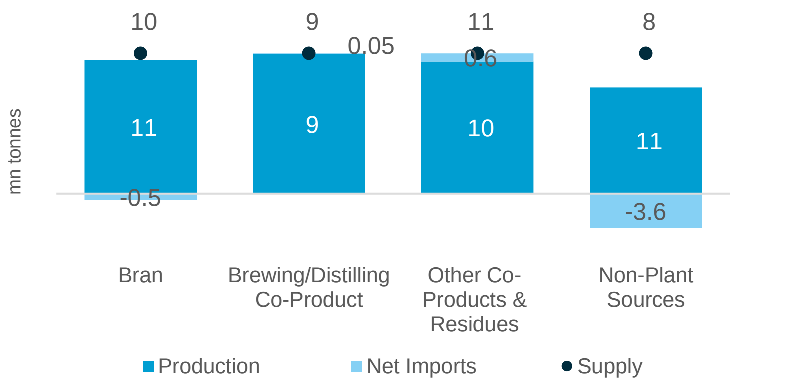
Roughage Use in the EU 2017 to 2022 (bn tonnes)[2]



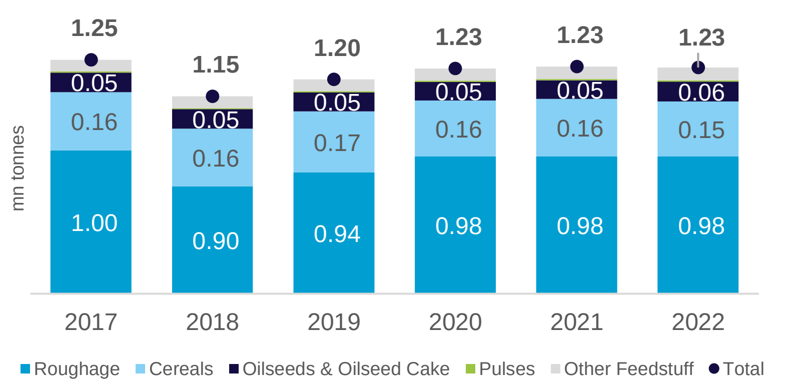
Soybean & Cake Imports by Origin & Destination[3]



Other Feedstuff Supply Balance by Type: Average Annual



Est. EU Feed Use by Ingredient Type 2017-22 (bn tonnes)[4]



Source: Eurostat Database, EU Feed Balance Database, FAOSTAT, Farrelly Mitchell Research

[1] Other co-products and residues excluding bran and oilseeds cake
[2] Estimated based on production volumes and areas under pasture. Fodder legumes account for +99% of other fodder crops. In addition, c11 mn tonnes of cereal crops are harvested green each year for use as animal fodder
[3] More than half of EU imports of soybean from other EU origins are re-exports. The majority of soybean cake imports from other EU countries are also either re-exports or exports of soybean cake processed from soybean imported from outside the EU
[4] Oilseeds feed use is estimated based on an oilseed cake equivalent basis

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APPENDIX C

GLOBAL EXPORTS & EXPORT PRICES BY COUNTRY

Global Trade: Soybean & Soybean Cake

Export prices of main suppliers are clustered around the global average export price, with lower volume supplier typically less price competitive

Global Exports of Soybean by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Brazil	79	9%	591	1.1%
USA	57	3%	602	0.6%
Argentina	5	-2%	593	1.4%
Canada	4	2%	632	0.5%
Uruguay	3	2%	627	1.5%
Paraguay	2	-3%	540	0.8%
Ukraine	2	3%	433	-0.9%
Netherlands	0.9	-5%	679	1.1%
Russia	0.8	21%	521	5.9%
Bolivia	0.6	7%	554	0.5%
South Africa	0.2	3%	701	3.4%
Romania	0.2	7%	710	1.7%
Croatia	0.2	11%	693	1.1%
Belgium	0.1	-2%	749	1.4%
Togo	0.1	51%	589	-4.3%
Other	1.4	3%	779	0.8%
Total	158	5%	596	0.8%

Global Exports of Soybean Cake by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Argentina	24	0.6%	480	0.8%
Brazil	20	3.6%	508	1.0%
USA	10	3.9%	517	0.0%
Netherlands	2.8	-3.8%	531	0.6%
Bolivia	2.2	6.3%	436	0.4%
Germany	1.7	1.1%	519	0.4%
Paraguay	1.2	9.7%	473	1.9%
Türkiye	0.9	56.3%	622	-0.6%
India	0.8	-15.8%	738	4.5%
Slovenia	0.7	-5.0%	602	2.1%
Russia	0.6	37.1%	690	0.6%
Belgium	0.5	-0.9%	517	0.0%
China	0.4	-10.1%	634	1.5%
Ukraine	0.4	39.6%	507	-0.5%
Canada	0.4	13.1%	710	4.3%
Other	3.1	4.9%	624	1.8%
Total	70	1.5%	511	0.9%

Source: FAOSTAT, Farrelly Mitchell Research

Global Trade: Rapeseed & Rapeseed Cake

The EU has a high share of global exports of rapeseed (+33%) and sunflower seeds (<50%)...

Global Exports of Rapeseed by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Canada	5.7	-4%	776	2.2%
Australia	5.4	7%	798	2.9%
Ukraine	3.1	9%	495	-2.1%
Belgium	1.1	8%	949	4.5%
France	1	-4%	946	4.3%
Netherlands	1.1	7%	809	1.6%
Romania	1	31%	737	-0.7%
Lithuania	0.6	4%	695	1.1%
Hungary	0.5	-2%	800	2.3%
Czechia	0.4	0%	808	2.5%
Poland	0.4	4%	724	1.6%
Slovakia	0.3	-7%	947	1.7%
Latvia	0.3	1%	699	1.5%
Germany	0.1	-6%	2395	6.7%
Uruguay	0.3		657	
Other	1.3	-5%	765	1.7%
Total	22.6	1%	761	1.8%

Global Exports of Rapeseed Cake by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Canada	4.8	3%	398	2.0%
Germany	1.5	-1%	355	2.0%
India	1.4	3%	305	1.4%
Poland	0.7	1%	351	1.7%
Belgium	0.7	2%	380	2.1%
UAE	0.5	11%	474	4.6%
France	0.5	2%	405	2.7%
Russia	0.3	3%	309	1.4%
Romania	0.3	11%	371	2.9%
Czechia	0.3	2%	347	2.0%
Netherlands	0.2	-6%	431	4.7%
Belarus	0.2	16%	296	0.0%
Lithuania	0.2	5%	403	1.8%
Austria	0.1	4%	371	2.4%
Latvia	0.1	6%	371	1.1%
Other	0.8	0%	399	2.5%
Total	12.4	2%	377	2.2%

Source: FAOSTAT, Farrelly Mitchell Research

FARRELLY MITCHELL

Global Trade: Sunflower Seed & Sunflower Seed Cake

However, +80% of this is already traded within the EU, limiting supply as an alternative to imported soybean

Global Exports of Sunflower Seed by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Ukraine	2.8	26%	457	-2.5%
Romania	1.5	8%	803	2.0%
Bulgaria	0.7	-1%	1100	5.0%
France	0.7	4%	1023	1.3%
China	0.4	9%	1527	0.3%
Moldova	0.4	14%	775	1.9%
Kazakhstan	0.3	24%	495	3.0%
Hungary	0.2	-9%	963	3.5%
Russia	0.2	-2%	454	0.5%
Slovakia	0.2	-3%	774	2.0%
Argentina	0.2	7%	791	-4.5%
Türkiye	0.1	11%	1995	-2.3%
Serbia	0.1	24%	739	-7.6%
Croatia	0.1	7%	676	0.0%
Netherlands	0.1	7%	1090	-0.4%
Other	0.4	-1%	2003	3.6%
Total	4.2	7%	822	0.0%

Global Exports of Sunflower Seed Cake by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Ukraine	3.3	-2%	232	2.5%
Russia	1.6	-2%	298	3.9%
Bulgaria	0.9	21%	358	4.6%
Argentina	0.6	-3%	255	3.6%
Hungary	0.5	8%	348	4.7%
Romania	0.4	8%	313	3.1%
Netherlands	0.3	0%	358	2.5%
Kazakhstan	0.2	5%	234	1.1%
Moldova	0.2	12%	257	1.6%
Latvia	0.2	60%	311	7.0%
Germany	0.1	1%	468	7.7%
Tanzania	0.1	2%	179	-9.9%
Belgium	0.1	7%	330	1.3%
Slovenia	0.1	7%	359	3.6%
Serbia	0.1		304	
Other	0.7	1%	336	1.3%
Total	9.3	1%	287	3.3%

Source: FAOSTAT, Farrelly Mitchell Research

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Global Trade: Other Oilseeds & Other Oilseed Cake

Other oilseed cake are a lower cost alternative, however, global trade is limited

Global Exports of Other Oilseed by Origin[1]

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Russia	0.6	-2%	422	3.1%
Australia	0.6	10%	609	-2.1%
Kazakhstan	0.4	7%	1,428	3.5%
Sudan	0.3	-1%	1,616	0.8%
India	0.3	7%	1,114	0.0%
Nigeria	0.3	-7%	1,482	7.6%
Canada	0.3	1%	572	2.2%
USA	0.3	2%	450	1.0%
Greece	0.2	58%	157	-9.1%
Benin	0.2	1%	1,036	3.9%
Belgium	0.1	-9%	1,607	2.1%
Ethiopia	0.1	3%	1,169	1.0%
Tanzania	0.1	19%	871	-0.5%
Mozambique	0.1	17%	1,983	-3.1%
Türkiye	0.1	11%	1,373	3.4%
Other	1.6	1%	1,549	6.1%
Total	6.4	2%	1,044	2.8%

Global Exports of Other Oilseed Cake by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Indonesia	7	6.0%	319	9.4%
Malaysia	2.4	1.0%	160	1.8%
India	1.1	50.0%	200	-4.8%
Netherlands	0.4	-3.0%	297	4.4%
Philippines	0.4	-2.0%	179	-4.2%
Côte d'Ivoire	0.2	16.0%	121	14.2%
Tunisia	0.2	n.a	122	n.a
Belgium	0.1	1.0%	456	2.5%
Sudan	0.1	40.0%	477	3.9%
Benin	0.1	20.0%	290	1.0%
China	0.1	4.0%	258	1.8%
Mali	0.1	48.0%	193	2.2%
Spain	0.1	21.0%	300	2.4%
Greece	0.1	30.0%	487	6.3%
USA	0.1	-6.0%	318	-0.2%
Other	0.9	1.0%	265	1.8%
Total	13.4	5.0%	269	5.4%

[1] Other oilseeds includes oil palm fruit, seed cotton, olives, linseed, groundnut, sesame etc.

Source: FAOSTAT, Farrelly Mitchell Research

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Global Trade: Pulses

Pulses are a more expensive alternative, with lower protein content and limited global availability

Global Exports of Peas by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Canada	2.4	2%	556	2.5%
Russia	1.3	6%	415	0.7%
Australia	0.8	-3%	562	-0.7%
Türkiye	0.6	29%	693	-2.5%
India	0.4	12%	720	-5.4%
USA	0.3	-3%	991	3.6%
Tanzania	0.3	8%	473	-2.4%
France	0.3	-2%	520	2.3%
Myanmar	0.3	17%	738	0.4%
Argentina	0.2	-1%	497	-2.0%
Other	1.9	6%	749	-1.5%
Total	8.8	3%	611	0.5%

Global Exports of Beans by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Myanmar	1.5	2%	794	-2.4%
Australia	0.7	6%	507	-1.8%
Argentina	0.4	2%	748	-3.3%
Egypt	0.4	13%	642	-6.5%
USA	0.4	-3%	1263	3.0%
Canada	0.3	2%	1058	-0.8%
UK	0.3	7%	420	-2.3%
China	0.2	-13%	1990	6.8%
Uzbekistan	0.2	114%	1017	7.6%
France	0.2	-6%	621	1.6%
Other	2.3	7%	1017	-0.6%
Total	7	2%	893	-0.7%

Global Exports of Other Pulses by Origin

	Export Volume 2022 (mn tonnes)	10-Year CARC	Export Unit Value 2022 (USD/MT)	10-Year CARC
Canada	1.9	5%	866	3.2%
Australia	1	11%	719	2.8%
Türkiye	0.5	10%	1076	2.8%
Mozambique	0.4	80%	435	9.2%
UAE	0.4	33%	1098	4.2%
USA	0.2	0%	917	3.3%
India	0.1	68%	1272	1.9%
UK	0.1	48%	444	-13.7%
Myanmar	0.1	n.a	706	n.a
Kazakhstan	0.1	35%	648	3.7%
Other	0.3	8%	1063	1.7%
Total	5.2	10%	848	2.6%

[1] Pulses includes various green and dry beans and peas, lentils, lupins and vetches and other pulses

Source: FAOSTAT, Farrelly Mitchell Research

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