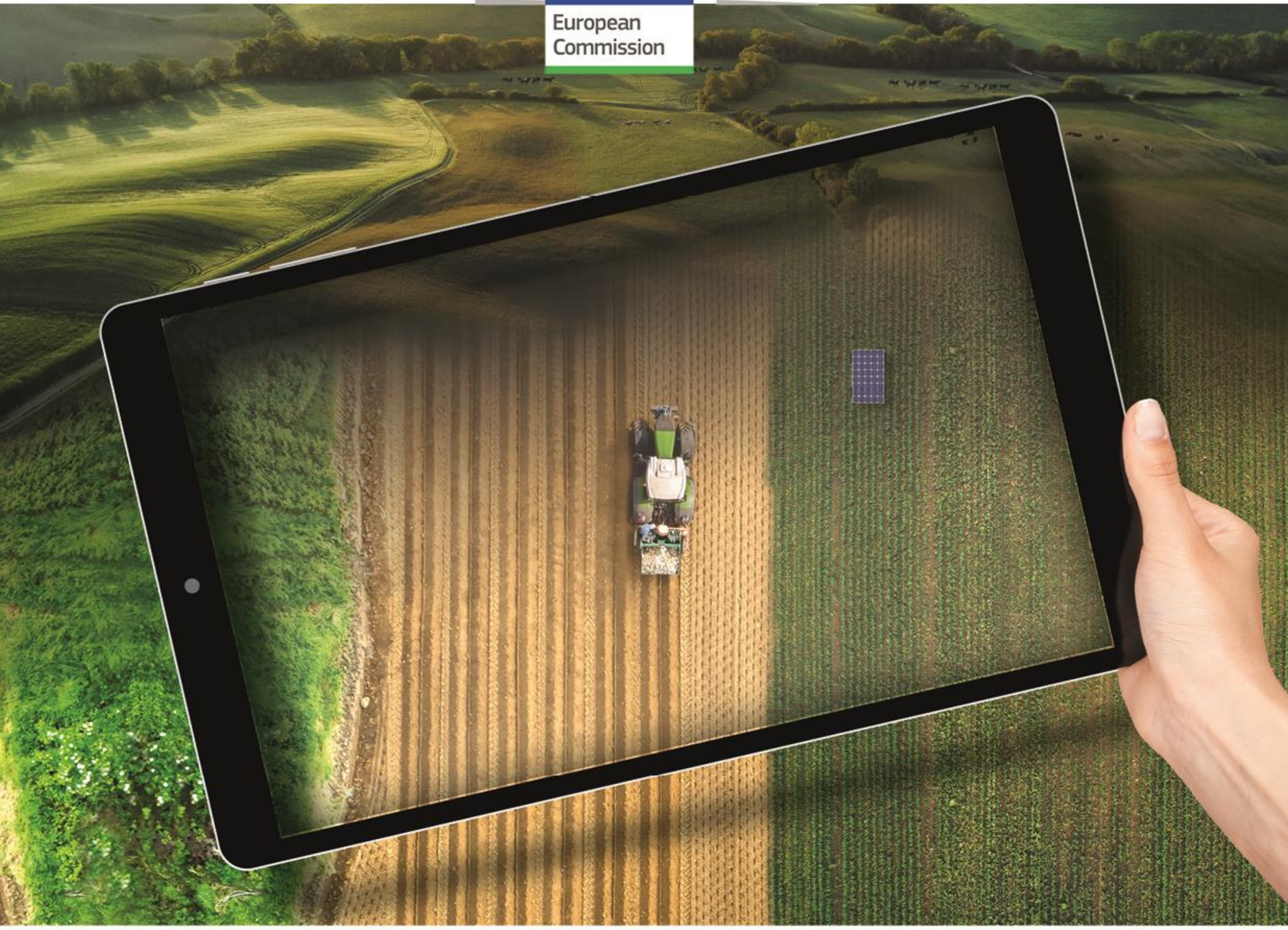
European Commission



EU AGRICULTURAL OUTLOOK

FOR MARKETS AND INCOME 2018-2030

Agriculture and Rural Development

NOTE TO THE READER

This report presents the medium-term outlook for the major EU agricultural commodity markets and agricultural income to 2030. It is based on a set of coherent macroeconomic assumptions deemed most plausible at the time of the analysis. The projections assume a continuation of current agricultural and trade policies. Our analysis is based on information available at the end of September 2018 for agricultural production and on an agro-economic model used by the European Commission.

It is accompanied by an uncertainty analysis. This quantifies potential variation in the results, stemming in particular from fluctuations in the macroeconomic environment and yields of the main crops and milk. Specific scenarios are also envisaged for trade disputes, development of protein crops and food waste.

As part of the validation process, an external review of the baseline and the uncertainty scenarios was conducted at an outlook workshop in Brussels in October 2018. Valuable input was collected from high-level policy makers, European and international modelling and market experts, private companies and other stakeholders and international organisations such as the OECD and the FAO.

This European Commission publication is a joint effort between the Directorate-General for Agriculture and Rural Development and the Joint Research Centre (JRC). Responsibility for the content rests with the Directorate-General for Agriculture and Rural Development. While every effort is made to provide a robust agricultural market and income outlook, strong uncertainties remain – hence the importance given to the uncertainty analysis. This publication does not necessarily reflect the official opinion of the European Commission.

In the Directorate-General for Agriculture and Rural Development, the publication and underlying baseline were prepared by Sylvie Barel, Andrea Capkovicova, Magdalena Grzegorzewska, Sophie Hélaine, Beate Kloiber, Barthélémy Lanos, Jean-Marc Leonard, Carl-Johan Linden, Pierluigi Londero, Koen Mondelaers (coordinator), Benjamin Van Doorslaer, Marijke van Schagen and David Zaitegui Pérez. The Directorate-General's outlook groups and market units contributed to preparing the baseline.

At the JRC, the team that helped to prepare the baseline, organise the outlook workshop and carry out the uncertainty and scenario analysis included Jesús Barreiro-Hurle, Mariia Bogonos, Thomas Chatzopoulos, Thomas Fellmann, Emanuele Ferrari, Giampiero Genovese, Manuel Gómez Barbero, Mihaly Himics, Jordan Hristov, Hans Jensen, Jonas Kathage, Sandra Marcolini, Robert M'Barek, Ignacio Pérez Dominguez (coordinator), George Philippidis, Martina Sartori and Guna Salputra (JRC D.4), María Bielza, Adrian Leip, Maria Luisa Paracchini, Carlo Rega, Jean-Michel Terres, Franz Weiss (JRC D.5) and Panos Panagos (JRC D.3).

The box on cereal use in the EU was prepared by the Agmemod consortium: Petra Salamon, Martin Banse, Verena Laquai, Marlen Haß, Birgit Laggner (Thünen Institute), Roel Jongeneel and Myrna van Leeuwen (Wageningen Economic Research).

We are grateful to the participants in the outlook workshop and many other colleagues for the feedback received during the preparation of the report

Please cite this publication as: EC (2018), EU agricultural outlook for markets and income, 2018-2030. European Commission, DG Agriculture and Rural Development, Brussels.

CONTENT

EXECUTIVE SUMMARY

This report presents the outlook for the major EU agricultural commodity markets and for agricultural income until 2030. The outlook is based on a set of assumptions that are deemed plausible at this point in time.

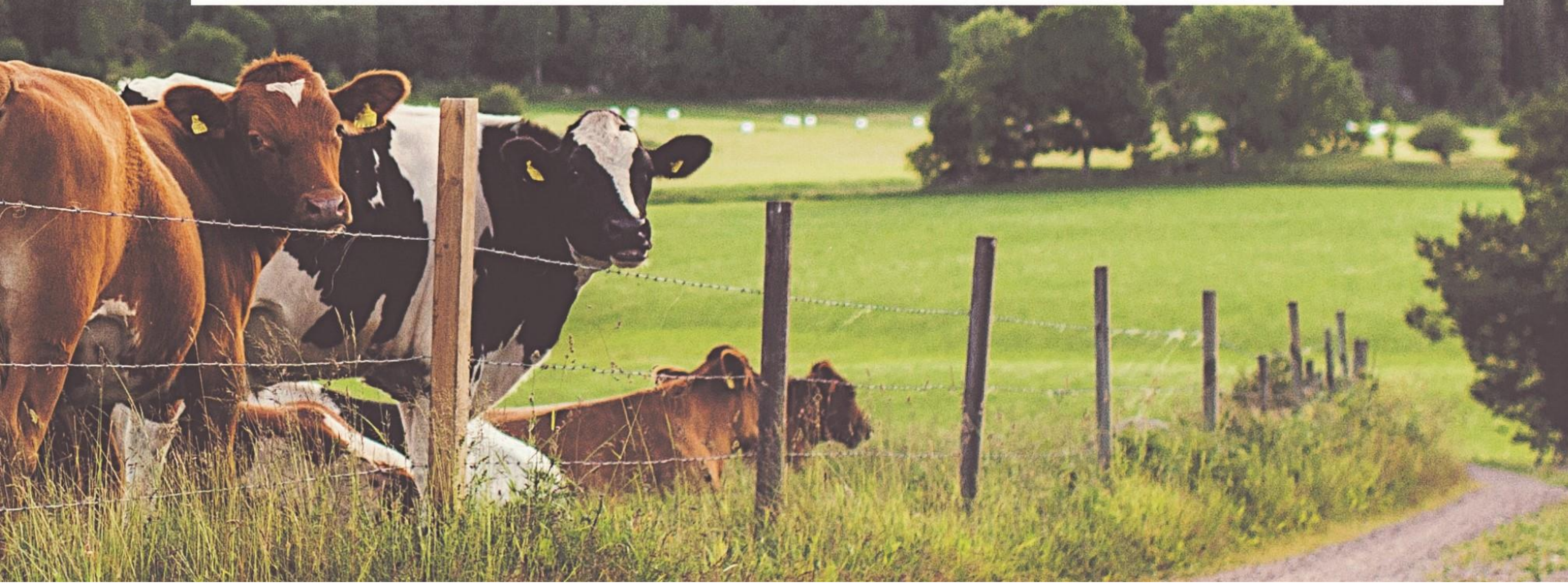
Many drivers will be at play in shaping agricultural markets over the next decade. This outlook tries to identify the impact of consumers' changes which are already apparent today and are expected to further strengthen. In the EU and beyond, the consumer and citizen will become more demanding towards food and its sourcing, its impact on the environment and climate change. For producers these evolving demands mean often higher production costs but also an opportunity to differentiate their products, adding value while reducing negative climatic and environmental impacts. Alternative production systems, such as local, organic or other types of certified production will further excel. At world level, both demand and supply will grow further, creating opportunities and pressures for EU imports and exports, depending on the product and target market.

EU cereal prices are expected to remain fairly stable throughout the outlook period, around EUR 170/t on average. This is due to only moderate growth in demand compensated by production growth on a stable area. Domestic soya bean production will continue to grow albeit from a low level, while also other protein-rich crops will benefit from strong demand and a favourable policy environment. With EU sugar consumption projected to decline, and production expected to stabilize after the end of production quotas in 2017, the EU will continue to be a net sugar exporter.

The livestock sector should benefit from steadily growing global demand and affordable feed prices. This could open the way for the EU dairy sector to expand in response to increasing global and domestic demand, despite the difficulties linked to high price volatility. Meat consumption is expected to stabilise before falling slightly. Poultry consumption and exports should continue to increase, while pigmeat production will decline driven by reduced domestic demand. By contrast, beef production and consumption are expected to fall.

Finally, specialised crops such as fruit and vegetables, olive oil and wine are expected to continue their recent trends, namely stagnating or slightly decreasing domestic consumption of traditional products compensated by growth in new ones and exports.

Since the negotiations on the UK's exit from the EU are ongoing, the projections are made on basis of a European Union of 28 Member States, i.e. including the UK, for the full duration of the outlook period. The new Common Agricultural Policy (CAP) proposals have also not been taken into consideration, as they are still under discussion in Council and Parliament.



Overall trends

This outlook, meant to serve as baseline for policy and market analysis and evaluation[1], is based on the existing policy framework and expected trends in the macro-economic environment. Under these assumptions, agriculture will still play a prominent role in the EU's society in 2030, with only a minor decrease in land use and some additional labour outflow. Consumers in the EU and abroad will become more demanding towards the food they consume, giving impetus to adding value (such as local, organic or other certified products) on the one hand and shifts between food categories on the other. Trends towards reduced meat, bread and sugar consumption compensated by increased consumption of plant based proteins exemplify this consumption shift. Pressure from climate change and environmental commitments is going to be compensated only partly by advances in management and technology, such as precision farming, resulting into increasing yields though at a slower pace compared to the past. Most of EU's production will be consumed domestically. The EU will win market shares in some export markets (e.g. for dairy products) while facing additional pressures on the import side for specific products (e.g. beef).

Arable crops

Agriculture remains the primary land use in the EU, despite competition from other uses. Total agricultural land use in the EU is expected to continue its decline, though at a slower pace than in the past decade, to 176 million ha by 2030. In line with this trend, the area of main cereals, permanent grassland and permanent crops are set to further decline in the period to 2030. The amount of land used for other arable crops and oilseeds is stabilising, while land used for fodder is increasing slightly. Although overall agricultural land use is declining, positive yield developments are providing for an overall increase in production.

EU consumption of **sugar** will decline by 5 %, driven by health initiatives and consumer preferences. Sugar is expected to be only partially substituted by an increasing use of isoglucose in processed food, and total sweetener consumption will decrease by 2 %. EU sugar production is expected to be slightly above 19 million t by 2030. The main drivers are a lower yield trend, combined with a decrease in sugar beet area. This level of EU production will allow the EU to remain a net exporter of sugar, in a world market dominated by Brazil.

EU **cereal** production is expected to continue growing to 325 million t by 2030. This growth is driven by a small increase in feed demand (in particular for maize), moderate export prospects and the growing importance of industrial uses. Stronger growth is, however constrained by the limited potential for area expansion and slower yield growth in the EU. Prices are expected to remain fairly stable at close to EUR 170/t at the end of the outlook period.

For **oilseeds**, given the opportunities and limits of biofuel policy after 2020 and only limited growth in feed demand, no further growth is expected in the rapeseed crop area. The domestic soya bean sector is set to continue expanding, albeit at a slower pace compared to recent few years. Driven by a favourable policy environment, **protein crops** have recently experienced a strong revival. Over the outlook period, strong demand both for feed purposes and for human consumption, as well as the supportive policy environment, will further drive production growth of soya beans and protein crops. This, together with some yield improvements, will lead to a further increase in EU production. However, with a share of only 1.4 % of total crop area, the protein crop area will remain limited.

Demand for **feed** (from arable crops, fodder and pasture) should grow in the outlook period despite mixed trends in animal production. Total feed use should reach 275 million t in 2030 for the three types of compound feed (low, medium and high-protein content). Low-protein feed (mainly wheat and coarse grains) will grow less sharply than the other two. Higher demand for feed from locally-produced, GM-free and organic crops will positively stimulate domestic feed production.

The **biofuels** market, which uses certain agricultural feedstocks, continues to be driven by changes in policy. With the RED II agreement, the biofuel industry now has a clearer framework for adjusting EU production and investing in the necessary production capacity. Due to remaining uncertainties, biofuel production levels are expected to remain stable overall until 2030. Switches in feedstocks may take place, in particular for biodiesel production. Advanced biofuels are also projected to increase. In a context of decreasing fuel use, blending rates may increase significantly.

Milk and dairy products

Growing world import demand driven by population growth (notably in Africa) and income growth will drive higher consumption of dairy products over the outlook period. More focus will be put on added-value products for which the EU has a clear competitive advantage. In addition, consumer preferences for differentiated products (e.g. organic, GM-free, pasture-based, local, etc.) will drive the development of alternatives to conventional production systems. Environmental requirements will also play an increasing role in shaping production systems.

The EU could supply close to 35 % of the global demand increase over the outlook period. EU exports of **cheese**, **butter**, **skimmed milk powder (SMP)**, **whole milk powder** and **whey powder** are expected to grow on average by around 330 000 t of milk equivalent per year (mainly in cheese, whey and SMP).
In parallel, close to 900 000 t of additional **milk** per year would be needed to satisfy the growth in EU domestic use for 'traditional' dairy products (mainly cheese). Alternatively, it can be used to make other products (such as dairy desserts, fat

[1] The 2017-2030 Outlook has been used as baseline for the impact assessment of the new CAP proposal.

filled powders, infant milk formula, protein and whey concentrates) that can be further exported. By contrast, liquid milk consumption is expected to further decline in the EU.

Increasing global and domestic demand are expected to translate into a rather modest increase in EU milk production, at 0.8 % per year on average, reaching 182 million t by 2030. EU average milk yield is expected to further increase over the outlook period to 8 240 kg/cow, 17 % above the level of 2017. However, this will be at a slower pace than in the past decade, given environmental constraints and the extensification of production in response to consumer expectations.

Meat

By 2030, EU meat production is expected to remain at 48 million t. This will be driven by changes in consumer preferences, export potential, profitability and, for beef, changes in the dairy sector. Although overall EU meat consumption is declining, still 90 % of EU meat production will be consumed domestically.

EU **beef** production has recovered since 2015, after three years of reduced supply following the rebuilding of the dairy herd. However, production is expected to decrease again, influenced by the shrinking cow herd, low profitability, declining beef demand and strong export competition despite the opening of niche markets. Prices are expected to fall in the first part of the projection period before stabilising towards 2030.

After several years of stabilisation, EU **sheep** and **goat** meat production is expected to recover slightly. This is due to improved returns for producers, maintenance of coupled support and sustained domestic demand.

As EU **pigmeat** consumption declines in the outlook period, additional quantities are expected to be shipped to world markets, mostly China, despite fierce competition from the US and Brazil.

Poultry meat is the only meat for which both EU production and consumption are expected to expand significantly over the outlook period (both by around 4 % between 2018 and 2030). Supported by continued growth of global demand, the EU will increase its exports thanks to the valorisation of different cuts of poultry meat and offal and a wide portfolio of destinations.

Specialised crops

Growing production and processing capacity in the EU **olive oil** sector is expected to further strengthen the EU net export position. Increasing consumption outside Spain, Italy, Greece and Portugal should offset the consumption loss in these countries over the outlook period.

EU total **wine** production and domestic use are expected to stabilise after a previous decade of decrease. Over the outlook period, some slight reduction in human consumption in the EU of wines and products prepared through distillation such as brandies is expected. The EU should maintain steady export growth, driven in particular by geographical indication and sparkling wines.

A reduction in production area combined with increasing yields is expected to lead to the stabilisation of **apple** production in the EU. The consumption of fresh apples should stabilise, while the consumption of processed apples is likely to decline slightly.

The consumption of fresh **peaches** and **nectarines** is expected to decrease slightly due to competition from other summer fruits. A reduction in production area is expected to lead to a slight decline in EU production.

EU production of fresh **tomatoes** is expected to remain relatively stable despite increasing yields driven by longer production seasons. However, the value of production is likely to continue to rise as greater product segmentation adds value.

Agricultural income

This market outlook also analyses how the market trends, given current assumptions and including sectors not explicitly covered by this outlook, would translate into farmers' income. The analysis shows a stabilisation of agricultural income per labour unit in real terms throughout the outlook period. This can be explained by a significant increase of the agricultural value of production (+17 % over the period) in nominal terms outweighed by a similar increase in production costs, stemming mainly from higher energy prices and stronger depreciation. The continued labour outflow from agriculture due to structural changes at EU level is also playing a significant role.

Environmental and climate aspects

This report also discusses the market outlook's expected impact on certain climate and environmental indicators such as those for emissions of greenhouse gases and air pollutants and the nitrogen surplus. The presented analysis is likely to be an overestimation of the agricultural pressure on climate and environment as the models used cannot fully capture the beneficial effects of certain CAP measures in place and farmers' changing management practices.

Changes in the livestock sector will have a major impact on the level of greenhouse gases emissions. This is because most **emissions** of greenhouse gases in agriculture stem directly or indirectly from animal production. The projected decrease in total EU livestock numbers by 2030 will thus contribute to a decrease in emissions. Meanwhile, higher crop production and manure application will contribute to an increase. As a result, compared with 2012, greenhouse gases are not expected to go down while ammonia emissions will decrease by 9 %.

In 2030, the projected total **nitrogen (N) losses to water** in the EU will be 8 % lower than in 2012. This is due to the expected productivity gains in (1) the dairy sector, with less manure produced and (2) the crop sector, with less N inputs per N outputs. However, the total increase in mineral fertiliser will lead to an increase in runoff (+3 %).

Nitrogen pressure is one of the driving factors affecting **plant biodiversity** in agricultural areas. Initial results of a preliminary analysis show that EU agricultural grasslands reach average levels close to 25 % of potential plant species richness due to nitrogen pressure. The average change in 2012-2030 for the EU is very small, at +2 % of potential plant species richness.

Soil erosion by water is considered to be the most significant land degradation process. Erosion rates are still higher than soil formation rates. Soil erosion rates in agricultural lands are not expected to change significantly by 2030. This is because of marginal overall changes in crop distribution in the EU.

This outlook also contains an agro-economic analysis of climate change impacts in Europe and a review of the effects of organic farming on climate change.

Main assumptions

The outlook presented in this report assumes:

- a continuation of current agricultural and trade policies;
- a continuation of current climatic trends (excluding extreme events); and
- no market disruptions (due for example to animal diseases or trade bans).

These assumptions imply relatively smooth market developments. This is because they correspond to the average trend agricultural markets are expected to follow. In reality markets tend to be much more volatile.

The 2030 outlook reflects current agricultural and trade policies, including future changes already agreed upon. The outlook takes account of the 2013 reform of the CAP and the options for implementing it. However, the level of aggregation of the model does not allow all details to be modelled. The impacts of the Agricultural Omnibus package on the CAP have been taken into consideration based on expert judgement.

Only free-trade agreements that are already in place are taken into account. This means that the agreements with Canada and with the Southern African Development Community and the update of the agreement with Ukraine are included. Other trade agreements that have been negotiated but not signed or ratified, such as those with Japan and Vietnam, are not taken into account. The outlook takes account of Russia's import ban on agricultural products and foodstuffs, which is expected to remain in place until the end of 2019.

Current climatic trends, such as a slight increase in average temperature, are expected to continue over the outlook period. The resulting production changes have been considered through expert judgement. More specifically, crop and milk yields are expected to grow below trend given the climatic pressure. However, extreme events are not accounted for. For these we refer to the uncertainty analysis as well as the specific scenario in last year's 2017-2030 Outlook.

Macroeconomic assumptions include an annual average Brent crude oil price of between USD 80-85 per barrel for the period 2022-2027, landing at USD 92 per barrel in 2030. The euro is likely to remain competitive in the short term. In the medium term, we assume that the exchange rate will appreciate moderately, reaching USD 1.20/EUR by 2030. Economic growth in the EU in the short term is expected at around 1.7 %. In the medium term (i.e. 2020-2030), we assume an annual growth rate at around 1.5 %.

The economic outlook takes into account changes in macroeconomic conditions originating from the UK vote of June 2016 and the subsequent withdrawal negotiations, in terms of the economic growth rate and the exchange rate. Although the withdrawal proposal currently on the table indicates a continuation of the close relationship between the UK and the rest of the EU, which would mean only minor deviations from this EU outlook in the near future, no assumptions are made as to the final withdrawal agreement or the resulting macroeconomic consequences, as at the time of this report going to press, the UK parliament still has to cast its vote.

Uncertainty analysis and caveats

This outlook for EU agricultural markets and income is based on a specific set of assumptions about the future economic, market and policy environment. The baseline assumes normal weather conditions, steady yield trends and no market disruptions (e.g. from animal or plant disease outbreaks, food safety issues, etc.).

An uncertainty analysis accompanying the baseline quantifies some of the upside and downside risks and provides background on possible variation in the results. In particular, it takes account of the variability in the macroeconomic environment and yield for the main crops and certain selected scenarios.

The scenarios covered in this report include:

- the potential market impacts of Chinese retaliatory tariffs on US soya bean and pigmeat imports;
- drivers for protein-rich crop development in the EU; and
- the market and non-market impacts of EU household food waste reductions.

ABBREVIATIONS

ASF	African swine fever
AWU	annual working unit
CAP	EU common agricultural policy
CC	Climate change
CETA	Comprehensive Economic and Trade Agreement
CMO	Common Market Organisations
CGIAR	Consultative Group for International Agricultural Research
CH_4	methane
CO_2	carbon dioxide
DDG	distillers dried grains
DME	dimethyl ether
EAA	economic accounts for agriculture
EBA	'everything but arms'
EC	European Commission
EEA	European Environmental Agency
EFA	ecological focus areas
EIP	European Innovation Partnership
EU	European Union
EU-N13	EU Member States which joined in 2004 or later
EU-15	EU Member States before 2004
EU-27	EU Member States without the UK
EU-28	current EU Member States
EUR	euro
FAME	fatty acid methyl ester
FAO	Food and Agriculture Organization of the United Nations
FCR	feed conversion ratio
FDP	fresh dairy products
FFMP	fat-filled milk powders
FQD	Fuel Quality Directive
FTA	free-trade agreement
GAEC	good agricultural and environmental conditions
GDP	gross domestic product
GHG	greenhouse gas
GI	geographical indication
GM	genetically modified
HFCS	high-fructose corn syrup
HISs	High intensity sweeteners
HPF	high-protein feed
HVO	hydrotreated vegetable oil
IGC	International Grain Council
ILUC	indirect land-use change
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
LPF	low-protein feed
LSU	livestock unit
LULUCF	land use, land-use change and forestry
MPF	medium-protein feed
N	nitrogen
N2O	nitrous oxide
NEC	National Emission Ceilings
NH3	ammonia
OECD	Organisation for Economic Cooperation and Development
OMSCO	Organic Milk Suppliers Cooperative
OPEC	Organization of Petroleum Exporting Countries
PDO	protected designation of origin
PGI	protected geographical indication
PSA	private storage aid
R&D	research and development
RED	Renewable Energy Directive
R.O.W.	Rest of the world
SMP	skimmed milk powder
SSA	sub-Saharan Africa
TRQ	tariff-rate quota
UAA	utilised agricultural area
UHT	ultra-high temperature processing
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
USA/US	United States of America
USD	US dollar
USDA	US Department of Agriculture
VCS	voluntary coupled support
WMP	whole milk powder
WTO	World Trade Organization

1st-gen.	first-generation
bbl	barrel
hl	hectolitres
ha	hectare
kg	kilograms
pp	percentage point
t	tonne
t.o.e.	t oil equivalent
w.s.e.	white sugar equivalent
c.w.e.	carcass weight equivalent
r.w.e.	retail weight equivalent
CV	coefficient of variation

INTRODUCTION BASELINE SETTING

/1

This report presents the medium-term outlook for the major EU agricultural commodity markets and agricultural income to 2030, based on a set of coherent macroeconomic assumptions. Since the negotiations on the UK's exit from the EU are still ongoing, the projections are made on the basis of a European Union of 28 Member States, i.e. including the UK, for the full duration of the outlook period.

The baseline assumes normal agronomic and climatic conditions, steady demand and yield trends, and no particular market disruption (e.g. from animal disease outbreaks, food safety issues, etc.). In addition, the medium-term projections reflect current agricultural and trade policies, including future changes that have already been agreed upon.

BASELINE SETTING

The assumptions in this outlook imply relatively smooth market developments. In reality, however, markets are likely to be much more volatile. Therefore, the outlook cannot be considered to be a forecast. More precisely, these projections correspond to the average trend agricultural markets are expected to follow were policies to remain unchanged, in a given macroeconomic environment that was plausible at the time of analysis but not certain.

Macroeconomic developments are difficult to predict. This outlook covers a long time period, from 2018 to 2030 and adaptations have been made accordingly: (1) a higher short- and slightly higher mid-term crude oil price assumption have been retained and (2) adjustments to the economic growth path and recent currency developments have been taken into account.

The projections are based on the OECD and FAO Agricultural Outlook 2018-2027[2] updated with the most recent global macroeconomic and market data. The macroeconomic projections stem from the European Commission macroeconomic forecasts[3] and those published monthly by IHS Markit[4]. The statistics and market information used in this report are those available at the end of September 2018[5].

As macroeconomic forecasts and yield expectations are by nature surrounded by uncertainty, a systemic uncertainty analysis around the baseline is performed. Such analysis enables us to illustrate possible developments caused by the uncertain conditions in which agricultural markets operate. Throughout this report possible price ranges around the expected baseline are regularly presented.

A more systematic representation of the variability in agricultural markets stemming from these uncertainties is summarised in Chapter 8. In addition, to address the implications of selected uncertainties, specific scenarios are analysed and presented in dedicated text boxes throughout the report. These text boxes analyse possible effects of US/China trade disruptions, drivers for plant protein-rich crop development, a reduction in household food waste, and organic farming and climate change.

2 OECD/FAO (2018): OECD-FAO Agricultural Outlook 2018-2027. OECD Publishing, Paris. http://www.agri-outlook.org/

3 European Economic Forecast, autumn 2018, November 2018. http://ec.europa.eu/economy_finance/eu/forecasts/2018_autumn_forecast_en.htm

4 https://ihsmarkit.com/

5 See autumn 2018 edition of the Short-term outlook for EU agricultural markets: http://ec.europa.eu/agriculture/markets-and-prices/short-term-outlook/index_en.htm.

POLICY ASSUMPTIONS

Our policy assumptions take account of the 2013 CAP reform, which entered into force fully in 2015. The following aspects of the reform have a particular impact on market and income developments:

1. **no production quotas:** expiry of milk quotas in April 2015 and of sugar and isoglucose quotas on 30 September 2017;

2. **intervention mechanisms:** within the market intervention periods set out in the CMO[6], up to 3 million t per year of common wheat, 50 000 t of butter and 109 000 t of SMP can be bought in at fixed intervention prices. Beyond these limits, intervention continues by tender. In 2016, the ceilings for butter and SMP were increased to 100 000 t and 350 000 t respectively. This was done as part of the support measures adopted for the dairy sector to overcome the market crisis. Following the recovery of the dairy market, and given the long standing price disconnection between dairy fats and proteins, in 2018 the Council set the volume under which public intervention for SMP takes place at fixed price at zero. The same approach has been adopted for 2019. Around 380 000 t of SMP were available in public stocks by the end of the 2015-2016 crisis. The sale of products was opened by a tender procedure by the end of 2016. Half of the volume was sold during 2018. The CMO also provides for the possibility of opening public intervention by tender for durum wheat, barley, maize, paddy rice, and beef and veal;

3. **private storage:** the European Commission can activate private storage schemes (PSA) for certain products (white sugar, olive oil, linseed, beef, pigmeat, sheep and goat meat, butter, SMP and PDO/PGI cheeses) if the market situation so requires. Since no specific trigger is provided for, these measures are not explicitly modelled. However, they were implemented in 2015 and 2016 for pigmeat, SMP, butter and, exceptionally, cheese;

4. **decoupled basic payment scheme:** while decoupled payments do not affect production decisions directly, further convergence of direct payments among farmers combined with the new distribution of entitlements may sometimes lead to major changes in farmers' subsidies and income. In addition, the redistribution of direct payments between Member States leads to a gradual increase in direct payments in the EU-N13 alongside a reduction in the EU-15; and

5. **coupled payments:** Member States can couple up to 8 % of their direct payment envelope (up to 13 %, in particular situations, or more, subject to the European Commission's approval). In 2014, 27 Member States decided to apply voluntary coupled support (VCS) between 2015 and 2020 for a maximum amount of EUR 4.2 billion per year. For the VCS, EUR 3.95 billion was spent in the 2016 claim year. Coupled payments are granted per hectare or per head within maximum limits.

Exceptional market measures can be deployed to address severe market disturbances. These are not explicitly modelled in the long run as decisions are taken on a case-by-case basis. Nevertheless, the effects of the measures adopted between 2014 and 2018 are taken into account. These measures include exceptional aid targeting the livestock sectors, the aid for the voluntary reduction of milk production and support measures in the fruit and vegetables sector.

The effects of 'greening' are taken into account to the extent possible. In 2016, the European Commission produced a review of greening after one year and in 2017 an evaluation of the effectiveness of the ecological focus area (EFA) was published[7]. Three main components for greening could have an impact on the outlook. Under the crop diversification requirement, the main crop of the farms in question should not represent more than 75 % of the farm's total arable land. The objective is to preserve agricultural diversity. The permanent grassland component of greening should slow down the reduction of areas with permanent grasslands. The third greening rule requires that 5 % of a farmer's arable land should be an ecological focus area. Farms under 15 ha and farms with high proportions of permanent grassland are exempt. Overall, these environmental measures have little effect on aggregate production levels.

[6] Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products, *OJ L 347, 20.12.2013, p. 671-854*.

[7] Commission Staff Working Document, Review of the greening after one year, SWD(2016)218 final, 22.6.2016 and Report from the Commission on the implementation of the ecological focus area obligation under the green direct payment scheme COM/2017/0152, final, 29.3.2017

Given the geographical aggregation of the model, it is not always possible to capture the redistribution of direct payments between and within Member States or the targeted allocation of all coupled payments. Similarly, the voluntary capping of payments over EUR 150 000 and specific schemes for small farmers and young farmers are not accounted for. Nor is the effect of the redistributive payment, a top-up to the basic payment for the first hectare of the holding, implemented by eight Member States, taken into account. Nevertheless, several elements are included in the expert judgement used to produce the projections.

Environmental policies are not explicitly taken into account in this model. However, the effects of the Nitrates Directive and other environmental rules on water and air quality are factored into the analysis. Similarly, the need to reduce GHG emissions is also taken into account.

In 2016, the European Commission adopted a cross-cutting proposal affecting several policy areas ('Omnibus package'). The Regulation was adopted in December 2017 and entered into force in 2018. The package simplifies and strengthens existing EU rules on a wide range of agriculture issues, from risk management to support for young farmers. The Omnibus package's impact on the market has been assessed as relatively modest but it has nevertheless been taken into account in this outlook.

On 1 June 2018, the European Commission presented legislative proposals on the CAP beyond 2020. These proposals aim to make the CAP more responsive to current and future challenges, such as climate change and generational renewal. At the same time, they seek to continue to support European farmers for a sustainable and competitive agricultural sector. The proposals are currently being negotiated by the legislators and are due to be adopted in 2019 and enter into force in 2021.

On international trade negotiations and agreements, it is assumed that all commitments under the Uruguay Round Agreement on Agriculture are fulfilled. No assumptions are made as to the outcome of the Doha Development Round. The implications of the Nairobi Package of December 2015, in particular the Ministerial Decision on Export Competition are taken into account, in particular the definitive phasing-out of all export subsidies.

The Comprehensive Economic and Trade Agreement (CETA) with Canada entered into force provisionally on 21 September 2017. The impact of the agreement is therefore reflected in this outlook. Additionally, the updated concessions for Ukraine are also incorporated. Bilateral and regional trade deals still to be signed or ratified, e.g. the FTAs with Vietnam and Japan, are not taken into account.

In August 2014, Russia imposed a food embargo on the EU countries, the US, Canada, Australia and Norway. This was further expanded in 2015 and 2016 to Albania, Montenegro, Iceland, Lichtenstein and Ukraine. In July 2018, this embargo was extended until the end of 2019 (despite some exceptions for goods intended for baby food).

MACROECONOMIC ENVIRONMENT

Macroeconomic assumptions are based on a combination of the European Commission economic outlook for the period until 2019. For the longer term they are mainly based on IHS Markit macroeconomic forecasts. Additional information was provided by other sources. These include the International Monetary Fund, the World Bank, the OECD, the US Energy Information Agency and expert judgement validated at a workshop held in October 2018 in Brussels[8]. Assumptions cover energy prices (through the Brent crude oil price), population trends and several macroeconomic indicators. The latter include economic growth, inflation and deflation, and exchange rates for around 55 countries and groups of countries in the world.

After low **crude oil** prices, down to USD 45 per barrel in mid-June 2017, prices picked up during 2017 and 2018, rising above USD 70 at the beginning of November 2018. The overall 2018 average Brent crude oil price is expected to reach USD 74.2 per barrel, around 35 % higher than in 2017.

The rise in the oil price since summer 2017 has been driven by continued strong world economic growth, particularly in India, China and North America. World oil demand is expected to continue to grow during the projection period up to 2030, particularly in Asia.

Oil supply has been tight since 2017 due to production cuts agreed by OPEC[9] members. Despite the tight supply several non-OPEC members operating below their technical capacity announced that they will follow the OPEC agreement and not increase output. The production difficulties in Venezuela have not been resolved and the sharp production decline has continued. Since 2015, production in Venezuela has approximately halved.

8 http://publications.jrc.ec.europa.eu/repository/handle/JRC113987

9 The Organisation of Petroleum Exporting Countries (OPEC) is a permanent intergovernmental organisation of 14 oil-exporting developing nations that coordinates and unifies the petroleum policies of its member countries. http://www.opec.org

The geopolitical turbulence in 2018, particularly the US sanctions against Iran, has increased uncertainty, resulting in a tightened oil supply. The full impact of these sanctions on the oil market is not currently known. Several countries, including Russia and China, have not communicated whether or not they intend to continue to import oil from Iran, which falls under sanctions.

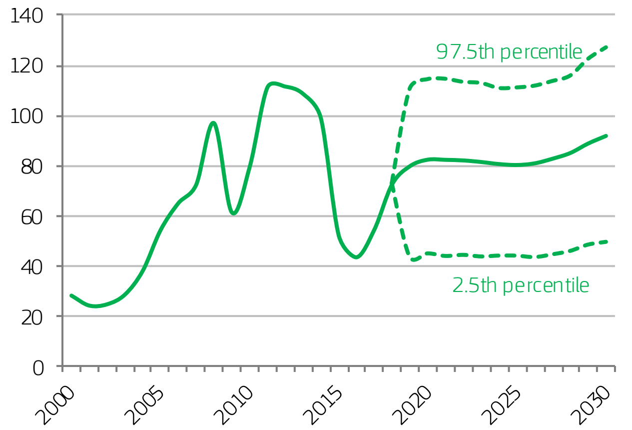
Reduced supply from Iran, solid economic growth and an increase in demand in Asia together with high prices are expected to trigger slightly increased oil production in 2019. Demand is expected to remain strong in years to come. The annual average price is expected to continue to move upwards to reach levels slightly above USD 80 per barrel for the period 2019-2021.

The market is assumed to remain in balance in the medium term. The baseline for this outlook is an annual average Brent crude oil price of between USD 80-85 per barrel for 2022-2027, increasing to USD 92 per barrel in 2030. A medium-term price level of around USD 80 per barrel is expected to be sufficient to turn further rigs in the US back into production. It will also incentivise a recovery in investments in US shale oil production. In the longer term, price levels above USD 80 per barrel will facilitate further investments in finding new reserves, including in areas as yet unexplored. Investments in new technologies will allow for exploration using more costly methods, for example, ultra-deep water drilling. Crude oil demand is expected to continue to rise in the medium term along with an increasing world population and a higher living standard per capita, primarily in Asia and Africa. The increase in demand will be met by an increased supply at current or only slightly higher price levels.

Several forecasters have revised estimates upwards since 2017 for short and medium-term prices but maintained estimates for the longer term. Uncertainties about oil demand are high, for example with the impact of increased electrification in the transport sector and technology gains resulting in higher energy efficiency. This outlook considers that in 95 % of cases the oil price will be between USD 50 and USD 127 per barrel in 2030.

Oil price affects the agricultural outlook through (1) production costs (directly through the cost of energy or indirectly through the cost of fertilisers and other inputs) and (2) the competitiveness and demand for biofuels.

GRAPH 1.1 Oil price assumption (USD/bbl) and uncertainty range



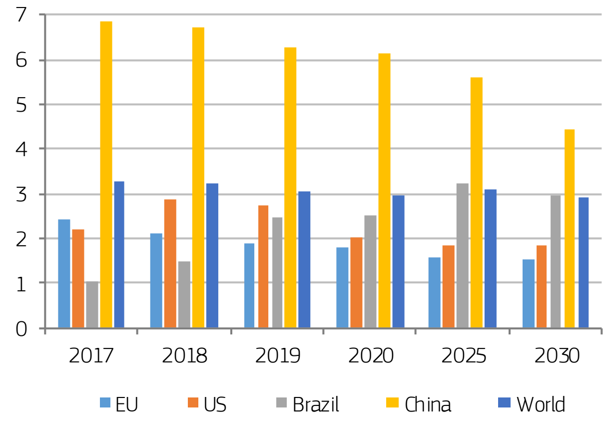
Source: European Commission

Continued world **population** growth is driving demand for food and supports prices of agricultural commodities. However, population growth is slowing down in Europe, North America, Russia and China. Further population growth is instead concentrated in Africa and Asia. The annual population increase, currently just above 80 million persons per year, should slow by 2030, falling to around 70 million persons per year. The world population is expected to grow by 12 % between 2018 and 2030. In Europe, the population is expected to remain stable (+0.7 %) during the same period. However, the development differs widely between Member States. The EU-15 is expected to grow by 1.9 % while the EU-N13 is expected to shrink by 4 % due to relatively low birth rates and low immigration.

EU **economic growth** began to slow down at the end of 2017 and the slowdown is expected to continue between 2018 and 2020. Short-term projections from several estimators were revised slightly downwards in 2018. Energy prices rose considerably in 2018. Despite lower levels of economic growth, investment in the EU is expected to remain at relatively high levels in the short term. This is due to strong global economic growth, the continued ease of financing conditions and historically low interest rates. The shortage of specialised labour has been an obstacle to growth in certain Member States. Uncertainty about EU medium-term economic development has increased due to several factors. These include the impact of global trade disputes, geopolitical tensions between countries in the Asia/Middle East and the US, and uncertainty around the negotiations on the future relationship between the EU and the UK.

World economic growth is expected to be slightly lower compared to last year's assumption reaching 3.2 % in 2018, 3.1 % in 2019 and 3 % in 2020. The macroeconomic situation in Brazil is expected to continue to recover amid uncertainty on key decisions to be taken by the recently elected new president. Russia is expected to continue to return to normal from the previous recession levels, supported by higher commodity prices. Meanwhile, growth in Argentina is expected to slow down and enter into negative numbers in the short term. Major forecasting institutes see China continuing to grow, albeit more slowly than in the past. The US economy is showing momentum due to fiscal stimulus and its economy is expected to remain strong throughout 2019. Economic growth directly impacts the demand for agricultural commodities, both domestically and in the main export markets.

GRAPH 1.2 Economic growth assumptions, GDP (%)



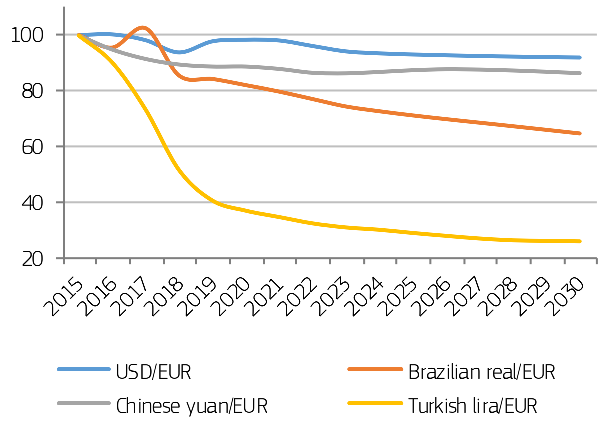
Source: European Commission and IHS Markit

Potential growth in EU agricultural exports is affected by **exchange rates,** which have a direct impact on competitiveness. Increased use of the euro in international transactions can facilitate for EU businesses to protect themselves from exchange rate volatility. The European Commission will consult EU businesses on ways to increase the role of the euro in the international trade of agricultural commodities.

The US dollar will be supported by a strong US economy in the short term and general expectations that the federal funds rate will continue to be tightened. The currency is expected to appreciate from 1.18 USD/EUR in 2018 to 1.13 USD/EUR in 2021. In the medium term the currency is expected to depreciate to 1.20 USD/EUR in 2030.

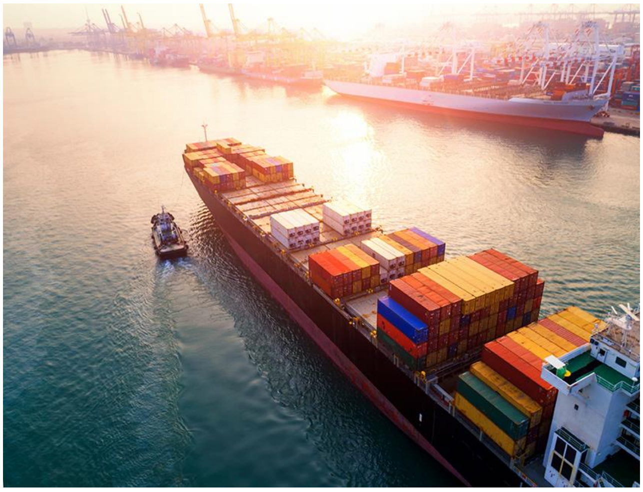
Higher uncertainty about the development of world trade and higher geopolitical tension, in particular directly linked to several developing countries, is expected to continue to channel investments towards economies with stable institutional structures. The exchange rates of currencies of several emerging economies, such as the Argentinian peso, the Brazilian real and the Turkish lira, are likely to continue to depreciate against the euro in the medium term. This will hamper the development of EU agricultural exports and facilitate imports.

GRAPH 1.3 Exchange rate assumptions (year 2015=100)



Source: European Commission and IHS Markit

The macroeconomic conditions are currently particularly uncertain, with more downward risks than upward potentials. Of these, several are related to economic and trade policies in the US. The **European economic forecasts** mention that, in particular, factors such as overheating in the US fuelled by fiscal stimulus could result in a faster than expected tightening of monetary policy. This could lead to major negative impacts both on the US economy and on emerging markets with large reverse capital flows. A deterioration of the US current account could escalate trade disputes with potential long-term negative effects in the form of permanently increased global uncertainty. For the EU, there are risks relating to high-debt euro area countries where disruptive sovereign bank loops could raise financial stability concerns and weigh on economic activity. Risks also remain over the outcome of the Brexit negotiations. This report includes a systemic uncertainty analysis in Chapter 8.



BOX 1.1 Potential market impact of Chinese retaliatory tariffs on US soya bean and pigmeat imports[10]

Background

Since the beginning of 2018, two of the biggest economies have duelled in an escalating trade dispute. Due to alleged unfair trade practices involving intellectual property and technology, US import tariffs were raised on metals and high-tech products originating from the People's Republic of China. China, on the other hand, responded with retaliatory tariffs on the grounds of alleged US violation of WTO principles. China's list of tariffs includes agricultural products such as soya bean, pigmeat, sorghum, cotton, fruits and vegetables. Against this background, this exploratory scenario examines how markets may react if the dispute is not resolved and China's additional tariffs remain in place until 2021. We consider *ad valorem* tariffs (i.e. tariff rates charged as percentage of the price) on the two commodities most likely to be affected:

- US soya bean (+25 %, to 27.4 %), and
- US pigmeat (+50 %, to 62 %)[11].

China is currently the leading importer of soya bean and the leading producer and importer of pigmeat. The country absorbs two thirds of global soya bean and over one fifth of global pigmeat imports. The extraordinary growth in soya bean import demand (over 600 % in the last two decades) is expected to continue. Increasing population and higher per capita income have lead diet to shift from grains to more animal-protein-based products. This has stimulated demand for meat and in doing so increased demand for high-protein feed. Soya bean imports are being further driven by the rapid development and modernisation of the country's sizeable pig sector. In conjunction with the latter, China's trade policy has traditionally favoured domestic crushing by keeping higher tariffs on by-products (meals and oils) than on soya bean. A fourth factor that encourages soya bean imports is the relative price support stemming from self-sufficiency policies during the last two decades. These have been more beneficial for rice, wheat and maize than for soya bean. Overall, China imports soya bean at a lower price and adds value through domestic crushing rather than producing it domestically at a higher cost.

In 2017, China imported 95.5 million t of soya bean compared to the 16.6 million t it produced domestically. China has historically been the US's top agricultural export market. However, US exports face significant competition from South America. Brazil, in particular, has increased its soya bean production and invested in infrastructure in partnership with Chinese companies. Since 2013, Brazil has been covering 48 % of China's import needs on average, thus leaving the US in second place (37 %). Prioritisation of maize-based biofuels, domestic livestock production and crushing industries have limited the volumes of US and Brazilian soya bean that remain available for export to up to 60 % of domestic production.

As regards pigmeat, in 2017 China imported an estimated 1.6 million t[12]. This corresponds to less than 4 % of its production. The US is China's second largest supplier (15 %) of pigmeat since 2014, after the EU (68 %), followed by Canada (9 %). China relies on high-protein meals to feed pigs. Therefore, simultaneous additional tariffs both on the end-product (pigmeat) and input (soya bean) may lead to higher feed costs and consumer prices in China.

Extended baseline

The simulation model used to generate the market projections presented in this report, Aglink-Cosimo, was extended with a bilateral trade sub-module between China, the US, and the 'Rest of the World' (R.O.W.)[13]. Baseline projections on bilateral trade flows are based on the assumption that the more stable import shares will continue their recent trajectories. Hence, it is assumed that the share of US soya bean in China's imports will gradually decline from 37 % in 2018 to 35.5 % in 2021. This decline reflects the general trend of increasing imports of non-US origin. Regarding pigmeat, the proportion of US exports to China has generally been dropping by roughly 0.3 % per year over the last decade. This trend is expected to continue (from 15 % in 2018 to 14 % in 2021).

Scenario results

The direct effect of Chinese tariffs would be an average reduction of soya bean imports from the US of 10 million t (27.4 %) (Graph 1.4). Lower imports induce a higher producer price for domestic soya beans. This creates an incentive for gradually increasing plantings (from +51 000 ha in 2019 to +109 000 ha in 2021) and production (+1 % per year). Agro-climate, land availability and relative soya bean competitiveness, which limit further expansion of the crop result in higher imports from the R.O.W. The latter substitutes three quarters of the foregone imports from the US (+7.4 million t per year). On average, total soya bean import demand falls by 2.6 million t (-2.5 %) while producer prices rise by 5.2 % (USD +33/t). Reduced crush margins for soya bean lead to higher imports of protein meals (+48 %), particularly meat and

[10] The analysis presented in this box was conducted by Thomas Chatzopoulos and Ignacio Pérez Domínguez from the European Commission, Joint Research Centre (JRC), Seville, Spain (contact: thomas.chatzopoulos@ec.europa.eu).

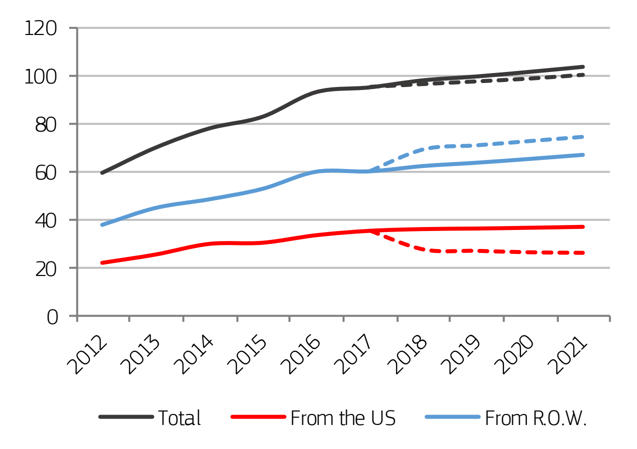
[11] See also OECD/FAO (2018): OECD-FAO Agricultural Outlook 2018-2027, OECD Publishing, Paris/Food and Agriculture Organisation of the United Nations, Rome, Box 1.5, and Choices Magazine, 2nd Quarter 2018, 33(2).

[12] Volumes always given in tonnes of carcass weight equivalent.

[13] Exports shares based on the USDA/GATS database were used to derive historical trade flows between China, the US and the R.O.W. Chinese imports from the US (R.O.W.) were specified as a function of relative competitiveness of Chinese to US (other key suppliers') prices, exchange rates and tariffs. Pigmeat and US export equations were specified similarly. Two systems of equations (soya bean, pigmeat) were estimated with seemingly unrelated regression. The resulting trade elasticities were found to be theoretically meaningful and statistically significant ($P < 0.05$). This extended model was calibrated to the OECD-FAO baseline (July 2018).

bone meals (+18 %) and DDGs (+4 %). An increase in domestic rapeseed production is also detected (+1 %).

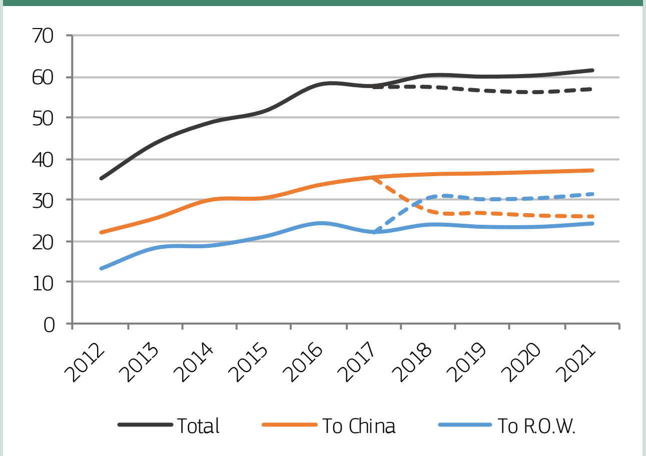
GRAPH 1.4 Chinese soya bean imports (million t)



Note: Continuous (dashed) lines depict baseline (scenario) results
Source: Own estimation based on the OECD-FAO baseline (July 2018)

About two thirds of foregone US soya bean exports are diverted from China to other destinations (+6.6 million t per year; +27.8 %) (Graph 1.5). This results in a decline in total US exports that exceeds the corresponding decline in Chinese import by about 1 million t. Pressure on US producer prices (-4.7 %; USD -16/t) dictates an average annual reduction in soya bean acreage of 230 000 ha, equivalent to -1 million t per year (Graph 1.6). An increase in crush use and exports of US soya bean by-products is explained by the higher crush margins.

GRAPH 1.5 US soya bean exports (million t)

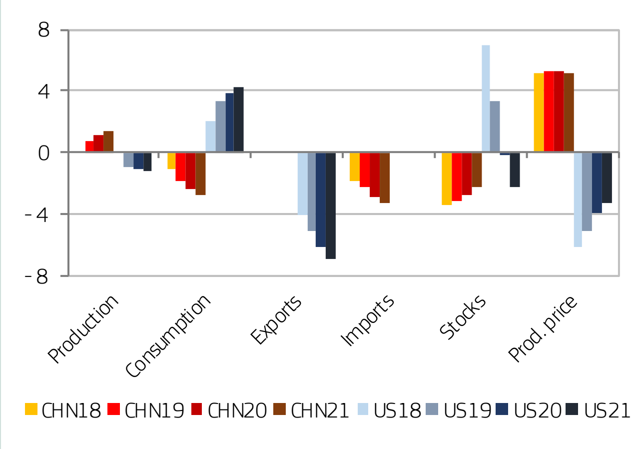


Note: Continuous (dashed) lines depict baseline (scenario) results
Source: Own estimation based on the OECD-FAO baseline (July 2018)

Changes in global trade of soya bean are relatively low (-3 million t; -1.9 %). The same holds for international prices, which rise by less than 1 %. Exports from Brazil and Argentina but also a few other countries (Canada, Paraguay and Ukraine) rise by up to 1 % each. Increased exports from 2019 onwards from Brazil and Argentina lead to higher planting and production.

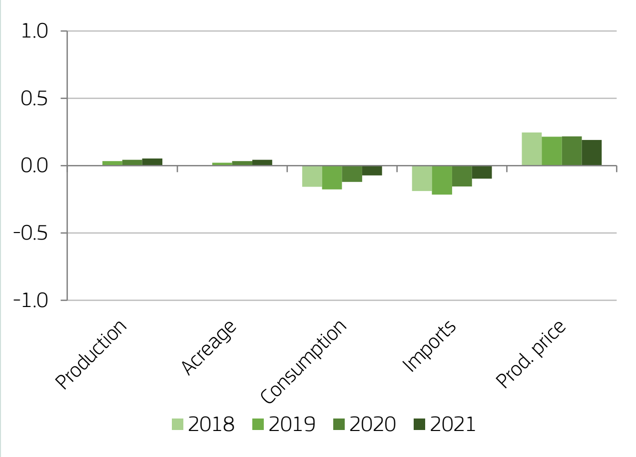
The impact on EU markets is low; a higher world price reduces soya bean imports relative to the baseline and increases domestic prices by less than 1 % (Graph 1.7). Domestic acreage and production effects are slightly positive, due to the price incentive and trade diversion.

GRAPH 1.6 Chinese and US soya bean markets : % deviation from the baseline, 2018-2021



Note: Bars show relative changes in the first four marketing years
Source: Own estimation based on the OECD-FAO baseline (July 2018)

GRAPH 1.7 EU soya bean markets: % deviation from the baseline, 2018-2021

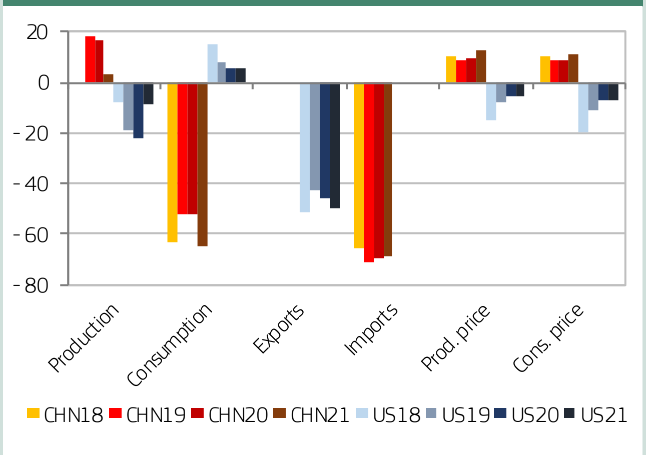


Note: Bars show relative changes in the first four marketing years
Source: Own estimation based on the OECD-FAO baseline (July 2018)

Chinese pigmeat imports from the US drop by about 105 000 t (-55 %) and are partially replaced by pigmeat from other countries (+36 000 t). Total Chinese import demand drops by 5 % (-69 000 t). US pigmeat exports to China are for the most part re-diverted elsewhere (+57 000 t) with total US exports decreasing by 1.9 % (-48 000 t). Chinese producer prices rise on average by USD 12/t (+0.5 %) and are almost fully transferred to consumers. Meanwhile, US producer prices fall by USD 15/t in 2018, stabilising at USD 6/t below the baseline in 2021 (-0.6 % on average) (Graph 1.8). Price transmission to other countries is negligible (less than +1 %). The US redirects exports to the R.O.W. (presumably Asia and Africa) gaining market shares of less than +1 % from the EU, Brazil and Canada.

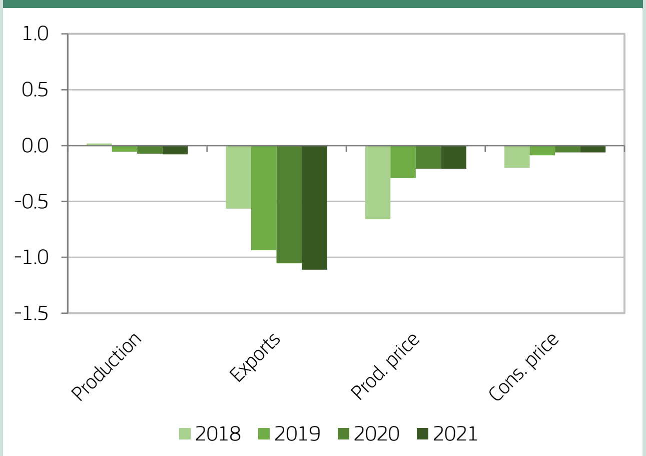
The effect on EU pigmeat markets is near-zero; exports and domestic prices decline by less than 1.1 % (Graph 1.9). Production also goes slightly down, pushed by the lower prices and lower export demand.

GRAPH 1.8 Chinese and US pigmeat markets : absolute change from the baseline, 2018-2021



Note: Bars show changes in the first four marketing years. Quantities are expressed in 1 000 t and prices in USD/t
Source: Own estimation based on the OECD-FAO baseline (July 2018)

GRAPH 1.9 EU pigmeat markets: % deviation from the baseline, 2018-2021



Note: Bars show relative changes in the first four marketing years.
Source: Own estimation based on the OECD-FAO baseline (July 2018)

Caveats

The changes in domestic policies and the macroeconomic environment due to increasing tensions between China and the US (e.g. higher inflation and lower global GDP growth) that could further affect markets are not taken into account in this scenario and could be of more concern than the actual increase in tariffs. Recent IHS Markit simulation results show that there are no real winners in this (and any) trade war as the countries facing new tariffs are affected directly through declines in real exports and GDP, while others are hit indirectly by facing weaker demand for their own exports.[14]

Furthermore, the analysis does not capture possible re-exports of US soya bean to China via third countries. Other factors that may drive bilateral trade, such as transport costs, different product qualities and (geo)political events, are not explicitly considered. Finally, we focus on agriculture and do not analyse the impact of retaliatory tariffs on other economic sectors.

Takeaways

The potential consequences of the US/China trade dispute are visible on global agricultural markets. On the one hand, China's crushing industry and consumers will be negatively affected by higher tariffs, while US producer prices will be under pressure. On the other hand, Chinese soya bean and pigmeat farmers may receive higher prices in the short-to-medium term. The US crushing industry may take the opportunity to increase exports of oils and meals to other destinations. At the world level trade diversion is unlikely to generate a dramatic increase in international prices as both commodities are highly tradable. China will likely import soya beans and other protein meals from non-US key suppliers, while US exports will be redirected for the most part to other markets.

In conclusion, China will likely minimise its current dependence on imports of US agricultural commodities by maximising imports from other suppliers and incentivising domestic soya bean production[15]. Agro-climatic constraints and land availability, however, will limit the expansion of domestic production. The US has already announced market facilitation programmes and funding for exploring new export markets, such as India and Pakistan.

[14] For more details, see https://ihsmarkit.com/solutions/us-china-trade-war-impacts.html.

[15] Following the South American harvest-to-export period (Q2, Q3), Chinese production can cover own demand for less than two months in Q4. US exports typically peak after Chinese harvest (Q1), and this information is not yet available at the time of writing.

ARABLE CROPS /2

On the supply side, the arable crop area in the EU is expected to continue its decline, which (alongside a small growth in yield) limits further expansion in production. EU domestic demand for cereals and oilseeds remains driven mainly by feed use, although industrial uses will grow more rapidly. Like the previous outlook, this year's medium-term outlook shows solid world demand, creating opportunities for increased EU cereal exports.

This chapter provides an overview of the outlook for arable crops (common wheat, durum wheat, barley, maize, rye, oats, other cereals, rapeseed, sunflower seed, soya beans and protein crops) and some processed products (sugar, vegetable oils, protein meals, biodiesel and ethanol). It looks first at land-use developments and continues with a closer look at biofuels, sugar, cereals (including rice), oilseeds and the feed complex.

LAND-USE DEVELOPMENTS

Agricultural area remains the main component of EU land use, but it faces competition from other uses. Total agricultural land use in the EU is expected to continue its decline, though at a slower pace than in the past decade. Main cereals, permanent grassland and permanent crops are expected to decline further in the period to 2030. Area for other arable crops (sorghum, rye, oats, triticale, roots and tubers, rice) and oilseeds is stabilising, while fodder area is increasing slightly. Further land consolidation, mainly in the EU-N13, and specialisation are driving the structural adjustment of the sector. Although overall agricultural land use is falling, positive yield developments are providing for an overall production increase.

Land coverage in the EU

According to the OECD-FAO outlook, agricultural area across the globe in 2015-2017 totalled around 4 800 million ha, while land used for pasture and fodder accounted for 3 400 million ha – principally in the Americas and Africa, while the EU and Asia have a smaller share.

In the EU, total agricultural area reached 178 million ha in 2018, which is a small proportion of global utilised agricultural area (UAA) but accounts for about 50 % of all land in the EU. Forest area accounts for a third and artificial area for 5 % (2015 data). The remainder is subject to other land uses, such as inland waters. EU agricultural area has declined by 6 % since 2000, mainly due to afforestation and urbanisation. The last available data show that forest and wooded land covered up to 42 % of EU territory in 2015, which is 2.6 % more than in 2009. The highest proportions are in Finland and Sweden (over 65 % of land covered by forests) and Slovenia, Estonia and Latvia (over 55 %). Urbanisation across the EU usually affects efficient UAA (fertile soils in plains). However, although there is a clear trend of urbanization, it remains minor in terms of total agricultural area.

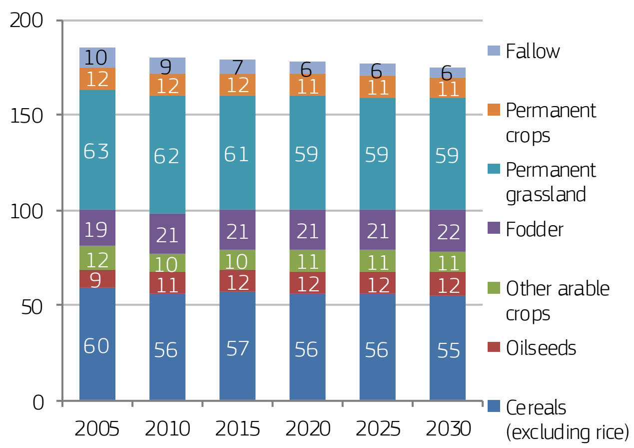
Arable crops account for 45 % (80 million ha) of total UAA in 2018. Permanent grassland covers a third (almost 60 million ha). It is followed by fodder area (21 million ha) and permanent crops (11.5 million ha), which represent 12 % and 6 % respectively. Fallow land accounts for 4 %. More specifically, cereals account for 31 % of the total UAA. France has the most extensive cereals area, accounting for 17 % of the EU total. It is followed by Poland (14 %), Germany and Spain (both 11 %). Common wheat, maize and barley represent the biggest share (79 %). The oilseeds complex uses only 7 % of total UAA, i.e. 12 million ha.

Outflow of cropland, while shares of grassland and fodder grow

Over the outlook period, it is expected that the land outflow will continue, but at a slower pace than in the past decade, to reach 176 million ha in 2030, as compared with 178 million ha now. Area for cereal production is expected to decline further, to 55 million ha.

Fodder area is expected to increase over the outlook period, mostly driven by silage maize. Silage maize increased by more than 40 % from 2000 to 2018, to meet the demand for feed and biogas production. Although area has been more stable in recent years, it is expected to continue increasing (by 3 %) in the period to 2030. Permanent grassland is expected to increase as a proportion of total agricultural area by 2030 (by 0.5 pp), despite declining slightly in absolute terms. To a certain extent, this will be sustained by the extensification of the dairy herd, which requires grass-fed systems. In addition, grassland can also be enriched, for instance with leguminous plants (clover), to provide higher protein-rich feed (see section on feed). Temporary grassland (included under fodder area in the graph below) increased by 1.4 % from 2015 to reach 9.3 million ha in 2018. This growth is driven by increasing protein demand in the EU. Over the outlook period, total fodder area is expected to reach 22 million ha.

GRAPH 2.1 Development of agricultural area in the EU (million ha)



Trends for different cereals are expected to vary. While common wheat area is expected to increase, the coarse grains area will continue to contract. EU area for permanent crops is expected to decline slightly in the outlook period, by about 3 %, to 11.2 million ha. Area for roots and tubers (potatoes, sweet potatoes) is expected to decrease at a faster pace (-16 % over the period). Rice area should also decline somewhat (-5 %), to 420 000 ha.

What about organics?

More agricultural land has been dedicated to organic production in recent years. In 2012-2016, it grew by 1 pp, to 6.6 %. While this is still small in absolute terms, the development can be considered dynamic. The annual increase in organic cereals area has been particularly significant in Bulgaria (+16 %), Croatia (+4.8 %), France (+5.5 %) and Italy (+3.3 %). Over the outlook period, it is expected that area for organic production will continue to increase at a steady pace, to address the increasing demand both for organic feed and food (see following chapters). On the basis of these expected trends, organic area could reach 19 million ha in 2030, which is around 11 % of total UAA. The development of organic production in the EU is likely to have a significant impact on yields. Available data for organic area and production in a number of Member States indicate that yields in organic production are significantly lower than in conventional production (see following section on arable crops).

BOX 2.1 Neonicotinoids, what is at stake?

In 2017, the European Food Safety Agency communicated the findings of its assessment of the impact of neonicotinoids on bees' population. As a result, the European Commission adopted, at the end of 2017, a Regulation to ban three substances commonly used in systemic pesticides: clothianidin, imidacloprid and thiamethoxam. From its entry into force at the end of 2018, these will only be authorised in closed greenhouses. These three neonicotinoids have been identified as having a significant impact on several species of bees via dust drift and residues in pollen, and can also remain and accumulate in the soil. This would thus have a positive impact on pollinators that are essential for the agricultural production and will probably result in an adaptation of farming techniques. A study from the Joint Research Centre (JRC) of the European Commission (2017) indeed showed that following the restriction; farmers reacted with different approaches, such as using untreated seeds, switching to using unrestricted-treated seeds, increasing the use of soil or foliar treatments. Others changed their pest management practices (increased sowing density, more frequent scouting for pests).

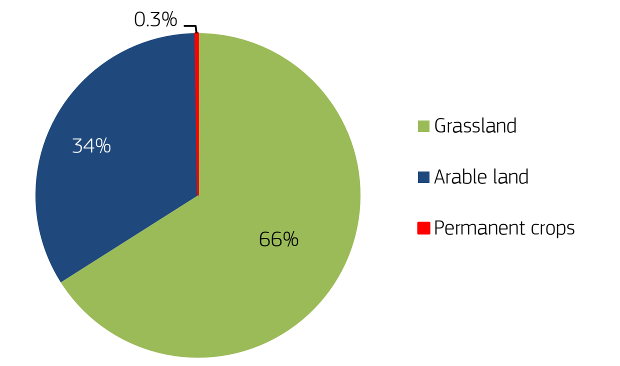
Yield developments in the EU

Over the outlook period, yields in the EU are expected to continue its upward trend. However, the increase remains moderate, especially in the western EU countries, as yield levels are already high. Also, more frequent extreme weather events are putting pressure on this positive trend. Finally, regulatory changes (such as rules on the authorisation of plant protection products) are placing additional constraints on yield developments. Still, yields are expected to increase overall, and at a faster pace in the EU-N13, which are gradually closing the yield gap. This is due mainly to further structural change as a result of mechanisation. Across the EU, it is expected that precision farming will play a significant role in allowing farmers to use fertilisers and plant protection products more efficiently. This could have a positive effect on yield developments and/or the costs of production (see section on income prospects). Another key element for land development over the outlook period is the need for irrigation in certain regions. With growing weather uncertainty, one option for farmers could be to increase their irrigation coverage, in dry conditions, at key plant development stages, although this will put pressure on ground water (see chapter on environmental matters). It is expected that irrigation will play a positive role in minimising potential yield drops due to extreme weather conditions, but come at an additional cost to farmers and the environment.

What about the UK?

After a peak in 2006, the UK's agricultural land use showed a rapid decline in the period to 2011, but regained some area afterwards. Over this whole period, a slight decline by 3 % is reported, but UAA was still around 17.4 million ha. Arable land recorded a drop of more than 6 %, while permanent grassland lost almost 4 % between 2006 and 2016. Permanent crops area increased by almost 9 %, with a noticeable rise in wine area, which almost doubled from 1999 (but is still at a very low level – 1 700 ha in 2015). Permanent grassland still accounts for the biggest proportion of land use in the UK (66 %), followed by arable land (34 %) and permanent crops (less than 0.3 %). In 2000, total organic area represented 3.3 % of the UK's UAA. The proportion increased to 4.2 % in 2009, but then declined gradually to 2.8 % in 2016.

GRAPH 2.2 Share of land use in the UK, 2016



BIOFUELS

The RED II agreement sets out a new policy framework for the period to 2030 and gives the biofuel industry a clearer framework for adjusting EU production and investing in the necessary production capacity. Due to remaining uncertainties, in particular with regard to feedstocks that could have a high indirect land-use change effect, biofuel production levels are expected to remain stable overall in that period. Switches in feedstocks may take place, in particular for the production of biodiesel, and an increase of advanced biofuels is projected. In a context of decreasing fuel use, blending rates may increase significantly.

New EU policy framework for 2020-2030

The growth of the biofuel industry since the early 2000s has been driven by developments in EU legislation. The 2010-2020 policy framework is set primarily by the 2009 Renewable Energy Directive (RED), which requires Member States to cover at least 10 % of their transport energy use from renewable sources, including biofuels. The Fuel Quality Directive (FQD) requires fuel producers to reduce the greenhouse gas (GHG) intensity of transport fuels. The 2015 Indirect Land-Use Change (ILUC) Directive addresses the risk that some production pathways increase overall GHG emissions due to indirect land-use change. It introduced a 7 % cap on renewable energy from food and feed crops in the transport sector.

Meanwhile, more ambitious targets were agreed under the 2030 Energy and Climate Framework in 2014 and the Paris Climate Agreement in 2015. To translate these into policy, the Commission adopted a proposal for the recast of the RED (RED II proposal) at the end of 2016.

At the end of June 2018, EU co-legislators reached an agreement on RED II that provides for a target of 14 % of renewables in transport by 2030. With regard to crop-based biofuels, a cap is set at 1 % above the Member States' 2020 consumption levels, with an overall maximum of 7 % renewable energy in total energy use in transport. Member States with consumption below 1 % may raise this share to 2 %. A target is set for advanced biofuels[16] at 3.5 % by 2030 and double-counting is allowed[17]. Biofuels produced from used cooking oils and animal fats[18] may also be double-counted, but their contribution towards the target is limited to 1.7 %. In addition, the agreement provides for a phasing-out of biofuels from feedstocks with a high risk of indirect land-use change (high-ILUC-risk biofuels). These will be capped at their 2019 level and then fully phased out between 2023 and 2030 unless they are certified as low ILUC-risk biofuels.

TABLE 2.1 EU policy framework for biofuels

	2010-2020 framework	2020-2030 framework
	RED / ILUC	RED II agreement
renewables in transport	10 %	14 %
cap on crop-based biofuels	7 %	2020 Member States level +1 p.p., max 7 %
target for advanced	no target, with double-counting	3.5 %, with double-counting
contribution of waste oils and fats	-	max 1.7 % with double-counting

While the agreement provides a clearer picture of the general 2020-2030 policy framework, some uncertainties remain, in particular on the precise high-ILUC-risk feedstocks to be phased out and the certification methodology for low-ILUC-risk biofuels. Uncertainties also remain with regard to the translation of the RED II agreement into national strategies. Member States have a certain degree of freedom in setting blending mandates and implementing double-counting.

Biofuel consumption boosted by RED II

The main market driver for biofuels consumption is fuel use in road transport. In recent years, innovation towards reduced fuel consumption by vehicles and initiatives for cleaner transport have exerted downward pressure on traditional fuel use. While a decreasing trend in petrol use has been observed since the early 2000s, diesel use is currently stagnating[19]. In the last decade, the switch from petrol to diesel and the recovery of road freight transport (heavily reliant on diesel) from the economic crisis have buoyed diesel consumption, despite increased fuel efficiency. However, in the coming years, fuel efficiency, combined with emerging national and regional initiatives to phase out private vehicles running on diesel, will offset the increased demand for diesel. Diesel use is therefore expected to start declining. In parallel, use of electric vehicles is expected to grow over the outlook period, putting further pressure on traditional fuel use. Overall, road transport fuel use is expected to fall by 21 % for both petrol and diesel by 2030. Besides energy efficiency initiatives and innovation, the

16 Annex IX, part A lists feedstocks that can count towards the advanced biofuels targets, e.g. forest and agricultural residues, municipal waste, algae.

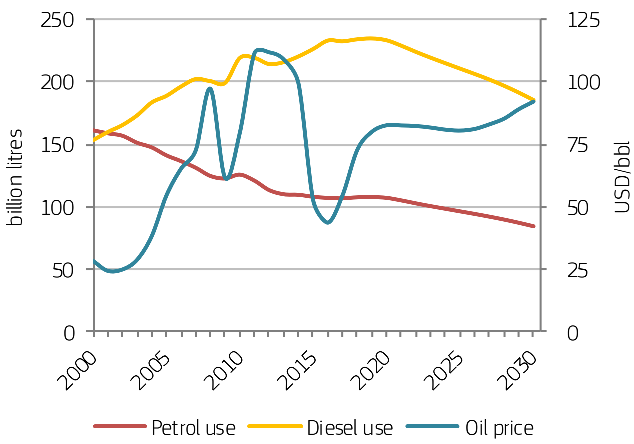
17 Double-counting allows Member States to count twice the contribution of biofuels produced from feedstocks in Annex IX, parts A and B towards the target for renewables in transport.

18 These feedstocks are listed in Annex IX, part B.

19 Consumption estimates for diesel and petrol-type fuels are taken from the EU 2016 reference scenario developed by the JRC and the European Commission's Directorate-General for Climate Action, using the POLES model.

increasing oil price over the outlook period will also play a role. The oil price is expected to increase from USD 73/bbl in 2018 to USD 92/bbl in 2030.

GRAPH 2.3 EU fuel use in road transport (billion litres) and world oil price (USD/bbl)



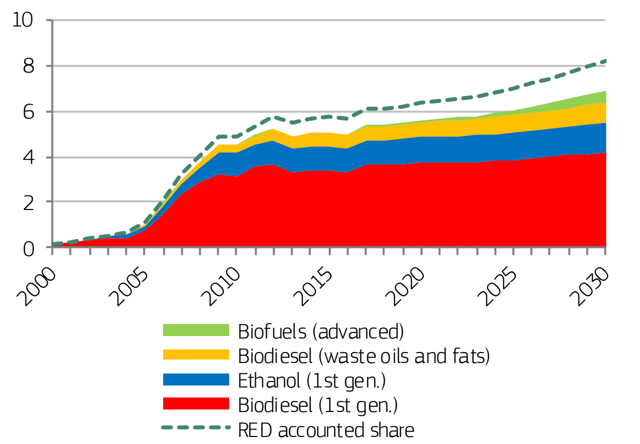
While higher oil prices make biofuels more competitive, the reduction in overall fuel use has a proportional dampening impact on demand for biofuels. Nevertheless, biofuel demand remains policy-driven and the RED II agreement is expected to drive higher blending rates.

In the shorter term, the industry has a real interest in boosting shares of crop-based renewables. The cap on biofuels produced from food and feed crops (to be set in 2020) could translate into a further increase in crop-based biofuel consumption in 2019 and 2020. The outcome of the assessment on high-ILUC-risk feedstocks and the results of applying the future methodology on low-ILUC certification of crop-based biofuels will have a significant impact on the types of feedstock and biofuel consumed in the biofuels mix in the EU. Overall, the share of crop-based biofuels, in energy terms, is projected to increase from 4.7 % in 2020 to 5.5 % in 2030, driven by biofuel mandates set by Member States. The 0.8 pp increase remains below the 1 pp allowed under the RED II cap, as some Member States (e.g. Austria, Bulgaria, France, Slovakia and Sweden) are already close to the 7 % overall limit. Also, not all Member States may make full use of the possibility of increasing crop-based biofuels further post-2020.

Consumption of biofuels from waste oils and animal fats may increase further from 2.3 billion litres to 2.5 billion litres, which would bring their share of energy use to 0.9 %, while their contribution towards the target would be capped at 1.7 %. Considering the limited currently available production capacity, advanced biofuels are expected to increase only slowly to begin with, before rising more strongly from 2025 onwards to a share of 0.5 % (before double-counting). This remains well below the target for advanced biofuels and highlights the need for significant investments in additional production capacity if the RED II targets are to be reached.

Notwithstanding national decisions on targets and limits, and assuming double-counting, the RED-accounted share[20] of renewable energy in transport by 2020 is expected to reach 6.3 % in energy terms by 2020 and 8.2 % by 2030.

GRAPH 2.4 Biofuel shares in transport energy (%)



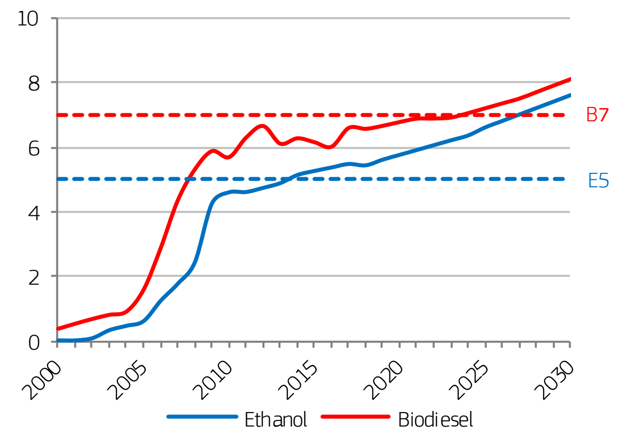
Note: The Aglink-Cosimo model covers only biodiesel and ethanol, while further renewables for use in transport, such as electricity and biogas, are not covered. Therefore, shares in energy terms as calculated in this outlook correspond to the shares of biofuels in total fuel use, and may differ from the official shares as calculated under the RED

The boost given by the RED II agreement on ethanol and biodiesel translates into higher blending in volume to break the traditional blend walls, i.e. the proportion of biofuels that can be mixed with fossil fuels for use in the current fleet. Most vehicles running on petrol are fitted with engines compatible with 10 % ethanol in volume (around 6.7 % in energy terms). While E5, which contains only up to 5 % bioethanol, has for years been the blend used most, E10 is now available in many Member States. A few also offer E85, but such blends spread more slowly, as they require specific engines. Blending of ethanol could reach 7.6 % in volume by 2030, as compared with 5.4 % in 2018. For biodiesel, diesel cars are currently certified for blends with up to 7 % biodiesel in volume: B7, i.e. fatty acid methyl ester (FAME) and dimethyl ether (DME). However, blending may be higher than the theoretical blend wall with the increasing use of drop-in diesel substitutes[21] such as hydrotreated vegetable oils (HVOs) or the deployment of engines adjusted to use higher blends. In 2018, HVOs account for almost 25 % of EU biodiesel production and about 20 % of EU biodiesel consumption. The forecast assumes an increase in biodiesel blending in volume from 6.6 % in 2018 to 8.1 % by 2030.

[20] The RED-accounted share of biofuels is calculated on the basis of the share of biofuel consumption in total fuel consumption in road transport, with double counting for waste oils and fats, and advanced biofuels. This share does not correspond to the official share of renewables in transport, as other renewables, such as electricity, are not accounted for.

[21] Drop-in fuels are renewable fuels that may be used without blend walls and engine modifications.

GRAPH 2.5 Biofuel blending shares in volume (%)



What about the UK?

The UK produced around 880 million litres of ethanol in 2017/2018, a decrease of 12 % compared to the previous year. This represents almost 12 % of the total EU ethanol production.

Despite the higher production capacity with 19 plants, the UK' biodiesel production showed a decline of 70 % to only 86 million litres in 2016/2017 (less than 1 % of EU production), which led to a significant change in the trade balance.

The volume of UK's biofuel trade with non EU countries is marginal. In 2016/2017, 0.45 billion litres of ethanol and 0.46 billion litres of biodiesel were imported by the UK from other EU countries, while 0.36 billion litres of ethanol and 0.22 billion litres were exported to other EU countries.

Decreasing trend in imported biofuels

EU biodiesel imports increased significantly from the end of summer 2017 and reached almost 3.4 billion litres in 2017/2018. This followed the US government's introduction of anti-subsidy and anti-dumping duties in the course of 2017 on biodiesel imports from Argentina and Indonesia. The EU had in the past also set anti-dumping duties on biodiesel from those two countries, but in September 2016 these were ruled out by the EU General Court[22] as inconsistent with WTO rules. In the meantime, the Commission has reopened an investigation into the use of subsidies by Argentina, for which a decision is expected by February 2019. The parallel anti-dumping investigation was closed in October 2018 due to lack of proof.

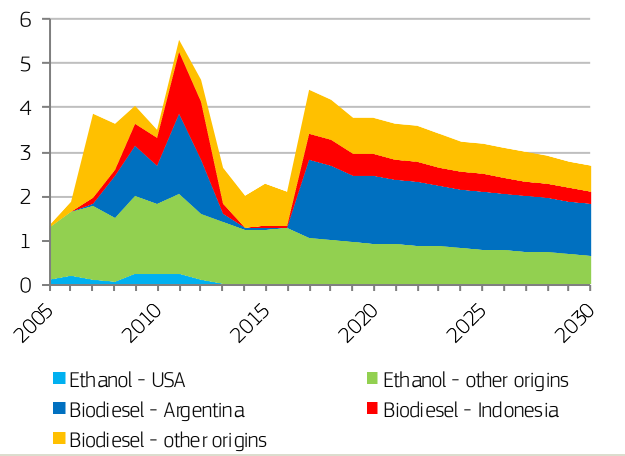
The outlook involves biodiesel imports remaining high in the next couple of years, in line with the short-term increase in the consumption of crop-based biofuels. A gradual decrease is expected mainly from 2023 onwards, to 2 billion litres by 2030.

In early 2018, the Commission launched an expiry review on US fuel ethanol anti-dumping duties[23]. The review should be completed by mid-2019. In the meantime, the outlook assumes that the duties will remain in place. Over the outlook period, a fall in ethanol imports from 1 billion litres to 0.7 billion litres is anticipated, driven by decreasing fuel use and increasing demand for advanced biofuels. Only ethanol for fuel use is affected by the expected decrease, while imports of spirits and liqueurs for human consumption are expected to remain stable.

BOX 2.2 Origin of biofuels imports and feedstocks

At present, the main sources of biodiesel imports include Argentina (53 %), Indonesia (18 %) and Malaysia (14 %). Argentina produces biodiesel from soya bean oil. Indonesian and Malaysian biodiesel is produced from palm oil.

GRAPH 2.6 EU biofuel imports (billion litres)



The main origins of imports of fuel ethanol over the last five years are Guatemala (13 % of total ethanol imports), Pakistan (18 %) and Peru (11 %). The main feedstock used in these three countries is sugar cane and cane molasses.

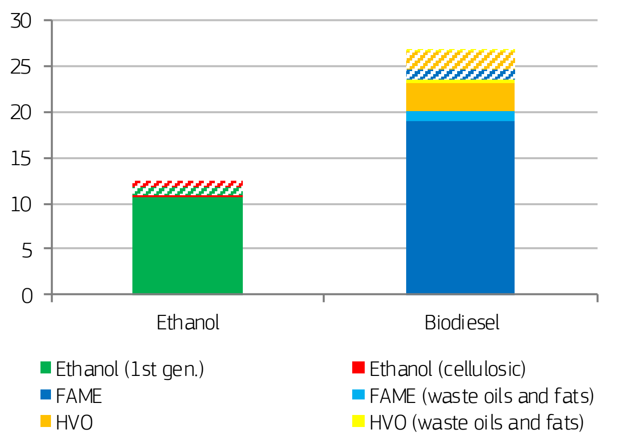
22 Constituent court of the Court of Justice of the European Union, which hears actions taken against the institutions of the European Union by individuals and Member States.

23 While anti-dumping duties on fuel ethanol imports from the US were set to expire in February 2018, the European Commission initiated (at the request of the European Renewable Ethanol Association (e-PURE)) an expiry review to investigate whether the expiry of the measures would be likely to result in the recurrence of dumping.

BOX 2.3 EU biodiesel and ethanol production capacity

The EU's biofuel production capacity is significantly underused. Ethanol production plants produce close to 11 billion litres, working at 74 % of capacity. Capacity for cellulosic ethanol is fully utilised, but biodiesel plants show even lower utilisation rates: only 59 % of the 23.5 billion litre production capacity is used. For HVO biodiesel, the rate is much higher, at 83 %, as compared with 46 % for FAME (B7) biodiesel production. Capacity usage is also close to maximum for biodiesel from waste oils and fats. Other advanced biodiesel fuels, such as 'biomass to liquids' (BtL) from wood and agricultural residues, are produced in more limited quantities.

GRAPH 2.7 Existing and planned production capacity (billion litres)

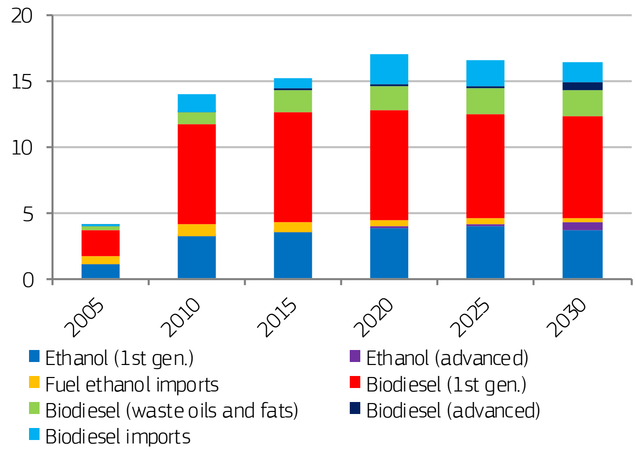


Notes: Solid fill indicates existing capacity; pattern fill represents under construction or planned capacity. Biodiesel production plants that use multiple feedstocks, including waste oils and fats, are included in FAME and HVO capacity. Capacity for production of BtL fuels is not covered
Source: own calculation based on F.O.Licht data

Currently planned production capacity will be insufficient to reach the RED II targets for advanced biofuels. Nevertheless, as the agreement is relatively recent, further announcements of investment in production capacity are expected. Such projects are not expected to be up and running before 2025, given the time needed for construction. The profitability of producing advanced biofuels is questioned and public incentives, in particular in the form of mandates, will be needed.

Despite higher biodiesel imports over the outlook period as compared with the previous period, domestically produced biofuels should remain the main source for EU consumption. Imports are expected to remain limited to 12 % of total consumption. The share of imports is slightly higher for biodiesel (up to 13 % of total biodiesel consumed) than for ethanol (up to 7 % of fuel and non-fuel ethanol consumed). Biofuels produced from waste oils and fats and from advanced feedstocks are expected still to come primarily from within the EU.

GRAPH 2.8 EU biofuel consumption by source (million t.o.e.)



Increase in consumption provides scope for higher biofuel production

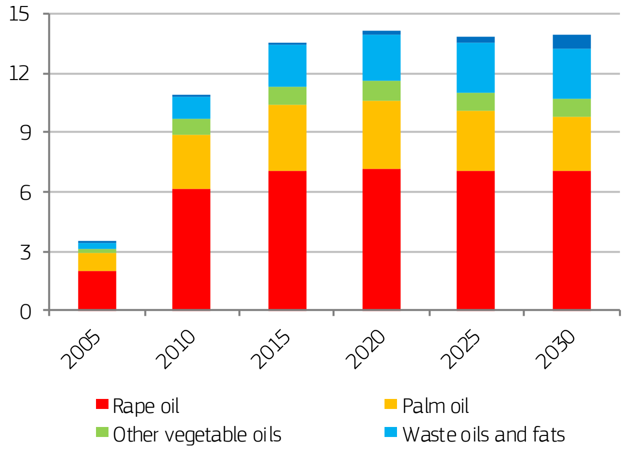
Biodiesel production is expected to increase further, by 0.3 billion litres, in 2019 to maximise the share of crop-based biofuels. From 2020 onwards, biodiesel production from vegetable oils may remain stable, at around 11.6 billion litres, before decreasing from 2023 onwards, as total diesel demand contracts (-5 % in 2030 compared with 2018). Among the different feedstocks, biodiesel from palm oil shows a stronger decline (15 %). Other vegetable oils decrease by 2 % on average. Apart from the role played by the RED II agreement on this outlook, the rise in imports also puts some downward pressure on biodiesel production.

Production of biodiesel from waste and by-products, such as tall oil and used cooking oil, shows a moderate increase of 6 % from the 2018 level, to 2.5 billion litres. While the increase to 2020 is driven by the double-counting allowed towards the RED targets, the more moderate increase post-2020 is explained by the RED II limit on the contribution of these feedstocks. Also, further growth is limited by availability and the cost of sourcing the used vegetable oils.

While production of advanced biodiesel from other waste sources may take off post-2025, it is expected to remain limited in the period to 2030, at around 0.7 billion litres. This increase will partly compensate the decline in biodiesel from vegetable oils and total biodiesel production could remain at a similar level as in 2018, close to 14 billion litres.

Ethanol production is projected to increase by 13 %, to 9.1 billion litres by 2030. With the cap on food and feed biofuels set at 1 pp above 2020 production levels and the technical feasibility of increasing ethanol blending, declining fuel use is not expected to translate into lower production. While ethanol production from most crop-based feedstocks will remain at its 2018 level, some increase in the short term may be expected for ethanol produced from maize, due to low prices and the high availability of the feedstock.

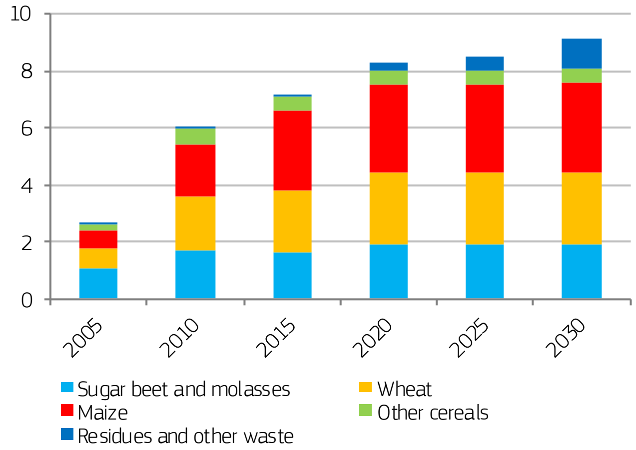
GRAPH 2.9 EU biodiesel production by feedstock (billion litres)



Cellulosic ethanol (produced from agricultural residues and waste) will be the main contributor to the increase in ethanol production.

The projection involves a slower, but still significant increase in the first half of the outlook, by about 80 %. Further investments could boost EU cellulosic ethanol production from 2025 onwards, by a tripling of 2024 production to about 1 billion litres by 2030.

GRAPH 2.10 EU ethanol production by feedstock (billion litres)



SUGAR

The EU is expected to produce 19.3 million t of sugar in 2030. The main drivers are a lower yield trend and a 6 % decrease in area. Production of over 19 million t will allow the EU to remain a net exporter of sugar. EU consumption will decline by 5 %, driven by health initiatives and consumer preferences. Sugar is expected to be only partially substituted by increasing use of isoglucose in processed food and total sweetener consumption will fall by 2 %.

The end of sugar quotas on 1 October 2017 represented a clear break with previous years, with a one-time high of white sugar production of 21.1 million t. To reach this level, beet growers increased the production area to 1.7 million ha. Due to the drought over summer and autumn 2018, this year's sugar production is estimated 2.5 million t lower, at 18.6 million t, despite an overall stable area.

Record world sugar production in 2017/2018 resulted in a sugar surplus of close to 9 million t. The excess supply on the world market has put severe pressure on world prices, which have fallen continuously over the last two years, from a peak of EUR 540/t in October 2016 to EUR 274/t in August 2018, a level not seen since 2007. Global 2018/2019 production is now estimated 5 million t lower than the previous year's and sugar prices have started to recover. While unfavourable weather conditions play some role in the lower production forecast, it is estimated that the switch in Brazil from sugar to ethanol production in 2018/2019 will result in a 20 % year-on-year drop in Brazilian sugar production.

In 2017/2018, the EU became a net exporter of sugar. With the end of production quotas, it is no longer bound by WTO export limits. Exports soared at the beginning of the marketing year, but were soon slowed by the drop in world sugar prices. Exports settled about 3.3 million t in 2017/2018, while for 2018/2019 they are forecast lower at 2.1 million t (factoring in lower EU production). As expected a year ago, imports fell back substantially in 2017/2018, due to lower import needs and unattractive EU sugar prices, and similar import levels are expected in 2018/2019.

Despite investments in increased EU production capacity of isoglucose, the expected increase in production post-quota did not materialise and preliminary data even indicate a slight fall from 0.7 million t in 2016/2017 to 0.6 million t in 2017/2018. Several factors may be behind this, including the low sugar prices and the redirection of starch to other uses.

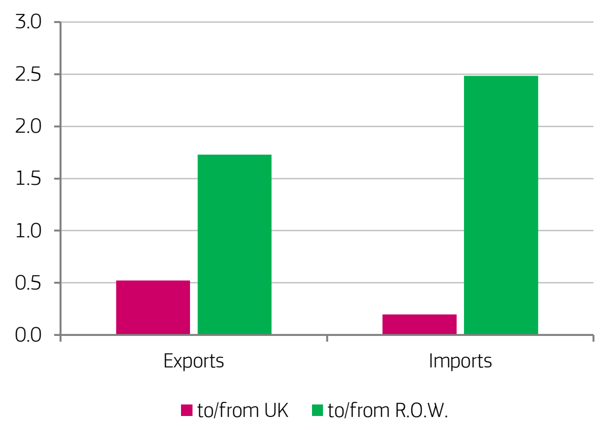
What about the UK?

Sugar production in the UK rose to close to 1.4 million t in 2017/2018, up from 0.9 million t in the preceding marketing year, representing a share of 6.4 % of total EU production.

Two operators share UK sugar production:
(i) AB Sugar, currently the sole sugar beet processor active in the UK, but soon to be joined by a new production plant to be operated by Northern Sugar, a subsidiary of Al Khaleej Sugar; and
(ii) Tate & Lyle Sugars, which refines imported raw sugar cane into white sugar and syrups.

The UK exported 84 000 t of sugar to non-EU countries in 2017/2018 and 245 000 t to other Member States (only 22 % of EU-27 imports). Imports into the UK from non-EU countries are mainly raw sugar – on average 482 000 t (26 % of overall EU imports of raw sugar) over the last five marketing years and around 475 000 t in 2017/2018. White sugar comes mainly from other EU countries. The UK imported close to 560 000 t in 2017/2018, of which about 550 000 t were from the EU-27 (17 % of total EU-27 exports).

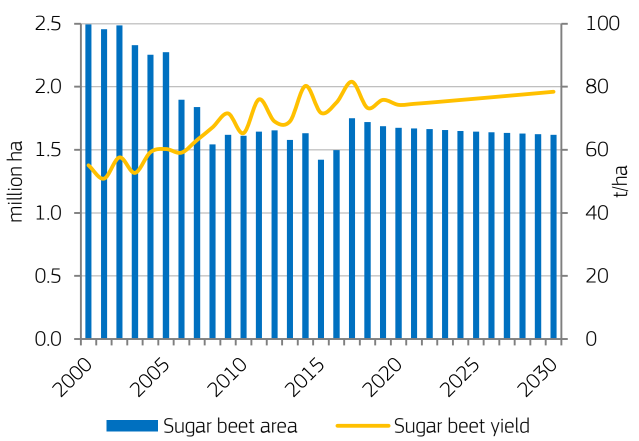
GRAPH 2.11 EU-27 sugar trade, average 2016-2017 (1 000 t)



Break in sugar beet yield trend will affect sugar production

Given the impact of neonicotinoids on pollinators, the European Commission adopted a regulation banning the use of three neonicotinoids in agriculture from 2019 onwards, including for the treatment of seeds. This ban is expected to affect the yield trend for sugar beet as from 2019 and 2020. Some regions will be affected more than others, as mostly areas with a maritime climate are vulnerable to the main pests concerned, and not all growers used treated seeds in the past. After an adjustment period, positive yield developments are expected, thanks to the experience of growers with alternative pest management practices and to research on making seeds more robust. Yields will grow more slowly than in the past, as production is already concentrated in high-yielding areas. The average EU sugar beet yield is expected to reach 78.4 t/ha by 2030. Yield prospects will result in a loss in profitability for growers in the short term and the sugar beet area is expected to decrease by 0.1 million ha over the outlook period as compared with 2018/2019.

GRAPH 2.12 EU sugar beet area (ha) and sugar beet yield (t/ha)[24]



The lower beet production will automatically translate into lower sugar production. Forecast sugar production levels for 2019 and 2020 are 18.8 million t and 18.4 million t respectively. This, together with some reduction in stocks over the coming years, will make it possible to satisfy domestic demand and to maintain exports, so that the EU remains a net exporter. Accounting for expected yield developments, production could reach 19.3 million t by 2030. This is 13 % more than average production over the last years of the sugar quota regime, but is 12 % below the particularly high 2017/2018 level.

What about organics?

EU organic beet sugar production is marginal. In 2016, organic sugar beet area was limited to 4 125 ha, i.e. 0.28 % of total sugar beet area. The main organic beet-producing countries are Germany (52 % of organic area) and Austria (23 %). Organic beet yield is estimated on average at around 50 t/ha, and current EU production of organic sugar is estimated at maximum 50 000 t. Additional organic sugar is available through imports of organic cane sugar (under a system of equivalence for organic production practices) or organic production certification. The main organic cane-producing region is Latin America (Paraguay, Argentina). Overall current availability of organic sugar on the EU market, including imports, is estimated at 150 000 t, i.e. 1 % of domestic human sugar consumption. As a result, the penetration rate of organic confectionery and biscuits remains below 2 %*.

While there is demand for more organic sugar, supply is rising only slightly, despite price premiums to compensate the high production costs (due to demanding pest and weed control) and lower beet yields (as compared with conventional yields). In Germany, sugar producers aim to boost organic production by offering beet prices of up to EUR 90/t, which is over three times the price for conventional beet. Nevertheless, organic sugar is expected to remain marginal over the outlook period.

* Source: Rabobank

Continuous increase in world sugar production

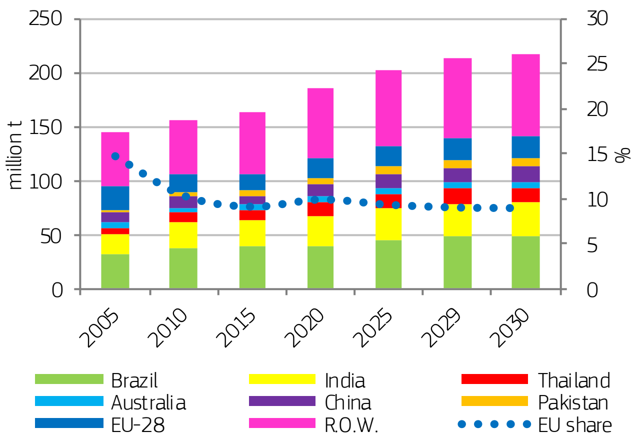
Over the outlook period, global sugar production is expected to increase further by 22 %, reaching 215 million t in 2030. Brazil will play a key role, with a 40 % rise. While this increase benefits from an assumed further devaluation of the Brazilian real[25] in the outlook period, policy decisions of the Brazilian government to boost ethanol may lead to strong redirections of the cane crop to ethanol fuel production. Other major sugar-producing countries (including India, Thailand, China and Pakistan) are also expected to raise their production further, in some cases on the back of their own policy stimuli.

While the EU's share in global production was about 15 % in 2005, it dropped to 9 % at the end of the quota regime. Thanks to the post-quota increase in production, the EU should remain at this level in the period to 2030.

24 Tonnes of sugar beets harvested per hectare, without consideration for the sugar content of beets.

25 As sugar is dollar denominated, a devaluation of the real favours the profitability and competitiveness of the Brazilian sugar industry.

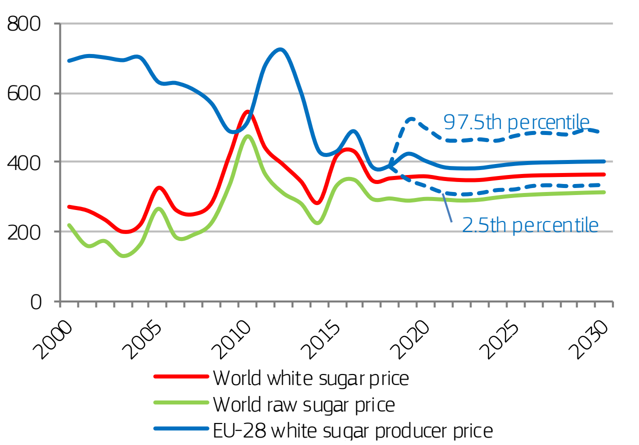
GRAPH 2.13 World sugar production (million t) and EU share in world production (%)



R.O.W.=rest of the world
Source: DG Agriculture based on 2018 OECD-FAO agricultural outlook

World white sugar prices are projected to hover around EUR 360/t. As in the previous period, the white sugar premium could vary between EUR 50/t and EUR 70/t. More closely aligned with world prices since the end of quotas, the EU white sugar price is expected to remain about EUR 40/t higher than the world white sugar price.

GRAPH 2.14 World and EU sugar prices (EUR/t)

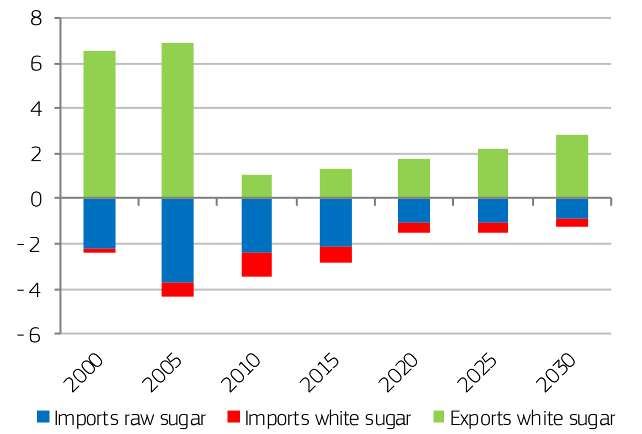


EU sugar production is currently largely covered by multiannual contracts between sugar producers and beet growers, which in some cases set a minimum beet price for the latter. In a context of increased market orientation (also considering that the EU is a 'price-taker') and with the prospect of more frequent extreme weather events and greater difficulties in managing pest outbreaks, parties may have an interest in addressing this unpredictability in future contracting terms, e.g. through annual contracts.

EU to remain net sugar exporter

Despite the projected drop in sugar production over the next couple of years, the EU is expected to remain a net exporter. Due to the price gap of around EUR 40/t *vis-à-vis* world prices, it is no longer an appealing destination and imports should remain below 1.5 million t. Exports could decline to 1.7 million t, before bouncing back to 2.8 million t by 2030. However, export levels will depend strongly on availability (in turn linked to weather conditions) and the world price level.

GRAPH 2.15 EU sugar trade balance (million t)



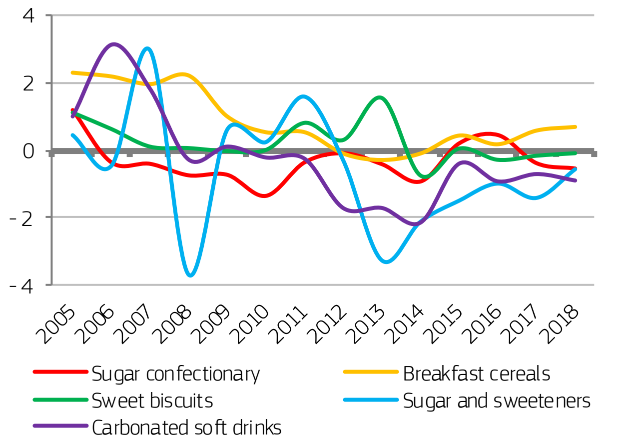
World sugar consumption rises further, while EU consumption comes under pressure

World sugar consumption has seen continuous growth over the last decade, driven by population increase but also by increased per capita consumption in large parts of the world. This trend is expected to continue throughout the outlook period, with the increase in population and a growth in consumption from 22.8 kg per capita in 2018 to 24.6 kg by 2030.

While increased consumption is expected in almost all other countries (including developed countries such as the US and Canada), EU consumption is under pressure due to health concerns. Consumers are increasingly concerned about sugar content, in particular due to high obesity rates and health issues in developed countries. This behaviour is also visible in the 2018 EU retail sales[26]. Data indicate that annual sales of sugar confectionery are stagnating in volume terms (2.5 kg per capita in 2018) and jams (1.3 kg). Sales of carbonated soft drinks (63 litres per capita) and bulk sugar and sweeteners (10.5 kg) have been falling since early in the decade. Consumption of other processed food with significant sugar content, such as biscuits and breakfast cereals, is still growing, though at a slower pace.

[26] Calculations based on Euromonitor data.

GRAPH 2.16 Annual growth in per capita consumption of confectionary and sugar drinks (%)



Source: based on Euromonitor data

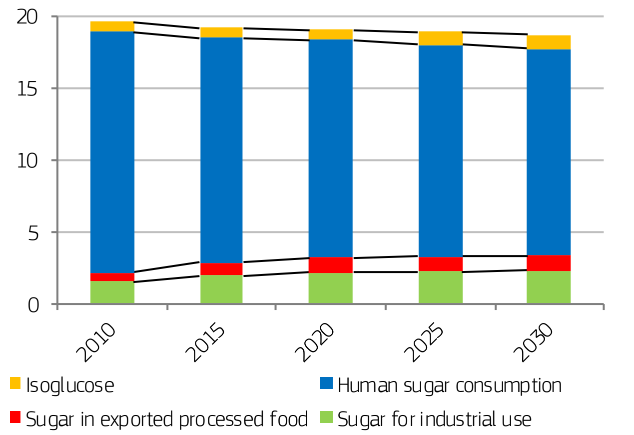
At the same time, the industry is responding to consumers' concerns by reformulating products and offering less caloric alternatives and smaller package sizes. The European soft drinks industry has decided to stop selling soft drinks containing added sugars in EU schools from end-2018 onwards.

There have also been national policy initiatives. Belgium, Finland, France and Hungary, and since 2018 also Ireland and the UK, have imposed taxes on soft drinks, sports drinks and energy drinks that are designed to reduce consumption of drinks with added sugars.

Overall, EU sugar consumption is expected to decrease from 18.5 million t in 2018/2019 to 17.7 million t in 2030 (-5 %). Further growth in the cosmetics and pharmaceutical markets provides scope for more sugar to go to industrial uses by 2030 (+8 %, industrial uses other than ethanol). Similarly, increasing global demand for sugar consumption could drive some additional exports of sugar in processed products[27]. All these factors together would result in a 7 % decrease in domestic consumption[28], from 30.0 kg per capita in 2018 to 27.8 kg in 2030.

While some sugar may be substituted by alternative sweeteners, none of the alternatives is a perfect substitute, in particular with regard to structural characteristics and taste profile. The main caloric alternative to sugar remains isoglucose (also referred to as high-fructose corn syrup (HFCS)) produced from maize or wheat starch. A moderate increase of isoglucose consumption could take place once sugar prices have stabilised, at 1 million t by 2030. This would boost the share of isoglucose in the total EU caloric sweetener market from 3 % to 5 %. Globally, the isoglucose market is estimated at 14 million t. The two main producing countries are the US (7.6 million t) and China (2.5 million t).

GRAPH 2.17 EU caloric sweetener consumption (million t)



A wide range of high-intensity sweeteners (HISs) is also available on the EU market. Whether from a natural or synthetic source, these are typically characterised by a comparatively high sweetening strength and low to no calories. At global level, HISs represent about 8 % of the sweetener market and their use, mainly in soft drinks, is estimated at 16 million t white sugar equivalent (w.s.e.) in 2017/2018. The main sweeteners are aspartame, saccharin and sucralose. On the EU market, while further partial substitution of sugar with HISs in soft drinks can be expected, growth prospects remain limited, as the consumption of low caloric soft drinks is stabilising.

27 Sugar processed in the EU into products destined for the export market is recorded as domestic consumption rather than exports.

28 Includes only human consumption.

CEREALS

EU cereal production is expected to continue its growth to 325 million t by 2030, driven by a small increase in feed demand (in particular for maize), moderate export prospects and increasingly important industrial uses. However, growth is constrained by the limited potential for area expansion and slower yield growth in the EU. Prices are expected to remain fairly stable at close to EUR 180/t for common wheat at the end of the period.

In 2018/2019, strong global demand and lower cereals harvest in Europe

According to the International Grains Council (IGC, 24 October 2018), global cereal production in 2018/2019 is expected to fall slightly, to 2 081 million t (down 1 % from the previous year), due to adverse weather conditions in a few key growing regions. Total use is projected to reach an all-time high of 2 138 million t, with expected increases in food, feed and (particularly) industrial use (+3 % year-on-year). As a consequence, stocks will fall by around 9 %, pointing to good prospects for cereal prices in the short term.

After five consecutive record harvests, global wheat production is expected to shrink by 6 % compared with last year. Weather conditions hampered crop development in the EU (where most of the decrease took place), Australia and Russia. Despite a slight decline in feed use, demand for wheat will remain strong in 2018/2019, due to growth in food use, which is, at 1.3 %, just below the five-year average, given firmer import costs (IGC, 27 September 2018). In the last five years, food use has outstripped the long-term trend. Global demand is expected to exceed production for the first time in six years. Maize output is expected to increase slightly compared with last year, to 1 074 million t (+2 %), due to favourable conditions, possibly resulting in high output in the US and Ukraine in particular, where a new record is expected. Global demand for maize is projected at a new record of 1 112 million t, exceeding production for the second year in a row. World barley production should reach around 140 million t, a 4 % decrease from last year.

After a rise in the summer, due to concerns about EU and Black Sea cereal production and associated rumours of export restrictions, world prices stabilised or declined, thanks *inter alia* to better prospects for wheat production in the US and strong exports from Russia. The maize price remains stable, below feed wheat and barley prices. World stocks are still ample, though tightening for the second year in a row

The latest estimates indicate that the EU cereal harvest will be significantly lower than forecast, because of the drought. At close to 283 million t, it is expected to be over 8 % below the last five-year trimmed average. The wheat harvest was severely affected by hot and dry weather conditions in the spring and summer that negatively impacted plant development. The EU harvest is estimated at 127 million t, a six-year low (-10 % compared with last year). Barley output was also negatively impacted by the dry conditions, but less so than wheat. It reached 57 million t (-4 % compared with last year). The grain maize harvest is expected to be down (-6 %) on last year's, at 62 million t. Other cereals, such as rye and triticale, were also hit by the difficult weather conditions.

EU cereal prices peaked in August, remaining higher than last year (around +EUR 50/t for wheat and +EUR 60/t for barley), and they should continue to follow world prices.

The EU's net trade in cereals declined further in the 2017/2018 marketing year (ending in June at 9 million t). Exports fell for the third consecutive year, to a five-year low of 34 million t. Imports were 33 % above the last five-year average. According to customs surveillance data for the first few months of the 2018/2019 marketing year, the trend is continuing, with exports of wheat and barley in July-August down on last year. On the import side, maize and wheat are following an upward trend.

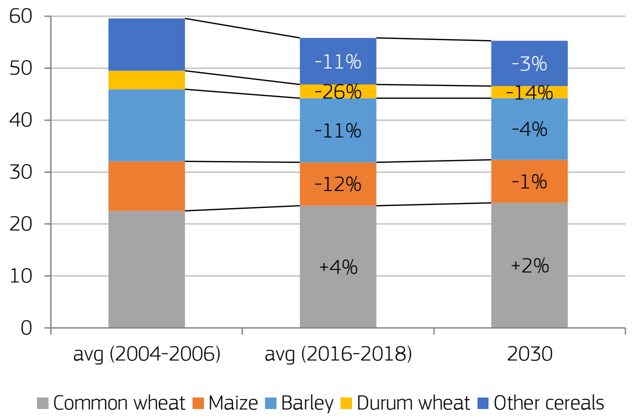
What about the UK?

Cereal production in the UK reached almost 23 million t in 2017/2018, or 7.4 % of total EU production. Common wheat and barley are the most important crops. Although the EU-27 is a net cereal exporter, it imports 2-4 million t from the UK every year, i.e. 10-20 % of EU-27 cereal imports. In the past three years, the EU-27 has been a net importer of cereals from the UK, in particular for common wheat and barley. The only notable exception is maize, for which it is a net exporter to the UK.

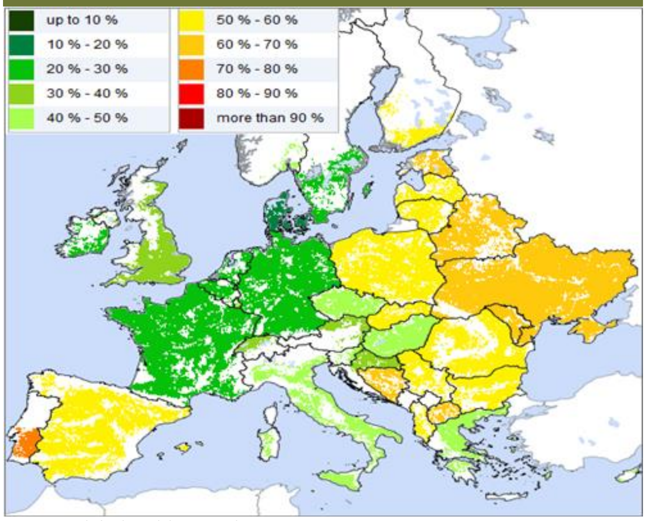
Small yield gains on a stable area

Given its high yields and grain quality, the EU has a comparative advantage for the production of common wheat. Advances in breeding and pest control techniques, mainly tailored to the main cereal crops, as well as better demand prospects, are expected to boost the relative profitability of common wheat further, as compared with the minor coarse grains. Several recent consolidation waves in the seed and chemical input sectors demonstrate the drive towards economies of scale. In addition, the demand side is dominated by a few large processors and traders shipping large volumes with relatively small margins. They have an interest in bulk quantities of homogenous products, which also encourages concentration at feedstock level. For maize, however, further area and yield growth in key producing areas across the globe is putting pressure on world prices and hence the profitability of EU maize.

GRAPH 2.18 Cereal area development (million ha)



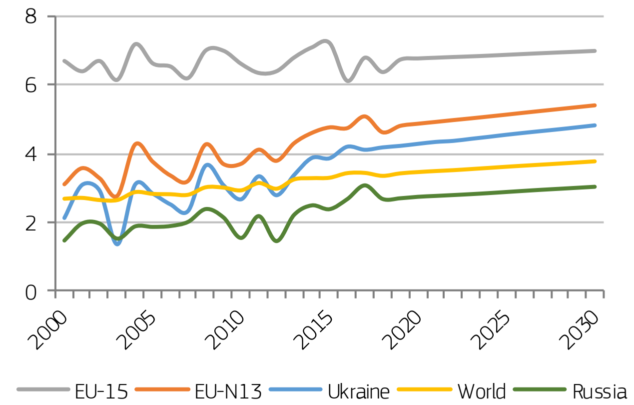
MAP 2.1 Relative yield gap for rainfed wheat in Europe (%)



Source: Global Yield Gap Atlas
Note: relative yield gap based on water limited yield potential

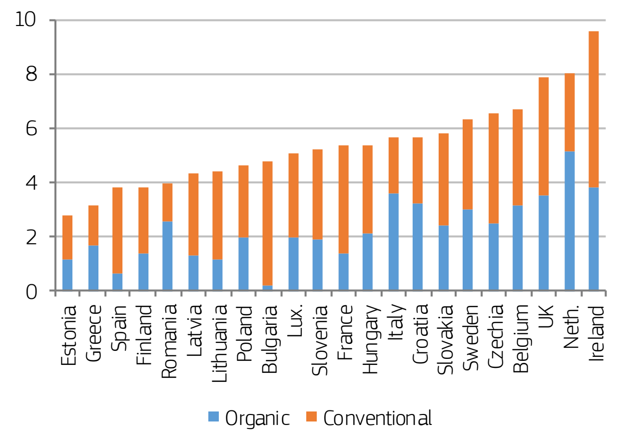
Climate change and the higher probability of extreme climatic events will have differing impacts in different parts of the EU. Advances in technology, especially precision farming, are expected to take off over the outlook period. While they have the potential to increase yields, their main advantage lies in more efficient resource management and cost optimisation. However, expectations as to agriculture's contribution to environmental (and climate) targets, such as reducing nitrogen input to avoid surplus, and banning some pesticides (e.g. neonicotinoids), mean that farmers will have to adapt their practices. Other production systems such as organic and low-input farming are also expected to gain ground. These practices normally do not attain the same yields as conventional farming. Taking all these factors together, we project mild yield growth in the period to 2030.

GRAPH 2.19 Yield development (t/ha) for common wheat



For the EU-15, nearly zero yield growth is projected, while a 0.7 % per year increase is expected for the EU-N13, a little below the growth of the wheat yield (1 % per year) in Ukraine, one of the EU's main competitors. Average world wheat yield is projected to grow faster, at around 1.2 % per year, but starting from a lower base. Russia has a considerably lower yield, even below the world average. Production growth for Russia will come from its wheat area, which is expected to expand further by 2 million ha.

GRAPH 2.20 Difference in yield between organic and conventional common wheat (t/ha) in 2016



Source: own elaboration based on Eurostat

What about organics?

Organic retail sales are growing much faster than organic area*. As shown in the previous graph, there are huge yield gaps between organic and conventional production of common wheat (over 70 % in some Member States and less than 35 % in others). All in all, the organic area remains small. In 2016, 2.3 % of the common wheat area was organic (or under conversion).

Cereals are needed for both food and feed, so the projected growth in organic animal production also creates good prospects for organic cereal production. Unlike conventional bread consumption, organic bread consumption is increasing.

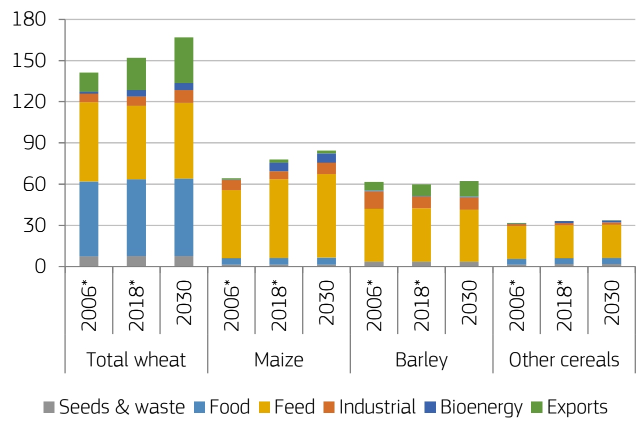
* Sanders *et al.*, 2016.

Main growth in exports and industrial uses

EU cereal demand is expected to increase by 4 % by 2030 compared with the 2016-2018 average. The feed market remains the most important outlet in volume terms, but overall growth is expected to be limited (only 0.2 % per year) given low growth in animal production and further improvements in feed-conversion ratios for non-ruminants. Due to its favourable price, maize will be preferred over the other main cereals, with annual growth of 0.5 %.

Wheat is used to a similar extent for food and feed. It remains the most important staple crop. In the EU, bread consumption decreased from over 66 kg per capita in 2007 to below 60 kg in 2017 (Euromonitor data). However, consumption of processed food, such as cakes, pastries, cereal bars and pizzas, is increasing, leading to overall fairly stable flour consumption. Over the outlook period, stable wheat food consumption is projected, with slight gains for durum wheat (used for pasta).

GRAPH 2.21 Demand for EU cereals (million t)

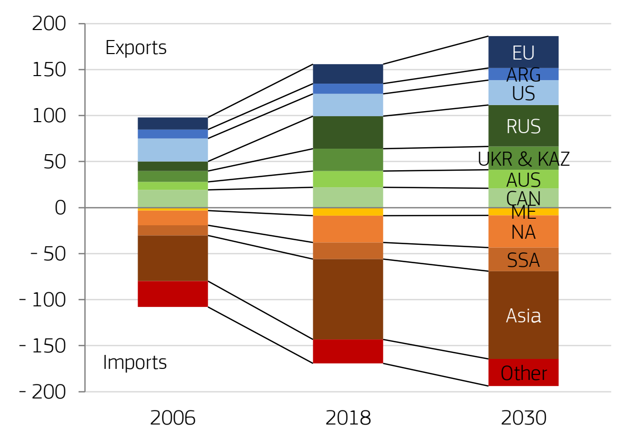


Note: 2006*=average(2006-2008); 2018*=average(2016-2018)

Industrial use is expected to see the most dynamic growth. Currently, more than 800 biorefineries have been identified in the EU, of which 507 produce bio-based chemicals, 363 liquid biofuels and 141 bio-based composites and fibres[29]. They are mainly located in the north-west of the EU. More details on industrial uses of cereals in selected Member States can be found in the next section. With the expected surge of the bio-economy, industrial uses (mainly through the starch industry) will increase further, giving impetus to demand for both wheat and maize. Maize will also benefit from moderate growth in isoglucose demand (see section on sugar). Industrial uses for barley relate mainly to malting barley and, with stable to declining beer consumption, not much growth is expected there. Demand for cereals for the production of ethanol is expected to stabilise over the outlook period (see section on biofuels) at around 14 million t, with maize most dynamic given the lower prices. The overall share of ethanol in total domestic demand for cereals is expected to remain limited to less than 5 %.

The prospects for EU cereal exports are positive, with a further 35 % increase over the 2016-2018 average and particular export opportunities for wheat in the Mediterranean, sub-Saharan Africa and the Gulf. However, further competition from the Black Sea region is to be expected.

GRAPH 2.22 Total imports and exports (million t) for wheat, by main importing/exporting region



Note: SSA=sub-Saharan Africa; NA=North Africa; ME= Middle East; RUS=Russia; UKR & KAZ=Ukraine and Kazakhstan; ARG=Argentina; AUS=Australia; CAN=Canada

Traditional wheat-producing countries such as the US, Australia and Canada are expected to stabilise their exports. Meanwhile, Russia, Ukraine and Kazakhstan are expected to continue their recent expansion, driven by large investments in both production and logistics. Russia will expand its share in global exports further, from around 20 % in 2018 to 23 % in 2030. Still, the quality of the grain remains an issue in those regions, where production (and thus exports) is mainly of low- to-medium protein content. Nevertheless, quality is also

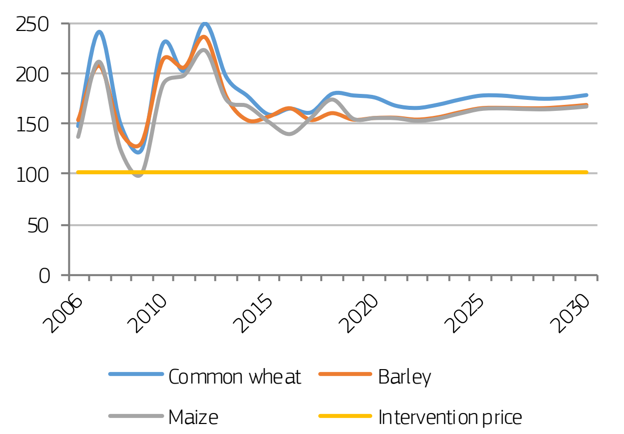
[29] Parisi, C. (2018), *Research brief: Biorefineries distribution in the EU*, European Commission - Joint Research Centre.

improving rapidly. Argentina is also expected to expand production and gain market share. Given its competitive prices, the EU is projected to increase its share of global wheat exports further, from 14 % in 2016-2018 to around 17 % in 2030. Barley exports are also expected to expand further, albeit more slowly than in the past, with China and Saudi Arabia expected to remain key markets. With small rises in cereal production, in tune with the growth in exports and domestic demand, imports of cereals, mainly maize, are expected to stabilise over the outlook period.

Starting from a fairly high stock-to-use ratio of 26 % in 2017/2018, EU maize stocks are expected to fall again to around 20 % of total maize use over the outlook period. The actual stock levels will of course vary depending on production shortfalls and surpluses here or abroad. Wheat and barley stock-to-use ratios are projected at around 12 % and 16 % respectively. These levels are higher than the 2012 low, but remain well below pre-2010 levels.

Competition weighs on EU prices

GRAPH 2.24 Development of cereal prices (EUR/t)

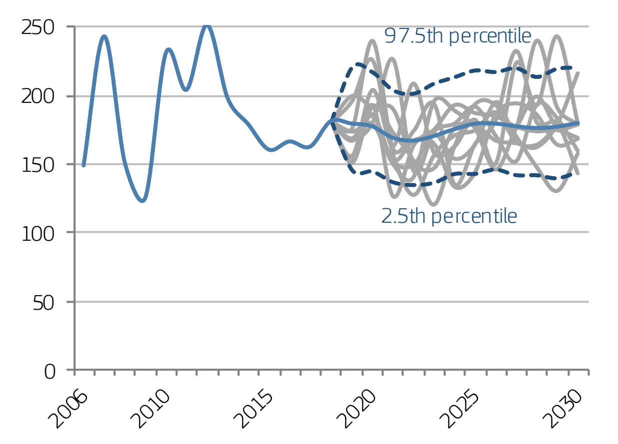


EU cereal prices are expected to remain below the peaks of five years ago, but above the long-term average, at EUR 168-180/t in 2030. In the early years of the outlook period, prices are expected to be lower than in the longer term, especially for maize and barley, driven by ample global supply, low energy and input costs, and a relatively weak euro. Barley and maize prices are expected to remain closely aligned. Due to good export demand, it is assumed that common wheat prices will remain above coarse grain prices over the outlook period. However, from 2020 they are expected to be affected more by an expected re-appreciation of the euro against the US dollar. Generally, all prices show an upward path from 2022 onwards. This may be related to the increasing energy and input costs assumed in the second half of the outlook period. The relatively low stock-to-use ratios indicate that prices may react to any unexpected production shortfall in the EU or major supplying regions.

BOX 2.4 Price uncertainty in the medium-term outlook

The baseline assumes normal weather conditions, allowing for stable yield development and a specific macroeconomic environment, but the reality might differ considerably. To account for uncertainty about future yields and macroeconomic indicators, alternative baseline projections are produced following a partial stochastic simulation (see Chapter 8). This approach enables us to illustrate different potential price paths around the core baseline, as demonstrated for common wheat in the graph below. The different paths can be interpreted as alternative prospects under different production and macroeconomic conditions.

GRAPH 2.23 Possible price paths for common wheat in the EU (EUR/t)



The average of the potential price paths is situated around the baseline price (in light blue). As an example, the grey lines show 10 out of almost 1 000 possible different price paths derived from the uncertainty analysis. These vary strongly between marketing years.

Two additional lines are included to present the 2.5th and 97.5th percentiles. Each year, 5 % of the stochastically simulated prices lie below or above the dashed lines, but these low/high price levels are determined by extreme macroeconomic assumptions or rather unlikely high/low yields. However, as not all sources of uncertainty are included in this assessment, one cannot exclude the possibility of the price moving outside this range under particular shocks.

BOX 2.5 Insights on developments in EU Member States[30]

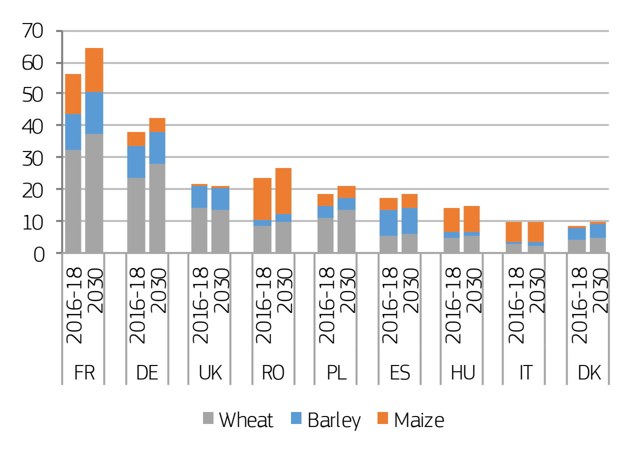
Production and use of cereals is stable with a growing demand for industrial purposes

Total EU production of main grains (common wheat, barley and maize) is projected to increase from 258 million t annually on average in 2016-2018[31] to 283 million t in 2030, while total domestic use is projected to increase from 246 million t to 257 million t, leaving room to expand net exports of main grains from 13 million t (2016-2018 average) to 25 million t in 2030. Primarily, this development stems from a projected growth in common wheat net exports, partly compensated by an increase in net imports of maize. In general, the situation indicates a saturated market for main cereals at EU level, characterised by only slight growth in domestic use. While the area for main cereals production is almost stable, with some competition from protein and oilseed crops, growth is driven mainly by increases in yields.

This development at aggregated EU level is mirrored in many Member States. However, in some countries (e.g. Germany), domestic demand is projected to decline slightly, driven by small reductions in feed and food use in the next decade.

The selected Member States whose production and use of main cereals are presented in Graphs 2.25 and 2.26, respectively accounted for more than 70 % of EU supply in 2016-2018.

GRAPH 2.25 Change in production for common wheat, barley and maize, selected Member States, 2016-2018 to 2030 (1 000 t)



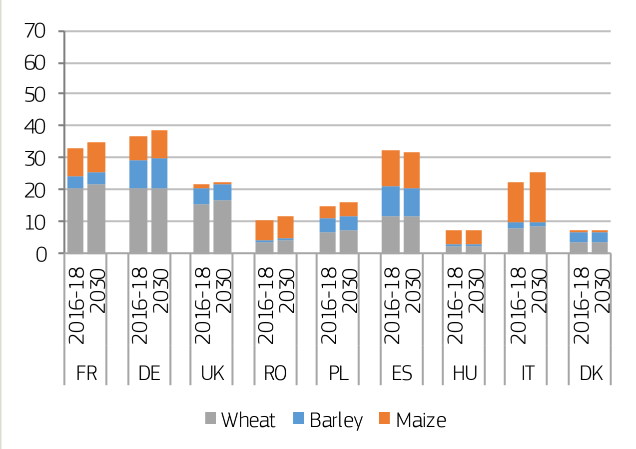
Source: AGMEMOD simulation

[30] The projections shown here are based on the outcome of the AGMEMOD model. This work was prepared by the AGMEMOD consortium: Petra Salamon, Martin Banse, Verena Laquai, Max Zirngibl, Marlen Haß, Birgit Laggner (Thünen Institute), Roel Jongeneel, Myrna van Leeuwen (Wageningen Economic Research), with the assistance of the European Commission's JRC.

[31] 2016-2018 refers to the period between marketing years 2016/2017 and 2018/2019.

The four biggest producing countries (France, Germany, the UK and Romania) are projected to account for about 55 % of EU production in 2030 and will remain significant net exporters at EU level. Other cereal-producing countries (Poland, Spain, Hungary and Italy) are expected to contribute about 23 % of EU supply (65 million t), but are notable net importers of main cereals in 2030 (by 17 million t). Production of main cereals is set to grow from 2016-2018 to 2030 in nearly all the Member States in question, with the exception of the UK. Most of the growth affects common wheat production, in contrast to barley, where growth might be limited due to a slight decline in harvested area.

GRAPH 2.26 Change in use for common wheat, barley and maize, selected Member States, 2016-2018 to 2030 (1 000 t)



Source: AGMEMOD simulation

Apparent use for food and feed saturated in most Member States

Domestic use of main cereals in the EU is dominated by feed and food use (over 85 % of total use). The remaining 15 % comprises a number of categories, such as seed, losses, bio-energy, further processing and 'other uses'. The total volume of main cereals directed to uses other than food and feed is around 33 million t. Domestic use is expected to stagnate or even decline in some of the selected Member States. Aggregate (apparent) use of cereals for food and feed in 2030 is projected to increase by only 4.9 million t, i.e. an increase of 2.4 % over the period from 2016-2018 to 2030.

Between 2016-2018 and 2030, significant changes are projected in the cereals net-trade potential of some Member States. In Germany, domestic use will decline due to a slight reduction in food demand and a halt in the expansion of animal production, enabling an increase in German net exports for the three cereals, but especially soft wheat. In contrast, for France use and production show an increase, with growth in the latter expected to outpace that in the former. As a consequence, French cereal exports are projected to increase. These divergent developments in cereal use in Germany and France may reflect differences in the perception of future animal production. In Germany, the expected cap on intense livestock production will also slow down the growth of feed demand. In France, however, growing feed demand might be induced by a stronger shift towards organic production.

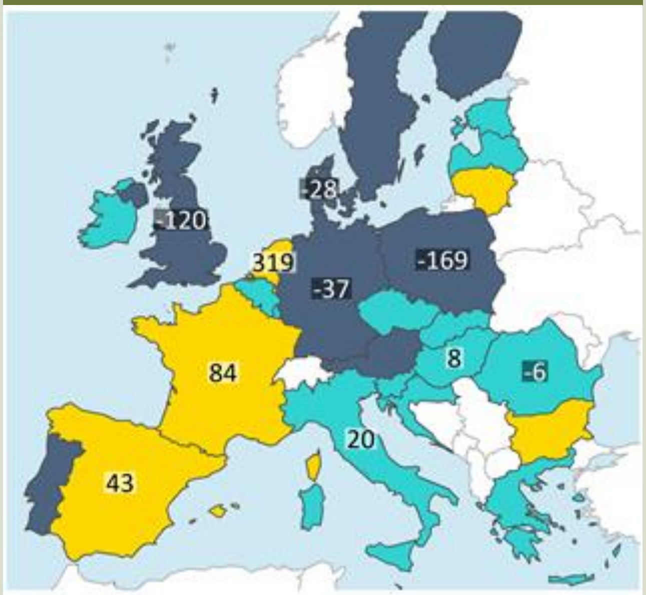
EU cereal demand for industrial use expected to increase

While demand for food and feed in cereals is hardly expanding at European level, demand for industrial use is expected to increase in the period to 2030. In this category, demand for starch and ethanol production plays an important role.

Starch production of around 10 million t in the EU is based mainly on common wheat, maize and potatoes. With 8.6 million t of common wheat, 8.1 million t of maize and 7.1 million t of potatoes processed to starch, cereal inputs in 2017 dominate its production in Europe. Drinks and other food are the most important outlets for this industry, indicating that also in industrial use most of the produce is used for food. While potato starch is used mainly in the corrugating and paper industry, around 10 % of EU starch production is used in non-food bio-based industries. This part of cereal use is expected to grow over the projection period.

The EU is a net exporter of starch and sends more than 660 000 t to other countries. In terms of intra-EU trade, the Netherlands, France and Spain are the main net exporters (marked in yellow in Map 2.2) and Poland, the UK and Germany are the main net importers. Member States marked in light blue have a neutral trade balance.

MAP 2.2 Regional net-trade in wheat- and maize-based starch (including first-stage processed products), average for 2015-2017 (calendar years)

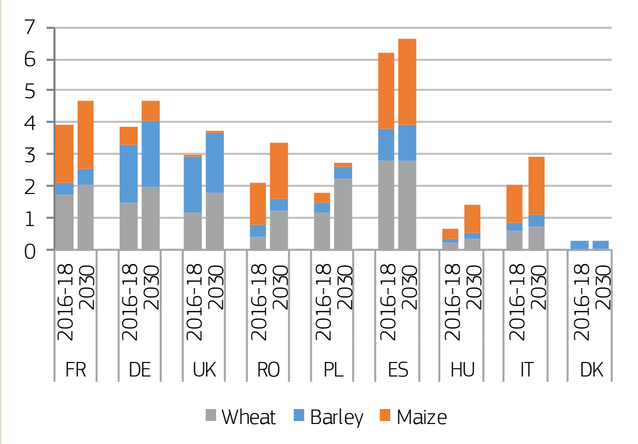


Source: EUROSTAT, 2018 (COMEXT)

Industrial use of cereals: dynamic market development, but market share remains small

In 2016-2018, around 14 % of domestic use of cereals has been either for seed or for processing in non-food/non-feed industries, including bio-energy. As the food and feed part of cereal use is projected to increase only marginally, industrial use will become more important as an outlet for increasing cereal production in the EU. Between 2016-2018 and 2030, cereal use is projected to increase by 12 million t in the EU and almost 60 % of the increase is caused by a growth in industrial uses. This development is projected to take place in almost all Member States (see Graph 2.27). Demand for wheat in industrial use shows the highest growth rates (1.9 % annually between 2016-2018 and 2030), followed by maize (1.6 %) and barley (0.8 %). With respect to barley, most of the industrial use and growth is in malt processing and breweries. The shares of the three crops used in 'other' industries differ significantly across the Member States. Some of the differences can be explained by different specialisations, e.g. common wheat is used for starch processing in the northern Member States, while starch production in southern Member States is based more on maize. However, detailed analysis is hampered by data availability limitations (to preserve confidentiality) or simply due to Member States' differing definitions of 'other' industries.

GRAPH 2.27 Change in the industrial use of cereals, selected Member States, 2016-2018 to 2030 (1 000 t)



Source: AGMEMOD simulation

The future development of the industrial use of both cereals and roots and tubers depends partly on market-driven determinants, e.g. the price level of food products such as sugar and the related isoglucose production, the growing trend in online trade (with an increase in parcels and paperboard) and new products and innovations in the bio-based industry. Industrial demand for cereals is also affected by measures promoting the transition to bio-based economies and mandatory policies by countries or firms (e.g. bans on plastic bags).

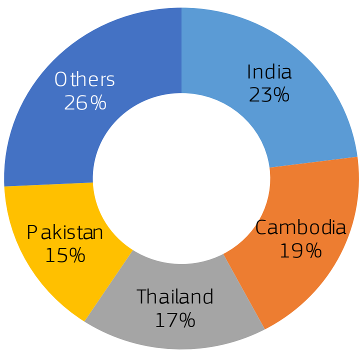
RICE

Rice is consumed all over the EU, but domestic production is fairly low compared with other grains and oilseeds. In the 2017/2018 cropping season, about 2.9 million t of paddy rice were produced in the EU, which corresponded to around 1.7 million t of milled equivalent. Total consumption stands at around 2.7 million t of milled rice.

The total harvested area reached 430 000 ha, of which over half is located in Italy. Spain is also an important producing country (about a quarter of the total area), followed by Portugal and Greece, and to a lesser extent France. The relatively limited spread of rice cultivation is mainly due to the specific conditions under which it grows (land preparation for submerged crops, but also climatic conditions).

Most of the rice produced in the EU is *Japonica* (short/medium grain), which (depending on the year) represents about 75 % of total EU production. The other type, *Indica* (long grain), is not widely produced in the EU and followed a declining trend from 2010, with a revival of production in 2017/2018. It is mostly imported. Both types of rice are consumed across the EU, with a preference for *Japonica* rice in southern regions, due to its use in traditional dishes such as paella and risotto, while *Indica* is preferred more in the north of the EU. The EU is self-sufficient in *Japonica* rice, but a net importer of *Indica*.

GRAPH 2.28 Shares of EU imports by country of origin, 2017/2018

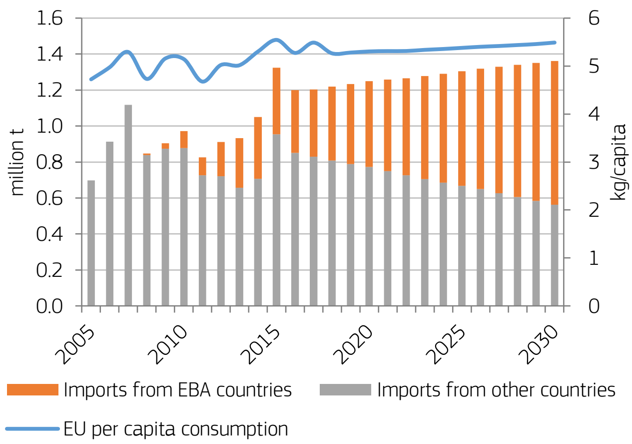


In 2017/2018, the EU imported 1.3 million t of rice (paddy, husked and milled, expressed in milled equivalent). This came largely from India, which represented 23 % of total imports (225 000 t). Cambodia is the second main exporter to the EU, representing 19 % of the market, closely followed by Thailand (17 %). Imports of *Indica* rice increased sharply from 2011, due to a rise in the domestic consumption of rice and the abolition of tariffs under the Everything But Arms (EBA) agreement, which has given least developed countries duty-free access to the internal market since 2001. For rice, the EBA concessions kicked in as of 2009.

Cambodia and Myanmar benefited from the concessions to increase their rice exports to the EU. From 2012 to 2017, both countries' exports rose by 85 %. In contrast, India's exports, which do not benefit from the EBA agreement, decreased slightly, by 4 %. Rice imports are mainly to the UK and France, and to a lesser extent the Netherlands and Germany. UK imports reached 213 000 t in 2017/2018, representing 12 % of the market; they consist mainly of *Basmati* rice from India and to a lesser extent Pakistan and Thailand. France, which represents about 8 % of the market, sources its rice mainly from Cambodia and Thailand.

In the outlook period, rice consumption is expected to expand further slightly, with the shift towards more diversified diets, including gluten-free and ethnic food, for which rice is a major ingredient thanks to its nutrition value. According to the Consultative Group for International Agricultural Research (CGIAR), long-grain white rice is a good source of energy and carbohydrates compared with wheat and potatoes. It is expected that rice consumption will increase by 0.4 % per year in the period to 2030, to reach 2.8 million t. Due to EU agro-climatic constraints and strong competition from other agricultural land uses, the total harvested area for rice is expected to decline slightly, to 420 000 ha. While agronomic research and technology take-up by rice farmers is expected to give a boost to yields, the bulk of the new demand will be met by a steady rise in imports throughout the outlook period, by around 1.1 % annually. The imports will come mainly from the EBA countries, from which the EU will source 60 % of all its imports. It is expected that imports from EBA countries will grow by 6.8 % a year.

GRAPH 2.29 EU rice imports and per capita consumption

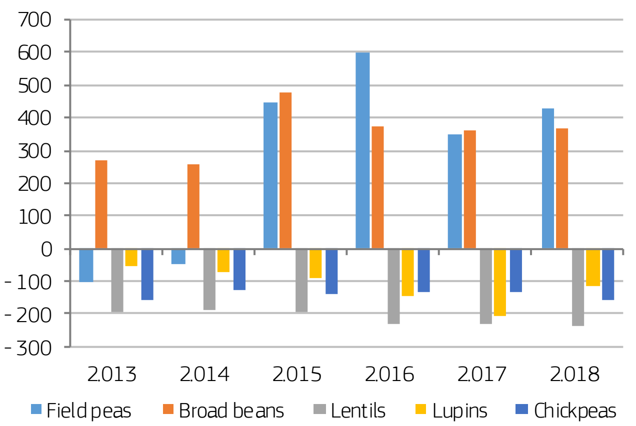


PROTEIN CROPS

Protein crops have recently experienced a strong revival, with record EU production in 2017/2018, and a slight decline in 2018/2019. Over the outlook period, the strong demand both for feed purposes (field peas, broad beans and lupins) and human consumption (lentils, chickpeas and other pulses), a favourable policy environment and some yield improvements will lead to an increase in EU production. However, with a share of only 1.4 % of total crop area, protein crop area will remain limited.

In the 2000s, area of both field peas and broad beans declined, as the crops were economically unattractive. Low yield development as compared with other crops was also a factor. This is due mainly to limited research activity and little knowledge of the relevant farming practices. From 2013, interest in these crops grew somewhat, thanks to a significant policy push and increased demand for them for food and feed purposes. Harvested area of field peas and broad beans almost doubled from 2013 to 2018. The dip in the 2018/2019 cropping season is due notably to adverse sowing conditions across the EU.

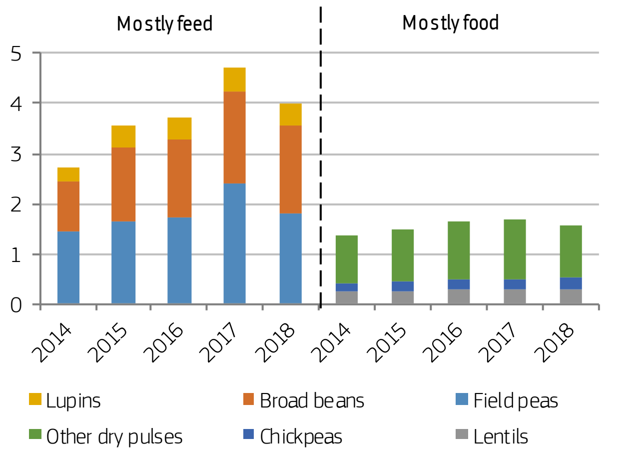
GRAPH 2.30 EU net trade for pulses (1 000 t)



Field peas and broad beans are still the most important pulses grown in the EU, both in terms of area harvested and consumption (which is predominantly for feed purposes). In 2018, production totalled 4.4 million t. Field peas are grown on 930 000 ha, mainly in France, Spain and Romania. Meanwhile, beans covered 675 000 ha, most of which was in the UK and Lithuania. About two thirds of production goes to the animal sector, thanks to their high protein content (24 % on average). From 2012 to 2018, the demand for pulses for feed purposes increased by 120 %. A smaller proportion of production is for human consumption (20 %), particularly for peas, and even less is exported. Still, the EU is a limited net exporter of these two crops.

Other pulses (lupins, lentils, chickpeas) are less common in the EU. Lupins area reached nearly 200 000 ha in 2018 and production amounted to over 300 000 t. Production of lentils and chickpeas is even smaller (around 100 000 t for the two crops together). Imports of lentils and chickpeas have increased over the years to meet demand. While most lupin production goes to the feed sector, all production of lentils and chickpeas goes to human consumption. With the growing popularity of the Mediterranean and other special (ethnic, flexitarian) diets, as well as increasing demand for new products in which pulses are used as ingredients (veggie burgers, protein shakes and alternative drinks), food demand for pulses is growing. Since 2014, food demand for lentils and chickpeas has increased by 24 % and 20 % respectively.

GRAPH 2.31 EU domestic use of pulses (million t)



Pulses also benefit from increasing consumer interest in regional products. Local varieties of pulses with characteristics linked to their place of production are eligible for registration as protected geographical indications (PGIs) or protected designations of origin (PDOs). Close to 40 from eight different Member States have been recognised to date, including Mediterranean pulses from Spain (e.g. Armuña lentils), Italy (e.g. *lenticchia di Castelluccio*), France (e.g. *lentilles du Puy*) and Greece (e.g. Santorini's faba bean), and others from Sweden, Latvia, Austria and Poland.

Policy drivers influenced the recent development of pulses area. Pulses are eligible for the voluntary coupled support (VCS) scheme and almost 12 %[32] of the VCS envelope is targeted to protein-rich crops such as pulses. In addition, farmers can grow pulses on ecological focus areas (EFAs) as nitrogen-fixing crops and can incorporate them in their rotation to fulfil the crop diversification requirement. In the current programming period,

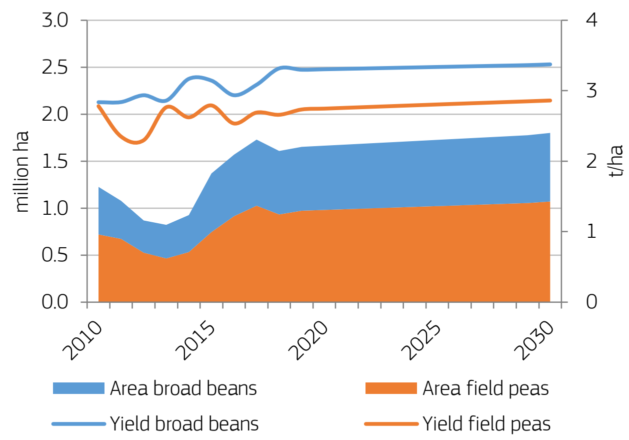
[32] As from Claim year 2019.

nearly all Member States have notified the use of VCS and EFA schemes targeting pulses. The ban of pesticides on EFAs in the context of the CAP omnibus revisions could play a role in yield development in the medium term, but the overall impact, especially on area development, is yet to be seen.

EU production to grow further thanks to market and research drivers

In the outlook period, it is expected that the production of protein crops will expand across the EU, thanks to an increasing area and a positive yield trend. The production of field peas and broad beans will reach 5.5 million t in 2030. Growth will be slightly more dynamic for the former (+2.5 %) than for the latter (+2 %).

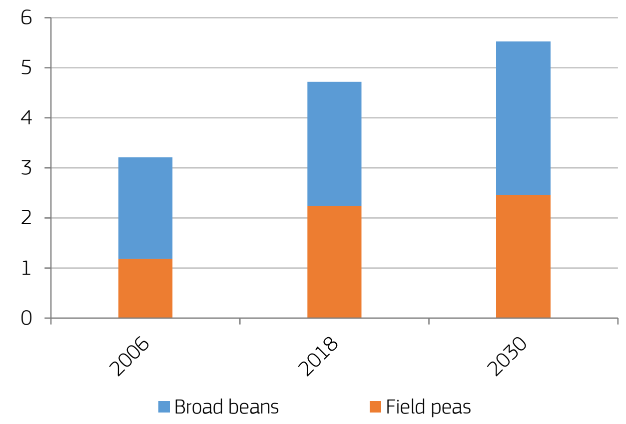
GRAPH 2.32 EU area and yield development for field peas and broad beans



Field peas area in the western Member States represents a high proportion of the EU total (58 %). Harvested area will increase more dynamically in the EU-N13 (+4.4 % annually). Similarly, broad beans area will increase by 1.6 % annually in the EU-N13, while growth will be less than 1 % in the EU-15. The dynamics in yields are similar, with faster yield development in the EU-N13. It is thus expected that the yield gap between the two groups of Member States will close further in the outlook period.

EU domestic demand for pulses is expected to increase at a dynamic pace, by over 2 % per year. Feed demand will continue to be the major factor in the demand for pulses and will drive the overall increase. This is due to the increasing demand for local feed, particularly non-GM, to satisfy in turn the demand for animal production (especially milk products and poultry), and further incentives to improve rotations at farm level. Food demand for pulses, including lentils and chickpeas, is also expected to increase significantly. Despite increasing production, it is expected that the EU will increase its imports of pulses, for both food and feed purposes. It will import more from Canada (and to a lesser extent India and Ukraine).

GRAPH 2.33 EU feed demand for broad beans and field peas (million t)



As mentioned in the recently published report on the development of plant proteins in the EU[33], research will be a key driver in the development of protein crops, in terms both of production and market outlets. R&D has been an essential trigger of upward trends in yield development in the past. Protein crops have benefited from research projects on varying scales by the European Innovation Partnership (EIP-AGRI). In particular, research on breeding and environmental assets of protein crops is strengthening knowledge of these crops. Farmers are becoming more aware of good farming practices specific to these crops and will be able to enhance their performance in the medium term. Finally, research on consumer taste and greater diversification of supply will be central for the development of the market. Other drivers that could be of crucial importance in the future are the inclusion of protein crops in the CAP strategic plans, better market information, increased promotion of these plants and the sharing of best farming practices.

33 European Commission (2018). Report from the Commission to the Council and the European Parliament on the development of plant proteins in the EU. https://ec.europa.eu/agriculture/cereals/development-of-plant-proteins-in-europe_en

BOX 2.6 Drivers for protein-rich crop development in the EU[34]

Background

The EU has a historical deficit in concentrated sources of protein and relies on protein imports mainly from the US and Latin America to feed its domestic livestock production. The EU plant-protein deficit has gained prominence in political discussion in 2017 and 2018, and the Commission is reflecting on possible ways to increase domestic production. This box investigates three potential drivers that could have a positive influence on the development of protein rich crops in the EU:

(i) indirect support through investment in research and innovation for breeding purposes, with the aim of increasing yields of domestically produced soya beans and pulses;

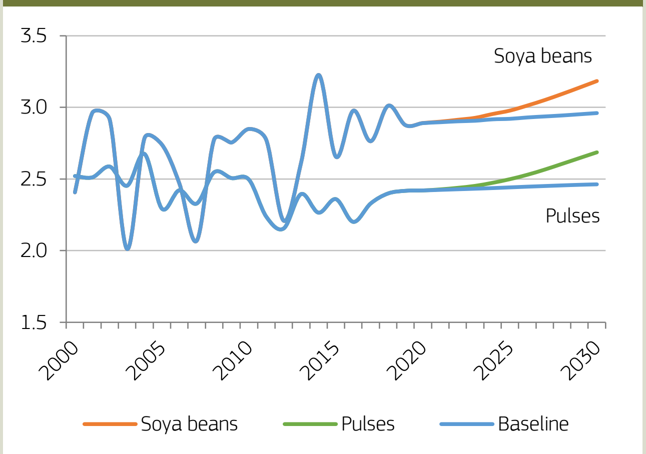
(ii) direct support through an additional coupled payment for protein-rich crops; and

(iii) a side-effect of phasing out high-ILUC-risk biofuel feedstocks.

Scenario assumptions

To understand the potential economic impacts of these drivers, a counterfactual scenario to the medium-term baseline presented in this report is constructed. For the analysis, the Aglink-Cosimo model is used.

GRAPH 2.34 Changes in EU yields for soya beans and pulses, in 2030 compared to the baseline (t/ha)



The need to close the competitive yield gap of protein crops relative to maize and wheat grown in the EU has been highlighted in the EIP-AGRI Focus Group[35]. This includes recommendations *inter alia* on better use of extension services (e.g. targeted education and training of farmers, advisors and teachers), involving farmers in long-term public breeding programmes, and increased funding for research on resilient crop varieties (e.g. more cold- and drought-resistance).

The scenario analysis assumes that yields for pulses and soya beans increase gradually relative to the EU's outlook baseline over the period 2020-2030, to reflect the relative impact of better productivity through increased R&D. The average yields increase by 1 % per year in 2020–2030 compared with the baseline 0.2 % (Graph 2.34).

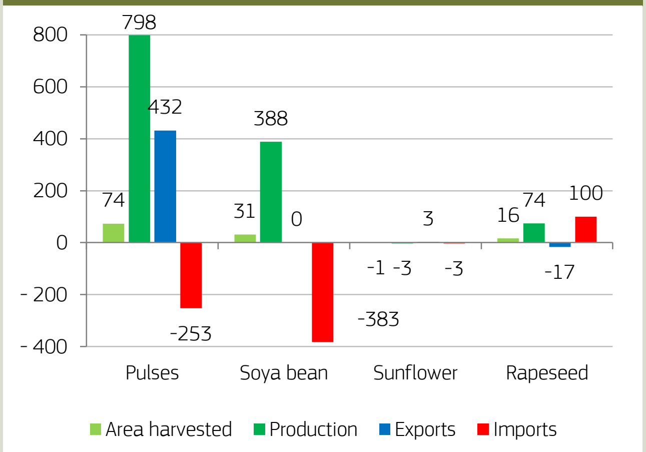
As regards further incentives to produce protein-rich crops, we assume additional direct support of EUR 75/ha for farmers cultivating soya beans and pulses, beginning in 2020, raising the level of coupled payments for protein crops to 2 % of direct support. We assume that these payments will be given only in Member States that have VCS payments currently.

Last but not least, we assess the side-effects on vegetable proteins availability of a possible gradual phasing out of the use of biofuel feedstocks with high risk of ILUC in the period 2023-2030, following the Commission's RED II proposal[36].

Land use, production and price effects for oilseeds and pulses

In presenting the results, we look first at land use and production effects (scenario vs. baseline). Harvested area of pulses and soya beans increases by a total of 105 000 ha, mainly thanks to increased yields and direct coupled payment (Graph 2.35).

GRAPH 2.35 Changes in EU area (1 000 ha), production and trade (1 000 t) for oilseeds and pulses, in 2030 compared to the baseline



Harvested area and production for pulses increase by 2.8 % (74 000 ha) and 12.2 % (798 000 t) respectively in 2030. Whereas improved yields raise the per-hectare crop value of pulses, leading to an additional 16 000 ha, additional direct coupled payment boosts land-use area by 58 000 ha. The yield impact on the total harvested area of pulses accounts for 82 % of the increased production, dominating the supply response.

[34] The analysis presented in this box was conducted by Hans Jensen and Ignacio Pérez Domínguez (JRC, Seville, Spain; contact: hans.jensen@ec.europa.eu).

[35] European Innovation Partnership - AGRI Focus Group on protein crops: final report, 2014.

[36] The contribution of high-ILUC-risk biofuels must not exceed 2019 levels.

This increased supply reduces EU market prices by 3.6 % (Graph 2.36), improving the EU's net trade position (i.e. higher exports and lower imports).

In the case of soya beans, harvested area and production increase by 2.4 % (31 000 ha) and 10.1 % (388 000 t) respectively. As with pulses, the improved yields raise the per-hectare crop value, increasing the harvested area by 14 000 ha, while at the same time additional coupled payment adds another 17 000 ha. The yield impact on the total grown area of pulses accounts for 87 % of the increased production, dominating the supply response. This increased supply reduces EU market prices marginally, by 0.3 % (Graph 2.36), in turn reducing imports.

GRAPH 2.36 Change in EU producer prices (%), in 2030 compared to the baseline

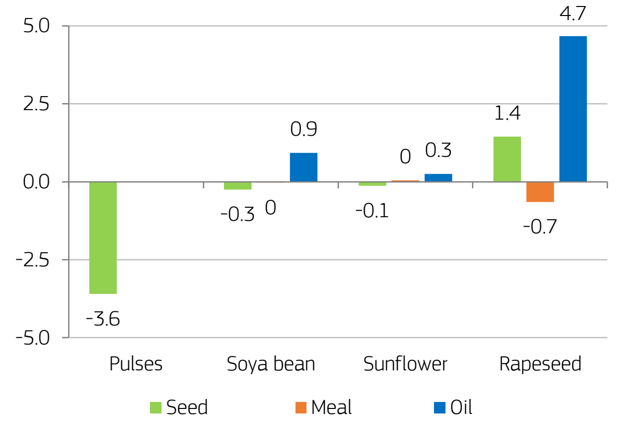


TABLE 2.2 Change in EU vegetable oil uses by source, in 2030 compared to the baseline (1 000 t)

	Biodiesel	Food & OU	Exports	Total
Vegetable oil from crushing EU produced oilseeds	336	-176	-62	99
Vegetable oil from crushing imported oilseeds	81	-82	-23	-24
Imported other vegetable oil	-2 350	160	0	-2 190
Total change	-1 933	-98	-85	-2 116

Note: OU=other use

The increased production of rapeseed in Graph 2.35 is not driven by increased yields or additional coupled payment, but is linked more to the phasing-out of biofuel feedstocks with high risk of ILUC. The increase in the use of vegetable oil crushed from EU oilseeds to replace imports of vegetable oils is highlighted in Table 2.2. Accordingly, domestically sourced vegetable oils increase by 99 000 t, with the increased soya bean production accounting for 64 000 t and the remaining 38 000 t being sourced from EU-grown rapeseed, with sunflower oil use declining by 3 000 t. This increased demand for rape oil increases rapeseed prices by 1.4 % (Graph 2.36), stimulating production and harvested area (by 16 000 ha).

Production and demand effects for vegetable protein meals and oils

The use of pulses as animal feed increases by 88 000 t (2.8 %) in the EU, whereas only a small increase in food consumption and other uses (25 000 t) is projected by 2030. The increased yields and additional coupled payment modelled in this scenario raise the feed use of pulses of EU origin from 85.4 % to 89.5 %. Rising yields and additional coupled payment for soya beans, combined with the phasing-out of biofuel feedstocks with high risk of ILUC, increase the use of vegetable protein meals in the EU by 46 000 t (0.1 %) (Table 2.3).

TABLE 2.3 Changes in EU vegetable protein meals use by source, in 2030 compared to the baseline (1 000 t)

	Soya bean	Rapeseed	Sunflower	Other	Total
Meals (from EU produced oilseeds)	272	51	-4	0	320
Meals (from imported oilseeds)	-273	55	-1	0	-219
Imported	-51	-9	7	5	-48
Exported	1	6	0	0	6
Total change	-53	92	1	5	46

The increased supply of domestically sourced vegetable oils increases EU-sourced protein meals by 320 000 t in 2030. Most of this comes from domestically grown soya bean meals (272 000 t). The increased yields and additional coupled payment modelled in this scenario raise the feed use of soya beans of EU origin from 8.2 % to 9.1 %. Feed use of rapeseed meal of EU origin declines from 86.4 % to 86.2 % in 2030, due to the rise in meal from imported oilseeds outstripping that in meal from EU produced oilseeds. The increased production of protein meals and pulses reduces feed prices (Graph 2.36), stimulating a slight increase in meat and milk production and a reduction in the amount of maize, wheat and other coarse grains being fed to livestock.

Summary conclusions

Promoting higher yields of protein-rich crops through R&D has great potential to increase domestically produced plant-based protein in the medium to long term. Moreover, the introduction of additional direct coupled payment for soya beans and pulses production could further contribute to increasing domestic production of protein-rich crops and reducing the EU's protein deficit, albeit moderately, as compared with the budget allocated in this scenario. Last but not least, it appears that a phasing-out of biofuel feedstocks with high ILUC risk would have a limited impact on protein meal produced from domestically sourced oilseeds. It is important to note that the results presented here are highly dependent on the assumptions used in the analysis. Further research should focus on the main uncertainties underlying these markets (see Chapter 9 on stochastics) and identifying the economically feasible yield potentials by crop and region.

OILSEEDS COMPLEX

Given the opportunities, but also the limitations, of biofuels policy after 2020 and only limited growth in feed demand, no further growth is expected in the rapeseed area, while palm oil imports are expected to decline. Domestic soya bean production is set to continue its expansion, albeit at a slower pace than in recent years, while for sunflower mild growth is foreseen in a context of positive food and feed prospects.

In 2018/2019, the world oilseed harvest is expected to increase from the already high level of the previous season. The USDA expects it to reach over 600 million t, due to bumper harvests of soya beans and sunflower seed. World production of rapeseed should decline, due to a drop in major producing countries such as certain EU Member States, China and Canada. A very competitive price for US soya beans has prevailed due to ample availabilities on the world market, following retaliatory tariffs from China and a record US harvest. While China is extending its sourcing from Brazil and Argentina, US shipments to the EU are increasing. With ample global supplies and a halt of Chinese imports of US soya beans since the introduction of countervailing duties, trade should strengthen for other countries and crushing is expected to increase worldwide. For a scenario on the Chinese retaliatory tariffs on soya beans, see Chapter 1.

In 2018/2019, EU oilseed production is estimated at 32 million t, nearly 3 % down on the last five-year average. The drop is driven mainly by a decline in rapeseed and (to a lesser extent) sunflower seed and soya bean production. Since oilseed acreage has increased (+3 % compared with the five-year trimmed average), yields are expected to be the main factor in the decrease: they should be 5 % lower than average.

Soya beans drive growth in oilseeds area

Over the last decade, the surge of the policy-driven biofuel market and the intensification of animal production have boosted rapeseed area and production. While around two thirds of domestic rapeseed is used as feedstock for biodiesel, rape meal is an important component of compound feed, especially for dairy cattle and pig production.

Driven by RED II, demand from the biofuel sector for domestically produced oilseed oils, mainly rapeseed oil, is expected to stabilise over the outlook period (see section on biofuels). Food and industrial (bio-economy) consumption of vegetable oil will increase only moderately, as will demand from the feed sector. In the feed sector, rapeseed meals are facing competition from sunflower and especially soya bean meals as protein-rich alternatives. Furthermore, the widespread inclusion of rapeseed crops in the rotation and the potentially reduced availability of plant protection substances (as a result of the Sustainable Use Directive) may also discourage farmers from opting for rapeseed. The EU rapeseed area is expected to decrease slightly from the current high to around 6.6 million ha in 2030.

For EU soya bean production, the prospects look different, with the policy and market environments both favouring production. On the policy side, different Member States, among which some major producers (Italy, France and Hungary) grant VCS, while areas cultivated with soya beans count as EFA in 15 Member States. It remains to be seen how the ban on pesticide use on EFAs will affect planting decisions in the longer term. Plantings were slightly lower (-3 %) in 2018/2019 than in the previous marketing year.

What about the UK?

In 2017/2018, UK oilseed production was slightly above 2 million t, or 6.3 % of total EU production, and consisted almost exclusively of rapeseed. Although the EU-27 is a significant net importer of oilseeds, it was a net exporter *vis-à-vis* the UK in 2017/2018, having been a net importer in previous years. The share in EU-27 exports of oilseeds to the UK was 24 % in 2017/2018, while on average it is 14 %. Nevertheless, this trade remains negligible compared with UK and EU-27 imports from the rest of the world.

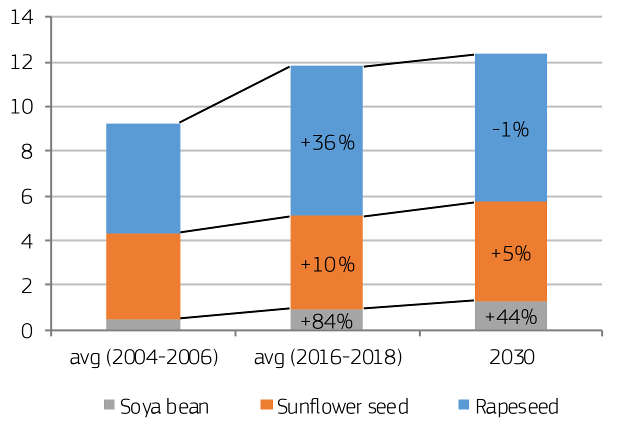
The EU-27 is a net exporter of oilseed oil and meals to the UK. On average, 24 % and 47 % of EU-27 exports of oilseed oil and meals, respectively, are to the UK. Compared with EU seed exports, this trade accounts for a far greater proportion of the UK's total oil and meal imports. It should be noted that a significant part of the traded volumes are transhipped through EU-27 ports and re-exported to the UK.

On the market side, the soya bean's high protein content makes it a valuable feed component, while domestically produced soya beans attract premium prices compared with imported GM soya. The 943 000 ha under cultivation in 2018/2019 was only slightly below the 2017/2018 record of 961 000 ha. Area is increasing in the EU-15, but even more so in the EU-N13, with Romania the biggest grower. Over the outlook period, we anticipate a further area increase of about 44 %, to around 1.3 million ha. Soya beans are thus expected to benefit from the strongest growth of all crops in the EU, although overall area remains small. Changes in area will depend on:

(i) relative profitability as compared with cereals and rapeseed (the main substitutes);

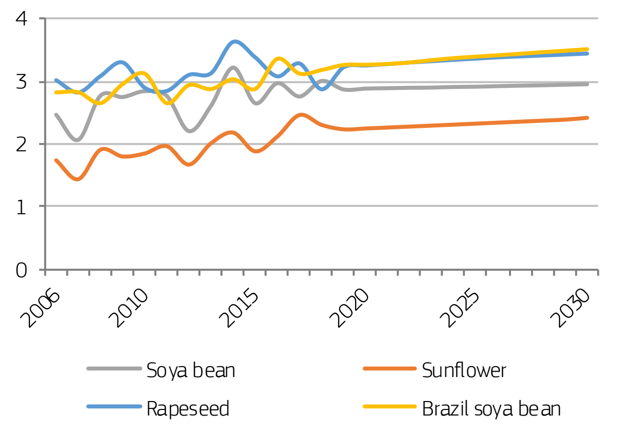
(ii) the price premium for non-GM soya, both for food use (production of meat substitutes and plant-based drinks or other processed foods) and feed use (with growing GM-free-fed, including organic, animal production); and
(iii) further advances in breeding for what has been a relatively minor crop in Europe.

GRAPH 2.37 Oilseeds area development (million ha)



While sunflower area has come down slightly in the EU-15 over the past few years, it has continued to grow in the EU-N13. This trend is expected to continue, leading to an overall increase of around 200 000 ha over the outlook period.

GRAPH 2.38 Oilseeds yield development (t/ha)

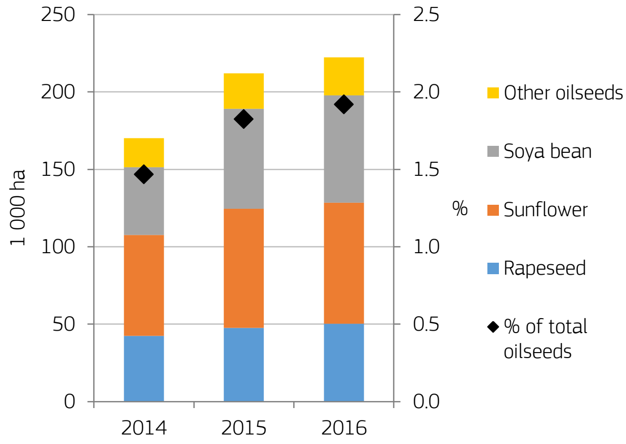


While the potential for oilseed yield growth is a matter for debate, soya bean and rapeseed yield will continue to outperform sunflower yield. The yield growth is projected to remain slightly below trend, indicating only modest growth in the coming decade. As a reference, the Brazilian soya bean yield is around 0.4 t/ha higher than that in the EU (including double cropping). Brazil's projected yield growth is also slightly more dynamic: 0.7 % per year, as compared with 0.3 % in the EU.

What about organics?

Organic oilseeds area is still marginal, but is expanding rapidly. It accounted for nearly 2 % of total EU oilseed area in 2016. Between 2014 and 2016, organic soya bean area expanded most dynamically, with annual growth of 26 %. France has by far the largest area (around 25 000 ha), followed by Austria and Romania (both around 15 000 ha). France and Romania attain yields of around 1.4-1.7 t/ha, or about 60 % of the yield attained in conventional soya production. For sunflower and rapeseed, Romania is the leader, followed by France.

GRAPH 2.39 Organic oilseeds area development



Over the outlook period, further area expansion for organic production is expected in response to the growing consumer base and some consumers' preference for non-GM crops and non-GM-fed animal products. Organic soya bean production is expected to remain the most dynamic, given the many possible food applications, such as soya drinks, margarines and tofu. Also, there is good demand for soya meal for organic compound feed.

Scope for increased soya bean meal imports and soya bean production in the EU

As explained in the following chapters, EU meat and dairy production is set to expand further. For poultry, unlike pigs, livestock numbers will rise, while dairy productivity will generally improve. This will depend on the inclusion of more protein meals in feed rations.

While rapeseed meal has been increasingly included in the feed mix in the past decade, at the expense of soya meal, the trend is now reversing in response to nutritional and economic concerns. Soya bean meal contains essential nutrients, such as lysine and other proteins, and is currently available at reasonably low prices. The first signs of higher soya bean meal use and imports have become apparent in recent years and this trend is expected to continue.

World soya bean production is expected to continue expanding (+20 %) in the period to 2030, to nearly 427 million t. This expansion will be seen mainly in Brazil (which will become the largest producer), the US and Argentina. Although the devaluation of the Brazilian and Argentinian currencies will stimulate exports, some of the increased production will support the expansion of their domestic meat production. On the demand side, China currently imports about 63 % of the world's soya beans traded, and this share will grow slightly, to 65 % by 2030. The Chinese do not import meals, as they mainly crush domestically. Regardless of whether current trade tensions with the US are resolved, China will remain dependent on soya bean imports. It has launched a support programme for domestic production, but this will most probably not alter its import dependency (around 88 % currently), given low profitability and land competition.

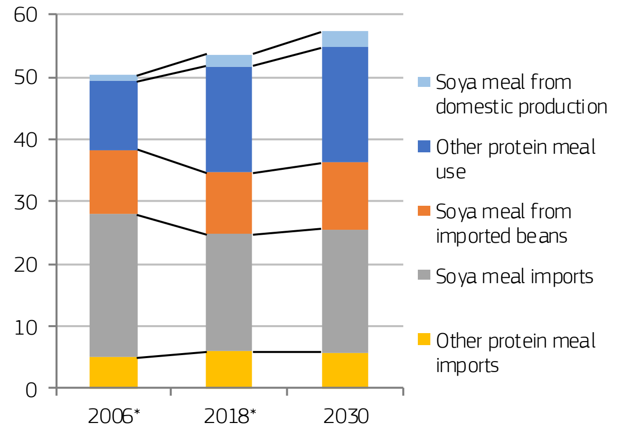
Currently, the EU imports around 9 % of the world's soya beans traded. This share will fall slightly to 8 % by 2030, but volumes will still rise in absolute terms. The EU also imports a large share (29 %) of the world's oilseed meals traded, mainly soya meal; this is also expected to shrink (to around 24 %), as the EU expands domestic protein meal production and other regions import more in response to more dynamic animal production growth. Import prices for soya beans and soya bean meals are projected at fairly low levels and this will stimulate imports further. The projected growth in biodiesel demand in the US and other regions across the globe will also contribute to relatively cheap availability of soya meals.

Most of the oilseeds produced in the EU are crushed domestically (mainly in the EU-15), as is the case for imported soya beans. For rapeseed, the crushing margin[37] will remain slightly below the previous 10 years' level, given the stabilisation of the biofuels market (see section on biofuels), low crude oil prices and generally low feed prices. This will also be the case for sunflower, as there will be more competition from other vegetable oils for food use, while the better nutritional value of soya meal weighs on sunflower meal prices. The soya bean crushing margin will improve further, as it is mainly determined by developments in the feed sector, while the rapeseed crushing margin follows developments in the biofuel sector more closely. Still, some crushing plants are set up to switch easily between different oilseeds in response to market signals. With the shift towards more soya bean production, additional crushing plants might be constructed inland, closer to the production regions.

Consumers in the EU are becoming increasingly conscious of methods of producing meat, eggs and dairy products. In response, and often prompted by leading retailers, different premium market segments for feed have emerged in the EU (e.g. GM-free, local and organic). These trends are expected to continue in the future. The premium for non-GM soya beans is around EUR 80-100/t, partly to cover the lower yield and higher costs, but also in response to high demand in a context of limited availability. Also promising is the market for meat substitutes and plant-based drinks, which is growing fast (average growth rate over the last five years of 14 % per year for meat substitutes and 11 % per year for dairy alternatives (Euromonitor)). Production of soya beans, one of the main ingredients (see Graph 3.10 in the dairy chapter), is also increasing as a result.

As indicated in Graph 2.40, these developments will further boost domestic production of soya beans, but this will remain limited as a proportion of total protein meal production. The EU's protein meal self-sufficiency will improve by only around 1.5 % over the outlook period, to reach 56 %. The rest will still come from imports, mostly of soya beans and especially soya bean meals. Imports of other protein meals are projected to decline, partially substituted by increased soya bean meal production from domestic beans, but mainly due to more competitive soya bean meals on the world market.

GRAPH 2.40 EU protein meal sources (million t)



Note: 2006*=average(2006-2008); 2018*=average(2016-2018)

Domestic vegetable oils gain on palm oil

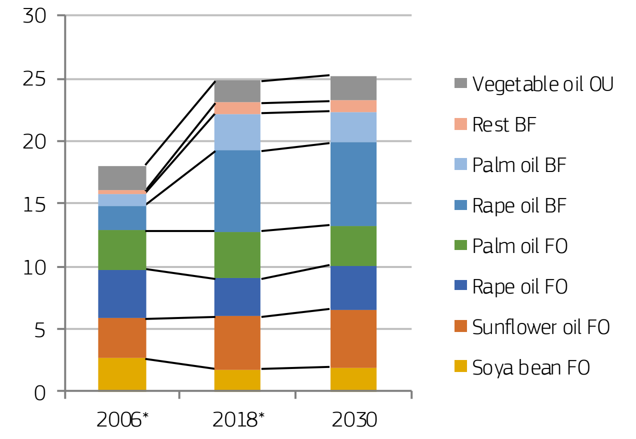
Developments in the use of vegetable oils in the last decade have been driven principally by the surge of the biofuels sector. In the future, the share of vegetable oils in the biofuels complex is projected to fall in favour of waste oils and residues. In the EU, rapeseed oil accounts for the largest share of vegetable oils used for biofuels (around 62 %), followed by palm oil (around 33 %). In addition to second-generation biofuels and waste oils, RED II might stimulate the use of oilseed oils, potentially at the expense of palm oil. This would be the case if the latter is judged to have a high ILUC[38] risk. Up to 2019, additional palm imports might be expected in anticipation of RED II; in fact, these are already visible. From 2023, the use of high-ILUC-risk biofuels should gradually fall. The use of palm oil might drop off in the period to 2030, from 3.1 million t to 2.5 million t.

[37] The ratio of oilseed meal and oil prices to the oilseed price.

[38] See section on biofuels for more information on ILUC and RED II.

Total EU food use is expected to increase further over the outlook period, from around 12.9 million t to around 13.4 million t. In retail and food services, sunflower oil is the most popular oil, although the volume used has decreased since the middle of the last decade in favour of rapeseed oil, which attracts a price premium in some key markets. However, the total food use of sunflower oil, including industrial use for food preparation, will keep on growing. Total palm oil food use has shown a decreasing trend since 2009 after years of increases, due to increased competition from biofuel use, together with nutritional and environmental concerns. It is expected that these concerns will contribute to a further decrease (from 3.8 million t in 2018 to 3.2 million t in 2030).

GRAPH 2.41 Vegetable oil uses (million t)



Note: FO=food; BF=biofuel; OU=other use
2006*=average(2004-2006); 2008*=average(2016-2018)

Another increasingly attractive outlet for vegetable oils are the fat-filled powders (FFPs) meant for export as cheap alternatives to whole milk powder (WMP) (see Chapter 3). Palm oil, copra oil and coconut oil are often used as viable substitutes for dairy fat, given their similar characteristics. Rapeseed and sunflower oil food use are expected to increase, supported by a shift towards high-oleic sunflower seed and rapeseed varieties, given their health benefits and associated price premiums. For rapeseed, stable demand from the biofuels sector also stimulates food use.

Price difference between soya bean and rapeseed

On the back of the China-US tensions, Brazilian soya bean prices are currently 5 % above last year's prices, while US prices are 15 % lower, contributing to a EUR 70/t price gap. As a consequence, regions other than China have increased their demand for US soya beans. Rapeseed prices hover around last year's level, while sunflower seed prices are lower, due to higher availability. In 2019, soya bean prices are expected to remain depressed compared with rapeseed and sunflower, with a price spread of more than EUR 50/t. This price spread is expected to be maintained over the outlook period, given good prospects for additional plantings of soya beans in South America, while world demand growth cools somewhat. In the period to 2022, all prices are likely to stabilise or decline slightly, in line with general crop price projections, the assumed re-appreciation of the euro against the US dollar, and stable crude oil prices. Subsequently, prices for oilseeds will recover due to:

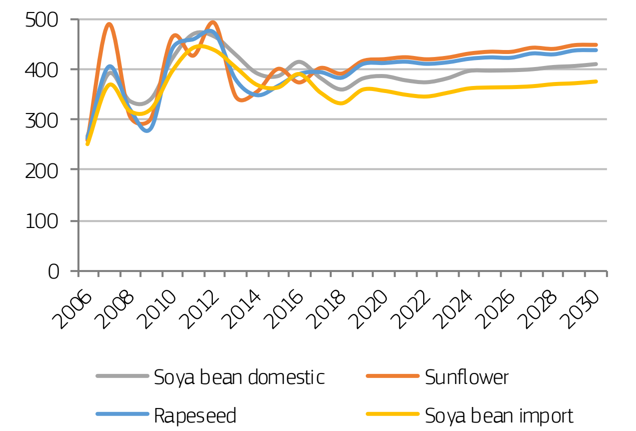
(i) the assumed price rise of crude oil, energy and other inputs;

(ii) the further appreciation of the euro; and

(iii) supply growth outpaced by demand.

An increased wedge between the EU soya bean producer price and the world price is also expected, as domestic production may be driven by higher domestic demand for non-GM identity-preserved soya beans.

GRAPH 2.42 Oilseed prices (EUR/t)



Uncertainty analysis of the macroeconomic environment and yield variability indicates that rapeseed prices will probably remain above the 2006 low over the outlook period and may even considerably exceed the 2012 high. There also seems to be a bit more scope for upward price peaks, as a result of possible supply disruptions due to adverse weather events in important rapeseed (or other oilseed) producing regions.

FEED

Demand for animal feed (from arable crops, fodder and pasture) should grow in the outlook period, despite mixed trends in the total EU herd (see sections on dairy and meats). Total feed uses, for the three types of compound feed (low-, medium- and high-protein content), should reach 275 million t in 2030. Low-protein feed (mainly wheat and coarse grains) will grow less dynamically than the other types. Higher demand for feed from locally produced, GM-free and organic crops will be the main driver of the increase. Demand for fodder, particularly silage maize, will also play a role.

Cereals feed uses follow animal production…

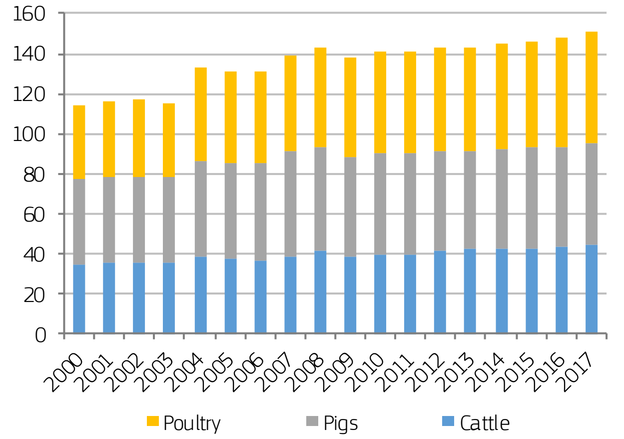
The EU livestock herd has been increasing overall, with mixed trends in different sectors. While poultry and pig numbers have risen steadily since 2013, the cattle herd has decreased (see dedicated sections). This has a significant impact on cereal feed use, as around 55 % of wheat and coarse grains produced in the EU are used for feed.

In terms of industrial compound feed usage (feed bought from the industry, as opposed to on-farm feed), the three main sectors (pig, poultry, cattle) have increased their use (by 13 % in total from 2006 to 2017) and the relative balance between them has remained stable. Despite the reduction of the cattle herd, the share of compound feed channelled to cattle feed has remained stable, at 30 %. As regards pigs, the larger numbers have not led to an increase in the share of compound feed use, due to a better feed conversion ratio (FCR)[39]. The most dynamic increase of compound feed usage was for poultry, which experienced a 22 % rise over the period 2006-2017.

In 2017, the top compound feed destination was poultry production, which accounted for 55 million t. The feed ration given to broilers is mainly composed of maize and wheat. Feed rations for beef cattle (44 million t annually) are mainly composed of the three main cereals (maize, wheat and barley) and soya bean meals, whereas dairy cattle are fed mostly on silage maize and rapeseed meal. The pig feed ration (50 % of cereals and a significant proportion made up of rapeseed meal) is broadly similar to that for beef cattle.

As highlighted in a recent European Commission report[40], plant proteins (soya beans, pulses, fodder legumes, rapeseed and sunflower) are also an important source of crude protein in the EU (around 27 million t), mainly for feed purposes (93 %).

GRAPH 2.43 Compound feed use by main animal types (million t)



Source: DG AGRI based on FEFAC

…but feed conversion ratio plays a role

In addition to the number of heads, FCR developments have played a significant role in the total use of feed in the EU. The FCR is of crucial importance for the overall farming system, as it has a direct impact on feed usage and thus on production costs. Both feed quality and breeding in the animal sector have played a significant role in this context.

Since 2000, the number of cattle has declined slightly faster than meat production (a difference of 0.8 pp per year). As regards pigs and poultry, meat production has increased at a faster pace than the number of heads. Overall, in the EU, the FCR for animal products has reduced. It declined for pigs and poultry, and for egg production, but remained fairly stable for the beef and dairy herd.

Feed demand to grow over the outlook period

A distinction can be drawn between different types of feed on the basis of their protein content:

- low-protein feed (LPF), such as coarse grains, wheat, rice, cereal bran, molasses, roots and tubers;
- medium-protein feed (MPF), such as corn gluten feed, distiller dried grains, field peas and whey powder; and
- high-protein feed (HPF), such as protein meals, fish meal and SMP. Since 2000, LPF has largely dominated the EU feed market in volume terms, partly because a lot more is

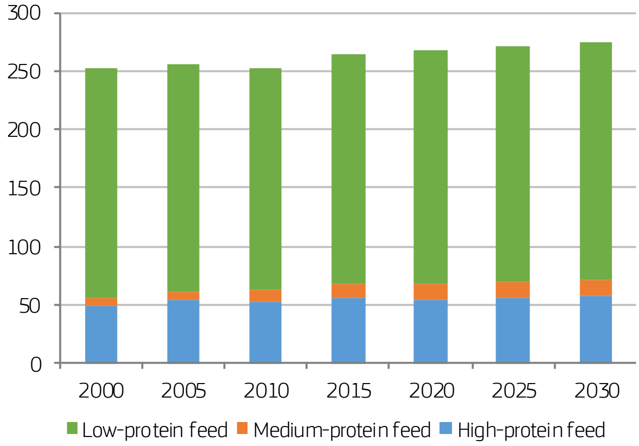
39 Measure of the efficiency of converting animal feed into meat, i.e. units of feed to obtain units of animal weight gain

40 European Commission (2018) Report from the Commission to the Council and the European Parliament on the development of plant proteins in the European Union. https://ec.europa.eu/agriculture/cereals/development-of-plant-proteins-in-europe_en

needed for a similar protein intake. Nevertheless, since 2010, MPF and HPF have gone up slightly (7 %).

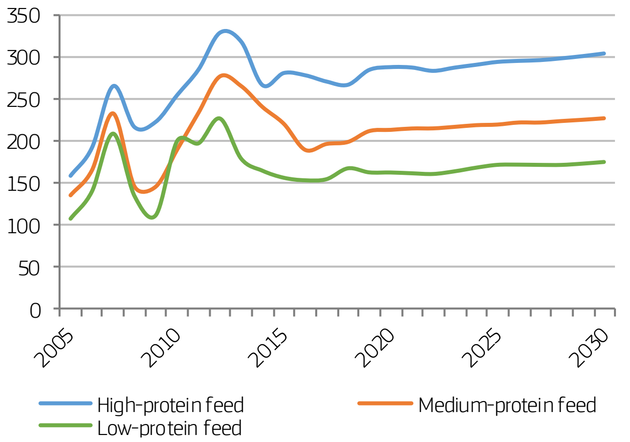
In the outlook period, total feed use in the EU is expected to keep on increasing, with a further increase of poultry and dairy production. By contrast, production of beef and pigmeat are expected to decline. In terms of feed, this will translate into an increase in the consumption of MPF in the EU-N13, such as distilled dried grains, available as a by-product of biofuels production, while consumption in the EU-15 should remain stable. Similarly, consumption of LPF and HPF will increase across the EU. Ultimately, livestock farmers meet their animals' needs for protein and amino acid at the best price and the feed industry translates such needs into optimised feed formulations. Soya bean meal is a favoured ingredient in compound feed formulation due to its high protein content (over 40 %), its amino acid content (lysine) and its year-round availability, which limits the need for frequent reformulation.

GRAPH 2.44 EU compound feed (million t)



Demand for feed will also be driven by consumers' stricter demands of animal products, as regards environmental and welfare requirements and different production methods. This will translate into a segmentation of the feed market between conventional and premium feed, which will include locally produced, GM-free and organic feed. More specifically, while organic milk production remains low at EU level (3 % in 2016), it is expected to increase over the outlook period (to 10 % in 2030). This should have an impact on the composition of feed rations and on the quantity and quality required.

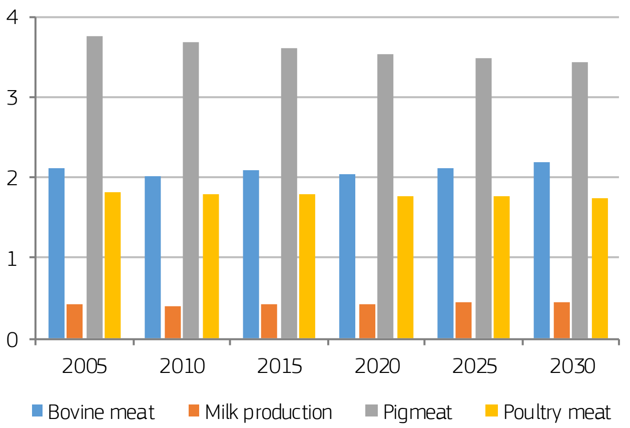
GRAPH 2.45 Feed prices (EUR/t)



This demand will create economic opportunities at both EU and world level. For instance, it is estimated that farmers can charge a price premium of EUR 80-120/t for GM-free soya beans in a context of limited traded amounts. In organic production, this will come at a cost, as organic yields are generally lower (see section on arable crops) and there are additional outgoings (linked to labelling and the segregation of crops, etc.).

The increase in organic and GM-free dairy and beef production is expected to drive an increase for fodder, in particular silage maize. Similarly, grass-fed systems are also projected to grow on both permanent pasture (which can be enriched with leguminous plants) and temporary grasslands. Still, the expansion will be limited by land constraints. This change in feed demand is also expected to have an impact on the FCR, especially for cattle and dairy production (where the FCR will rise over the outlook period).

GRAPH 2.46 Feed conversion ratio



MILK AND DAIRY PRODUCTS

/3

Growing world import demand driven by population growth (notably in Africa) and income growth will drive higher consumption of dairy products over the outlook period. However, global trade will grow at a significantly slower pace than in the past decade. The EU and New Zealand will lead the export market.

There will be more of a focus on added-value products for which the EU has a clear competitive advantage. In addition, consumer preferences for differentiated products (e.g. organic, GM-free, pasture-based, local) will drive the development of alternatives to conventional production systems. Environmental requirements will also play an increasing role in shaping production systems.

PRODUCTION

In 2018, milk production was affected by climatic events. These were mainly cold and wet weather conditions, delaying grass growth in early spring. In addition, the summer drought had a severe impact on grassland growth and forage production in many dairy areas of northern Europe. Due to the lack of forage, some farmers brought forward the slaughtering of cows and heifers. This could limit annual production growth, which is expected nevertheless to be 0.6 %, at 167 million t. The effect of the drought may be felt into the first quarter of 2019, unless the milk price is high enough to allow for feed purchases. Nevertheless, given the sustained demand for EU dairy products, milk production is expected to grow by 0.7 % in 2019.

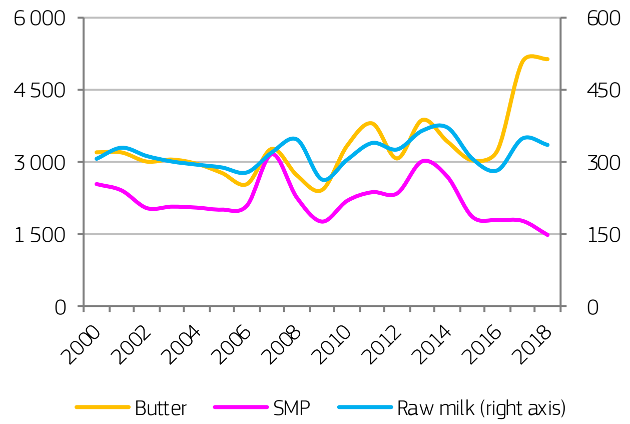
The average EU raw milk price in 2018 is likely to reach close to EUR 34/100 kg, i.e. 2 % below the last five-year trimmed average. Several factors played a role in the recovery and stabilisation of milk prices:

- the continued reduction in skimmed milk powder (SMP) stocks;
- the continuing high demand for EU dairy products; and
- the fact that, due to lower milk production in some key producing Member States and lower milk fat content, the butter market remains undersupplied, resulting in an average butter price of around EUR 5 100/t, around 50 % above the last five-year trimmed average.

By contrast, the annual average SMP price remains at a historical low (roughly EUR 1 500/t, i.e. almost EUR 200/t below the intervention price), although some signs of price recovery could be observed as sales out of public stocks accelerated (around 190 000 t sold in total at the beginning of November). Domestic SMP production has contracted in 2018 and exports to non-EU countries are robust. This could result in a further release of intervention stocks before the end of the year. The ceiling for public intervention at fixed price has been set to zero for 2019, so buying-in would take place only under justified market conditions. According to industry experts, the remaining intervention stocks (around 170 000 t) could be released in the course of 2019.

Although cheese prices are currently below 2017 levels, cheese processing has offered the best returns compared with other products in 2018. Prices have remained relatively stable over the year, at around EUR 3 300/t. The high price of dairy fat affected WMP competitiveness to the benefit notably of FFPs[41], and resulted in lower production.

GRAPH 3.1 EU butter, SMP and raw milk price (EUR/t)



Source: DG Agriculture and Rural Development

[41] FFPs are a mix between dairy proteins and vegetable fat (often palm oil) with around 25 % protein content.

GLOBAL DAIRY MARKET

By 2030, world milk production is expected to exceed 1 billion t, increasing annually by more than 15 million t, slightly faster than in the last decade.

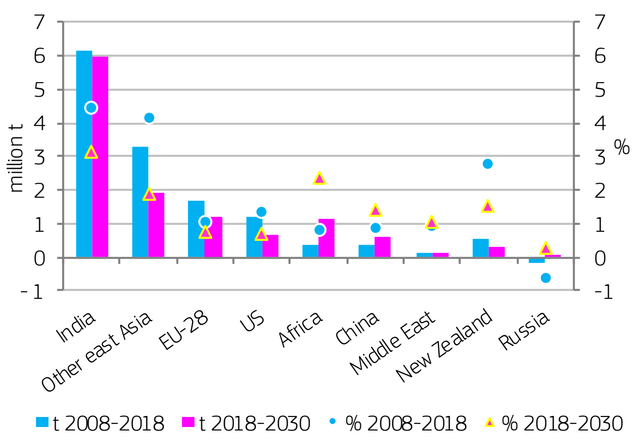
More than 40 % of this increase should take place in India, which is continuously investing in large modern farms and infrastructure. However, India is expected to trade on the world market only in exceptional market conditions (e.g. export subsidies for SMP because of high stocks, as observed in 2018).

On average, an annual increase of milk production of 2.1 million t is expected in other Asian countries, mainly Pakistan, where milk is mostly consumed on farm (less than 5 % enters the commercial supply chain).

In Africa, the increase in milk production should be almost five times greater than in the past decade. The additional production (+1.2 million t per year) should be mainly in east Africa. Nevertheless, domestic demand will grow faster and additional imports will be needed.

In China, the expected growth in milk production, though higher than in the past, is relatively small (+650 000 t per year) due to environmental constraints limiting dairy herd expansion and to producers' lack of competitiveness. Nevertheless, demand for domestic raw milk should be supported, to some extent, by the implementation of standards for raw milk and dairy products, and the increasing demand for fresh dairy products.

GRAPH 3.2 Average yearly change in milk production



Note: Other east Asia excludes India, China and Japan

The EU will remain well positioned on the world dairy market, despite on average higher production costs than its main competitors. The modest production rise projected in the EU (+1.3 million t per year on average) is larger than the expected annual increases in New Zealand (+0.4 million t) and the US (around 0.7 million t), the EU's main competitors.

New Zealand expects to grow less dynamic domestically compared to the past (+1.6 % per year), so its investments abroad are expected to increase. Any dairy herd expansion will be constrained by resource availabilities. Productivity growth based on the use of feed supplements (e.g. palm kernel meal) could be limited, due to their impact on milk fat composition, which makes it difficult to manufacture some dairy products, for example butter.

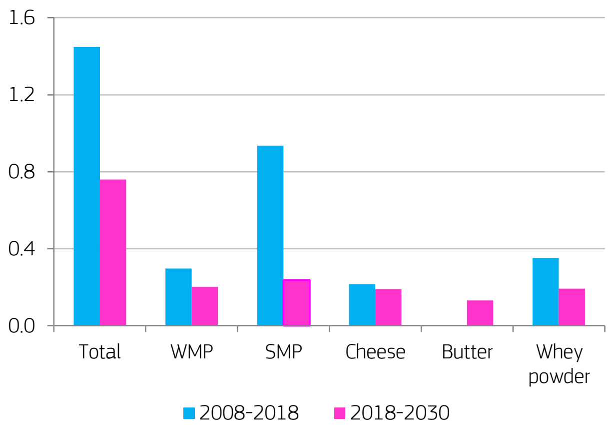
In the US, milk production is expected to see sustained growth, though lower than in the past (around +0.7 % per year), thanks to the economies of scale and efficiency gains from continuous farm consolidations. The domestic market will absorb a significant share of this additional milk due to population growth (+0.7 % per year) and a small but steady increase in per capita consumption of dairy products. In addition, the US is expected to take a bigger share of an expanding global dairy trade (15 % in 2030, +3 million t of exports of milk equivalent over the outlook period, mainly SMP and cheese).

Slower global trade expansion

Increasing demand in Africa and Asia will outpace their production growth, leading to increased import demand and trade. Up to 50 % of world SMP production is traded, but cheese and butter are mostly consumed domestically (only around 10 % of world production, by volume, is traded).

Global trade in WMP, SMP, cheese, butter and whey powder is expected to grow on average by less than 1 million t of milk equivalent per year. This is just half the average growth seen in the past decade. Only cheese should grow at the same rate (+2 million t of milk equivalent). SMP is used for the processing of various products, such as yogurt, ice cream, dairy desserts and bakery. The increase in SMP trade will be much lower than in the past, when the processing of large quantities of (easier to store) SMP and low prices boosted exports, especially in 2017 and 2018. Nevertheless, the traded volume of SMP should outperform WMP, under pressure from the higher price of dairy fat and the market development of FFPs. Like WMP, which they can therefore substitute, FFPs are re-constituted into liquid milk directly by households in Africa. They are also used for processing (e.g. bakery, ice cream, yogurt), particularly in Asia.

GRAPH 3.3 Average annual increase of dairy product global trade (million t milk equivalent)



In Africa, population growth (+2.4 % per year) and increasing per capita dairy consumption are the main drivers of higher domestic consumption, which is expected to increase by more than a third by 2030 (by a total 73 million t milk equivalent) compared with 2018. In 2030, around 20 % of consumption should be covered by imports (around 13 million t milk equivalent). Not only trade in powder will rise: imports of cheese and butter are also expected to more than double over the outlook period.

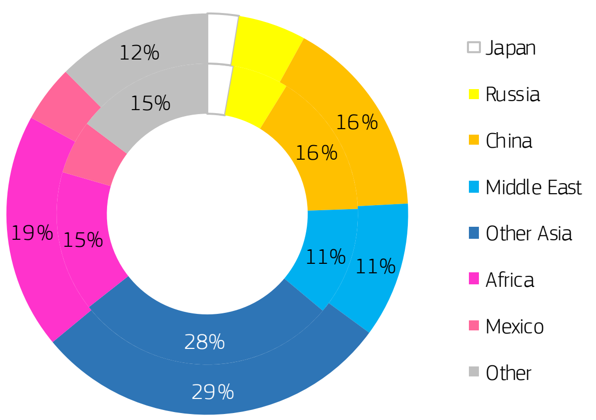
Demand in sub-Saharan Africa (SSA) should grow at a faster rate than in the last 10 years. In addition to population growth, urbanisation and income growth are expected to drive higher consumption of fresh dairy products and more sophisticated retailing should boost smaller but more frequent purchases. Due to perceived higher rates of lactose intolerance in the SSA population, fermented products (especially fermented milk and yogurt[42]) are gaining in importance. In addition, UHT milk consumption is expanding rapidly, due its conservation properties.

North Africa, in particular Algeria, should lead SMP import demand, which is currently mainly supplied by the EU (around 80 % in the last five years). However, growth should be slower than in the past decade, due to a policy push towards self-sufficiency and the expansion of FFPs. Milk powders are used in industrial channels, e.g. for pizza cheese manufacturing in Egypt.

China should remain the world's no 1 importer of dairy products. However, the slowdown in economic growth and increasing consumer prices should slow down the import growth.

Given the relatively modest development of production in China, the growing demand for dairy products, by around 1.5 % per year, should lead to increasing imports of close to 2 % per year over the outlook period. By 2030, reliance on imports is expected to remain relatively stable and account for 18 % of domestic consumption (taking into account imports of cheese, butter, WMP, SMP and whey powder). Infant milk formula is by far the most important product imported by China in terms of value (USD 3.6 billion, out of close to USD 8.5 billion imports of all dairy products in 2017).

GRAPH 3.4 Share of main importers of dairy products on world imports in 2018 (inner) and 2030 (outer)



The product portfolio is expected to diversify to more products with high added value, for which Chinese production capacity is still small. Yogurt is the main driver of consumption growth. In addition, food service demand remains strong, especially for cheese and dairy fats. Despite being still small, the bakery sector (and thus the use of butter and cream) is expected to expand.

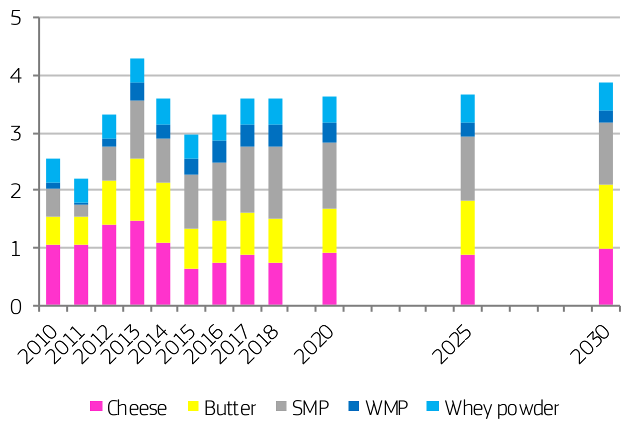
In the coming years, shipments to Japan are expected to grow by a third as compared with the last decade. Cheese and whey powder should see the most dynamic growth. Cheese consumption remains small but is growing continuously thanks to the lowering of tariff barriers and incentives for domestic producers to mix their cheese with imported cheese. By 2030, imports should represent 85 % of cheese consumption. The EU's share is increasing continuously and rose from 18 % in 2013 to 34 % in 2017. The potential for EU exports should be higher than in these projections, which do not take account of the (as yet unratified) free trade agreement with Japan.

Russia has extended its import ban to the end of 2019, but it is assumed that it will be lifted afterwards. Russia's domestic production (like its foreign investments) has grown slightly, particularly as regards cheese, but also infant formula. However, it still does not satisfy domestic demand, especially for specific products such as milk powders and technical whey ingredients. Shipments to Russia are not likely to return to 2013 levels by 2030 (4.3 million t of milk equivalent), even if the ban is removed, due to:

42 In fermented dairy products, the presence of lactase helps lactose digestion.

- a decline in dairy consumption as a result of a worsening economy; and
- partial substitution of the banned traditional suppliers.

GRAPH 3.5 Russian imports of selected dairy products (million t of milk equivalent)



Production is also expected to grow in Latin America. With an expected milk production increase, Mexico should become less reliant on imports, particularly of WMP. Better macroeconomic conditions should contribute to the recovery of Argentina's supply and trade position.

EU supplying increasing world demand – general trends

The EU could supply close to 35 % of the increase in global demand over the outlook period. Demand is expected to grow for high added-value (e.g. organic, geographical indications, etc.) products (notably cheeses), for which Europe has a clear competitive advantage. EU exports of cheese, SMP and whey powder (but also butter and WMP) are expected to grow, on average, by around 330 000 t milk equivalent per year. This is slower than in the last 10 years (+660 000 t per year), but faster than New Zealand's expected export growth (+250 000 t) and the US's (+270 000 t).

While the increase in EU export volumes is expected to be rather modest (close to 2 % per year in cheese, butter, SMP, WMP and whey powder), export value should rise at a faster pace (+4 % per year).

In parallel, close to 900 000 t of milk per year will be needed to satisfy the growth in EU domestic use. This should be processed into 'traditional' dairy products consumed domestically (mainly cheese) or products for which we lack production statistics and may later be exported (such as dairy desserts, FFPs, infant milk formula, protein and whey concentrates). By contrast, liquid milk consumption is expected to decline further. This will be discussed further in this report

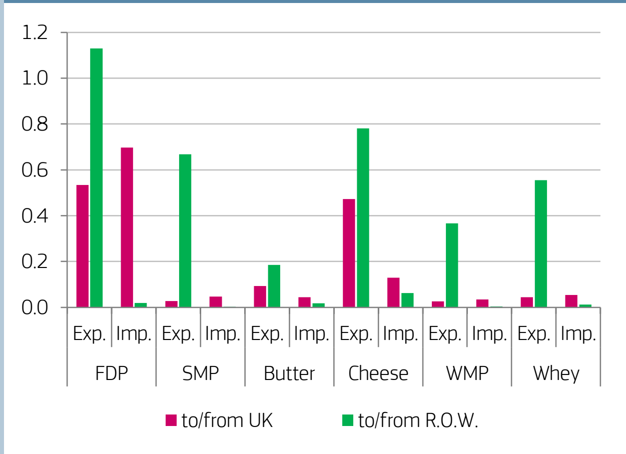
What about the UK?

In 2013-2017, the UK accounted for around 9 % of EU milk production. The UK average yield is well above the EU average, at 8 100 kg per dairy cow as compared with 7 000 kg. According to the December 2017 livestock survey, the UK dairy herd remains at the level of the last four years (around 1.9 million heads) and represents around 8 % of the EU total.

The UK is an important trading partner for the other Member States, especially for cheese and fresh dairy products. In 2017, the EU-27 exported almost 4 million t of dairy products to the UK (in milk equivalent), representing 20 % of total EU-27 exports. Although lower in quantity terms (89 000 t in 2017), butter exports from the EU-27 to the UK still accounted for 35 % of total exports.

More than 70 % of imports of dairy products into the EU-27 in 2014-2017 were from the UK. The UK holds a strong trade position with the EU-27 for fresh dairy products as an importer, but even more so as an exporter, supplying large quantities of liquid milk to Ireland especially from Northern Ireland.

GRAPH 3.6 EU-27 dairy trade, average 2016-2017 (million t)



The consumption of dairy products is expected to be influenced downwards by campaigns promoting lower dairy product intake, awareness of the climate and environmental footprint of livestock products, and increasing claims of lactose intolerance. On the other hand, the growing consumption of convenience foods (e.g. ready meals, burgers, frozen baked goods) results in higher use of dairy ingredients such as cheese, SMP and butter (especially in pastry and cakes). In parallel, there is increasing demand for organic and local products, geographical indications, non-GM fed, pasture-based, etc. According to a Nielsen survey[43], 66 % of consumers around the world are willing to pay more for sustainable brands.

The growth of GM-free-fed dairy production is already noticeable in some Member States. For example, in Germany[44] it grew by around 40 pp (to around 50 % of production) between 2016 and June 2018. This change not only reflects the demand push, but also sets new standards of production, which are expected to play an increasing role in the future. In other Member States, the share of GM-free production systems is even higher (e.g. 100 % in Sweden and Austria). As far as organic production is concerned (see Box), the growing sales of organic products, especially liquid milk, should boost the share of this production system: from 3 % of milk production in 2016 to an assumed 10 % in 2030.

The increasing world and domestic demand are expected to drive a modest (0.8 % per year on average) increase in EU milk production, which will reach 182 million t by 2030.

EU productivity driven by environmental constraints and societal demands

With respect to productivity development, there are two opposing drivers:

- the need to reduce nitrogen leaching, phosphate and GHG emissions should lead to a shift to production systems with fewer cows and higher yields (i.e. intensification). In addition, environmental sustainability constraints could result in production restrictions in targeted regions, changes in production location and disconnection of breeding and milk production; but, on the other hand
- changes in consumers' expectations imply increasing reliance on pasture-based systems (i.e. extensification of production).

At EU level, permanent grassland makes up almost 50 % of UAA on dairy farms, with Ireland being an outlier (over 90 %). The proportion of grass-fed systems varies widely across Europe, ranging from 20-30 % of feed composition on a typical farm for lactating cows in Poland, the Czech Republic and Germany, to 60-80 % in Ireland and the UK[45]. The potential to expand permanent grassland area is limited. However, pastures can be enriched with leguminous crops and more on-farm feed production, notably of protein-rich crops, is expected (see Chapter 2). The milk yield in pasture-based systems is lower

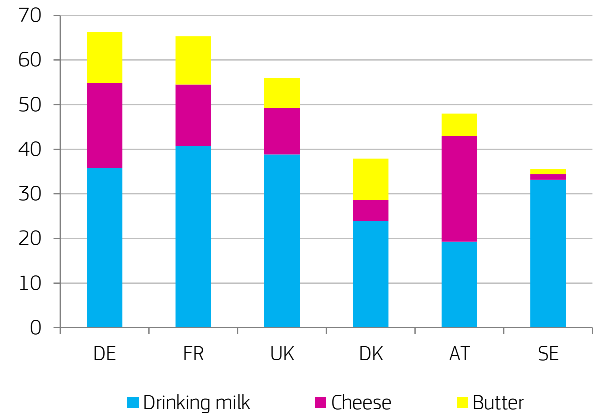
What about organics?

At global level, dairy is one of the consumption categories in which organic products are most prominent*. In the EU, organic milk production represents only a small proportion of the total (around 3 % in 2016). Six Member States (Germany, France, the UK, Denmark, Sweden and Austria) account for more than three quarters of EU organic milk production. The proportion of the dairy herd raised organically varies considerably. In the top three producing countries (Germany, France and the UK), only 4 % of dairy cows are organic. In others (Denmark, Sweden and Austria), the proportion ranges from 10 % to 20 %. The milk yield in organic production systems is on average 30 % lower than in conventional systems. However, there are differences between Member States. In the UK and Sweden, yield is 20 % lower, while in Denmark and the Netherlands it is only around 10 % lower.

Around a quarter of organically produced raw milk is processed into drinking milk. At Member State level, this can vary from around 20 % in Austria to close to 40 % in France and the UK.

Organic milk supply is forecast to increase in the coming years, in particular in Germany and France, and to a lesser extent in Denmark, due to growth of domestic demand and (often intra-EU) export opportunities*.

GRAPH 3.7 Organic raw milk use, 2016 (%)



Source: DG Agriculture and Rural Development, based on Eurostat

* OMSCO Organic milk market report 2017)

[43] https://www.nielsen.com/us/en/press-room/2015/consumer-goods-brands-that-demonstrate-commitment-to-sustainability-outperform.html

[44] *Barry Wilson's Dairy Industry Newsletter* (August 21, 2018), Vol. 30, No. 8.

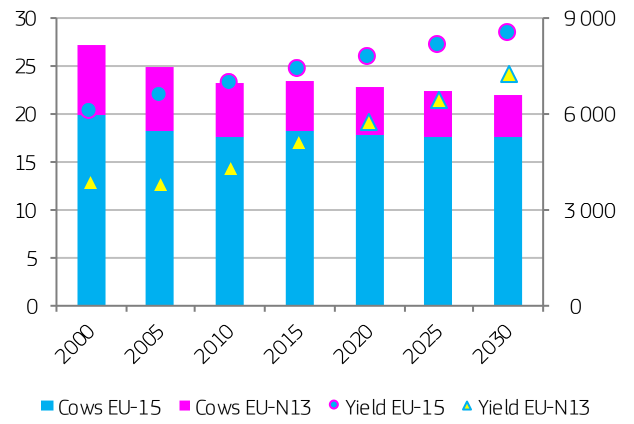
[45] IFCN Dairy Report 2018.

(e.g. 5 600 kg/cow in Ireland) and climatic disruptions are more likely to slow its development.

The interplay of the above drivers is expected to result in the EU average yield increasing further over the outlook period, to 8 240 kg/cow (17 % above the 2017 level of around 7 050 kg/cow), but more slowly than in the past decade. In any case, large discrepancies among Member States persist: yields in 2017 ranged from around 3 200 kg/cow in Romania to almost 9 600 kg/cow in Denmark. The average EU yield increase is expected to be driven mainly by stronger progress in east and central Europe. As a result, by 2030, the EU-N13 yield should reach close to 90 % of the EU-15 average. In the EU as a whole, efficiency gains should result from improved genetics. In addition, the increasing, though still limited, use of semen sexing implies a faster change in the genetic potential of herds.

The number of dairy cows should remain quite stable in the EU-15, at 17.6 million dairy cows in 2030 (back to the 2010 level, before the increase at the time of quota abolition). Further restructuring in the EU-N13 is expected to result in an annual 1.4 % decrease. The total number of dairy cows in the EU is expected to be 21.9 million heads by 2030.

GRAPH 3.8 Number of cows (million heads) and yield (kg/cow)



DAIRY PRODUCTS

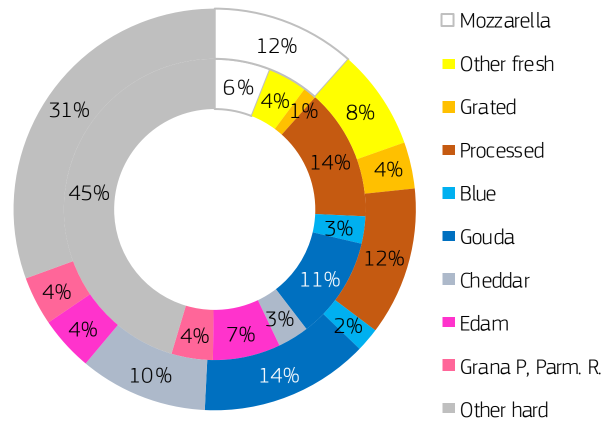
Cheese remains an EU asset

In recent years, **cheese** has offered the best and most stable returns, supported by strong demand on domestic and export markets. The main driver are increasing sales of fresh and quality cheeses (including geographical indications). In addition, industrial use (close to 50 % of cheese use) remains strong, particularly supported by processing into convenience food, which favours mozzarella-type cheeses.

As a result, EU cheese consumption is expected to increase further, by 1.3 kg per capita over the outlook period, to 20 kg by 2030.

On export markets, the volume of EU cheese traded is expected to grow further, to close to 1.2 million t, and the EU should supply close to 40 % of world import demand (as compared with 34 % in 2018). The EU's exports have a higher unitary value than any of its main competitors', mainly due to a high share of hard cheeses and geographical indications in the export mix, and despite the progress of cheaper fresh cheeses. Between 2007 and 2017, the EU's exports of cheese increased by around 40 %. The portfolio has changed over time, most notably reflecting an increasing preference for mozzarella, other fresh cheeses and cheddar. In 2017, fresh cheeses represented 20 % of EU exports, twice the level of 10 years previously. The share of cheddar increased from 3 % to 10 %.

GRAPH 3.9 Shares of exported EU cheeses by type in 2007 (inner) and 2017 (outer), in volume



Source: DG Agriculture and Rural Development, based on Comext

Although the main export destination is the US, the growing markets for the EU are mainly in Asia – in particular Japan, which remains its second largest export market. In addition, growing demand in China should result in further trade flows. Demand there is fostered by the development of innovative products such as cheese snacks and the expanding use of cream cheese to add to tea. This further supports the expectation that China should take over from the US as the world's no 1 cheese importer. Chinese cheese imports increased most in 2007-2017 (+24 % per year), although starting from lower absolute volumes. The share of EU shipments is growing steadily and represented 16 % in 2017.

The expected increase in domestic and export demand should result in an additional 4 million t milk equivalent being channelled into cheese production by 2030.

Whey market driven by processing of specialised nutritional products

The demand for **whey**, a by-product of cheese manufacturing and casein production, has been increasing over the years, in particular through demand for nutritional products and other high added-value products such as infant formula. This involves greater use of whey protein concentrates and demineralised whey. Together with other technical dairy ingredients, whey is used in adult nutrition for a wide segment of products (e.g. sport and senior nutrition, weight management). There is ongoing innovation in the convenience of their use (e.g. on-the-go snacks) and in the creation of products appealing to new consumers (e.g. by focusing on flavour).

However, this outlook covers only standard whey, for which the EU should still be the main world supplier in 2030, covering more than 50 % of the market and accounting for around 45 % of global production growth. On the domestic market, the trend is towards lower use of standard whey powder for feed (52 % in 2030, as compared with 57 % in 2018). The total quantity used should continue to rise, although by only around 2 million t a year, i.e. half the rate of the past 10 years, which have seen a steady increase in whey collection[46]. In addition, exports are expected to continue growing, by close to 2 % a year. These developments are expected to mean that an additional 1.3 million t of milk equivalent go into standard whey processing by 2030.

Plant-based drinks on the rise

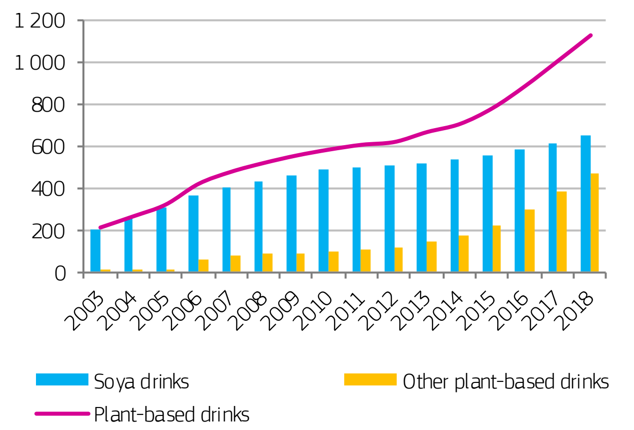
The decreasing trend in EU **liquid milk** consumption should continue over the outlook period. In the 10 years to 2018, it declined by 6 kg to 52 kg per capita, mainly due to a drop in the EU-15 (almost 8 kg per capita less, as compared with an increase of close to 2 kg in the EU-N13). By 2030, the declining trend in the EU is expected to slow to half the rate of the last decade, leading to consumption of 49 kg per capita by 2030.

[46] Previously, whey was often wasted or fed to animals on farms. With the increase in whey powder valorisation in high added-value products, whey collection increased over time.

Nevertheless, consumers' behaviour with respect to liquid milk differs depending on the production system. For example, in France, demand for conventional milk fell in 2018 (by close to 4 %), whereas consumption of organic drinking milk increased at a more dynamic pace (18 %)[47].

Besides the decline in the number of breakfasts taken at home, the reduction in drinking milk consumption is also driven by a partial substitution of milk by plant-based drinks. While their share relative to the volume of cow's milk sold in retail and food services remains small (only 4 % in 2018), this market is growing fast. In the last decade, sales more than doubled, in particular for non-soya drinks, which represented more than 40 % of plant-based drinks in 2018 (as compared with 17 % a decade ago).

GRAPH 3.10 Retail and foodservice volume of plant-based drinks (million litres)



Source: DG Agriculture and Rural Development, based on Euromonitor

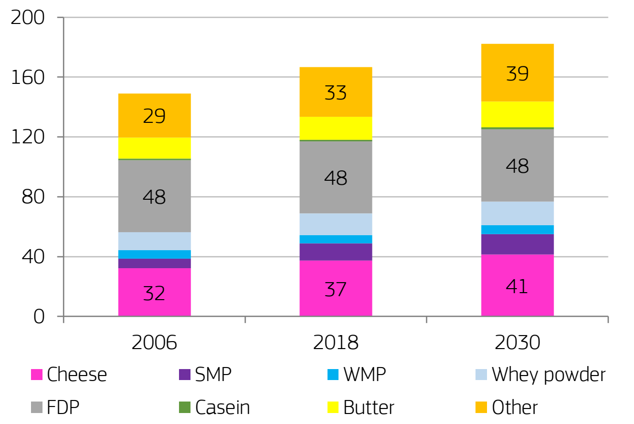
On the world market, demand for liquid milk stays strong, especially in China, where imports complement domestic production. By 2030, EU exports are expected to grow further, reinforcing the EU's position as a net exporter. Nevertheless, it is expected that the decline in liquid milk consumption will result in 1.1 million t of milk equivalent less being channelled to the production of liquid milk over the outlook period.

In contrast to liquid milk, the production of **yogurt, cream** and **other fresh dairy products**, including dairy desserts, is expected to grow further, driven by domestic demand. Cream will see the most dynamic growth, as it continues to benefit from its natural image and is associated with western cooking on export markets. In addition, yogurt consumption is expected to stabilise. Therefore, despite the expected decline in liquid milk consumption, the total intake of fresh dairy products should decline only slightly, to 74 kg per capita in 2030, compared with 77 kg in 2018.

[47] % change in volume year-on-year (5 August 2018); presented by Eurocommerce at DG AGRI Milk Market Observatory (25 September 2018).

Due to the expected production growth for cream and yogurt, the total production of fresh dairy products should stabilise.

GRAPH 3.11 EU production by product (million t of milk equivalent)



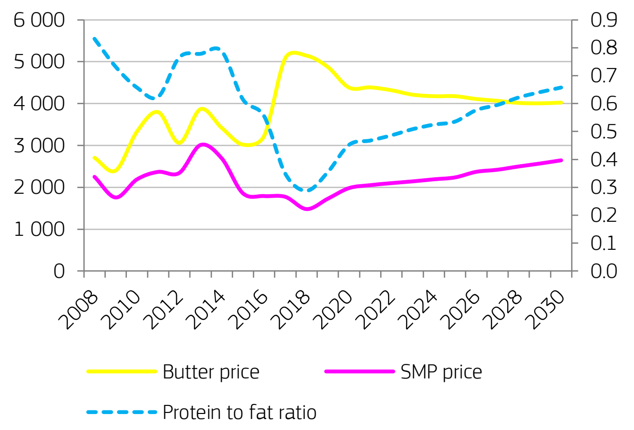
Continuous high fat valorisation

In past years, the shift towards more natural products led to a big increase in the use of **butter** (and butteroil), particularly in pastry and cakes, in Europe and worldwide. In turn, this resulted in strong growth of dairy fat prices. In this context, some processors might have adapted their recipes to reduce butter use. Nevertheless, EU consumption of butter is expected to reach close to 4.6 kg per capita in 2030, 0.3 kg above the 2018 level. World demand should drive a further increase of EU exports, to an absolute volume of around 260 000 t. New Zealand will remain the world's main supplier, with a 50 % share of world exports. The EU should be in second place, with 23 %.

The increase in demand is expected to translate into the processing of an additional 1.8 million t milk equivalent into butter in the EU. Compared with the past, this increase is small, also due to relatively stable fat content (4.07 % by 2030).

After skyrocketing prices of butter in 2017 (reaching the top in September close to EUR 6 400/t), EU butter price is expected to drop to EUR 4 500/t towards the end of 2018. Nevertheless, the gap between butter and SMP prices is expected to remain wider than in the past, with a butter price of around EUR 4 000/t by 2030. Compared with the past, this trend suggests a market valuation shift in favour of dairy fat.

GRAPH 3.12 EU butter and SMP price (EUR/t), protein to fat ratio (right axis)



EU WMP production faces stronger world competition

EU **WMP** production is challenged by increasing competition on the world market, especially from New Zealand and South America. In 2017, the EU's share in the world's WMP production was only 14 % and this is expected to decline further, to 12 %, by the end of the outlook period. In particular, production is expected to grow in Brazil.

The level of EU WMP production varies with relative milk valorisation. In export markets, the possible substitution of WMP by SMP and palm oil in manufacturing (especially ice cream, confectionery and FFPs) will probably dampen export growth. Exports in 2030 should remain around the 2018 level.

Therefore, EU production of WMP is expected to increase by 4 million t a year in the period to 2030, driven mainly by higher domestic demand (+4.2 million t per year), in particular for chocolate. As exports should remain stable, it is expected that, by 2030, the EU's domestic use of WMP will have moved further ahead.

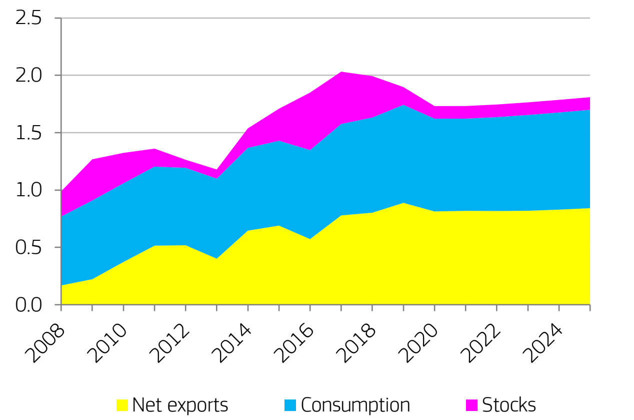
More SMP to be exported worldwide

Growing global demand for **SMP** is driven by the variety of uses to which it can be put. For example, it can be processed into fresh dairy products, desserts, chocolate, bakery, ready meals and FFPs. In 2008-2018, the quantity traded worldwide almost doubled (to around 2.5 million t in 2018). The EU is very competitive on this market and was responsible for around 50 % of the global trade increase. By 2030, it is expected that 15 % more SMP will be consumed worldwide than in 2018, resulting in an 18 % increase in imported volumes.

In the last decade, EU exports grew by an average of more than 16 % per year, leading to a record level of 780 000 t in 2017. Over the outlook period, the EU should remain one of the world's biggest exporters (together with the US). World exports are expected to grow by 240 000 t milk equivalent per year and the EU should have a 30 % share of the total.

Due to demand expansion, total SMP production is expected to reach 1 820 000 t in the EU by 2030, 18 % above the 2018 level, leading to an additional 2.2 million t milk equivalent being channelled into SMP processing.

GRAPH 3.13 EU SMP net exports, consumption and stocks (million t)



Growing market of fat-filled powders

More and more dairy proteins are being processed into dairy products other than the traditional ones, in particular **FFPs**, primarily an export product. They can be produced either directly in dairies or by mixing SMP and vegetable fat (in which case they are recorded under domestic SMP production and consumption).

The GIRA consultancy has estimated the size of the global FFP market at around 600 000 t in 2017. The EU supplies around two thirds of this market. More than half of world production is consumed in (particularly sub-Saharan) Africa and expanding African dairy imports have favoured FFP imports. GIRA estimated that the share of FFPs in total SSA dairy imports grew from 23 % in 2006 to more than 40 % in 2017.

FFPs have a competitive advantage over WMP, which currently dominates trade in powders in Africa, in particular because:

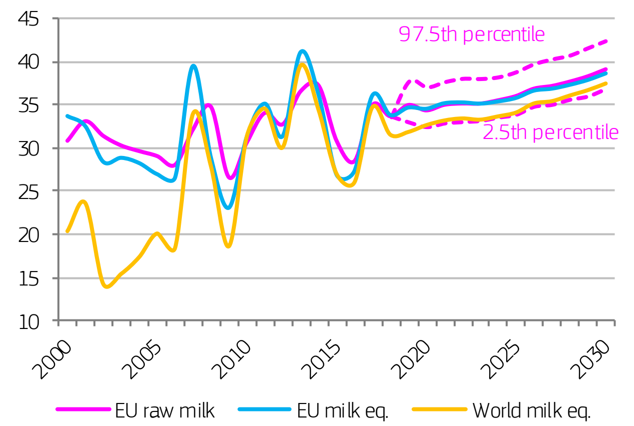
- of the price difference between butter oil and palm oil;
- the price of FFPs is less volatile; and
- FFPs are continuously improving in terms of quality and performance (e.g. storage duration and processing in dairy products).

Milk price to increase over medium term

The expected growth in worldwide demand should raise milk prices and thus stimulate production over the outlook period. In particular, the milk price will be supported by high demand for dairy fat and the increasing share of higher added-value products in the product mix. Another driver is rising energy prices, while feed prices should remain relatively stable in nominal terms.

However, some fluctuations can be expected in the balance between supply and demand, and these will be reflected in prices. The uncertainty analysis of macroeconomic conditions, crop yields and Oceanian milk yield highlights that prices above the trend are more likely than lower prices.

GRAPH 3.14 Milk price development and possible price paths (EUR/t)



MEAT PRODUCTS

/4

By 2030, EU meat production is expected to remain at around 48 million t. However, the shares of the different meats will change driven by changes in consumer preferences, export potential, profitability, and by changes in the dairy sector in the case of beef. Poultry production will keep expanding, albeit at a slower rate, sustained by a favourable domestic market and positive export prospects. Pigmeat production is expected to decline slightly as export competition increases and social and environmental pressures mount. Beef production should return to its downward trend after the restructuring of the milk sector, with exports facing strong competition. Production of sheep and goat meat is likely to grow by 5 % by 2030, having stagnated in recent years. Although overall EU meat consumption is declining, it will represent the main part of EU production. However, a greater proportion of poultry and pigmeat production will need to be exported to a challenging international market.

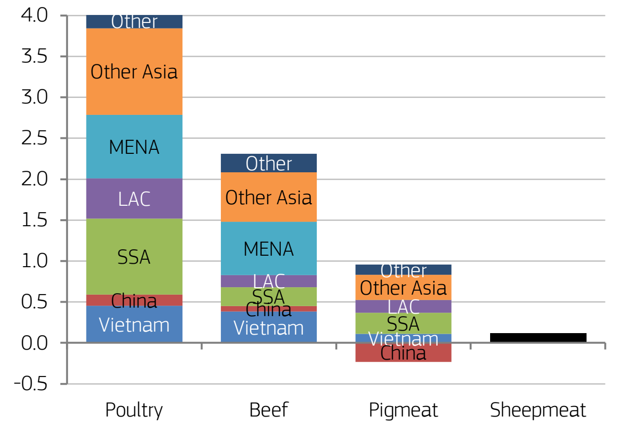
World consumption and import demand offer mixed opportunities for EU exports

World meat consumption[48] is set to grow by 48 million t between 2018 and 2030, reaching 378 million t, or 35.7 kg per capita[49]. This represents an increase of nearly 1 kg per person. However, the average annual growth of total consumption (+1.1 %) will be slower than between 2008 and 2018 (+2 % per year). Population and economic growth in developing countries, albeit slower than in the previous decade, will largely contribute to higher consumption. A large part of world demand will be met by domestic production[50] but import needs will increase even faster than demand.

World meat import demand is projected to reach 38 million t by 2030, 7.2 million t above the level in 2018. Asia and Africa will generate most of world import demand. Major growing markets are Vietnam, the Philippines and other Asian countries (all meats), sub-Saharan Africa (poultry and pigmeat), and the Middle East and North Africa (poultry and beef). Although China will accommodate its increase in consumption mainly through domestic production, it will continue to be the world's largest export destination. Global demand for poultry meat is expected to change the most, increasing by 4 million t. This almost equals the combined increases for the other types of meat (beef, pigmeat and sheepmeat[51]). The increase in demand for pigmeat and especially for sheepmeat will be largely met by domestic production and world imports of these meat products are projected to increase at a slower pace. Pigmeat import demand from China is expected to decline, after the restructuring of its pig sector, with a possibility of additional import demand provoked by the recent outbreaks of African swine fever. Russia's meat imports have fallen since the country introduced sanitary and economic import restrictions on a range of agricultural products from several countries, including the EU, in 2014. These restrictions have been extended until 31 December 2019 and only a partial EU export recovery is expected after this date.

Overall, the outlook for world import demand is favourable for poultry and beef, and less so for pigmeat and sheepmeat. Subsequent sections explore whether or not the EU will benefit from this increased demand, amid competition from key world players, and the resulting trade balance.

GRAPH 4.1 Changes in world imports of meat and live animals, 2018-2030 (million t)



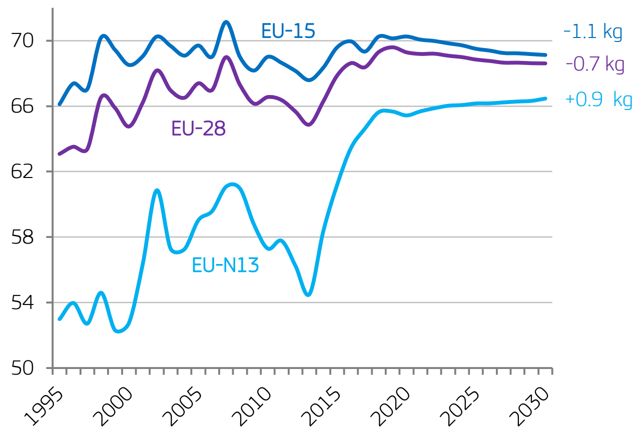
Note: SSA=sub-Saharan Africa; MENA=Middle East and northern Africa; other Asia excludes Vietnam and China; LAC=Latin America; Other=other regions, namely Europe, North America and Oceania

Source: DG Agriculture and Rural Development, based on the OECD-FAO Agricultural Outlook

Slight decline in EU meat consumption, with a changing consumer meat basket

Meat consumption per capita in the EU has so far been on a broad upward trend. The financial and economic crisis and a dip in 2013 (due to the restructuring of the dairy sector, new regulations on the pigmeat sector and tight meat supply in general) broke that trend. Consumption has recovered strongly since 2014 (+4.4 kg per capita until 2018). This is thanks to the improved economic situation and ample supplies of all meat categories, despite growing export volumes.

GRAPH 4.2 EU total meat consumption (kg per capita)



Over the projection period, consumption is expected to gradually decline from 69.3 kg to 68.7 kg per capita. This equates to a modest reduction of 700 g per person. The decline in consumption will be driven by lower availability, despite higher imports. It will also be affected by an increasing preference for a lower meat intake and meat substitutes.

[48] Consumption in this chapter refers to 'apparent use' in a balance sheet approach, i.e. production plus imports minus exports.

[49] Consumption per capita is measured in retail weight. Coefficients to convert carcass weight into retail weight are 0.7 for beef and veal, 0.78 for pigmeat and 0.88 for poultry and sheepmeat.

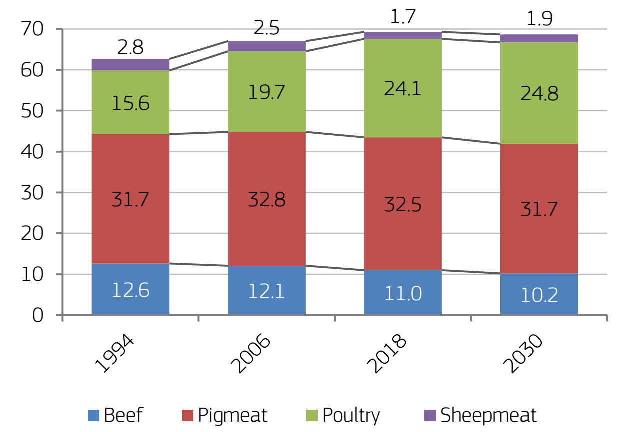
[50] Production in this chapter refers to 'gross indigenous production', i.e. including trade in live animals (domestic slaughtering minus live imports plus live exports). Volumes are always given in tonnes of carcass weight equivalent.

[51] Sheep and goat meat will be referred to as sheepmeat.

Convergence in meat consumption per capita within the EU is projected to continue but will depend on the meat type. Consumption in the EU-15 is expected to decline by 1 kg per person, driven by a drop in beef and pigmeat consumption. Meanwhile, it will continue its upward trend in the EU-N13 (except for pigmeat), increasing by nearly 1 kg per capita.

At EU level, the overall decline will lead to a shift in the consumer meat basket. Pigmeat and beef are expected to follow the declining trend of the last 10 years, giving way to increased poultry consumption. The proportion of sheepmeat is expected to increase slightly, contrary to the declining trend seen since 2008. This is thanks to the diversification of the meat diet and changes in the EU population structure (including religious convictions and migration).

GRAPH 4.3 EU consumption by meat type (kg per capita)



A declining trend in meat consumption is more pronounced for the EU, compared to other countries. Reduction in EU-15 meat consumption contrasts with the EU-N13 and other countries which will see further increases in consumption, such as Canada, the US, Japan and especially China (+7.7 kg). It is worth noting that meat consumption in Japan is gradually increasing due to a switch to more western diets based on more meat instead of fish.

Concerns over meat still not translating into significant drop in meat consumption

Meat consumption is expected to decrease. This is due to:

- growing social and ethical concerns (animal welfare, water pollution);
- environmental and climate issues (carbon footprints);
- health concerns (supported by the WHO);
- an ageing European population (with lower protein needs); and
- lower availability.

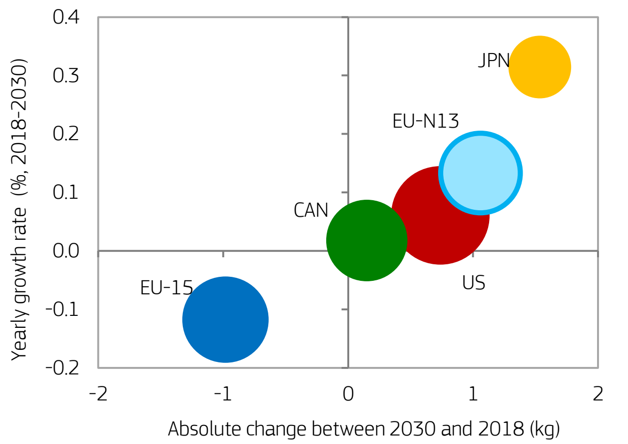
Various trends in meat consumption are emerging, which are expected to push fresh meat consumption on a downward trend. These include:

- changing dietary patterns with a shift towards plant-based proteins and the increasing number of flexitarians, vegetarian and vegans, especially among younger consumers;

- the increasing importance consumers attach to the origin of meat and how it is produced (i.e. organic methods, conforming to animal welfare standards), and preference for quality over quantity;

- a shift away from fresh meat towards more processed meat and meat use in ready-to-eat meals and other food/feed products.

GRAPH 4.4 Changes in per capita meat consumption (retail weight)



Note: The size of the bubble represents the absolute quantity of per capita meat consumption (kg/capita/year)
Source: DG Agriculture and Rural Development, based on OECD-FAO Agricultural Outlook

However, the declining trends are not yet visible in the available balance sheet statistics[52]. Diverging trends across Member States hamper the assessment at EU level. Past trends do not help specify the turning point towards lower consumption. It is therefore difficult to assess when the exact turning point towards lower consumption at EU level may be in the longer term.

[52] Detailed statistics on the supply and use of meats (including human consumption) are not available. It is therefore difficult to draw strong conclusions about consumption trends.

What about organics?*

Demand for organic food products is growing in the EU. Euromonitor reports an increase between 2012 and 2017 in the proportion of organic meat in retail sales, in analysed countries: the UK (from 2.6 % in 2012 to 5.1 % in 2017), France (from 2.4 % to 3.7 %), Italy (from 0.8 % to 1.7 %), Spain (from 1.3 % to 1.5 %), and Germany (from 1.2 % to 1.6 %).

The organic meat production sector develops rapidly, albeit with significant differences between countries and animal categories. The potential for organic production is higher in the case of cattle, sheep and goats that are farmed in extensive grass-fed systems that are easier to convert to organic production. By contrast, grain-fed systems are more complicated to convert due to several factors. For instance, they require more expensive organic feed that is to be obtained, at least partially, from the farm itself (particularly challenging in the case of protein feed). They also need to follow stricter rules, for example on antibiotic usage and animal welfare.

Thus, while around 5 % of the cattle herd and of sheep and goat flocks are estimated to be organic (2016 data), the proportion for poultry was just below 3 %, and for pigs it was less than 1 %. One country stands out for its proportions of organic meat livestock: Austria, with 20 % of cattle, 35 % of sheep and goats, and 2.3 % of pigs. Scandinavian countries and Latvia, among the EU-N13 Member States, also show high proportions: Sweden (20 % of both cattle and sheep, 2.3 % of pigs), Denmark (13 % of cattle and 2.3 % of pigs), and Latvia (20 % of cattle and 35 % of sheep and goats).

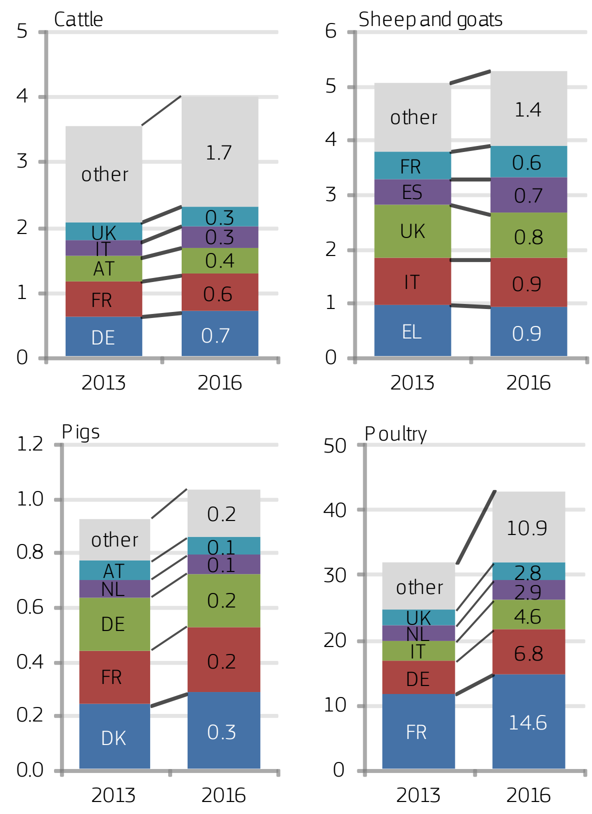
On the number of organically raised cattle, Germany and France lead (700 000 and 600 000 heads, respectively), while in the EU-N13 the Czech Republic has the biggest herd (250 000 heads), followed by Latvia (95 000 heads). Between 2013 and 2016, the EU organic herd grew by 4 % per year on average. Higher rates were seen in countries with smaller organic herds, such as Ireland, Italy and Slovakia, which expanded by an annual average rate of 8 % or more.

Organic sheep and goats are concentrated in five Member States (Greece, Italy, the UK, Spain and France), which account for three quarters of the total EU organic flocks. The organic sheep flock is expanding the least (+1.1 % per year between 2013 and 2016). Expansion can be seen in leading Member States (Spain and France), but also in countries with smaller organic flocks (Croatia, Bulgaria, Ireland). This is offsetting contractions in several Member States (including the UK, Greece, Romania, Poland and Slovakia).

In total numbers, the organic pig herds are the most concentrated as nearly 70 % of organic pigs are in Denmark, France and Germany. By contrast, Spain, which has the biggest EU pig herd, has just 10 000 organic heads (0.04 %). This is a similar picture to the main EU-N13 producer, Poland (4 000 heads or 0.04 %, and declining). Nevertheless, at the EU level the organic pig livestock expanded by 4 % per year between 2013 and 2016.

Organic poultry production is dominated by France, which has most of the EU heads (35 %), followed at some distance by Germany, Italy, the Netherlands and the UK. Other major poultry producers such as Spain and Poland still show insignificant numbers. Organic poultry expanded at a solid pace of 13.5 % per year between 2013 and 2016.

GRAPH 4.5 Organic livestock (million heads)



Source: DG Agriculture and Rural Development, based on Eurostat, Statistics on organic farming

* EU statistics on number of organic animals are not complete; they only allow for a partial picture of the sector. Definition of organic farming in the Eurostat survey based on specification in Regulation (EC) 889/2008. EU aggregates are DG AGRI estimates based on Eurostat survey national data

BEEF AND VEAL

EU beef production has recovered since 2015, after three years of reduced supply following the rebuilding of the dairy herd. However, production is expected to return to a downward trend. This is influenced by the shrinking cow herd, low profitability, declining beef demand and strong export competition despite the opening of niche markets. Prices are expected to fall in the first part of the projection period before stabilising towards 2030.

Recovery of the market for beef and veal continues in 2018

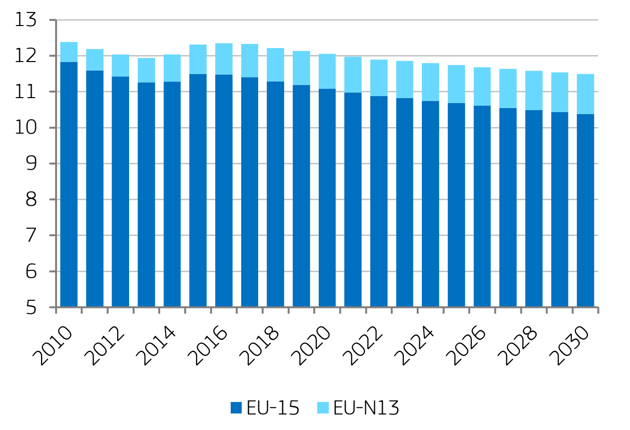
The recovery in beef production observed since the low of 2013 is set to continue, at an estimated 1.6 % in 2018. The current increase is driven by the anticipated slaughtering of reproductive cattle, due to the drought in many Member States in 2018, and the expected shortage of forage in winter 2019. Increased availability and improved incomes, especially in the EU-N13, will lead to higher beef consumption. EU exports of beef are forecast to decrease by 8 % in 2018 as demand from key destinations, except Turkey and Israel, falls. Imports are expected to grow by 6 % as Brazil and Argentina strengthen their position on the EU market, attracted by firm EU prices.

Milk sector and productivity gains to determine beef production potential

Given that nearly two thirds of the EU cow herd is of the dairy type, changes in the dairy herd have a major impact on beef supply. When the milk price dropped in 2016, the restructuring of the milk sector led to the culling of cows or a partial reconversion to beef production. As a result, after 4 years of expansion, the dairy cow herd started to decrease in the EU-15 in 2016. At the same time, the decades long declining trend in the EU-N13 continued. A gradual decline in EU dairy herds is expected to continue as milk yields continue to grow (as described in the previous chapter).

The recent development of the suckler cow herd is influenced by the implementation of voluntary coupled support (VCS). Many Member States opted for VCS in the beef sector, in order to maintain a specialised beef herd. However, some Member States with a large suckler cow herd, like the UK and Germany, did not implement VCS in the beef sector (except for Scotland). Ireland also did not avail of the possibility of granting VCS, instead making provisions for a specific beef scheme in its rural development programme. The ceiling (maximum number of head of cattle for which a payment can be granted) and the exact implementation of VCS payments in the Member States have a significant impact on changes in the herd size. At the same time, Member States can revise their schemes (in terms of ceiling, reference period, etc.). In that way, the suckler cow herd in Spain has increased since 2014 to a level close to the VCS ceiling while France shows the first signs of lowering the number of suckler cows closer to the currently applied ceiling.

GRAPH 4.6 EU suckler cow herd (million heads)



The EU suckler cow herd has been on a general downward trend since 2000. Reductions in the EU-15 have been only partially compensated by the expansion in the EU-N13 which started in the mid-1990s. By the end of the outlook period, the EU-15 herd is expected to fall to 10.4 million heads (-8 % or -900 000 heads fewer than in 2018). Meanwhile, contrary to the outlook for the dairy herd, the EU-N13 herd is likely to rise by one third (+320 000 heads) to 1.2 million heads, notably in the Czech Republic, Poland, Hungary and Bulgaria. Overall, more than one third of the reduction expected for 2018-2030 in the EU-15 is likely to be replaced by expansion of the suckler cow herd in the EU-N13.

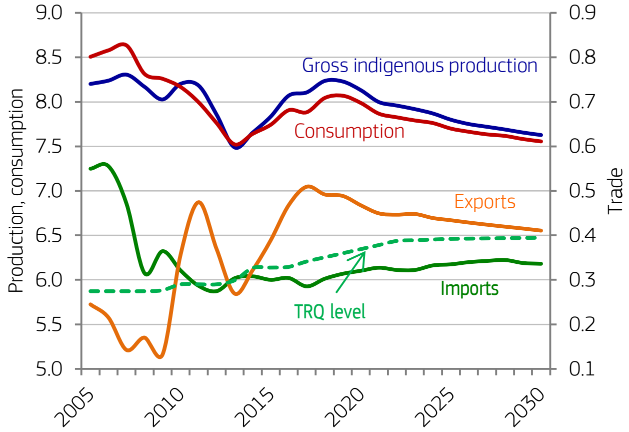
Competition in economic and environmental terms with other agricultural activities such as dairy production is likely to reduce suckler cow herds further in certain intensive meat producing regions of the EU (such as the Netherlands).

Production and consumption back to downward trends

EU beef production is expected to return to a downward trend and gradually fall to 7.7 million t by 2030 (-500 000 t or -6 % compared to 2018). The decline will be driven by developments in the domestic cow herd as previously described. Other factors include low profitability in the beef sector and weaker export prospects, even though prices will start to recover slightly in the middle of the projection period. The production drop will take place despite an expected increase in the average carcass weight and against a background of relatively stable feed prices.

Beef consumption in the EU is expected to resume a downward trend, gradually declining from 11 kg per capita in 2018 to 10.4 kg per capita in 2030. Convergence within the EU will remain limited. Consumption is expected to decline in the EU-15 and flatten in the EU-N13, leaving a significant gap (11.9 kg per capita against 4.0 kg per capita respectively) by 2030.

GRAPH 4.7 EU beef market developments (million t)



Note: Trade includes live animals

EU exports expected to fall despite increasing world import demand

Key EU trade partners will provide most of the additional supply to the world beef market. Brazil will continue to play a major role for several reasons: (1) a competitive Brazilian real assumed throughout the whole outlook period (2) low production costs and (3) increased access to the main importing countries due to the recent status of 'foot-and-mouth disease free with vaccination'. However, its meat availability for export will depend on the medium-term impact of the economic recession on the sector and on local consumption. Australia is rebuilding its cow herds which will increase its slaughtering potential and boost exports. Argentina will benefit from a competitive peso and favourable policies for export that stimulate expansion of its herd. US production, strengthened by its recently rebuilt herd, will mostly meet additional domestic demand and US exports are set to stabilise by 2030 after an initial decline.

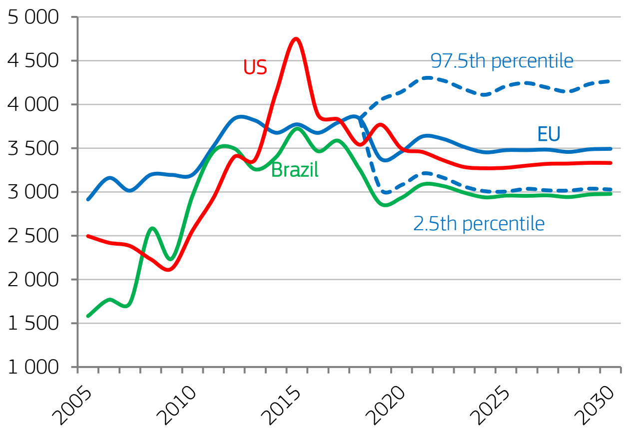
EU exports of both live animals and beef meat are projected to decline over the outlook period. This will be influenced by the exchange rate, strong competition from key players and lower demand from Turkey. By 2030, exports of live animals are expected to fall gradually to 200 000 t (-17 % compared to 2018). Sanitary issues and animal welfare concerns may also act as a downward factor for live exports. Exports of beef are projected to fall rapidly and stabilise in the middle of the outlook period at around 227 000 t (-10 % compared to 2018). This is due to competition mainly from Brazil, Argentina and Australia. By 2030, live exports will represent 47 % of total exports (down from 49 % currently).

Destinations for EU beef exports are likely to change. Demand from Turkey is expected to decline due to the macroeconomic situation (high inflation and devaluation of the Turkish lira). Meanwhile, competition from other players, including Uruguay and Brazil, which recently became the leading Turkish suppliers, is expected to increase. Russia is expected to resume some beef imports from the EU after the removal of the import ban (assumed for the end of 2019). However, this will be at a much lower level than before due to its self-sufficiency policies, lower demand and sourcing from other countries, especially Brazil. By contrast, demand from Asian countries, the Middle East and North Africa could grow and offer new opportunities. The further removal of certain sanitary barriers could also present new trade opportunities to the EU and other countries.

EU imports to follow gradual increase in tariff-rate quotas

EU imports of beef meat are expected to follow an upward trend over the outlook period, largely coinciding with the gradual increase in tariff-rate quotas (TRQs). The EU's TRQs for high-quality produce are expected to be almost completely filled, while others remain unused. Overall, by 2030, imports are expected to increase to 350 000 t (+15 % compared to 2018). This equates to a filling rate of 90 % of the aggregated TRQ level in 2030 (395 000 t).

GRAPH 4.8 Beef prices and possible price paths (EUR/t)



Note: US=choice steers, 1 100-1 300 lb dressed weight, Nebraska; Brazil=frozen beef, export unit value, product weight

EU beef prices to fall under world pressure, before stabilising towards 2030

EU beef prices are expected to come under pressure from declining world prices. The completed rebuilding of the US herd and the ample supplies expected from Brazil and Argentina in the next few years are expected to push the world beef price down. Over the medium term, a deceleration in world production should lead world prices to rise in the second half of the outlook period.

SHEEP AND GOAT MEAT

After several years of stabilisation, EU sheep and goat meat production is expected to recover slightly. This is due to improved returns for producers, maintenance of coupled support and sustained domestic demand. The EU price will stabilise in the second half of the outlook period to a level higher than the trend seen between 2010 and 2017.

Difficult market for sheep and goats in 2018

After stabilising in recent years, EU sheepmeat[53] production decreased by 3.5 % in the first half of 2018, mainly due to lower sheep slaughtering in the UK and Romania. The overall decrease expected for 2018 results from the reduction in sheep and goat flocks in the previous year. It also stems from the impact of unfavourable weather in key Member States, with lower lambing rates and lower carcass weight due to poor grazing conditions. Imports are also expected to stay broadly stable, resulting in an increase in EU prices[54] in 2018. EU exports of live animals and meat are forecast to decrease by 15 % in 2018, as demand from Libya, Jordan and Hong Kong falls.

Production and consumption to start growing

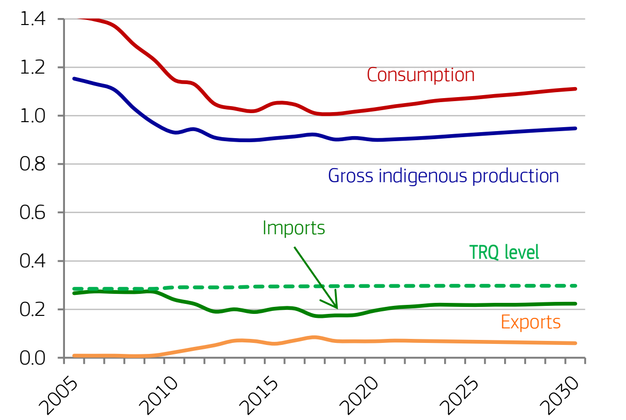
Sheepmeat production is expected to recover in 2019 and slightly expand during the outlook period. The EU flock is projected to increase to 105 million heads by 2030. This equates to 6.5 million more animals than in 2018. EU production is expected to increase slightly to 950 000 t in 2030 (+47 000 t), driven by sustained domestic demand, in a context of limited production increases of world traders. Production potential will be stimulated by prospects of improved returns for producers, despite the expectation of lower exports. In addition, production will continue to be supported by the implementation of VCS in most sheep-producing Member States.

Sheepmeat consumption is expected to rise to 1.9 kg per capita in 2030. This constitutes an increase of 160 g per person compared to 2018. Sheepmeat consumption, which is the lowest compared to other meats, is also relatively weakly affected by price developments.

EU trade limited by world competition

EU exports of live animals are expected to drop over the outlook period to 25 000 t (-38 % compared to 2018), and focus on destinations in the Mediterranean area. Exports of meat will be small due to the slowdown in world demand coupled with tough international competition. Australia and New Zealand, which represent 80 % of international trade, are expected to meet nearly the whole additional world import demand in the period 2018-2030. Production potential and exports are projected to increase significantly in Australia, as flocks are rebuilt following the drought in 2015-2016. In contrast, while sheepmeat production in New Zealand is expected to recover, growth will be lower due to competition for pasture from the dairy sector.

GRAPH 4.9 EU sheep and goat meat market developments (million t)



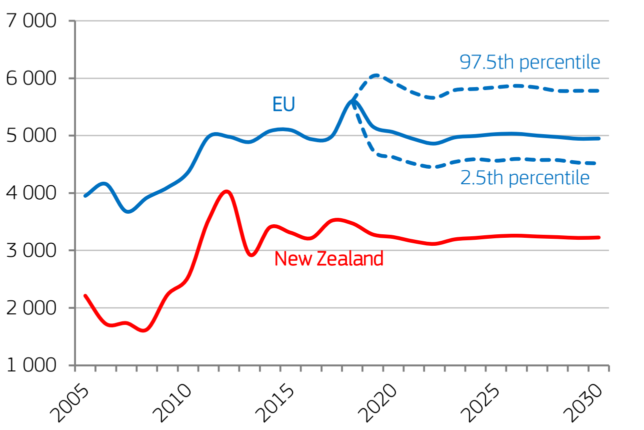
Note: Trade includes live animals

Assuming little disruption in trade[55], imports are expected to gradually increase to 220 000 t (+25 % compared to 2018) over the outlook period. Australia is expected to fill its TRQ. In contrast, New Zealand is assumed to fill its TRQ only partly, due to growing opportunities in other markets (Asia and the Middle East) amid limited production growth.

After the period of downward adjustment from the peak of 2018, EU prices are expected to recover in the second half of the outlook period to a level higher than the trend in 2010-2017. This will be supported by tight supplies. The possible variations around the sheep price are not symmetric (blue dashed lines on the graph) due to stronger uncertainties surrounding sheep supply. These uncertainties include weather events and grazing problems. A significant gap between the EU and world prices will remain as a result of higher production costs and the presence of tariffs.

53 Sheep and goat meat will be referred to as sheepmeat.
54 The EU price relates to the price of 'heavy lamb'.
55 Developments in EU trade for sheepmeat, where the UK accounts for 34 % of the EU production, will largely depend not only upon global market conditions, but also on any deal regarding the withdrawal of the UK from the EU.

GRAPH 4.10 Projected sheep prices and possible price paths (EUR/t)



PIGMEAT

As EU pigmeat consumption declines in the outlook period, additional quantities are expected to be shipped to the world markets, mostly China. This is despite fierce competition from the US and Brazil.

Production to fall slightly under social and environmental pressure

In recent years, the EU pork sector has been affected by important developments in both (1) production capacity (adaptation to animal welfare regulations) and (2) trade prospects (Russian import ban and Chinese demand surge), which after some ups and downs resulted in record levels of pigmeat production and exports for 2018.

Following the implementation of new animal welfare rules, in 2012-2013 pigmeat production fell significantly and prices reached record levels. Meanwhile, the required investments translated into large productivity gains. As a result, production rose quickly in 2014-2015, exceeding the level of 2011. The excess supply, aggravated by the loss of the Russian market (26 % of EU exports[56]), drove prices down in 2015. This in turn triggered the intervention of the European Commission, which offered private storage aid schemes while production levels readjusted. In 2016, thanks to a surge in Chinese demand, stocks were sold and prices rose, at a time of shrinking production capacity. High prices translated into a new increase in production, after 2 years of reductions. However, when Chinese demand began to decline by mid-2017, a new excess supply pushed prices down once again. In 2018, production is expected to continue growing but prices have remained at the low level of 2015 and markets are beginning to show signs of a new readjustment: the sow herd in the main producing countries contracted slightly in 2018, which should be reflected in lower 2019 slaughter numbers.

Environmental[57] and public concerns have led, among other things, to national and subnational legislation on various aspects of manure management. These same concerns will probably limit the expansion of production in the EU in general and more particularly in the current hotspots. For instance, in Germany production is decreasing, while partially shifting from piglet production to pig fattening. By contrast, Denmark is increasing production while continuing its specialisation in piglet production, exporting high numbers of piglets to Germany and increasingly to Poland. Overall productivity is expected to continue rising, as fertility rates and feed conversion ratios improve, thanks to the extension of improvements in genetics and production systems. By the end of the outlook period, in a context of declining domestic demand, EU pigmeat production is expected to decrease slightly (-0.2 % per year).

EU exports to grow slowly under strong competition

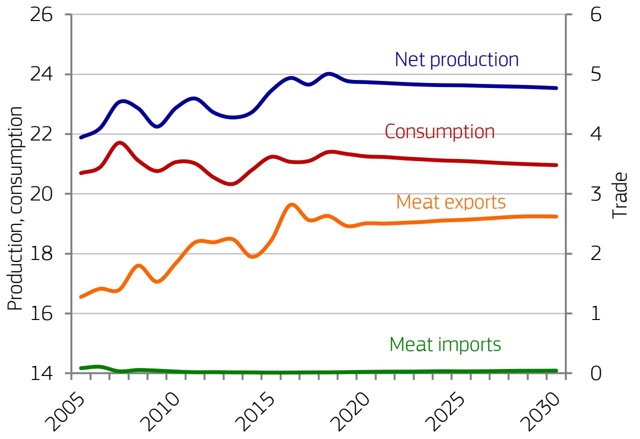
World import demand for pigmeat is expected to grow but more slowly than in the previous decade. A rate of 0.7 % per year is expected in the outlook period (+724 000 t in total), reaching 8.7 million t by 2030. Significant growth is likely in two major

56 2013 figure, of total pork exports.

57 In response to the Nitrates Directive, some Member States (e.g. Denmark, France and the Netherlands) have introduced rules limiting the expansion of pigmeat production. GHG emissions from enteric fermentation and manure management in the sector totalled 25.4 million t, or around 5.3 % of total agricultural emissions in 2012 (EEA, 2015).

EU trade partners in Asia: the Philippines (+155 000 t) and Vietnam (+112 000 t).

GRAPH 4.11 EU poultry meat market developments (million t)



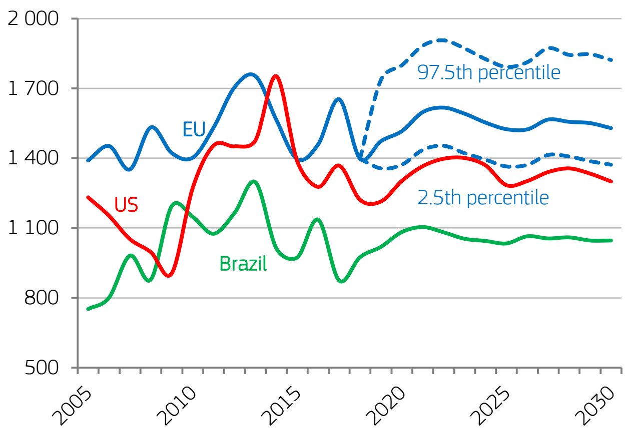
After the peak in 2016, EU pigmeat exports have remained fairly stable. The reduction in Chinese demand has been partly offset by increased shipments to other destinations such as Japan and South Korea. China remains the main destination for EU pork (28 % of pigmeat exports and 50 % of offal exports in 2017). However, the level of Chinese import demand will depend on how quickly its pork sector is restructured. This pace may in fact accelerate following the pig movement restrictions provoked by the recent African swine fever (ASF) outbreaks in several Chinese regions, as well as further measures taken to contain the epidemic. As a result, some regions are facing product shortages and price spikes, while others are oversupplied and experiencing price drops that accelerate structural changes. In the short term, the situation may translate into additional demand in regions with pork shortages, which should benefit EU exporters. The EU's share of Chinese imports will also depend on the development of the trade row between the US and China, which is reducing US pork exports to China. It will also depend on competition from Brazil, which is increasing its presence on the Asian markets. Brazil was granted 'foot-and-mouth disease free with vaccination' status in 2018. This could lead to the remaining sanitary restrictions in Asian countries being gradually lifted.

If Chinese demand for EU pork rises considerably due to the impact of ASF in China, the outlook for 2019 would change as EU prices rise and production follows. On the other hand, if further ASF outbreaks occur in the EU, particularly if any of the main exporter countries are affected, EU trade flows could be considerably disrupted.

It is assumed that Russia will continue to ban imports of EU pork products until the end of 2019. However, even if the ban is lifted, the country's ambitious self-sufficiency targets and its decreased purchasing power will lead to lower imports from the EU. Russia's self-sufficiency ratio has already risen from 79 % in 2013 to 91 % in 2018. Moreover, since December 2017, Russia has also banned imports of Brazilian pork over concerns that its meat contained the growth promoter ractopamine. This was despite Brazil having a 90 % share in Russian pork imports in 2017. Russia is thus practically self-sufficient in 2018. Russia partially lifted this latest ban only in November 2018, allowing five Brazilian suppliers to resume shipments. However, it still excludes the bigger players.

US pigmeat production is rapidly increasing and thus its export availability. Given the competitive US prices, the US is expected to increase its share in world exports while the EU's decreases slightly. Brazil's production is expected to grow even faster than the US, but growth will mainly feed its domestic market and its participation in international trade will remain at current levels. EU exports are expected to grow slowly, reaching almost 2.7 million t at the end of the outlook period. This would account for around 30 % of world pigmeat trade, while the US will account for up to one third.

GRAPH 4.12 Projected pigmeat prices and possible price paths (EUR/t)



Note: US=barrows and gilts, No 1-3, 230-250 lb lw, Iowa/South Minnesota — lw to dw conversion factor 0.74; Brazil=OECD producer price

EU consumption expected to fall slowly

EU pigmeat consumption per capita fell sharply in 2012-2013 when high prices weakened the competitiveness of pork compared to other meats. Since then, consumption recovered and remained above 32 kg per capita per year, with some fluctuations depending on availability levels. In 2018, with high availability, consumption should increase to 32.5 kg. In the longer run, per capita consumption should start to decline slowly to 31.6 kg by 2030, as pigmeat loses out to poultry meat. Differences between per capita consumption in the EU 15 and the EU-N13 are expected to persist, at 30.5 kg and 36.4 kg, respectively, in 2030.

Thanks to the strong import demand from China in 2016 and an improved balance between EU supply and demand in 2017, pigmeat prices rose again after 2 years of lower levels. However, the situation changed once the surge of Chinese demand waned. As supply levels readjust, EU prices are expected to remain firm over the outlook period, closely following the changes in the world market, reaching an average of EUR 1 540/t in 2030. However, uncertainties relating to the macroeconomic environment and changes in feed costs could see pigmeat prices fluctuate between EUR 1 370 t and EUR 1 820/t.

POULTRY MEAT

Poultry meat is the only meat for which both EU production and consumption are expected to expand significantly over the outlook period (both by around 4 % between 2018 and 2030). Supported by continued growth of global demand, the EU will increase its exports thanks to the valorisation of different cuts of poultry meat and offal and a wide portfolio of destinations.

Poultry production growth slows down

Poultry meat enjoys several comparative advantages over other meats: affordability, convenience, absence of religious restrictions limiting consumption, healthy image, limited GHG emissions, lower production costs, short rearing time and lower required investments. As a result, production and consumption have been increasing steadily for many years throughout the world, including in the EU.

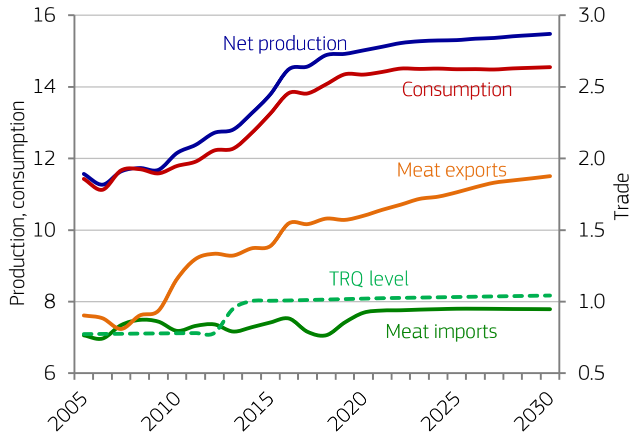
In 2017, EU poultry meat production was significantly affected by bird flu episodes in several EU countries and fell by 1 %. In 2018, production was expected to recover to previous levels but growth is now higher. This is driven by a reduction in imports from Brazil which is keeping prices above those recorded in the previous 2 years. By the end of 2018, EU poultry production is expected to reach 14.2 million t (+2.2 % year-on-year).

Over the outlook period, EU poultry meat production is expected to continue growing. However, the growth rate is likely to slow down to 0.3 % per year, after having averaged 2.5 % in the past decade. The production increase is expected to be larger in the EU-N13 (+0.8 % per year). This is due largely to sustained productivity gains and investments in Hungary, Poland and Romania. In a context of relatively stable feed prices throughout the outlook period, strong domestic and world demand will together contribute to expected growth in total EU production of up to 15.5 million t by 2030.

EU exports adapt to volatile demand in world market

World import demand for poultry meat is expected to remain strong. It is predicted to grow in the outlook period at the same rate as over the previous 10 years (+2.3 % per year), reaching 17 million t by 2030. The additional import demand will come mostly from Asia (e.g. Vietnam, the Philippines, China), but also from sub-Saharan Africa (e.g. South Africa, Ghana, Benin) where demand is growing the fastest, and from the Middle East. Significant demand growth is also expected from South America and the Caribbean countries, while Mexico's demand growth is expected to slow.

GRAPH 4.13 EU poultry meat market developments (million t)



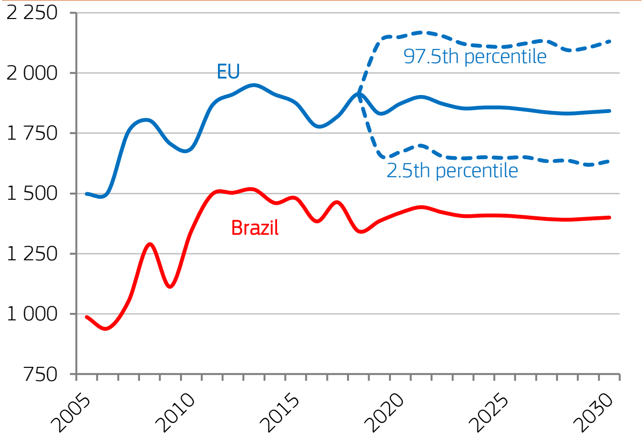
EU poultry exports fell only slightly in 2017. This was despite multiple sanitary bans on imports from the EU in a number of key destinations, following the 2016-2017 bird flu epidemics that hit numerous EU countries. EU exporters showed adaptability and were able to redirect most of the product to other destinations. Exports recovered in 2018 and are expected to grow by 2 %. This is after a 2018 winter with few bird flu outbreaks and rising production reacting to a fall in imports. Increased competition is apparent in certain markets (e.g. whole chicken), mainly from Brazil, which is able to export at competitive prices, including thanks to its currency devaluation. As a result, EU exports of frozen whole chickens have been falling for several years. In 2017, they represented just half of the volume of 5 years earlier, and 20 % of total poultry meat exports. EU exports are therefore increasingly made up of different cuts that are valorised in different markets. For instance, around half of the shipments of frozen wings are directed to Hong Kong, while halves and quarters are mostly shipped to Africa. In the outlook period, EU exports will continue rising, by an average of 1.4 % a year until 2030, reaching almost 1.9 million t. It is assumed that the Russian import ban will be in place until the end of 2019. However, given Russia's improved self-sufficiency, lower imports from the EU are expected, even if the ban is lifted. Russia's self-sufficiency ratio rose from 89 % in 2013 to 98 % in 2017.

EU countries import mostly high value poultry products such as cooked preparations and poultry breasts. This is in contrast to exports, mainly made up of different cuts with a significantly lower average value. EU poultry imports fell in 2017-2018 due to restrictions in shipments from Brazil, which is traditionally the source of over half of the EU's imports. This was following the detection of deficiencies in the Brazilian food safety inspection system. Those shipments have been partly replaced by increased imports from Ukraine, Thailand and Chile. However, overall imports fell by 10 % in 2017 and are expected to fall by a further 3 % in 2018. As soon as the issues with Brazil are resolved, imports should recover and reach the previous level. In the outlook period, imports are expected to grow gradually to fairly close to the TRQ level (around 1 million t) by 2030. This will be supported by increased production in the two EU's main suppliers: Thailand and Brazil.

Poultry meat consumption reaching maturity

Poultry meat consumption grew rapidly in the past decade and should reach 24 kg per capita in 2018. In the outlook period, it is expected to continue increasing, albeit slowly (by 0.2 % annually), reaching 24.8 kg per capita by 2030.

GRAPH 4.14 Projected poultry meat prices and possible price paths (EUR/t)



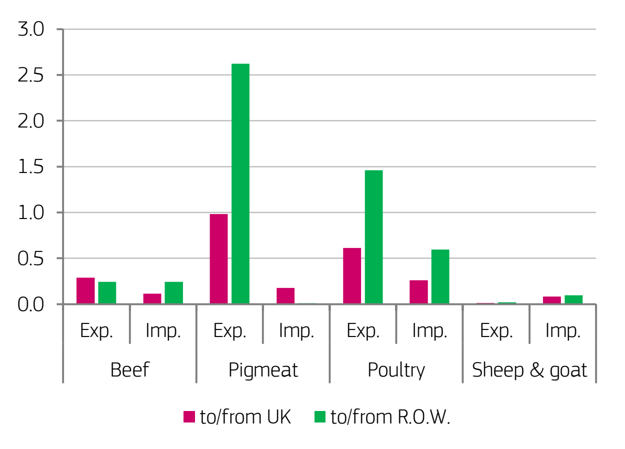
EU poultry meat prices are expected to remain around current levels in the first years of the projection period. After this they will slowly decline under increased competition (mainly from the US and Brazil) and reach around EUR 1 860/t by the end of the period. Depending on developments in the macroeconomic environment and of feed prices, the uncertainty analysis provides a possible variation of poultry meat prices between EUR 1 630/t and EUR 2 130/t over the outlook period. The price gap between the EU price and the Brazilian price is explained by differences in production costs. However, the prices used in the graph are prices of whole chicken, which is not the main export product for the EU, as previously indicated.

What about the UK?

The UK is a major EU meat producer. It is the largest sheep producer and is in second and third place for poultry meat and beef production respectively (2017 data).

In 2017, the UK accounted for 12 % of EU beef production, or 905 000 t, while having 13 % of the EU suckler cow herd on its territory. In terms of poultry meat, the UK produced 1.8 million t or 12.5 % of total EU production. By far the UK's most dominant position is in the sheep and goat sector, where it contributed almost 300 000 t or 34 % of total EU production.

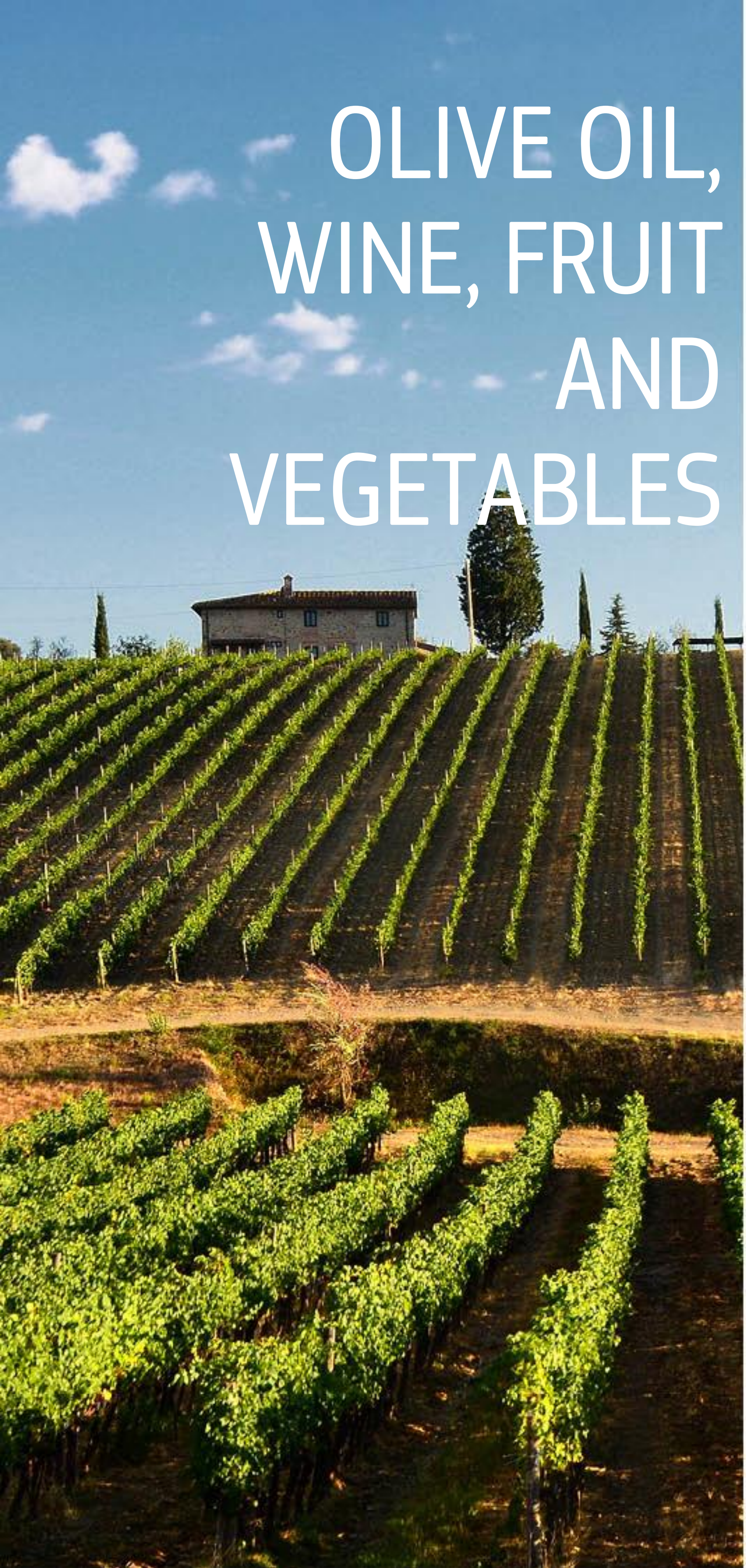
GRAPH 4.15 EU-27 trade by meat type, average 2016-2017 (million t)



The rest of the EU (EU-27) is the biggest meat trade partner for the UK in terms of meat imports and exports, except for imports of sheepmeat. More specifically, the EU-27 is a net exporter to the UK of beef, pigmeat and poultry meat, and a net importer of sheepmeat. In 2017, pigmeat constituted the largest quantity of meat shipments to the UK, recording around 1.1 million t or 23 % of total EU-27 pigmeat exports. Poultry meat followed, with around 810 000 t exported, one third of total exports. For beef, almost 500 000 t were exported to the UK, or 40 % of total beef exports. While the UK is the largest consumer market for sheepmeat from the EU-27, it exports more to the EU-27: 80 000 t of sheepmeat in 2017, or 46 % of total EU-27 imports.

The UK is also a major trade partner of the EU-27 for live animals, especially pigs and cattle. More than 500 000 pigs (piglets and fattened pigs) are exported yearly to the UK. Meanwhile, the UK is a major supplier to the EU-27 of live sheep for slaughter, mainly to Ireland.

OLIVE OIL, WINE, FRUIT AND VEGETABLES



5

In this chapter, we look at three sectors, olive oil, wine and fruit and vegetables, which are not covered by the modelling tool used to derive projections. In its absence, our projections are based mostly on expert judgement, taking into account historic trends in supply and demand.

Price developments are not explicitly taken into account. At this stage, the large degree of differentiation and segmentation of these markets is not fully accounted for. For fruit and vegetables in particular, given the diversity of production and supply chains involved in the sector, the projections were limited to apples, peaches and nectarines and tomatoes. Other sectors that are also important to EU agriculture, such as flowers and ornamental plants, were left out of the projections.

OLIVE OIL

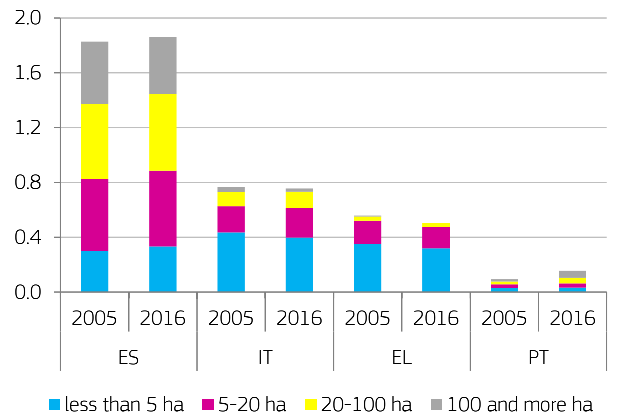
Growing production and processing capacity in the EU olive oil sector is expected to further strengthen the EU net export position. Increasing consumption outside Spain, Italy, Greece and Portugal should offset the consumption loss in these countries over the outlook period.

After an average harvest in 2017/2018, production is expected to rise to close to 2.3 million t in 2018/2019, mainly due to the recovery in Spain. The resulting lower prices should allow consumption to rise.

Concentration of the EU olive oil sector

The EU olive oil sector is dominated by four main producing countries: Spain, Italy, Portugal and Greece. Together they account for 99 % of EU production and two thirds of world production. There were around 790 000 olive growers in the EU in 2016. As a result of sector restructuring, a higher proportion of land is in the hands of a smaller number of olive growers (-8 % in 2016 compared to 2005), while the area remained relatively stable. Resulting economies of scale allowed larger farms to invest notably in irrigated production systems. In Italy and Greece, the sector is dominated by small farms (up to 5 ha). Land availability and landscape restrictions have complicated the concentration process in these countries.

GRAPH 5.1 Development of utilised agricultural area by size categories of specialised olive growers (million ha)



Source: DG Agriculture and Rural development based on Eurostat (Farm Structure Survey)

Although at a lower scale, non-EU countries (e.g. Tunisia and Turkey) are also progressively increasing their production capacity, especially through the development of irrigated systems. Together with a higher quality of production, this leads to more export potential and increasing competition on the world market.

Sustained production growth

New plantations and improvement in agronomic practices are expected to be the main drivers behind an increase in EU production capacity. At Member State level, these drivers include for example: (1) investment in irrigation in Spain and Portugal; (2) improvement in harvesting operations in Italy and (3) the modernisation of the milling industry in Portugal. As a result, EU production is expected to increase by 1.3 % per year by 2030.

What about the UK?

Although the UK is not a producer of olive oil, it is a significant and stable consumer market. Around 64 000 t (including pomace oil) were shipped from the EU-27 to the UK in 2016 and 2017 on average, representing around 9 % of total EU-27 exports. The UK is the second export market for EU olive oil after the US.

Production is expected to increase sharply in the Iberian Peninsula (around 2 % per year, compared to the average in 2015-2017). In Greece, it is expected to increase at a slower pace (+0.9 %). Meanwhile, it is expected to stabilise in Italy (+0.4 %). This development is likely to be driven by increasing yields, given the restrictions on area expansion in the two latter cases.

Production and prices will remain volatile. This will be due to: (1) the proportion of rain-fed olive groves in the EU (around 70-75 %), which are more subject to variability in climatic conditions, (2) the natural alternate bearing of olive trees and (3) the presence of Xylella fastidiosa in certain production areas. In order to limit the negative impact on farmers' income, more emphasis on value creation strategies is needed, especially for small producers and smaller producing Member States (e.g. France or Slovenia). This should stimulate the development of quality labels such as geographical indication (GI) as well as organic production.

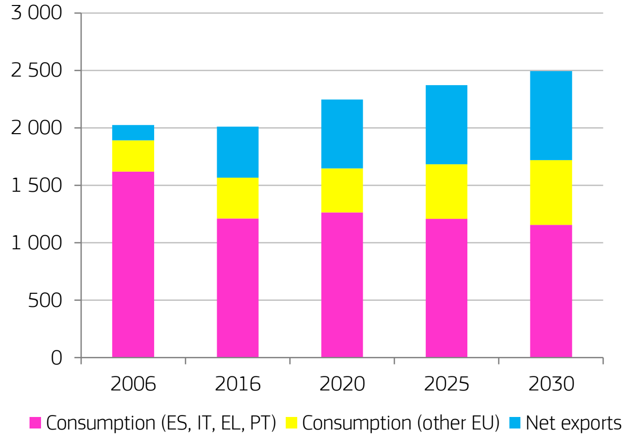
Diverging trends in consumption

Olive oil consumption in the main producing countries is decreasing due to changes in lifestyles and price increases in recent years with lower harvest. By 2030, consumption in these countries is expected to further decrease by 5 % (compared to the average of 2015-2017) to 9.2 kg per capita. By contrast, consumption in the rest of the EU should continue increasing, albeit remaining at a low level (1.5 kg per capita). It is expected that, by 2030, one third of EU consumption will be outside of the main producing Member States (compared to 23 % in 2015-2017). The main drivers of this are likely to be awareness campaigns targeting specific consumer groups (e.g. young generations, sportsmen etc.), further uptake of the Mediterranean diet and the incorporation of olive oil into modern lifestyles (e.g. foodservices).

Growing exports strengthen the EU's net trade position

Global demand for EU olive oil is steadily growing, especially in Asian markets. Thanks to growing production and processing capacity, EU exports should further expand (+3.3 % per year by 2030). Imports in years of low harvest will continue to partially compensate for production losses. Nevertheless, export growth should help strengthen the EU net export position (close to 780 000 t in 2030).

GRAPH 5.2 EU consumption and net export development (1 000 t)



WINE

EU total wine production and domestic use are expected to stabilise after a decade of decrease. Over the outlook period, a slight reduction in human consumption in the EU of wines and products produced through distillation, such as brandies, is expected. The EU should maintain steady export growth, driven in particular by geographical indication and sparkling wines.

Stable demand despite fluctuations in production

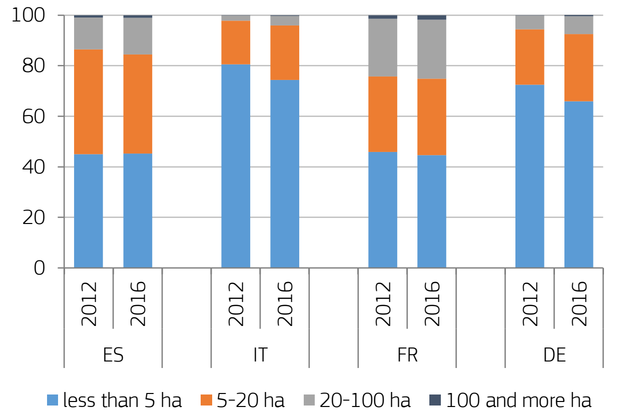
Wine production is characterised by high fluctuations due to climatic conditions. After an exceptionally low harvest in 2017, EU wine production is expected to reach 168 million hl in 2018, 2 % above the last five-year trimmed average. Three Member States (Italy, France and Spain) account for more than 80 % of production.

The negative impact on consumption of low production in 2017 (-1.6 % compared to the last five-year average) was limited by the buffering impact of large stocks. Stocks decreased by 17 million hl to 155 million hl at the end of the 2017/2018 marketing year. This was 7 % below the last five-year trimmed average. Per capita consumption in 2018/2019 is expected to rebound, reaching 26 litres per capita on average. With stable imports and exports, stocks should be 3 million hl higher at the end of 2018/2019.

Concentration of the EU wine sector

In 2016, there were around 450 000 specialised wine farmers in the EU. While the number of wine specialised farms has fallen significantly compared to 2005 (-22 %), the area for wine production has declined only slightly (-3 %), in particular due to the reconversion of old vineyards. Wine is thus increasingly being produced on larger farms. In 2016, 1 % of farms were larger than 100 ha and accounted for 17 % of the total land used for wine production. In contrast, 50 % of farms were smaller than 2 ha and accounted for 4 % of the land used for wine production.

GRAPH 5.3 Development of number of specialised wine farms by size category, main producing countries (%)



The concentration process is strongest in Italy and Germany. In those countries the number of farmers fell most significantly (-40 % and -38 % respectively). Meanwhile, the agricultural land used for wine production increased (+16 % and +2 % respectively). In line with this process, the proportion of small farms (farms smaller than 5 ha) shrank in Italy and Germany (-7 % to 74 % and -6 % to 64 % respectively) over the last decade, while the proportion in France and Spain remained stable at 45 %.

Per capita consumption is projected to stabilise at 25.3 litres per capita towards 2030. The main drivers of this are the increased popularity of sparkling and lighter wines, and the increased consumption of wine thanks to economic growth in the eastern European Member States. This is expected to partly outweigh the decline in consumption in most other countries in Europe due to, among other things, health warnings. In addition, total domestic use will decline in the outlook period due to further decrease in the use of vinified production for 'other uses', such as distillation into brandies or transformation into processed products.

Sustained export growth

Wine exports rose by close to 2 % per year over the last decade, reaching 24 million hl in 2017/2018. Exports are not affected by the fluctuation of domestic production due to the buffering effect of stocks. They are growing steadily thanks to strong demand for sparkling wines and wines with geographical indication. Exports of EU bottled still wines increased by 11 % over the last 5 years. Meanwhile, those of sparkling wine boomed (+36 % over the last 5 years) and accounted for 14 % of EU exports in 2017/2018. It is expected that the market share of these types of wine will further increase over the outlook period to the detriment of the export of bulk wines (15 % of exports in 2017). By contrast, the proportion of bulk wines in EU wine imports, currently accounting for 63 % of total EU wine imports, is expected to rise. This will make it the main contributor to the slight increase in imports by 2030 (+7 %).

Despite strong competition from non-EU producing countries and possible trade tensions, including with the US, sustained growth in EU exports is expected in the outlook period (+1.6 % per year) to around 27 million hl in 2030.

Based on projected domestic demand and trade, production is expected to stabilise at 165 million hl. This is in contrast to the decline of 0.5 % per year seen between 2008 and 2018.

What about the UK?

With very low production and a large consumer market, the UK is a significant importer of wines from the EU-27. In 2017/2018, 24 % of EU-27 wine exports were shipped to the UK, mainly from Italy (44 %), France (23 %) and Spain (18 %), representing 7.7 million hl in total. Exports from the EU-27 to the UK are mainly still and sparkling bottled wine. In terms of value, exports to the UK accounted for 19 % of EU-27 exports, corresponding to EUR 2.6 billion in 2017.

What about organics*?

In 2016, around 9 %** of EU vineyards were organic (more than 313 000 ha), with the highest shares in Italy (15 % of Italian wine area), Spain (11 %) and France (9 %). EU's organic viticulture has shown a significant growth over the last 7 years. Growth has been strongest in Spain where the share of organic vineyards increased from 5 % in 2010 to 11 % in 2017 (107 000 ha).

Spanish organic vinified production reached 3.3 million hl in 2016, attaining an average yield of 30 hl/ha. This corresponds to about 70 % of the average yield under conventional production***. Whereas, based on market sources, a large part of the organic wine produced in France is consumed at national level, organic wine produced in Spain and Italy is mainly exported, mainly to Germany.

It is expected that organic wine production will continue to grow until 2030, although this will amongst others depend on alternatives to copper (and their cost) that will be developed to strive against mildew. With strong demand, the growth of organic production will also depend on future price premium for organic wine, which compensates farmers for lower yields and higher costs.

* Data based on Bio Marche and MAPA.

** Both areas that are fully converted as well as land under conversion.

*** Production data is not available for other Member States.

APPLES

A reduction in production area combined with increasing yields is expected to lead to a stabilisation of apple production in the EU. The consumption of fresh apples should stabilise, while the consumption of processed apples is likely to decline slightly.

Stabilisation of production

EU apple production is expected to reach 12.7 million t in 2018/2019, which is a level similar to the last five-year trimmed average. Four Member States account for almost 70 % of production (Poland, Italy, France and Germany). With a share of around 13 %, the EU is the second largest global producer after China (almost 50 %).

By 2030, EU production is expected to stabilise at around 12.4 million t. Even if the yield is expected to be 9 % higher in 2030 compared to the last five-year trimmed average, the positive impact on production will be largely offset by a decrease in area (-10 % in 2030 against 2018), particularly in Poland where the sector is likely to undergo further restructuring.

The main thrust of this restructuring is the grubbing up of old orchards. Some of these will be replaced by new varieties that match new consumer preferences and new production methods. In particular, varieties that were previously destined for the Russian market are likely to be replaced by varieties that can find new markets.

Stable consumption

Consumption of fruit and vegetables is expected to increase slightly in the coming decade, mainly driven by health motivations and the increasing availability of these products at ‘new’ marketplaces (e.g. at petrol stations, snack bars, etc.). The consumption of fresh apples is not expected to follow this trend as consumers seem to favour new tastes and easy-to-eat products such as (pre-cut) tropical fruit or berries, which are regularly offered in supermarket shelves next to the more common apples. However, apples remain the main fruit available in winter and benefit from the development of new higher quality varieties. After the last eight years, in which the consumption of fresh apples declined by 1 % per year, the consumption of apples is expected to remain stable at around 13.2 kg per capita towards 2030.

Surplus of processed products driving exports up

In 2018/2019, EU exports of fresh apples should reach the same level of exports recorded before the Russian import ban. The sector strove to find alternative markets after the introduction of the ban in 2014, partially compensating for the loss of the Russian market. The latter represented around 40 % of total EU exports before the ban in terms of volume and 33 % in terms of value.

EU exports of fresh apples are expected to increase further (+3.5 % per year up to 2030) thanks to new destinations and the assumed end of the Russian import ban after 2019. Imports will continue to decline at a slow pace (-0.6 % per year up to 2030).

GRAPH 5.4 EU trade of fresh and processed apples (million t)

Surplus of processed products driving exports up

In 2018/2019, approximately 35 % of the total usable EU apple production should be processed. This proportion varies yearly depending on, among other things, total apple production and the impact of weather conditions on apple quality.

Per capita consumption of processed apples fell in 2017/2018 to 7.2 kg, in line with the declining trend (-2.1 % per year over the last eight years). It is expected that the consumption of processed apples will continue to decrease over the outlook period, albeit at a slower pace (-1.4 % per year), driven by declining consumption of juices, which take up most of the EU’s processed apples. However, products with a higher quality than traditional apple juice made from concentrate are developing. Compotes and baby food are also likely to remain significant destinations for processed apples.

The decline in domestic demand is expected to lead to high availability of cheaper processed products from apples in the EU market, generating increasing exports (+1.2 % per year) and decreasing imports (-1.1 % per year), over the outlook period.

PEACHES AND NECTARINES

The consumption of fresh peaches and nectarines is expected to decrease slightly due to competition from other summer fruits. A reduction in production area is expected to lead to a slight decline in EU production.

In 2018, the EU produced 4.1 million t of peaches and nectarines, of which approximately 85 % was consumed fresh and 15 % was processed. The production was concentrated in four Member States (Spain, Italy, Greece and France) which accounted for 96 % of EU production. Of these, Greece and Spain are the main producers of peaches and nectarines for processing.

EU production of peaches and nectarines is expected to remain stable at around 4 million t by 2030 (-0.2 % per year). Average yield is expected to be 8 % higher in 2030 compared to 2012-2017, but this will be offset by a decrease in area (-0.7 % per year on average). A restructuring of the sector is expected, in particular in Spain where production recently boomed (+54 % from 2012 to 2017).

In order to respond to demand for improved varieties, orchards are being replaced. These varieties do not only respond better to consumer preferences in terms of quality but may also be more productive and better adapted to climate change. In addition, improved disease and pest resistance should also contribute to better economic results.

The per capita domestic consumption of fresh peaches and nectarines increased by more than 3 % per year in the period 2012-2017, driven by high availabilities and low prices. The pressure on prices was the result of, among other things, the Russian import ban introduced in 2014, abundant crops and the overlap of harvesting periods due to particular weather conditions. However, it is expected that EU per capita consumption will decrease towards 2030 (-0.4 % per year) due to competition from other summer fruits such as melons, tropical fruits and berries, which are more commonly offered in supermarkets. Consumers, affected by the varying quality of peaches over the last years, are also switching to other fruits which are increasingly available in ready-to-eat packages. The latter responds to consumers demand for convenient food.

Exports of fresh peaches and nectarines fell by 8 % over the period 2012-2017 as a result of the ban on shipments to Russia, the EU's most important export destination (more than 50 % of exports in 2014). The increased trade flows to Belarus, Ukraine and Switzerland did not entirely compensate for the loss of the Russian market. Imports, which mainly occur outside the production season, remained stable over the same period. By 2030, EU exports of fresh peaches and nectarines are expected to grow (+1 % per year), thanks to new destinations and the assumed re-opening of the Russian market after 2019. Imports are expected to remain stable.

The production of peaches for processing decreased by 13 % between 2012 and 2017, while exports remained stable and imports declined slightly. Lower availability on the EU market led to a reduction in consumption. As a result, per capita consumption fell to 1.2 kg in 2017 (around -3 % against 2012) but is expected to remain stable up to 2030.

What about organics?

Fruit is one of the most important sectors in the organic market. In 2016, around 6 % of the area used for apple production (30 000 ha) was organic and another 3 % (15 000) was under conversion. The proportion of organic area rose by 1 % from 2012 to 2016, with the largest increase in France (+2 700 ha). With production of 100 000 t of organic apples (4 % of apple production in Italy), Italy is the largest producer with yields of around 31 t/ha. This corresponds to 70 % of the yield attained in conventional apple production.

In 2016, organic EU peaches and nectarines accounted for 0.6 % (3 000 ha) of the total EU area used for the production of those fruits. An additional 1 800 ha was under conversion. Italy had the largest fully organic area (1 500 ha) followed by Spain (550 ha) and France (500 ha). The organic area in Spain and France increased significantly between 2012 and 2016 (+26 % and +41 %). With a production of around 4 000 t, Spain attained yields of close to 14 t/ha. This corresponds to 74 % of the yields attained through conventional apple production.

Over the outlook period, further expansion of organic apple, peach and nectarine production is predicted, due to growing demand in the EU.

TOMATOES

EU production of fresh tomatoes is expected to remain relatively stable despite increasing yields as producers expand the production seasons. On the other hand, the value of production is likely to continue rising as greater product segmentation adds value. Consumption of fresh tomatoes is expected to go down slightly, while consumption of processed tomatoes is expected to marginally grow.

The EU is expected to produce more than 16 million t of tomatoes in 2018, out of which approximately 40 % is consumed fresh and 60 % is used in the processing industry. These are separate production streams. Five Member States (Spain, Italy, the Netherlands, Poland and France) account for almost 73 % of the production for fresh consumption, while three Member States (Spain, Italy and Portugal) concentrate more than 90 % of the production for processing.

Stable production with increasing value

EU production of fresh tomatoes is expected to remain relatively stable (-0.3 % per year until 2030), though with an increasing share of tomato types with higher value added such as cocktail, cherry and other miniature tomatoes. Similarly, in the last decade the stability of production volume was accompanied by a growing value of production (close to +25 % in France, Germany, Italy and Spain in the period 2007-2017).[58]

Fresh tomatoes are mainly produced in greenhouses or under other types of protection. While the production area is expected to decrease, the average yields of fresh tomatoes are increasing, driven by the installation of artificial lightening and heating in greenhouses. Moreover, producers are extending the production seasons in all producing regions to cover a higher share of the marketing season. The traditional summer campaign in the northern producing countries is being extended to fall, and the traditional winter campaign in the southern countries is being extended to spring. By contrast, the increasing share of higher added value types of tomatoes in total fresh tomato production is pushing down the average yield. However, the impact of the extension of the production seasons might have a positive impact on the average yield.

Increasing consumption of smaller sized tomatoes

Domestic per capita consumption of fresh tomatoes remained stable during the last decade, at around 14 kg per capita, and is expected to slightly decline by 2030 to 13.6 kg (-0.5 % per year compared to the last five-year trimmed average.) This is amongst others due to the fact that consumers switch to smaller size tomatoes.

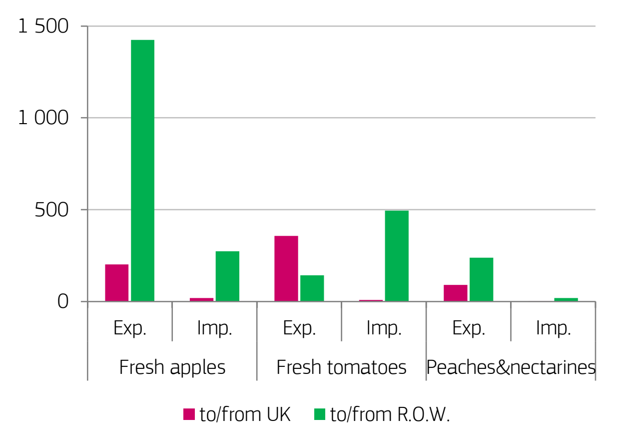
In contrast to the declining exports in the last decade (-0.3 % per year) mainly due to the introduction of the Russian import ban in 2014, it is expected that exports will increase to 200 000 t by 2030 (+1.6 % compared to the last five-year trimmed average).

What about the UK?

The UK accounted for around 4 % and 0.5 % of total EU production of fresh apples and fresh tomatoes respectively in 2017/2018. The UK is a net importer of these products from the EU-27.

The EU-27 exported more than 200 000 t of fresh apples to the UK, mainly from France (56 %) and Italy (18 %). The UK accounts for 13 % of total EU-27 exports. The small quantity of UK exports to the EU-27 (20 000 t) is mainly destined for Ireland.

GRAPH 5.5 EU-27 trade of fresh apples, fresh tomatoes and peaches & nectarines, average 2016-2017 (1 000 t)



The UK is also a major market for EU-27 exports of fresh tomatoes, importing 72 % of total EU-27 exports. The UK's main trading partners are the Netherlands and Spain, which together accounted for almost 85 % of EU-27 exports to the UK in 2017/2018. Exports from the UK to the EU-27 are very small and mainly go to Ireland.

For peaches and nectarines, the UK is the most important export destination of the EU-27. In 2017, 93 000 t or 21 % of total EU-27 exports went to the UK, mainly from Spain.

58 Based on data from Euromonitor

Around 72 % of EU imports come from Morocco and another 18 % from Turkey. Whereas imports from Morocco showed an increasing trend over the last decade (+34 %), imports from Turkey are strongly fluctuating. The last two years imports have been at a high level due to the closed Russian border for Turkish tomatoes in 2017 and a devaluation of the Turkish lira this year. Imports are expected to continue rising (+0.4 % per year to 500 000 t in 2030) as the main competitors still have production capacity to increase.

With regard to processed tomatoes, the production is expected to slightly increase during the outlook period (+0.7 % per year until 2030 to 11 million t). Growth will mainly be driven by increasing yields, particularly in the main producing countries. It is likely that the EU's strong share on the world market will be sustained although with some adjustments of supply and demand.

The EU consumption of processed tomatoes is expected to increase from 20.5 kg per capita in 2018 to around 21 kg in 2030 (in fresh tomato equivalent). This growth will be mainly driven by increasing demand for convenience food such as prepared meals and products representing a Mediterranean lifestyle. Yet the concentration of raw tomato in those products is decreasing due to the addition of other vegetables.

EU to become net exporter of processed tomatoes

Extra-EU trade in processed tomatoes is stronger than for fresh tomatoes, the latter being more perishable than the first. It is expected that EU exports of processed tomatoes will continue increasing by 1 % per year up to 2.7 million t in 2030. EU imports of processed tomatoes are also expected to grow albeit at a slower pace (+0.7 % per year, compared to +1 % per year over the last decade), up to 2.6 million t in 2030. While there is decreasing domestic demand for tomato concentrate which is being replaced by domestic tomato pulp and peeled tomatoes, the demand for the latter type of prepared or preserved tomatoes is projected to increase in the EU and also worldwide. Therefore, the EU is expected to become a net exporter of processed tomatoes by 2030.

GRAPH 5.6 EU production and trade of fresh and processed tomatoes (million t)

AGRICULTURAL INCOME

/6

This section analyses how changes in the markets over the outlook period translate into farmers' income. The analysis is based on current assumptions, including sectors not explicitly covered by this outlook. The analysis shows a stabilisation of the agricultural income per annual working unit (AWU) throughout the outlook period, despite higher energy prices. The agricultural income in nominal terms will remain stable in the outlook period, remaining around the level of 2016-2018. This takes into account that income levels in 2017 were high across the EU, explained by a high gross value of production. The income gap between the EU-15 and EU-N13 is expected to narrow by 3 %. The stabilisation of EU agricultural income over the period can be explained by a significant (+17 %) increase in agricultural output, but this will be outweighed by a similar increase in total intermediate costs. The current situation on subsidies applies throughout the outlook period. The continued labour outflow from agriculture due to further mechanization and modernisation of the sector at EU level is also playing a significant role in the evolution of income.

Factor income in real terms per labour unit stabilising

EU agricultural income has been increasing, especially after the 2011 price spikes. It has stabilised in the last few years, although the last decade has seen an increase in energy costs and other consumption of inputs such as advisory services, maintenance and plant protection products.

The EU's agricultural sector accounted for about 4 % of the total labour force in 2016. In full-time equivalents, 15 million people were engaged in agriculture in 2000 and slightly above 9.4 million people remained in the sector in 2017. The labour outflow was higher in the countries joining the EU after 2004 due to stronger structural adjustments (mainly the exit of many subsistence farmers).

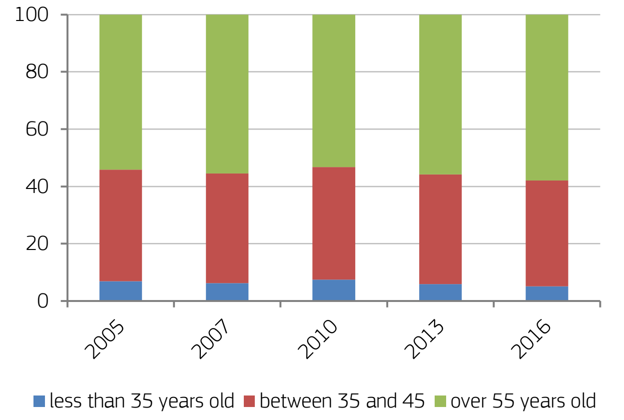
According to the farm structure survey data for 2016, there are 10.5 million farms across the EU, a 30 % decline since 2005. The number of medium-sized and large farms increased during the same period, due to land consolidation. The number of medium-sized farms (between 5 and 50 ha) increased by 4 pp across the EU from 2005 to 2016 and large farms (more than 50 ha) increased by 2 pp. By contrast, the number of farms with less than 5 ha of land decreased by 5 pp, accounting for 64 % of the total number of farms in the EU.

Family labour and non-salaried workers represent on average 70 % of the total labour force in agriculture. The share of family labour in agriculture decreased by 6 % between 2005 and 2016 due to a decrease in the total labour force and an increase in salaried employees in absolute terms. Since 2013, the salaried, educated and trained labour force has increased by 7 %, after having declined between 2005 and 2013.

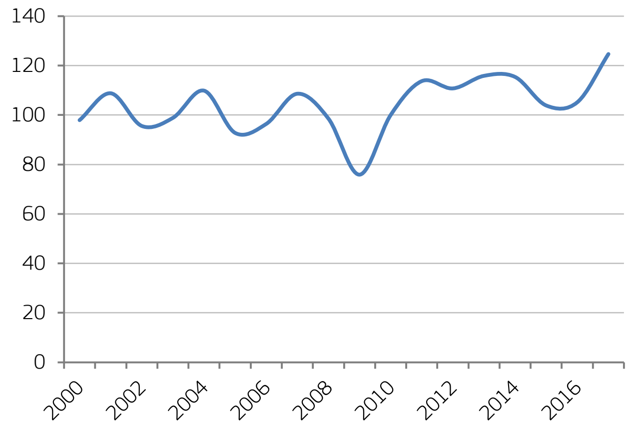
The diversity of farm managers is an important issue in the development of the farming sector. In 2016, male farmers managed more than 70 % of the total farms in the EU. The ratio of young (less than 35 years old) to elderly managers has decreased since 2010 and dropped below 10 % in 2016. Despite an overall decline in the number of farms between 2005 and 2016, the number of farms managed by young farmers (less than 25 years old) is increasing in some Member States (Italy, France, Austria and Bulgaria).

The attractiveness of the agricultural sector plays a significant role in having vibrant rural areas. As a result, ensuring a stable agricultural income for farmers is a major issue. In the past decade, agricultural income (measured as the entrepreneurial income) remained relatively stable in the EU. Despite income volatility due to weather conditions and world market prices, the EU agricultural market reacted in a resilient manner. The CAP has met one of its important objectives to stabilise income for farmers.

GRAPH 6.1 Pyramid of age of farm managers in the EU agricultural sector (%)



GRAPH 6.2 EU farm entrepreneurial income (2010=100)



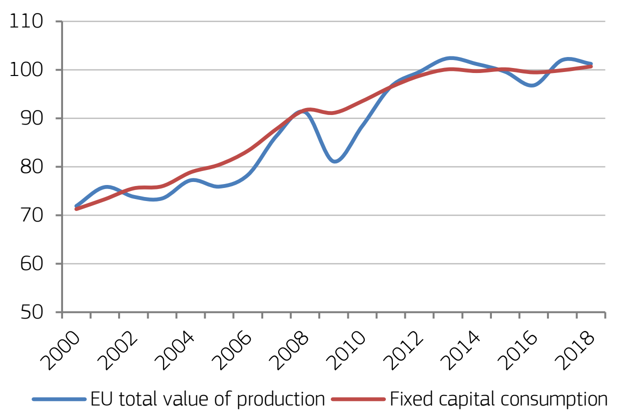
Further structural changes to be expected

Labour. Labour outflow from agriculture is expected to continue over the outlook period but at a slightly slower pace than in the past decade. This conclusion is based on analysis of long-term developments at Member State level. The decline should reach 2 % per year in the EU by 2030 and the overall agricultural labour force is projected to reach around 7.7 million people. The mild growth of the EU economy (see Chapter 1) should result in fewer people leaving the agricultural sector. Indeed, low outflow is expected to continue, following on from the low outflow of agricultural labour following the economic crises in 2011 and in 2015. The same can be said for the increase in the share of the educated and trained agricultural workforce expected to remain in the sector. An upward trend in the size of the labour force has already occurred in the past 3 years, as in Spain and Italy.

Land. The trend towards larger farms and crop specialisation is expected to continue during the outlook period. Small and medium-sized farms are expected to continue to account for a high share of the total number of farms, which will continue to provide for diversified agriculture across the EU. Land prices have increased in the last decade due to limited agricultural land availability in the EU and competition from other land uses.

Capital. Structural change is also driven by capital invested in the sector and by higher capital productivity. Since 2000, agricultural investments (measured as fixed capital consumption) have increased at a steady pace, apart from a slowdown in 2008-2009 due to the financial crisis. Capital productivity increased by 3 % per year in the EU, while the rate was higher in the EU-N13 (6 %). This is mainly due to the faster restructuring of the sector in the EU-N13. Since 2012, investments have slowed and remained relatively stable across the EU. During the same period, the value of agricultural production was stable. The slow growth in the value of production was also due to a period of low prices after the price spikes for grains in 2011/2012 and in 2013/2014 for milk, skimmed milk powder and pigmeat.

GRAPH 6.3 EU value of production and capital consumption (average 2016-2018=100)



The agricultural sector is expected to face further structural changes in the outlook period thanks to a recovery in agricultural investments, including high take-up of precision agriculture. Productivity in agriculture is expected to increase in the medium term.

Some methodological considerations: the medium-term prospects for agricultural income were calculated using the projections for the main agricultural markets and the economic accounts for agriculture (EAA) as the statistical background of this analysis. Key assumptions were made for the rate of fixed capital consumption and the pace of structural change in the 12 coming years. Agricultural income is obtained by subtracting intermediate costs and depreciation from the value of production, adding subsidies and deducting taxes. The depreciation of fixed capital such as equipment and buildings is a function of the increase in production, inflation and capital productivity.

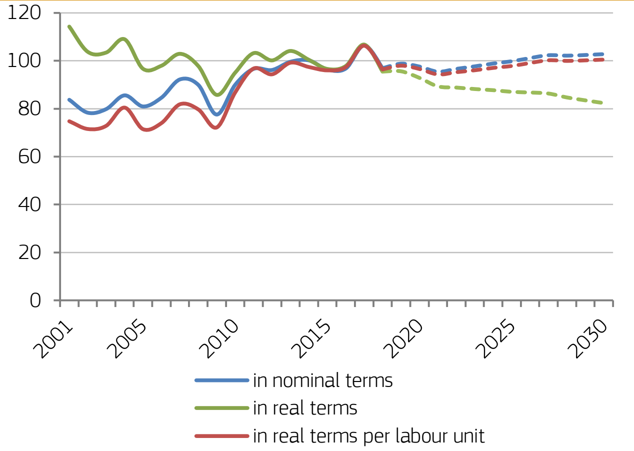
What about precision agriculture?

Precision agriculture is defined as the introduction of more modern farming techniques and management systems targeted at more efficient use of inputs. The aim should be to optimise the agricultural production system. A crucial driver is the use of digital technologies that enable farmers to optimise decisions and better monitor their performance. Examples of key technologies to be further developed and used in the farming sector are sensors, satellite navigation and positioning. These technologies aim to lead agriculture towards: (i) more sustainable production (through more efficient use of inputs); (ii) increased food safety (with better traceability); and (iii) increased comfort for farmers. It will also foster the development of businesses using these technologies in the agri-food chains. Up to now, precision agriculture remains a niche market and the potential is to be realised even though some technologies become increasingly used such as tramlining, milking robot and farm management systems. Innovation is still key in the sector and will require trained and skilled workforce to use the full potential of these new technologies. The new digital tools are also expected to help foster and speed up knowledge exchange and information flows between farmers and across value chains. Better knowledge sharing would also improve farmers' skills. Digital and online training tools could foster the development of virtual learning through MOOCs (massive open online courses) and peer-to-peer learning, which already exists in several domains. Digital technologies are also expected to result in new business models and closer connections with consumers. However, both farmers and the wider public are concerned about the ownership of the data produced, which poses a question mark for the uptake of these technologies.

Factor income per labour unit in real terms to remain stable

Agricultural income in nominal terms is expected to remain stable in the outlook period, remaining around the level of 2016-2018.

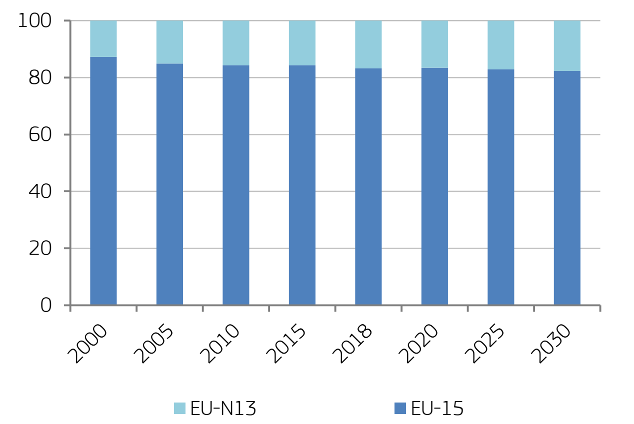
GRAPH 6.4 Agricultural income across the EU (average 2016-2018=100)



Agricultural output and costs of production to further expand

The total value of EU agricultural production is projected to grow in volume and value terms during the outlook period. Agricultural output is expected to increase for cereals and dairy products and for poultry. Oilseeds production will grow dynamically in the outlook period but remain a small share of total EU arable crops production. Price increases are driving the growth in value of production, as the EU production mix is developing towards higher value products. The most significant increase in value of production is expected for dairy; this is due to higher demand for value added products. The increase in the value of production is expected to grow faster in the EU-N13 (+2.7 % annual growth) than in the EU-15. Despite this, the total value of production in the EU-15 at the end of the period is expected to remain five times higher than in the EU-N13.

GRAPH 6.5 Share of EU total agricultural value of production (%)

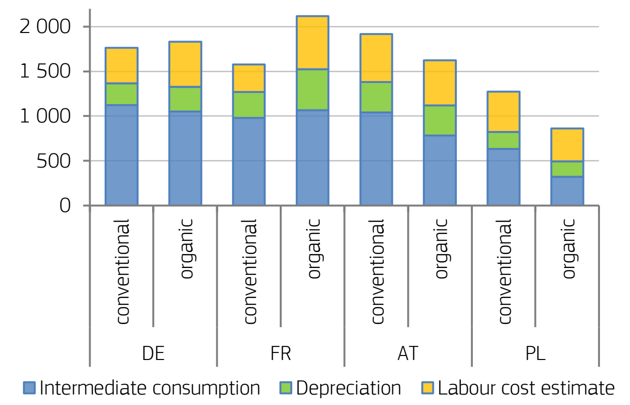


The total costs of production are expected to increase by about 2 % per year over the outlook period, mainly due to higher energy prices, which result in higher fertilisers and fuel prices.

What about organics?*

Organic farming is growing across the EU. It differs from conventional farming both in output and in production methods. For instance, organic crop farms tend to produce less output and use less input than conventional farms, and organic dairy production uses a higher share of pasture in the feed composition. Organic farms tend to be more labour- and capital-intensive, as they rely more on fixed assets. This could lower the effects of variations in input prices. Still, production costs are not always lower than in conventional farming. Based on the limited case studies, margins per unit of production are mostly higher for organic than for conventional production but the agricultural income per unit of labour can be lower in certain sectors and Member States.

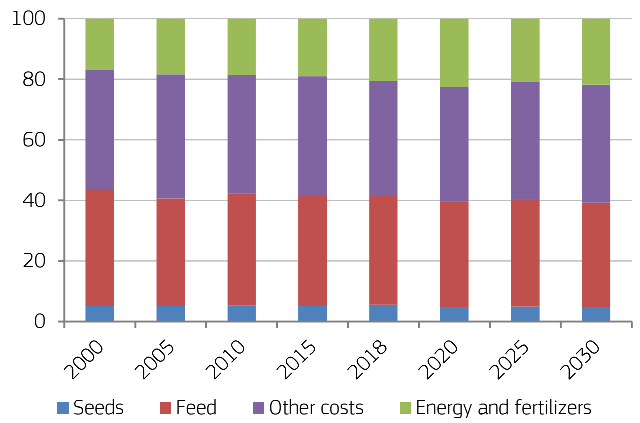
GRAPH 6.6 Average costs of production for fieldcrop farms, average 2010-2015 (EUR/ha)



* based on FADN data for crop and milk farming in five Member States. See Farm Economics Brief. Organic versus conventional farming, which performs better financially? (November 2013).

The share of energy and fertilisers in total costs should increase by 2 % over the next decade.

GRAPH 6.7 Intermediate costs in the farming sector (%)



ENVIRONMENTAL ASPECTS

7

This chapter presents an environmental analysis of the medium-term developments of EU agricultural markets based on a set of environmental and climate indicators. These indicators include non-CO_2 greenhouse gas (GHG) emissions, ammonia (NH_3) emissions, a proxy indicator for Nitrogen (N) losses to water, a pressure indicator for biodiversity (N pressure on plant species richness in grasslands) and soil erosion.

The environmental analysis is based on the 2018 CAPRI baseline, which provides a medium-term outlook for the EU and global agricultural commodity markets. In the EU, the baseline provides harmonised projections for the main agricultural commodities, land use and herd sizes, at Member State and regional level. The baseline covers current CAP policies, assuming the continuation until 2030 of CAP post-2013 and of Member State policy options. This reflects the impact on regional agricultural output development, including livestock herd size, with a direct impact on environmental aspects.

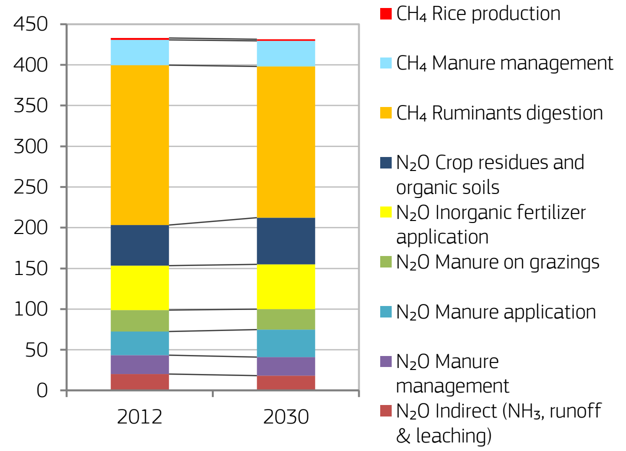
Although some CAP and environmental legislation restrictions in place at EU and national level are implicitly taken into account (e.g. in the number of animals, change in production), this modelling analysis does not take into account environmental constraints in an explicit way. This may lead to an overestimation of the negative environmental and climate impact in the regions in question.

GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions[59]

Agriculture[60] accounts for 10 % of total[61] EU GHG emissions[62]. Total non-CO_2 (CH_4 and N_2O) GHG emissions from agriculture are not projected to change significantly (-0.3 %) between 2012, the year used as a reference for the environmental baseline, and the CAPRI projection for 2030. In 2030, livestock will continue to be responsible for 99 % of all methane (CH_4) emissions from agriculture, the biggest share (85 %) coming from ruminants digestion. A decrease in emissions from ruminants digestion (-5 %) is expected due to a decrease in dairy cattle heads associated with an expected increase in productivity. Nevertheless, this decrease will be offset by an increase in nitrous oxide (N_2O) emissions. These emissions come mostly from crops (higher crop yields and production) but also from manure application on fields, although the total amount of manure will slightly decrease. This is a consequence of changing manure management[63], which tends to reduce NH_3 but increase N_2O emissions.

GRAPH 7.1 EU agricultural non-CO_2 GHG gas emissions sources in 2030 (million t CO_2 equivalent)[64]



Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017][65]

[59] The analysis of greenhouse gas emissions, ammonia emissions, nitrogen surplus and biodiversity was carried out by Maria Bielza (Seidor consultant for JRC), Adrian Leip, Maria Luisa Paracchini, Carlo Rega and Jean-Michel Terres, JRC Food Security Unit. The analysis is based on the results of the CAPRI baseline [2030; MTO 2017] constructed by Mihaly Himics, Mariia Bogonos and Jordan Hristov, JRC Agricultural Economics Unit. For more details, contact: adrian.leip@ec.europa.eu.

[60] Total GHG emissions do not include net removals from land use, land use change and forestry (LULUCF). Agricultural emissions do not include emissions from agricultural transport and energy use as they are not part of the agriculture sector as defined by the current IPCC reporting guidelines.

[61] Without LULUCF, without indirect CO_2.

[62] Data for 2016. Source: EEA (2018). Data on greenhouse gas emissions and removals, sent by countries to UNFCCC and the EU Greenhouse Gas Monitoring Mechanism. https://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-14.

[63] For further information see the following section on ammonia.

[64] AR4 (IPCC Fourth Assessment Report: Climate Change 2007) conversion factors have been used for CH_4 and N_2O into CO_2 equivalent (respectively 25 and 298).

[65] The 2018 CAPRI baseline is calibrated to the mid-term Outlook of the European Commission published in 2017, and it provides projections for the agricultural sector for 2030.

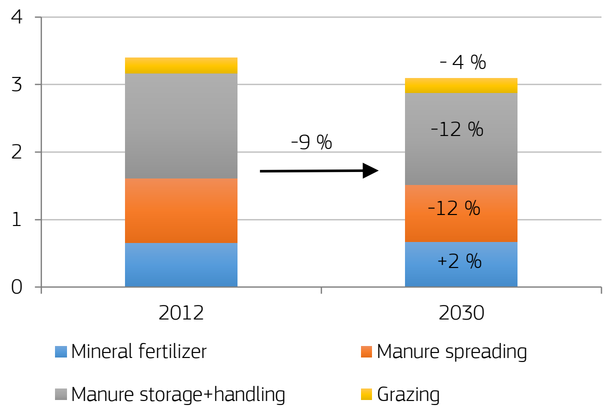
AMMONIA EMISSIONS

Ammonia emissions to the air

Animal and crop production processes release ammonia (NH_3) into the atmosphere, increasing air pollution[66]. More than 90 % of EU NH_3 emissions (92 % in 2015[67]) are associated with agriculture (of which approx. 80 % from manure, including manure management and application, and 20 % from mineral fertiliser).

The CAPRI model projects a decrease in EU NH_3 emissions for 2030, both in total and per hectare. The CAPRI environmental module tracks all nitrogen flows associated with feed, animal products, manure management and spreading, and mineral fertiliser, as well as NH_3 and other losses. It assumes that low NH_3 emissions technologies will increase in importance[68]. The module does not explicitly include national NH_3 abatement obligations that may be enacted by Member States to comply with the National Emission Ceilings (NEC) Directive[69] (or obligations derived from the Nitrates Directive).

GRAPH 7.2 Projected EU ammonia emissions change by sources (million t of NH_3)



Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017]

The CAPRI calculations show that EU agricultural NH_3 emissions are expected to decline by approximately 9 % between 2012 and 2030, with the largest emission reductions resulting from manure storage, handling and spreading. Emissions from fertilisers would be slightly higher. Ammonia reductions occur despite a 9 % increase in meat production and a 20 % increase in milk production, resulting in an increase of nitrogen in animal proteins of 11 %. This is due to the increasing efficiency of meat and milk production, as animal numbers (in livestock units) will decline by 3 % and nitrogen (N) contained in manure by 2 %. Further driving factors leading to lower NH_3 emissions are specific changes in herd composition (e.g. more poultry and less dairy), and lower emissions from manure management systems.

GHGs have a long atmospheric residence time and are homogeneously mixed, resulting in an equal impact on climate change irrespective of the emission location. In contrast, a significant share of emitted NH_3 is deposited at a short distance from the emission source and can reach high concentration levels in specific areas. Therefore, the spatial distribution of NH_3 emissions is relevant for pollution problems. For this reason, we have mapped the density of NH_3 emissions by agriculture in the EU.

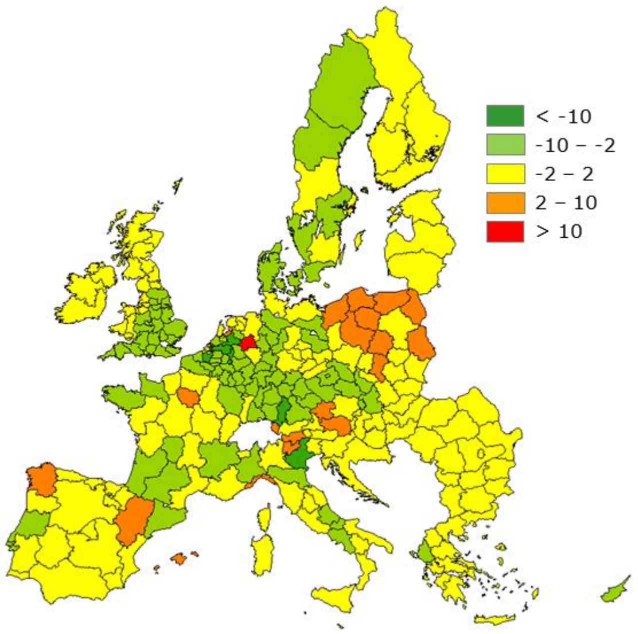
66 Ammonia (NH_3) is a gas produced by the decay of organic vegetable matter and from the excrement of humans and animals. When released into the atmosphere, it can combine with other air pollutants such as nitrogen oxides released by transport, industrial and household activities and sulphur dioxide from industry, and contribute to the formation of airborne particulate matter (also called PM2.5), with strong negative impacts on human health. Once deposited in water and soils, it can damage sensitive vegetation systems, biodiversity and water quality through acidification and eutrophication. (EEA Report No 13/2017; Air quality in Europe, Downloaded 11 October; https://www.eea.europa.eu/publications/air-quality-in-europe-2017, Luxembourg: Publications Office of the European Union, 2017; Maas R., P. Grennfelt (eds) (2016). 'Towards Cleaner Air. Scientific Assessment Report 2016'. EMEP Steering Body and Working Group on Effects of the Convention on Long-Range Transboundary Air Pollution, Oslo. xx+50pp.).

67 EEA web (2018): NECD directive data viewer. https://www.eea.europa.eu/data-and-maps/dashboards/necd-directive-data-viewer-1.

68 CAPRI's abatement measures for ammonia have been assumed to change over time. Scenarios and coefficients have been taken from the MITERRA project and GAINS/RAINS model (IIASA). Further details can be found in:
Velthof, G.L. et al. (2007). Development and application of the integrated nitrogen model MITERRA-EUROPE. Alterra Report. Alterra, Wageningen. 102.
Velthof, G.L. et al. (2009). 'Integrated assessment of nitrogen losses from agriculture in EU-27 using MITERRA-EUROPE'. Journal of environmental quality 38, 402-17.
Oenema, O. et al. (2009): 'Integrated assessment of promising measures to decrease nitrogen losses from agriculture in EU-27'. Agriculture, Ecosystems and Environment 133, 280-288.
Klimont and Winiwarter, 2011. Integrated ammonia abatement — Modelling of emission control potentials and costs in GAINS. In http://pure.iiasa.ac.at/9809/1/IR-11-027.pdf.

69 Since air pollution can travel hundreds or thousands of kilometres, European countries have multilaterally agreed to reduce their national ammonia emissions as part of a larger package to reduce air pollution, the National Emission Ceilings (NEC) Directive. For the EU, NH_3 emissions need to have been reduced by 6 % by 2020 and by 19 % by 2030, compared to the base year of 2005.

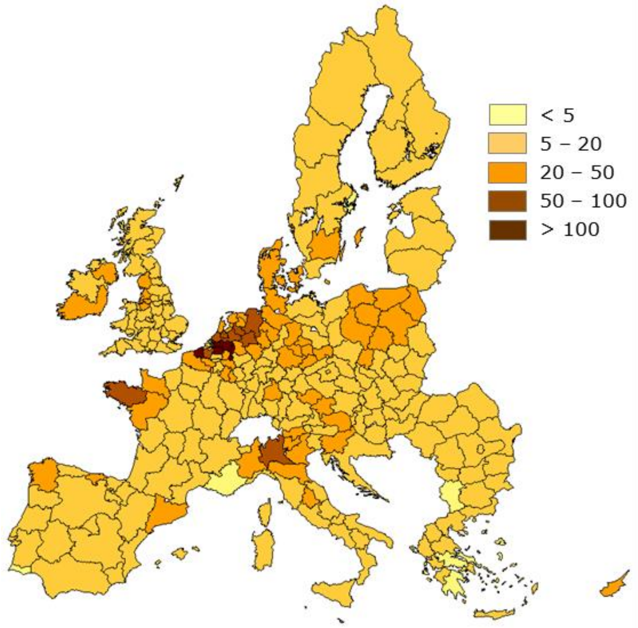
MAP 7.1 Ammonia emissions change 2030-2012 (kg NH_3/ha UAA)



Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017]

The map on the projected absolute changes in ammonia emissions shows that although many regions are following the general EU trend for a decrease in emissions, many others show no significant change and some may even experience an increase in NH_3 levels, for example a number of regions in Poland. The main drivers can be found in the production projections. Looking at animal products, we can find three different examples: in Bulgaria meat production and N in manure are decreasing; in Romania and Poland, meat production and N in manure from pigs and poultry are increasing but production and manure from dairy cattle are decreasing. Whereas the decrease in dairy cattle in Romania offsets the increase in the pigs and poultry sector, resulting in a net decrease in total N in manure, results for Poland show large increases in total animal production (+35 % protein production), and N in manure (+15 %). Additionally, in Poland the increase in cereal yields is leading to higher cereal production (+30 %) and higher total use of N mineral fertiliser (+21 %). As a result, total NH_3 emissions between 2012 and 2030 are predicted to increase in Poland by 13 %, a figure that can be split into emissions from manure (+8 %) and from mineral fertiliser (+22 %). The emissions from manure are explained not only by the increase in total manure but also by projected changes in manure management systems. In Aragon (north-eastern Spain) the increase is mostly due to increased pigmeat production (+40 %). As the model does not account for additional measures to be taken to meet the limits in the NEC Directive, the 2030 NH_3 emissions are likely to be lower.

MAP 7.2 Ammonia emissions in 2030 (kg NH_3/ha UAA)



Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017]

On the map showing the projected regional distribution of NH_3 emissions in 2030, we can see that despite the increase in emissions projected in Poland, Spain and Austria, levels are still lower than in those of most of the current hotspots (regions in Belgium, the Netherlands, France, Italy, etc.). The decreases projected for Germany and the UK show a better situation for 2030, except for north-western Germany.

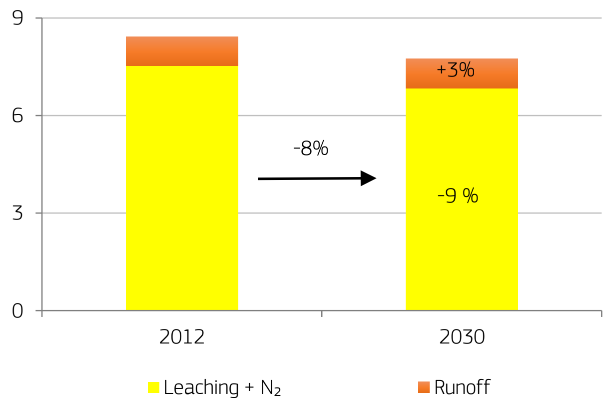
NITROGEN SURPLUS

Nitrogen losses to water

Nitrogen (N) losses to water occur mainly through surface runoff of mineral and organic fertilisers and through leaching from the soil. After subtracting N_2O emissions, the CAPRI model calculates the N which remains in the soil below the root zone, of which a share will be leached, the rest being released into the atmosphere as N_2 (non-polluting gas, the final product of denitrification). As the information on the split between leaching and N_2 is lacking, we present the sum of both plus runoff as a proxy for potential water pollution.

In 2030, the projected total N losses to water in the EU are 8 % lower than in 2012. This is due to the expected gains in production efficiency in the dairy sector, with less manure produced, and in the crop sector, with less N inputs per N outputs (e.g. mineral N fertiliser for cereals is predicted to increase by 3 % while cereal production would increase by 16 %). However, the total increase in mineral fertiliser leads to an increase in runoff (+3 %).

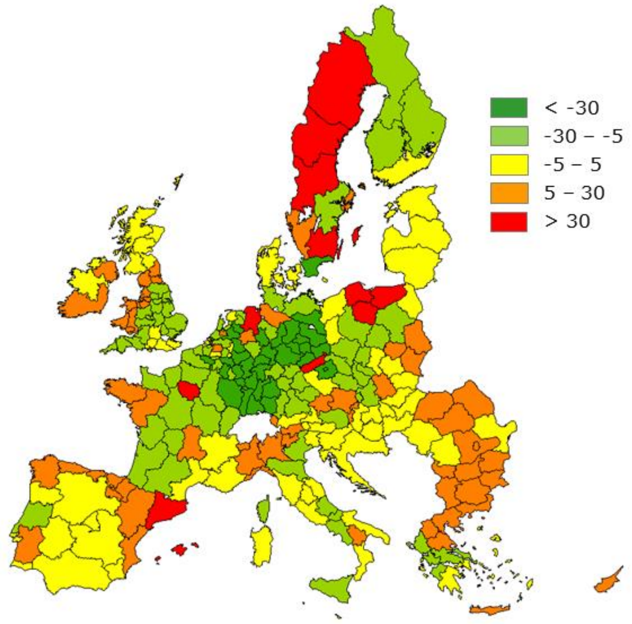
GRAPH 7.3 Projected N losses to water in the EU (million t of N)



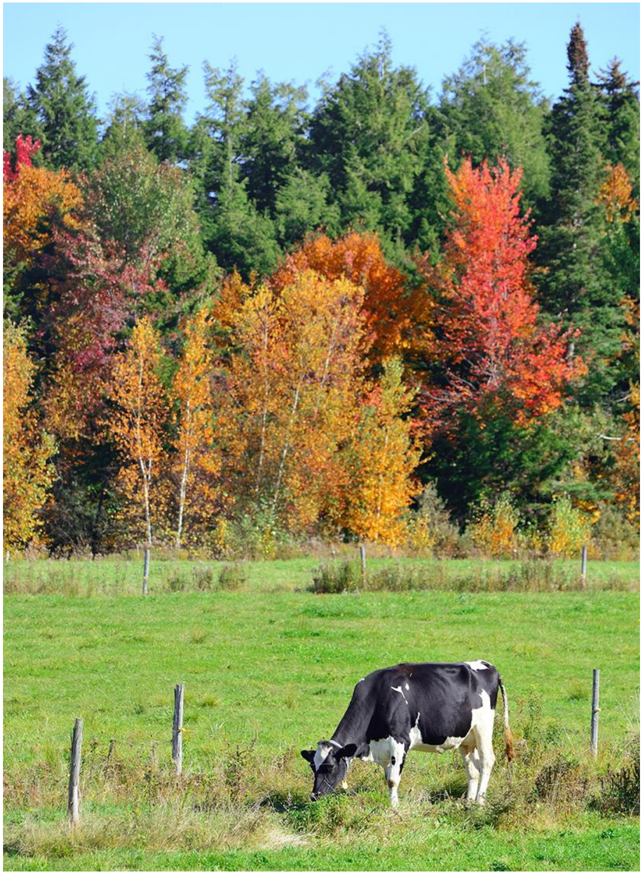
Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017]

As for ammonia, the geographical distribution of N losses to water is relevant as a high concentration of N in surface and groundwater can lead to eutrophication and health problems. The largest projected increases in N losses per hectare to water are led by increases in mineral fertilisation in north-eastern Spain and in Sweden (in fact, total manure excretion is projected to decrease in Sweden and in Catalonia, as can also be seen from the decrease in NH_3 emissions in these regions), However, in other regions (e.g. Poland) the increase in manure also contributes. These increases may be particularly problematic in sensitive regions ('nitrate vulnerable zones'), when the increase in N surplus adds to pre-existing high levels.

MAP 7.3 Changes in N losses to water, 2030-2008 (kg N / ha UAA)



Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017]



BIODIVERSITY

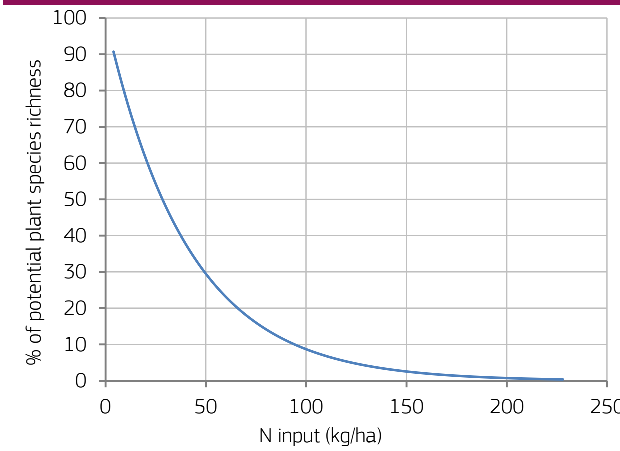
Nitrogen pressure on plant species richness in grasslands

Modelling policy impacts on biodiversity is a complex task, which due to data limitation, within the Outlook modelling framework can only be approached by targeting specific and restricted aspects. Through increasing and decreasing management pressure, driven by agricultural trends, agriculture affects biodiversity[70]. A way to illustrate this link is by analysing N input effects.

Nitrogen (N) input is affecting biodiversity in agricultural areas through soil acidification, eutrophication, direct toxicity and ecological simplification. Moreover, N input, being one of the main components of intensive management, is often used as a descriptor of overall management intensity[71] (which is also assumed to be associated with a high use of pesticides, high livestock density and, in general, more intensive use of the land). There is substantial scientific literature on the impact of N on biodiversity, providing a consolidated view of N pressure on plant species richness in grasslands[72]. This offers a basis for the implementation of an indicator in the CAPRI model. Even though plant species richness is associated with other species richness (e.g. soil microorganisms, insects), those relationships are not quantified. Therefore, the proposed indicator cannot be considered as an indicator of biodiversity, but only of a specific pressure (i.e. N) on plant species diversity.

The indicator on N pressure on plant species richness measures the pressure of total N input (including manure, mineral fertilisers and atmospheric deposition[73]) on the ratio of plant species richness relative to the potential plant species richness[74] with no N pressure.

GRAPH 7.4 Indicator on N pressure on plant species richness in permanent grasslands[75]



Source: DG JRC, based on the 2018 CAPRI baseline *[2030; MTO 2017]*

The estimation of this indicator presents, however, some issues. On top of the uncertainties involved in modelling the projected N pressure, the CAPRI model results are available at NUTS[76] 2 level. Therefore, they are not capturing differences of N intensity use in grasslands within a NUTS 2 region, which can be very large, while changes in species richness are local. Two main sources of uncertainty can be identified in the results: (i) the uncertainty in the actual spatial distribution of N intensity levels in permanent grasslands within the region; and (ii) where (forecasted) changes in N use intensity will take place. Here, we

70 Dudley, N. and S. Alexander (2017) Agriculture and biodiversity: a review, Biodiversity, 18:2-3, 45-49.
Lanz, B., S. Dietz, and T. Swanson (2018). The expansion of modern agriculture and global biodiversity decline: an integrated assessment, Ecological Economics 144, 260–277
EC (2016). The hidden biodiversity impacts of global crop production and trade. Science for Environment Policy. European Commission, DG Environment, News Alert Service, edited by SCU, The University of the West of England, Bristol.

71 Levers C, Müller D, Erb K et al. (2015). Archetypical patterns and trajectories of land systems in Europe. Reg Environ Change. 2015:1-18.
Niedertscheider M, Kastner T, Fetzel T, et al. (2016). Mapping and analysing cropland use intensity from a NPP perspective. Environmental Research Letters, 11(1), 14008. https://doi.org/10.1088/1748-9326/11/1/014008.
van der Zanden, EH., Levers, C., Verburg, P. H., et al. (2016). Representing composition, spatial structure and management intensity of European agricultural landscapes: A new typology. Landscape and Urban Planning, 150, 36–49. https://doi.org/10.1016/j.landurbplan.2016.02.005.

72 References:
Kleijn, D., Kohler, F., Báldi, A. et al. (2012). On the relationship between farmland biodiversity and land-use intensity in Europe. Proceedings of the Royal Society B. Biological Sciences, 276 (1658), 903-909.
Maskell, L.C., Smart, S.M., Bullock, J.M. et al. (2010). Nitrogen deposition causes widespread loss of species richness in British habitats. Global Change Biology 16, 671-679.
Stevens C.J., Dupr C., Dorland E. et al. (2010). Nitrogen deposition threatens species richness of grasslands across Europe. Environmental Pollution 158 (9), 2940-2945.
Soons, M.B., Hefting, M.M., Dorland, E. et al. (2017). Nitrogen effects on plant species richness in herbaceous communities are more widespread and stronger than those of phosphorus. Biological Conservation 212, 390-397.
de Schrijver, A., de Frenne, P., Ampoorter, E. et al. (2011). Cumulative nitrogen input drives species loss in terrestrial ecosystems. Global Ecology and Biogeography, 20(6), 803-816.

73 NUTS2 regional average rates of atmospheric deposition in European semi-natural areas range from 1 to 36 kg N/ha year (Source: calculated from 2006-2010 average data from David Simpson, EMEP MSC-W, Norwegian Meteorological Inst., 2016).

74 Number of different species present per surface area.

75 The indicator was designed following the curve by Stevens et al. (2010).

76 NUTS is a geographical nomenclature based on Regulation (EC) No 1059/2003 of the European Parliament and of the Council on the establishment of a common classification of territorial units for statistics (NUTS), which is regularly updated. It subdivides the economic territory of the EU into regions at three different levels (NUTS 1, 2 and 3, moving from larger to smaller territorial units). Above NUTS 1, there is the 'national' level of the Member States.

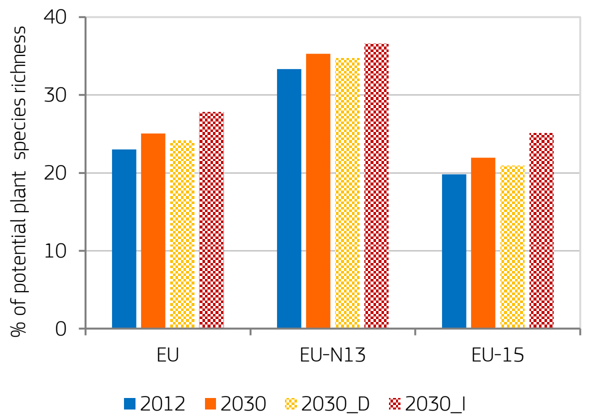
deal with this uncertainty to a certain extent by using a simple sensitivity analysis that considers two extreme scenarios of N distribution to describe the range of possibilities:[77]

- Scenario 2030_I allocating all N increases to intensive grasslands and N decreases to extensive grasslands;

- Scenario 2030_D: allocating all N increases to extensive grasslands and N decreases to intensive grasslands.

Results show EU average levels close to 25 % of potential plant species richness, with lower pressure in the EU-N13 than in the EU-15 due to lower livestock densities and fertilisation rates. The average change for 2012-2030 for the EU is very small — an increase of 2 pp in potential plant species richness. However, the sensitivity analysis shows that this change can range from +1 % to +5 %, showing a small but generalised decrease of N pressure on permanent grasslands. This decrease can be associated, among other factors, to the decrease of grazing animals (-5 % for cattle), stronger than the decrease of permanent grasslands area (-1 % for EU), the latter also due to the CAP limitations to reduce permanent grassland area.

GRAPH 7.5 Plant species richness in grasslands: values of the indicator for 2012, 2030 and two extreme N allocation scenarios



Source: DG JRC, based on the 2018 CAPRI baseline [2030; MTO 2017]

77 Due to the uncertainty in the actual distribution, the area of permanent grasslands in each region has been artificially split into two categories (regional lower and higher intensity), and average N input levels on grasslands have been assigned to them from simple assumptions.

SOIL EROSION

Soil erosion by water is considered the major land degradation process. Erosion rates are still higher than soil formation rates, despite the slight decrease in soil erosion between 2000 and 2012, benefiting from the use of good agricultural and environmental conditions (GAEC), the soil thematic strategy and increased awareness among farmers. Soil erosion in agricultural lands is not expected to change significantly by 2030. This is because of marginal overall changes in crop distribution in the EU. However, these future projections do not include the climate change effect and the impact of the planned agricultural policies (e.g. the post-2020 CAP) on reducing soil erosion.

Unsustainable soil erosion rates in one third of EU agricultural lands[78]

Soil erosion by water is a natural process and occurs through sheets and rills as a result of rainfall and limited vegetation protection. The raindrop splash and then the surface water runoff tend to remove topsoil, the most productive asset of land. Human activities generally accelerate these processes due to inappropriate management practices[79]. The modified version of RUSLE2015, the 'Revised Universal Soil Loss Equation' model, is used to estimate soil loss by water erosion in the EU. The model takes as inputs soil property data, rainfall intensity, land cover, topography and agricultural management practices[80,81].

Land cover (arable, permanent crops, grasslands) and agricultural management practices influence the magnitude of soil loss. Among the different soil erosion risk factors, cover management is the one that can be changed by farmers and targeted by policy measures. As part of this factor, crop type plays an important role in protecting against soil erosion in agricultural lands.

TABLE 7.1 Crops and soil erosion

Crops can be classified from less erosive to more erosive on the basis of canopy cover, canopy height, root mass, residue cover, the time that crops need to develop and the protection the crop offers against soil erosion (Table 7.1). The classification of crops is based on a review of literature in the field[82], also taking into account experimental data from research studies.

The mean soil loss by water erosion for 2012 was 2.40 t ha^{-1} yr^{-1}, resulting in a total annual loss of about 950 million t[83]. The mean soil loss by water erosion is higher in agricultural lands (3.25 t ha^{-1} yr^{-1}) compared to forest or shrublands. As the mean natural soil formation rate is about 1.4-2.0 t ha^{-1} yr^{-1}, this means that more than a quarter of EU lands are eroded at higher than the sustainable rate[84]. More than 24 % of EU lands and almost one third of agricultural areas experience erosion higher than the sustainable rates (Map 7.4).

[78] Analysis by Panos Panagos (JRC, Ispra, Italy; contact: panos.panagos@ec.europa.eu).

[79] Borrelli et al., 2017. An assessment of the global impact of 21st century land use change on soil erosion. Nature communications 8, 2013.

[80] Panagos et al., 2015. The new assessment of soil loss by water erosion in Europe. Environmental science & policy 54: 438-447.

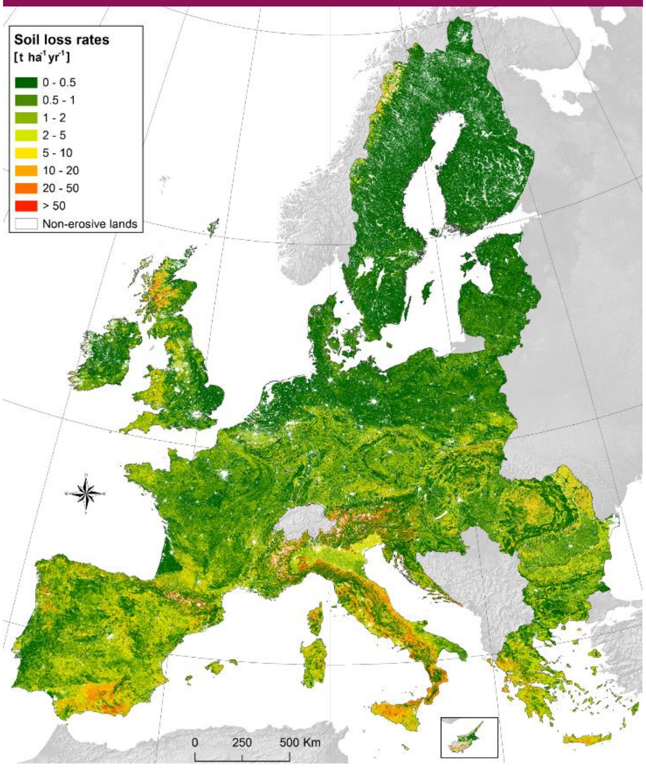
[81] The agricultural management practices to reduce soil erosion considered by the model are: reduced tillage, cover crops, plant residues, grass margins, stone walls and contour farming. For more on how the practices are introduced in the RUSLE2015 model, see: Panagos et al. 2015 Estimating the Cover-Management factor at the European scale 48: 38-50.

[82] Panagos et al., 2015. Estimating the Cover-Management factor at the European scale 48: 38-50.

[83] CAP Context Indicator #42: Soil Erosion by Water (2017). https://ec.europa.eu/agriculture/cap-indicators/context/2017/c42_en.pdf

[84] Verheijen et al., 2009. Tolerable versus actual soil erosion rates in Europe. Earth-Science Reviews 94 (1-4), 23-38.

MAP 7.4 Soil loss by water erosion (t ha-1 yr-1)

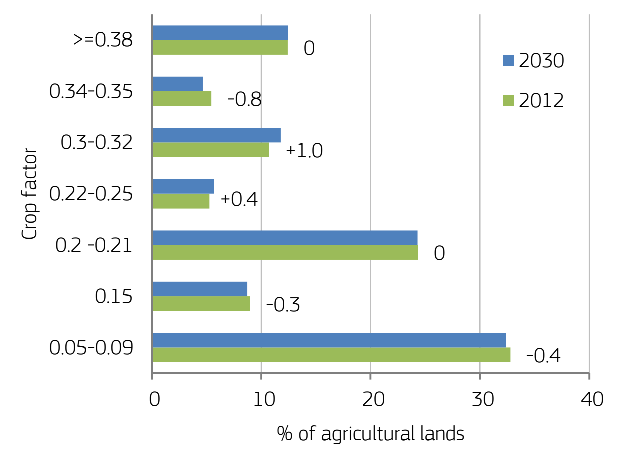


Crop changes and influence on soil erosion

In the EU agricultural area (approx. 180 million ha), the overall expected changes in crop distribution between 2012 and 2030 will have a limited impact on soil erosion. Low erosive crops (permanent grasslands) are expected to slightly decrease by 0.4 % and other fodder areas by 0.3 %, while the permanent crops area is projected to increase marginally (by 0.4 %), mainly due to an increase in olive groves. Medium-high erosive crops will have the highest area increase (+1 %) due to a rise in the rapeseed share. The decrease in sugar beets and potatoes contributes to a reduction of 0.8 % in the highly erosive areas (Graph 7.6).

The shifts in crop distribution of EU agricultural lands will marginally increase soil erosion by water on average by 0.5 %, from 3.25 t ha^{-1} yr^{-1} in 2012 to 3.27 t ha^{-1} yr^{-1} in 2030. Soil erosion will also increase slightly in arable lands, from 2.64 to 2.66 t ha^{-1} yr^{-1} in 2030.

GRAPH 7.6 Changes in crop distribution classified by erosive categories



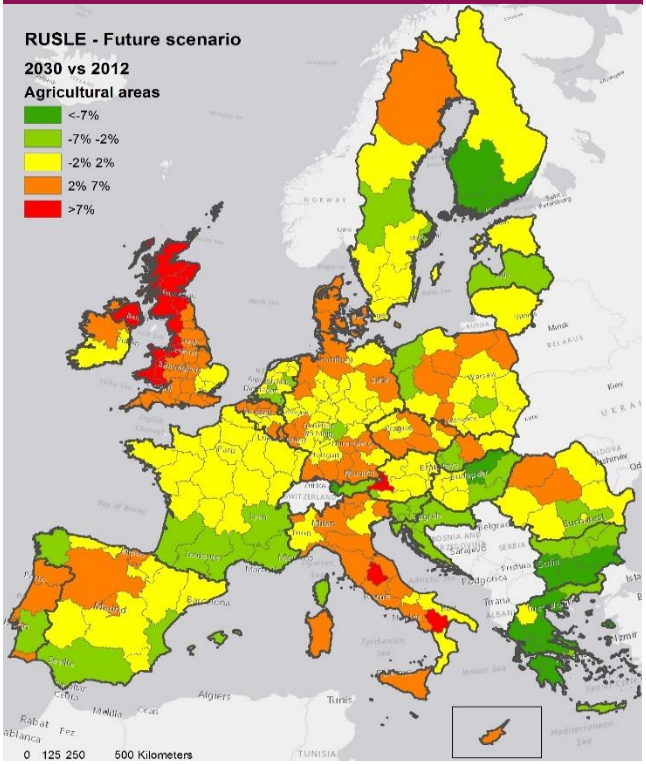
Changes in soil erosion are unevenly distributed across the EU. Soil erosion by water will not change or changes are marginal (Map 7.5). In most NUTS 2 regions, soil erosion change is absent or minor (-2 to +2 %). Green represents regions where soil erosion will decrease by more than 2 %, while orange and red indicate where soil erosion will increase by more than 2 %.

Most Member States will not experience significant relative changes in soil erosion by 2030 (yellow colour in Map 7.6). In four countries (Italy, Cyprus, the UK and Denmark), the soil erosion projections for 2030 will have a relative increase above 3 %. By contrast, five countries (Greece, Slovenia, Bulgaria, Latvia and Finland) will have a significant relative decrease (< -3 %).

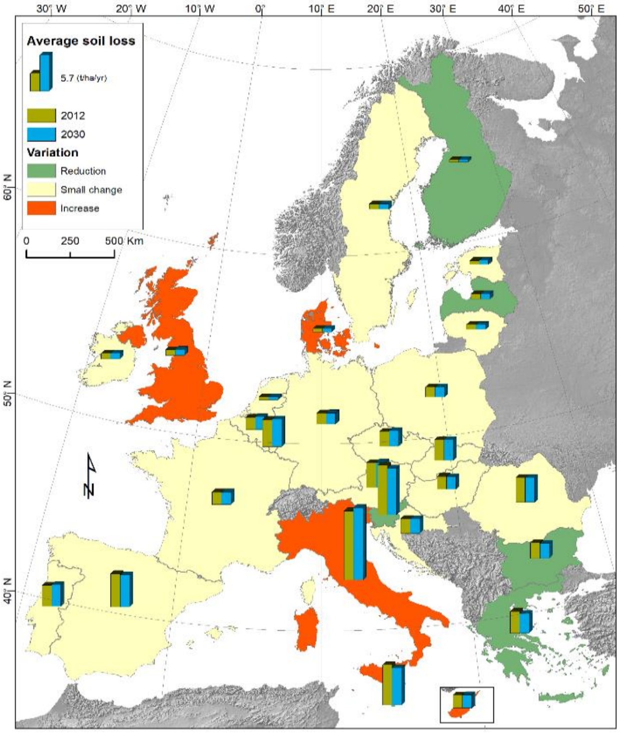
At the national scale, the changes are significant in countries with a high risk of soil erosion (Italy, Greece and Slovenia). As Italy has a high soil erosion risk, the relative increase of 3.9 % is significant. This increase is due to a 1.5 % decrease in less erosive agricultural areas (other fodder crops, barley and wheat) and an increase in fallow land, which is considered highly erosive. Denmark also shows a high relative increase (+4.6 %) in soil erosion but the country is at a low erosion risk (0.59 t ha^{-1} yr^{-1}) because of its flat topography, soil properties and the low intense rainfalls. In the UK, a relative soil erosion increase of 4.5 % is projected as rapeseed increases, replacing soft wheat and barley

.

MAP 7.5 Soil erosion change at regional level (2012-2030)



MAP 7.6 Mean erosion rates at national level and variation for the period 2012-2030



Greece is projected to have the highest relevant decrease in soil erosion (-11.7 %) due to a significant increase in fodder crops, which will replace tobacco, cotton and fallow lands. As Slovenia is a country with a high erosion risk, the 3 % decrease in soil erosion by 2030 is significant. This trend is explained by maize areas being replaced by new energy crops. In addition, soil erosion is projected to decrease in Bulgaria as rapeseed and flowers replace highly erosive crops.

The projections on soil erosion do not include the impact of climate change and the result of agro-environmental policies, which aim to reduce soil erosion. Rainfall intensity, and as a result rainfall erosivity, is expected to increase by 2050[85]. On the other hand, future EU agro-environmental policies (the post-2020 CAP) will further address soil protection.

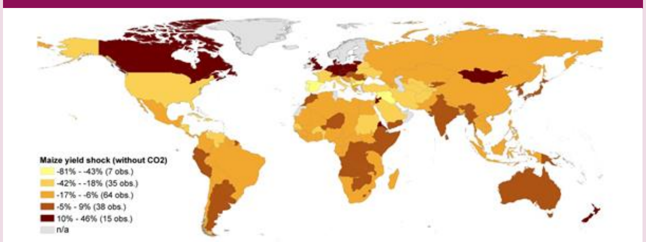
85 Panagos et al., 2017. Towards estimates of future rainfall erosivity in Europe based on REDES and WorldClim datasets. Journal of Hydrology, 548: 251-262.

BOX 7.1 Agro-economic analysis of climate change impacts in Europe[86]

Introduction

This box summarises the main elements of the agro-economic analysis carried out under the PESETA III project (Pérez Domínguez and Fellmann, 2018), which focuses on the effects of climate change on crop yields and related impacts on EU agricultural production, trade, prices, consumption, income and welfare by 2050. In this project, the central scenario selected was a combination of a 'shared socioeconomic pathway' (SSP2) and a 'representative concentration pathway' (RCP8.5, i.e. a scenario of relatively high GHG emissions). The CAPRI modelling system was used for the economic analysis of the EU agricultural sector. For climate change-related EU-wide biophysical yield shocks, input from the agricultural biophysical modelling of the PESETA III project was used, which provided crop yield changes under water-limited conditions based on high-resolution bias-corrected EURO-CORDEX regional climate models, also taking gridded soil data into account.

MAP 7.7 Biophysical grain maize yield shocks for an RCP 8.5 scenario without enhanced CO_2 fertilization



Source: PESETA III: Agro-economic analysis of climate change impacts in Europe

As agricultural markets are globally connected via world commodity trade, it is important for the agro-economic analysis to also consider climate change-related yield effects outside the EU. The analysis, therefore, was complemented with biophysical yield shocks in non-EU countries from the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP) fast-track database. These CC-related yield changes were aggregated from the grid to the country level within the AgCLIM50 project[87] (see Map 7.7).

Scenario implementation

To simulate and assess the response of key economic variables to the changes in EU and non-EU biophysical crop yields, one reference scenario (without yield shocks) and two specific climate change scenarios were constructed. One scenario had yield shocks under the assumption of long-term benefits from enhanced CO_2 fertilisation[88] and another scenario had yield shocks but without enhanced CO_2 fertilisation. The period covered by the scenarios runs until 2050.

Scenario results are the outcome of the simultaneous interplay of: (i) macroeconomic developments (especially GDP and population growth); (ii) climate change-related biophysical yield shocks in the EU and in non-EU countries; and (iii) the induced and related effects on agricultural production, trade, consumption and prices on domestic and international agricultural markets. The results show that by 2050 the agricultural sector in the EU will have been influenced by both regional climate change and climate-induced changes in competitiveness. Accordingly, the presented impacts on the EU's agricultural sector account both for the direct changes in yield and area caused by climate change and for autonomous adaptation as farmers respond to changing market prices by changing the crop mix and input use.

Prices

Agricultural prices are a useful distinct indicator of the economic effects of climate change on the agricultural sector. In general, the modelled climate change in a global context results in lower EU agricultural crop prices by 2050 in both scenarios, with and without enhanced CO_2 fertilisation. Livestock commodities are not directly affected by climate change in the scenarios provided, but they are affected indirectly as the effects on feed prices and trade are transmitted to dairy and meat production.

In the scenario without enhanced CO_2 fertilisation, aggregated EU crop producer price changes vary between -3 % for cereals (-7 % for wheat) and +5 % for other arable field crops (e.g. pulses and sugar beet). Producer price changes in the livestock sector vary between -6 % for sheep and goat meat (mainly due to an increase in relatively cheaper imports), and +4 % for pigmeat (mainly due to a favourable export environment). In the scenario with enhanced CO_2 fertilisation, EU agricultural producer prices decrease even further for all commodities. This is due to the general increase in EU domestic production, which, compared to the reference scenario and the scenario without enhanced CO_2 fertilisation, will face tougher competition on the world markets, leading to decreases in producer prices.

86 Analysis by Thomas Fellmann and Ignacio Pérez Domínguez, JRC Agricultural Economics Unit. For more details, contact: thomas.fellmann@europa.eu. The analysis is based on a recent publication (Pérez Domínguez, I., Fellmann, T. (2018): PESETA III: Agro-economic analysis of climate change impacts in Europe, JRC Technical Reports, EUR 29431 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-79-97220-1, doi:10.2760/179780).

87 Van Meijl, H., P. Havlik, H. Lotze-Campen, E. Stehfest, P. Witzke, I. Pérez Domínguez, B. Bodirsky, M. van Dijk, J. Doelman, T. Fellmann, F. Humpenoeder, J. Levin-Koopman, C. Mueller, A. Popp, A. Tabeau, H. Valin (2017): Challenges of Global Agriculture in a Climate Change Context by 2050 (AgCLIM50). JRC Science for Policy Report, EUR 28649 EN, doi:10.2760/772445

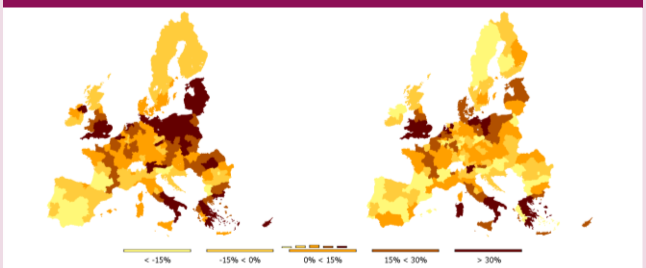
88 The enhanced CO_2 fertilisation effect is the additional increase in the rate of photosynthesis in plants that results from increased levels of carbon dioxide in the atmosphere through climate change. Climatologists and biophysical scientists continue to experience large uncertainties when measuring this effect.

Accordingly, aggregated EU producer prices in the crop sector will drop between -20 % for cereals (-25 % for wheat) and almost -50 % for vegetables and permanent crops. In the EU livestock sector, producer price changes vary between -7.5 % for cow milk and -19 % for beef meat as livestock benefits from cheaper feed prices (and some EU producer prices are further subdued due to increased imports).

Area and production

The harvested area increases for nearly all crops in the scenario without enhanced CO_2 fertilisation, leading to a reduction in set aside areas and fallow land of almost -6 %, and an overall 1 % increase in the EU's total utilised agricultural area (UAA). In the livestock sector, beef, sheep and goat meat activities decrease, both in animal numbers and in production output. This is mainly due to a loss in competitiveness of fodder maize production, the main feed for ruminants, compared to non-EU countries. Conversely, pig and poultry meat production slightly increase, mainly benefiting from the decrease in ruminant meat production and increasing exports. In the scenario with CO_2 fertilisation, production output in the crop sector increases despite a decrease in area, indicating on average stronger (and more positive) EU biophysical yield changes than in the scenario without enhanced CO_2 fertilisation. However, effects on crops can be quite diverse, as for example EU wheat production increases by +18 %, whereas grain maize production decreases by -18 %. Aggregated oilseeds production slightly drops, owing to a -7 % decrease in EU sunflower production, as rapeseed and soya bean production increase by 3 % and 6 % respectively. A positive production effect due to increased CO_2 fertilisation is also evident in fodder activities, mainly grassland, which show an increase in production of 11 % despite an 8 % drop in area. The net effect of the changes in area and production is a drop of -5 % in total EU UAA, and a considerable increase in area of set aside and fallow land (+36 %). The EU livestock sector benefits from lower prices for animal feed, leading to slight production increases.

MAP 7.8 Change in cereal production relative to the reference scenario (%)

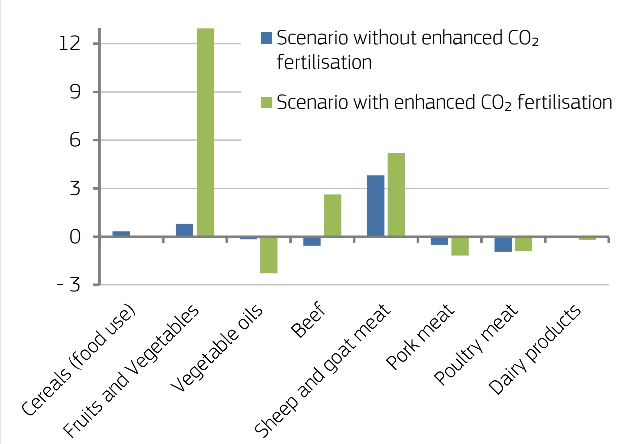


Note: EU-NUTS-2 regions, CC scenarios without enhanced CO2 fertilization (left) and with CO_2 fertilization (right) CO_2 fertilization (left)

Consumption

Agricultural output used for human consumption is determined by the interaction of production, demand and the resulting prices with individual preferences and income. In general, the EU consumption changes provoked by the modelled climate change are of a relatively lower magnitude, and basically follow the changes in consumer prices. In the climate change scenario without enhanced CO_2 fertilisation, consumption of fruit and vegetables increases by about 1 %, whereas meat consumption declines by 0.5 % compared to the REF2050 scenario (see Graph 7.7). However, while beef, pig and poultry meat consumption goes down, consumption of sheep and goat meat increases to the relatively bigger decrease in consumer prices of those types of meat compared to beef meat and the increasing prices for pigmeat and poultry. The scenario with enhanced CO_2 fertilisation in particular shows increases in consumption of fruit and vegetables (almost 13 %). Consumption of beef, sheep and goat meat also rises as they become relatively cheaper compared to pigmeat and poultry.

GRAPH 7.7 Change in EU consumption relative to the reference scenario without climate change (%)



Trade and agricultural income

The EU trade balance improves for most agricultural commodities in both scenario variants, except for beef, sheep and goat meat. Following the changes in production, trade, prices and consumption, the effect on total agricultural income at the aggregated EU level is positive in the scenario without enhanced CO_2 fertilisation (+5 %). In contrast, when enhanced CO_2 fertilisation is considered, a decrease in total agricultural income of 16 % is projected, mainly due to the lower producer prices obtained by farmers. The variance in agricultural income change is, however, quite strong at Member State and regional level. In the scenario without enhanced CO_2 fertilisation, six Member States show a negative income development (Italy, Greece, Croatia, Malta, Slovenia, Finland), but about 67 % NUTS 2 regions experience an income increase. In the scenario with enhanced CO_2 fertilisation, only four Member States would experience an income increase (the Netherlands, the UK, Poland, Cyprus), whereas about 90 % of the NUTS 2 regions experience a reduction of total agricultural income.

Conclusions

Scenario results underline the importance of considering market-driven effects and production adjustments when analysing the impacts of climate change on the agricultural sector. Farmers react to climate change-induced biophysical yield changes by adapting their crop mix and input use. This means that to minimise their losses, farmers will opt to plant more of those crops that show more positive yield effects (or produce them in a more intensive way) and less of the crops that show more negative yield effects (or produce them in a more extensive way). However, this will influence prices, so that for instance producer prices will decrease for crops that are produced more and prices will increase for crops that are produced less. This, in turn, further influences farmers' decisions. Moreover, adjustments also take place outside the EU and in the international trade of agricultural commodities. The market interactions occur simultaneously, with yields and production undergoing further re-adjustment (either downward or upward) depending on the region.

Caveats

The quantitative response of crop yields to elevated CO_2 levels in particular is scientifically still very uncertain. Our results, however, are marked by several uncertainties that go beyond those inherent in any study dealing with future impacts of climate change. For example, technical possibilities for adaptation, like the use of new and different crop varieties, are not taken into account. Moreover, the modelling input for the biophysical yield shocks used for the EU and non-EU countries relies on different combinations of climate change and crop growth models. Consequently, the modelling approach taken for the agro-economic analysis is not fully consistent. Although the approach taken was considered better than ignoring climate change effects in non-EU countries altogether, it led to distortions in the market adjustments and hence in the scenario results. Future agro-economic analysis therefore needs to improve consistency between EU and non-EU biophysical modelling input. Furthermore, future analysis could also consider the direct impacts of climate change on livestock activities.

BOX 7.2 Organic farming and climate change[89]

An expansion of organic farming may affect some of the major sources of GHG emissions associated with agriculture, as well as carbon sequestration. The most significant difference between organic and conventional farming concerns the use of synthetic fertilisers and pesticides. Organic farming uses no synthetic fertilisers and fewer pesticides. Instead, organic farmers rely more on nitrogen-fixing legumes and farmyard manure for crop nutrition. For crop protection, organic farmers count on a much smaller number of chemical plant protection products and more on mechanical and agronomic practices. In addition, organic livestock production can be characterised by divergent breeds, feeds, housing conditions and stocking densities. *What consequences for climate change mitigation could these differences have?*

Evidence of organic farming's impact on climate change is scant. One of the few more established findings is that organic crop production is associated with lower average GHG emissions than conventional farming when compared on a per-hectare basis (Mondelaers et al., 2009, Skinner et al., 2014, Clark and Tilman, 2017). However, hectare-based comparisons will underestimate the impact of expanding organic farming on overall GHG emissions as: (i) organic farming tends to have lower yields than conventional farming (de Ponti et al., 2012, Seufert et al., 2012, Ponisio et al., 2015); and (ii) maintaining agricultural production with lower yields requires farmland expansion. Findings from literature reviews and meta-analyses show no clear, consistent general difference in GHG emissions per unit of output between organic and conventional production, although considerable variation lies behind the average, with organic sometimes emitting less and sometimes emitting more than conventional farming (Mondelaers et al., 2009, Tuomisto et al., 2012, Clark and Tilman, 2017).

Furthermore, many output-based comparisons do not capture all the impacts a conversion from conventional to organic farming would have on GHG emissions. A major limitation is that studies often do not adequately account for the nitrogen supply of organic farming (Connor, 2013, Connor, 2018, Nowak et al., 2013, Kirchmann et al., 2016). In addition, studies have a number of other methodological weaknesses which have prevented them from reaching reliable conclusions about the impact of expanding organic farming on GHG emissions (Leifeld, 2016, Meemken and Qaim, 2018).

Apart from GHG emissions, agriculture's other contribution to climate change and its mitigation is carbon sequestration (and the loss of this). Any serious assessment must account for the deforestation that may occur as a result of expanding arable and pasture land under an organic scenario (forests are usually greater carbon sinks than agricultural lands). The other effect related to sequestration concerns soil organic carbon, i.e. the possibility that carbon sequestration in agricultural soils may differ between organic and conventional practices. However, it is not clear whether there is a difference from a systems perspective if higher soil organic carbon results from adding manure to the soil rather than from a net transfer of atmospheric carbon (Leifeld and Fuhrer, 2010, Gattinger et al., 2012, Gattinger et al., 2013, Leifeld et al., 2013, Kirchmann et al., 2016).

89 The research presented in this box was conducted by Jonas Kathage (JRC, Seville, Spain; contact: jonas.kathage@ec.europa.eu).

References

Clark, M., Tilman, D., 2017. Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. Environmental Research Letters 12: 064016.

Connor, D. J., 2013. Organically grown crops do not a cropping system make and nor can organic agriculture nearly feed the world. Field Crops Research 144: 145-147.

Connor, D. J., 2018. Land required for legumes restricts the contribution of organic agriculture to global food security. Outlook on Agriculture: 0030727018805765.

de Ponti, T., Rijk, B., van Ittersum, M. K., 2012. The crop yield gap between organic and conventional agriculture. Agricultural Systems 108: 1-9.

Gattinger, A., Müller, A., Haeni, M., Skinner, C., Fließbach, A., Buchmann, N., Mäder, P., Stolze, M., Smith, P., Scialabba, N. E.-H., Niggli, U., 2013. Reply to Leifeld et al.: Enhanced top soil carbon stocks under organic farming is not equated with climate change mitigation. Proceedings of the National Academy of Sciences of the United States of America 110: E985-E985.

Gattinger, A., Müller, A., Haeni, M., Skinner, C., Fließbach, A., Buchmann, N., Mäder, P., Stolze, M., Smith, P., Scialabba, N. E.-H., Niggli, U., 2012. Enhanced top soil carbon stocks under organic farming. Proceedings of the National Academy of Sciences 109: 18226.

Kirchmann, H., Kätterer, T., Bergström, L., Börjesson, G., Bolinder, M. A., 2016. Flaws and criteria for design and evaluation of comparative organic and conventional cropping systems. Field Crops Research 186: 99-106.

Leifeld, J., 2016. Current approaches neglect possible agricultural cutback under large-scale organic farming. A comment to Ponisio et al. Proceedings. Biological sciences 283: 20151623.

Leifeld, J., Angers, D. A., Chenu, C., Fuhrer, J., Kätterer, T., Powlson, D. S., 2013. Organic farming gives no climate change benefit through soil carbon sequestration. Proceedings of the National Academy of Sciences 110: E984.

Leifeld, J., Fuhrer, J., 2010. Organic farming and soil carbon sequestration: what do we really know about the benefits? Ambio 39: 585-599.

Meemken, E.-M., Qaim, M., 2018. Organic Agriculture, Food Security, and the Environment. Annual Review of Resource Economics 10: 39-63.

Mondelaers, K., Van Huylenbroeck, G., Aertsens, J., 2009. A meta-analysis of the differences in environmental impacts between organic and conventional farming. British Food Journal 111: 1098-1119.

Nowak, B., Nesme, T., David, C., Pellerin, S., 2013. To what extent does organic farming rely on nutrient inflows from conventional farming? Environmental Research Letters 8: 044045.

Ponisio, L. C., Gonigle, L. K., Mace, K. C., Palomino, J., de Valpine, P., Kremen, C., 2015. Diversification practices reduce organic to conventional yield gap. Proceedings of the Royal Society B: Biological Sciences 282.

Seufert, V., Ramankutty, N., Foley, J. A., 2012. Comparing the yields of organic and conventional agriculture. Nature 485: 229.

Skinner, C., Gattinger, A., Müller, A., Mäder, P., Flieβbach, A., Stolze, M., Ruser, R., Niggli, U., 2014. Greenhouse gas fluxes from agricultural soils under organic and non-organic management — A global meta-analysis. Science of The Total Environment 468-469: 553-563.

Tuomisto, H. L., Hodge, I. D., Riordan, P., Macdonald, D. W., 2012. Does organic farming reduce environmental impacts? — A meta-analysis of European research. Journal of Environmental Management 112: 309-320.

BOX 7.3 Food Waste - Quantifying the market and non-market impacts of EU household food waste reductions[90]

Background

The Sustainable Development Goals (SDGs) are a roadmap for achieving a more environmentally and socially responsible model of global prosperity. In the context of the current research, Goal 12 seeks to foster 'responsible consumption and production', and target 12.3 aims to halve per capita global food waste at retail and consumer levels, and reduce food losses along production and supply chains, including post-harvest losses. Food waste can be seen as an ethical issue and its reduction should, in principle, generate positive effects, both from an economic and an environmental point of view. The European Commission is taking the issue of tackling food waste very seriously and food waste prevention is already an integral part of the new circular economy package. Nevertheless, behavioural changes in food consumption patterns to reduce waste are not costless, and might have negative repercussions on the production chain. The scientific recognition of this issue is also reflected in the growing literature from different academic disciplines, which examines, for example, food waste's causes[91], accounting and measurement[92], prevention and management measures (e.g. prevention, reuse, recycle-recovery)[93] and economic impacts[94].

Estimating food waste in the EU is still an open issue, considering the limited data. Eurostat estimated food waste generation in the EU at 81 million t (161 kg/capita) in 2012 and 76 million t (149 kg/capita) in 2014. The figures are similar to the results from the FUSIONS report (87.6 ± 13.7 million t for 2012). Examining the contribution to total food waste from the different parts of the EU food supply chain, the available literature estimates that household-driven food waste (not including food services such as hotels and restaurants) is the largest portion of EU food waste[95]. For this reason, this research focuses on reducing household food waste. Market impacts of food waste reduction extend beyond the direct impacts on reducing consumption of food and the consequent reduced demand and supply of agriculture and food activities. They also include the ripple effects on upstream input markets and the resulting labour and capital reallocations. Therefore, an economy-wide assessment is favoured, employing a computable general equilibrium model, called MAGNET[96].

Scenario analysis

Comparing with a baseline[97], four food waste reduction scenarios are designed (Table 7.3), reflecting two fundamental market mechanisms. The first of these mechanisms is a downward 'demand shift' due to falling household food consumption while reducing food waste. In addition to a food waste reduction of 50 %, as stipulated in target 12.3 of the SDGs, a more moderate scenario of a 25 % food waste reduction is also considered. The second mechanism is an upward 'supply shift', driven by the hypothesis that behavioural changes in European household food consumption are motivated by adjustments to the logistical, packaging, labelling and administrative traits of the European food supply chain selling domestically (and extra EU producers exporting into the EU). Examples of this include improved labelling schemes to remove misinterpretations, technological improvements to identify microbial risks, improved re-sealable packaging (to reduce water loss), interactive films, and new technologies to reduce oxygen degradation.

TABLE 7.2 % food wasted by EU household per category, 2011.

COMMODITIES	% HH food waste
Fruits	19 %
Vegetables	26 %
Sugar	12 %
Cereals (including bread and pastry)	12 %
Fish	12 %
Meat	19 %
Dairy	8 %

Source: Caldeira, C., V. De Laurentiis, S. Corrado, F. van Holsteijn, S. Sala. Quantification of food waste per product group along the food supply chain in Europe: a Mass Flow Analysis. Submitted to Resources, Conservation and Recycling

Given the paucity of the literature on the implementation costs of such adjustments, we assume that the compliance costs borne by the European food industry (and importers) vary between 1 % of sales (packaging design such as re-closable packs, smaller and subdivided packs, more detailed label advice associated with a limited cost increase) and 5 % of sales (introduction of intelligent packaging linked to high investment costs).

90 Analysis by George Philippidis, Emanuele Ferrari, Robert M'barek and Martina Sartori (JRC, Seville, Spain; contact: emanuele.ferrari@ec.europa.eu).

91 Schanes, K. et al. (2018). Food waste matters — A systematic review of household food waste practices and their policy implications. Journal of Cleaner Production, 182, pp. 978-991.

92 Corrado, S., Sala, S. (2018). Food waste accounting along global and European food supply chains: State of the art and outlook, Waste Management, 79, pp 121-130.

93 Cristobal, J. et al (2018). Prioritising and optimising sustainable measures for food waste prevention and management, Waste Management, 72, pp 3-16.

94 Campoy-Munoz, P. et al. (2017). Economic impact assessment of food waste reduction on European countries through social accounting matrices. Resources, Conservation and Recycling, 122, pp 202-209 and Rutten, M. et al. (2013). Reducing Food Waste by Household and in Retail in the EU: a Prioritisation Using Economic, Land Use and Food Security Impacts. LEI Wagenigen UR.

95 Monier, V. et al. (2011). Preparatory Study on Food Waste across EU 27. European Commission (DG ENV) Directorate C-Industry. 2010. Final Report. ISBN: 978-92-79-22138-5.

96 Woltjer, G.; Kuiper, M. (Eds.) The MAGNET Model-Module description; Report 14-057; LEI Wageningen UR: The Hague, The Netherlands, 2014. http://edepot.wur.nl/310764

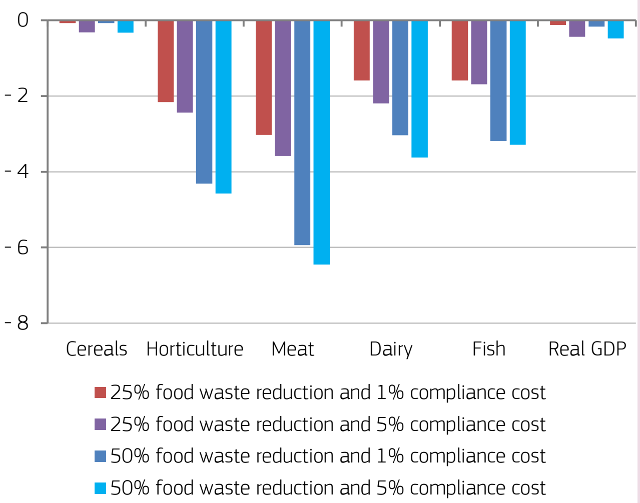
97 Philippidis, G. et al. (2018). The MAGNET Model Framework for Assessing Policy Coherence and SDGs: Application to the Bioeconomy; JRC Technical Reports, European Commission; doi:10.2760/560977.

TABLE 7.3 Food waste scenarios.

	Compliance costs 1%	Compliance costs 5 %
Food waste reduction 25 %	25_1	25_5
Food waste reduction 50 %	50_1	50_5

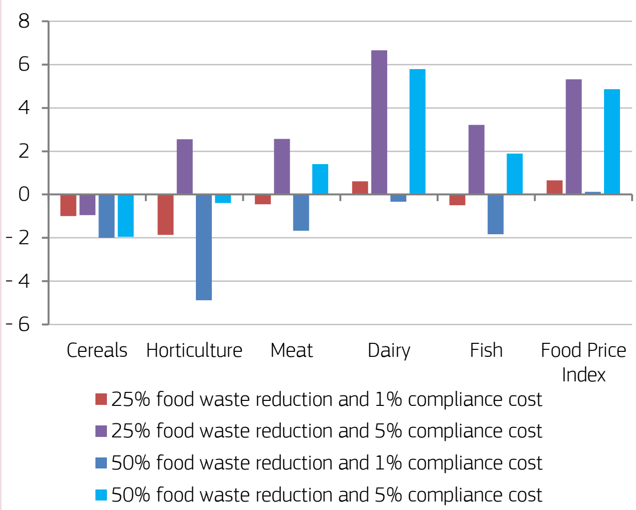
Consistent with previous studies (Rutten, 2013), reducing food waste results in an unambiguous production fall in all agricultural sectors against the baseline (Graph 7.8). The largest decrease affects fruit and vegetables, as well as meat, where the household food waste reduction driver is stronger (Table 7.2). The decrease in dairy and fish is also marked. A negligible real GDP loss is expected in all scenarios (last column). The macroeconomic impacts are in general relatively muted, as the shocks to the economy (household food waste reduction and compliance costs) are localised to a few economic activities.

GRAPH 7.8 Change in EU production trends and real GDP versus baseline, 2020-2030 change (%)



The food price index (Graph 7.9, last column) increases under all scenarios. However, impacts on prices differ across sectors, since price changes are a net effect of opposite forces: demand and supply adjustments, their sensitivity to a change in prices and income and the size of the compliance costs. The demand effect dominates for cereals and other crop sectors, so the price change is always negative. For horticulture, meat and fish, the demand effect is stronger under the scenarios with 1 % compliance costs assumed, as opposed to the scenarios with 5 %. Overall, the compliance cost effect is the strongest driver on food prices, as can be clearly seen for dairy.

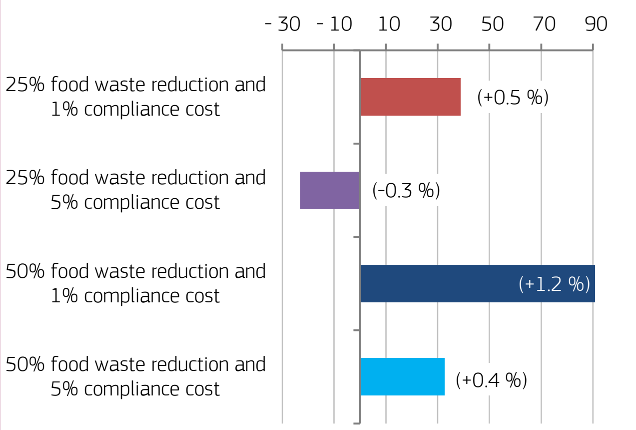
GRAPH 7.9 Change in consumer food prices versus baseline, 2020-2030 change (%)



The reduction in household food waste increases household savings in most scenarios (Graph 7.10). The quantitative effect generated by food waste reduction (i.e. fewer purchases, larger savings) dominates the price effect due to the compliance costs (higher prices, lower savings). Yearly per capita savings are EUR 93 under the 50 % waste reduction and 1 % compliance cost scenario (highest food waste reduction, lowest compliance cost). Under the 25 % and 5 % scenario (lowest food waste reduction, largest compliance cost), they result in a loss of EUR 23.

Household food waste reduction has only a marginal repercussion on the agri-food trade balance, as consumers reduce purchases of imported and domestically produced goods.

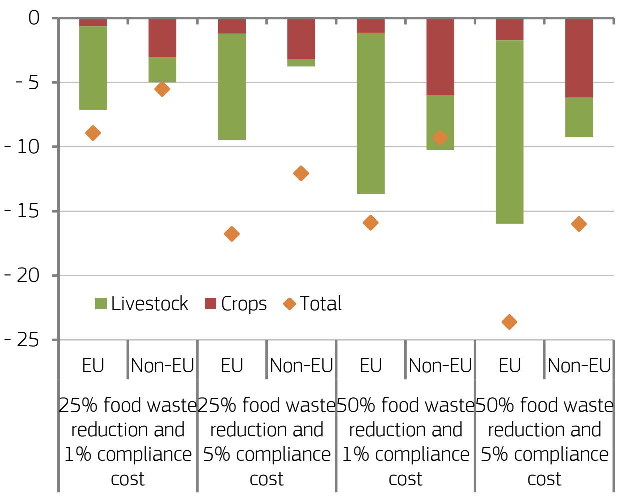
GRAPH 7.10 Change in per capita household expenditure (EUR/year) versus baseline, 2020-2030 change; share over total household expenditure in parenthesis



Among the non-economic impacts, changes in water withdrawals for irrigation and in GHG emissions (Graph 7.11) are closely linked to changes in EU agricultural production. Compared with the baseline, the reduction in water abstraction is between 0.2 % and 0.6 %, for the EU, and approximately 0.06 % to 0.12 % globally.

Total EU (and non-EU) emission reductions are driven by agriculture (crops and livestock). The range of emission reductions in EU agriculture is estimated between -7.1 million tonnes (-1.6 %) and -16 million tonnes (-3.5 %). In relative terms, these falls are moderate compared to the baseline. Livestock, the most emissions-intensive sector, is the biggest contributor to the fall (-2 % up to -4.3 % under the 50_5 scenario), driven by the reduction in meat sales. EU household food waste reduction also has an indirect positive impact on the rest of the world's emissions (-0.1 %).

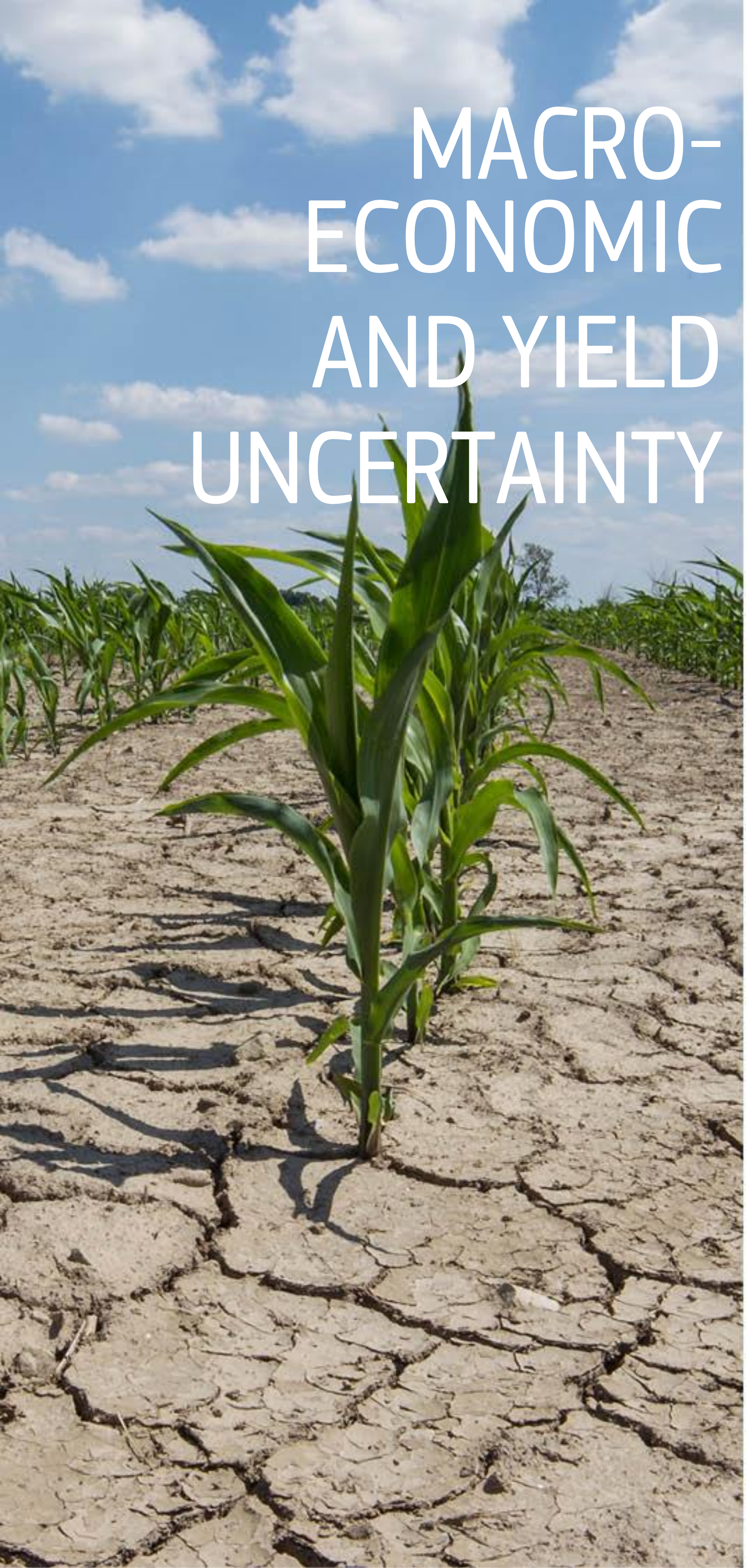
GRAPH 7.11 Change in EU and non-EU GHG emissions (million t) versus baseline, 2020-2030 change



Summary conclusions

Subject to the key market assumptions discussed above, the model shows an unambiguous fall in agri-food production and a negligible macroeconomic impact due to households' food waste reduction. Non-market and environmental indicators (land usage, GHG emissions and water abstraction) improve.

Future research should look at: (i) the distinction between avoidable and unavoidable waste; (ii) pay-offs related to improved logistics and its cost; (iii) the role of food waste in municipal waste management (soil compositing, anaerobic digestion for methane (biogas, electricity etc.)); and (iv) the role and impacts of public policy (e.g. awareness campaigns) on food that are already in place. The income- and job-related impacts on the agricultural sector could also be analysed, as well as the sustainable usage of the released land as part of the bioeconomy.



MACRO-ECONOMIC AND YIELD UNCERTAINTY

/8

The baseline projections presented in this report are deterministic: they are based on a single set of plausible assumptions to generate a single set of outcomes. Those assumptions, which are the result of consultation with internal and external market experts, scientific research, literature, and news reviews, lead to projections that reflect the 'most likely' path of market developments out of many possible trajectories. The procedure described in this chapter takes into account partial uncertainty around specific assumptions and their potential impacts on the projections.

The stochastic modelling process of the Aglink-Cosimo model generates a range of potential market outcomes using the baseline as a reference. Historical uncertainty is used to simulate multiple 'what-if' scenarios that lead to alternative market developments. The procedure pays particular consideration to two groups of variables: macro-economic factors (GDP, inflation, the consumer price index, exchange rates, crude oil price) and crop and milk yields. The analysis is partial in the sense that: (i) it does not capture random variability stemming from factors other than the above (e.g. acreage harvested); and (ii) does not consider other types of uncertainty (e.g. pertaining to model parameters).

UNCERTAINTY ANALYSIS: METHODOLOGY AND RESULTS

Overview of methodology[98]

The implemented procedure can be summarised in three steps:
(i) quantification of historical uncertainty;
(ii) generation of 1 000 potential development paths of yields and macroeconomic factors;
(iii) generation of 1 000 alternative results around the deterministic baseline.

Historical uncertainty of macroeconomic factors and yields was quantified using vector autoregression and non-linear de-trending methods respectively. Uncertainty simulation was performed on the basis of semi-parametric (empirical marginal) copulas. This procedure generated 1 000 sets of alternative values for the stochastic variables over the projection period. The Aglink-Cosimo model executed each one of the 1 000 alternative scenarios. This step was performed twice: one treating only yields as stochastic, and another one treating only macroeconomic variables as stochastic.

Results of the uncertainty analysis, 2018-2030

Some 129 variables were treated stochastically using the variability observed in the period 2000-2017: 82 country-commodity combinations of crop and milk yields, 46 country-specific macroeconomic variables, and the crude oil price (Brent barrel). Those variables are assumed to represent major sources of uncertainty for EU agricultural markets.

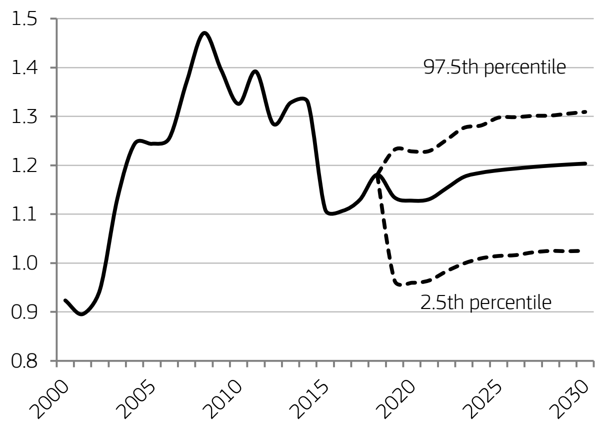
The procedure yielded 993 ('macro' only) and 979 (yields only) successful simulations. The system is a mathematically complex representation of real-world policies and expert judgement. Therefore, extreme shocks in one or several stochastic variables cannot exclude infeasible solutions.

Tables 8.1 and 8.2 summarise the simulated variability of macroeconomic factors and yields by means of the coefficient of variation (CV, %)[99]. Historically, the most uncertain macroeconomic variables have been the oil price, the EUR/USD exchange rate, and inflation in Russia (Table 8.1). On the yield side, the most uncertain EU crop yields are soya bean, maize, sunflower, sugar beet, rye and oats (Table 8.2).

TABLE 8.1 Macroeconomic uncertainty in 2030 (CV, %)

Regions	Consumer price index	GDP deflator	GDP	Exchange rate (home currency/ USD)	Oil price
Australia	0.3	2	1	6	-
Brazil	1	1	1	6	-
Canada	0.2	1	0.4	3	-
China	1	1	1	1	-
EU-28	1	1	1	6	-
India	1	1	1	4	-
Japan	0.4	0.3	1	6	-
New Zealand	0.4	0.4	1	4	-
Russia	1	3	2	6	-
US	0.4	0.3	1	-	-
World	-	-	-	-	21

GRAPH 8.1 Exchange rate (USD/EUR)



Note: Dashed lines depict the 97.5th and 2.5th percentiles from 1 000 stochastic draws.

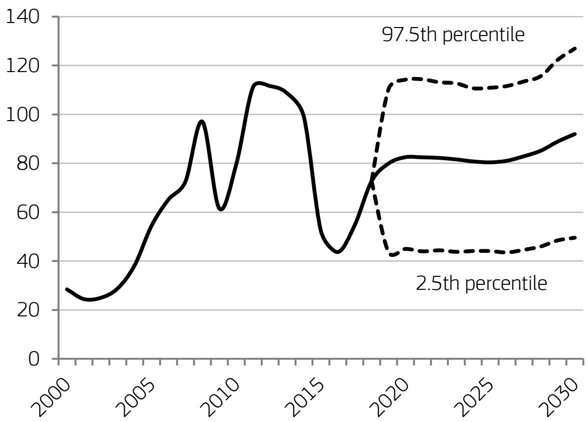
The CV is a relative measure of uncertainty that does not provide information on the actual level of the stochastically treated variables. Therefore, it is also useful to look at the various percentiles of the stochastic results. The area between the dashed lines of Graphs 8.1 and 8.2, for example, shows where the 95 % of the alternative USD/EUR exchange rates and oil prices — that were used as stochastic inputs — lie. Similar

98 For more details, see Araujo Enciso, S., Pieralli, S. and Perez Dominguez, I. (2017): 'Partial Stochastic Analysis with the Aglink-Cosimo Model: A Methodological Overview', EUR 28863 EN, Publications Office of the European Union, Luxembourg, 2017, doi: 10.2760/680976, JRC108837. URL: http://publications.jrc.ec.europa.eu/repository/handle/JRC108837.

99 Coefficient of variation (CV, %) = 100 × standard deviation ÷ mean. CV values differ per variable but are virtually identical across all projection years for the same variable.

graphs with percentiles of various market variables, most notably EU commodity prices, are presented in the corresponding commodity chapters of this report. Another example is Graph 8.3, which shows the relative positioning of baseline prices and production over the whole range of 1 000 stochastic results.

GRAPH 8.2 Oil price (USD/bbl)



Note: Dashed lines depict the 97.5th and 2.5th percentiles from 1 000 stochastic draws

Table 8.3 displays CV values of selected commodity prices at the end of the projection horizon. Macroeconomic and yield uncertainty affect crop and milk prices though market balances: they directly alter production and related costs, with demand, exports, imports and ending stocks adjusting while markets find a new equilibrium. Macroeconomic and yield uncertainties are transferred to other commodities as well, such as livestock products, mainly through feed markets. Important factors in livestock markets include the world crude oil price and the price of protein meals. The main driver of uncertainty for biofuels is the crude oil price, which impacts consumption through policies such as the blending mandate. Moreover, yield developments in vegetable oil markets affect biodiesel production which is of relevance in Europe. From a global perspective, uncertainties in sugar and maize markets have a significant impact on ethanol production, particularly in Brazil and the US. Imports and exports are driven mainly by exchange rates that alter the relative competitiveness of EU commodities on international markets.

Finally, EU prices generally appear to be more uncertain than international prices. International prices are related to domestic prices (incl. EU) through different price transmission mechanisms and typically act as a buffer for market disruptions (as long autarky is not assumed). Overall, uncertainty on the supply side has a larger impact on the results than macroeconomic uncertainty that persists even if both groups are treated simultaneously as stochastic.

GRAPH 8.3 Examples of stochastic EU projections in 2030

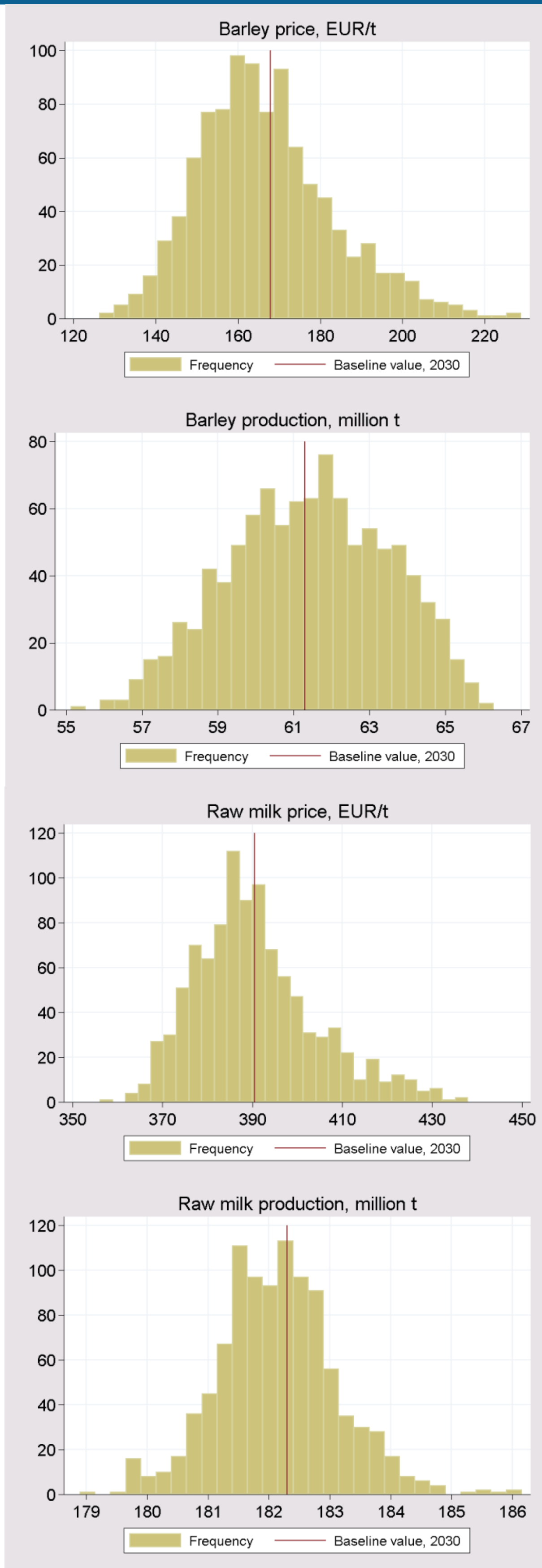


TABLE 8.2 Yield uncertainty in 2030 (CV, %)

Commodities	Argentina	Australia	Brazil	Canada	China	EU-15	EU-N13	India	Indonesia	Kazakhstan	Malaysia	Mexico	New Zealand	Paraguay	Russia	Thailand	Ukraine	USA	Vietnam
Common wheat	**9**	**15**	**9**	**5**	**2**	**4**	**11**	**2**	**1**	**10**	**0.4**	**7**	**0.4**	**7**	**11**	**0.4**	**13**	**3**	**0.4**
Durum wheat	-	-	-	-	-	**5**	**5**	-	-	-	-	-	-	-	-	-	-	-	-
Barley	7	2	-	8	-	4	6	-	-	-	-	1	-	-	0.4	-	-	1	-
Maize	5	1	8	6	1	4	18	0.2	0.3	0.4	0.4	6	1	7	0.4	0.3	16	3	0.4
Milk	1	14	0.4	0.3	0.1	1	1	0.2	0.3	0.2	0.2	0.1	2	0.2	0.4	0.2	-	0.3	0.2
Other coarse grains	3	2	1	7	1	-	-	0.3	0.4	0.3	0.3	1	1	10	0.4	0.3	19	1	0.3
Oats	-	0.4	-	7	-	4	6	-	-	-	-	-	-	-	0.2	-	-	-	-
Rye	-	-	-	-	-	6	9	-	-	-	-	-	-	-	0.1	-	-	-	-
Other cereals	-	-	-	-	-	5	8	-	-	-	-	-	-	-	-	-	-	-	-
Rice	1	0.1	1	-	5	4	1	3	0.1	0.2	0.2	0.1	-	0.2	0.3	1	0.2	5	3
Other oilseeds	20	17	-	3	1	3	9	1	1	12	1	-	-	12	8	1	12	-	1
Soya bean	19	-	4	4	0.4	7	17	0.4	1	6	1	-	-	16	0.3	1	8	5	1
Rapeseed	-	17	-	3	1	3	5	-	-	-	-	-	-	-	0.2	-	-	-	-
Sunflower seed	25	-	-	-	2	4	15	-	-	-	-	-	-	-	9	-	-	-	-
Palm oil	-	-	-	-	-	-	-	0.3	3	-	4	-	-	0.3	-	0.3	-	-	-
Sugar beet	-	-	-	-	2	9	7	0.2	0.3	0.2	-	-	-	-	15	-	0.2	5	-
Sugar cane	20	4	4	-	2	-	-	3	0.3	-	0.2	0.3	-	0.2	-	7	13	5	0.2

TABLE 8.3 Impacts of macroeconomic and yield uncertainty on prices in 2030 (CV, %)

Commodities	EU-28 domestic producer price		International reference price	
Uncertainty	*Macro*	*Yield*	*Macro*	*Yield*
Cereals	5	9	2	7
Wheat	6	11	2	8
Coarse grains	4	8	2	7
Barley	7	10	-	-
Maize	3	7	2	8
Oilseeds	7	16	3	15
Sunflower	6	17	-	-
Rapeseed	8	14	-	-
Soya bean	7	18	3	17
Protein meal	6	11	2	10
Vegetable oils	7	10	2	7
Sugar (white)	6	9	2	4
Ethanol	7	8	6	7
Biodiesel	11	11	9	9
Meats	6	7	1	3
Beef and veal	7	8	2	3
Sheep meat	6	6	1	2
Pigmeat	7	7	2	3
Poultry meat	6	7	1	3
Milk	3	4	-	-
Butter	5	6	3	5
Cheese	3	4	2	3
SMP	3	3	2	2
WMP	4	4	2	2

MARKET OUTLOOK DATA

/9

TABLE 9.1 Baseline assumptions on key macroeconomic variables

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Population growth (EU-28)	**0.1%**	**0.1%**	**0.3%**	**0.3%**	**0.3%**	**0.3%**	**0.3%**	**0.2%**	**0.2%**	**0.0%**	**0.0%**
EU-15	0.2%	0.1%	0.4%	0.5%	0.5%	0.4%	0.4%	0.3%	0.3%	0.1%	0.1%
EU-N13	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.3%	-0.2%	-0.4%	-0.4%
Real GDP growth (EU-28)	**1.6%**	**-0.5%**	**0.2%**	**1.6%**	**2.2%**	**1.9%**	**2.2%**	**2.1%**	**1.6%**	**1.5%**	**1.4%**
EU-15	1.6%	-0.5%	0.2%	1.6%	2.2%	1.9%	2.2%	2.1%	1.6%	1.5%	1.4%
EU-N13	3.1%	0.6%	1.2%	2.9%	3.8%	3.1%	4.6%	4.4%	3.1%	2.7%	2.5%
World	3.1%	2.6%	2.7%	2.9%	3.0%	2.6%	3.3%	3.2%	2.9%	3.1%	2.9%
Inflation (Consumer Price Index) (EU-28)	**3.1%**	**2.6%**	**1.5%**	**0.5%**	**0.0%**	**0.3%**	**1.7%**	**1.9%**	**1.8%**	**1.8%**	**1.8%**
EU-15	2.9%	2.5%	1.5%	0.6%	0.1%	0.3%	1.7%	1.9%	1.7%	1.8%	1.7%
EU-N13	3.7%	3.7%	1.4%	0.2%	-0.4%	-0.2%	1.8%	2.2%	2.5%	2.1%	2.1%
Exchange rate (USD/EUR)	**1.39**	**1.28**	**1.33**	**1.33**	**1.11**	**1.11**	**1.13**	**1.18**	**1.13**	**1.19**	**1.20**
Oil price (USD/ bbl Brent)	**111**	**112**	**109**	**99**	**52**	**44**	**55**	**73**	**83**	**80**	**92**

Sources: DG AGRI estimates based on the European Commission macroeconomic forecasts and IHS Markit

TABLE 9.2 EU cereals market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**292.4**	**281.4**	**307.6**	**331.0**	**314.5**	**299.3**	**309.7**	**286.9**	**310.5**	**317.4**	**324.7**
of which EU-15	202.8	202.0	212.3	225.3	218.4	196.0	203.4	186.5	208.1	209.8	211.7
of which EU-N13	89.6	79.4	95.3	105.8	96.1	103.3	106.3	100.3	102.4	107.7	113.0
Consumption	**280.7**	**277.4**	**277.2**	**285.5**	**286.8**	**287.0**	**289.7**	**289.9**	**292.7**	**297.3**	**301.0**
of which EU-15	224.4	220.0	219.9	227.3	228.7	227.1	230.9	231.0	232.2	235.3	237.8
of which EU-N13	56.3	57.3	57.3	58.2	58.1	59.8	58.7	58.9	60.5	61.9	63.2
of which food and industrial	105.3	105.5	102.2	102.9	102.7	102.0	103.1	102.3	104.8	107.0	108.5
of which feed	167.0	163.2	164.9	172.3	173.3	172.8	174.0	174.4	173.8	176.1	178.3
of which bioenergy	8.5	8.7	10.1	10.3	10.8	12.2	12.6	13.2	14.1	14.2	14.2
Imports	14.4	16.9	19.2	15.6	20.6	19.4	24.4	23.0	24.0	23.0	22.3
Exports	25.2	31.6	43.5	51.7	50.8	38.2	33.5	32.0	40.0	43.1	46.6
Beginning stocks	39.4	40.2	29.5	35.6	45.1	42.5	36.0	46.9	39.6	44.5	44.0
Ending stocks	40.2	29.5	35.6	45.1	42.5	36.0	46.9	34.9	41.4	44.6	43.5
of which intervention	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stock-to-use ratio	*14%*	*11%*	*13%*	*16%*	*15%*	*13%*	*16%*	*12%*	*14%*	*15%*	*14%*

Note: the cereals marketing year is July/June

TABLE 9.3 EU wheat market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**139.7**	**134.3**	**144.3**	**157.4**	**160.9**	**144.6**	**152.5**	**138.4**	**151.9**	**156.6**	**161.6**
of which EU-15	104.0	100.9	104.7	113.9	115.9	98.7	105.5	95.4	106.2	107.8	109.7
of which EU-N13	35.7	33.4	39.6	43.5	45.0	45.9	47.0	42.9	45.7	48.7	51.9
Consumption	**130.4**	**119.5**	**116.0**	**126.9**	**130.7**	**127.2**	**127.9**	**130.4**	**128.7**	**131.6**	**133.6**
of which EU-15	108.5	98.8	95.3	104.9	108.3	105.1	105.7	107.9	106.4	108.9	110.5
of which EU-N13	21.9	20.7	20.7	22.0	22.5	22.1	22.2	22.5	22.3	22.8	23.1
of which food and industrial	70.8	70.0	69.0	70.1	70.3	70.1	70.2	70.3	71.0	72.3	73.2
of which feed	55.0	45.2	42.6	52.5	56.0	52.7	53.0	54.9	52.4	54.1	55.3
of which bioenergy	4.6	4.3	4.4	4.4	4.5	4.5	4.7	5.2	5.2	5.2	5.2
Imports	7.1	5.3	3.7	5.7	6.6	5.0	5.5	6.1	5.2	5.2	5.2
Exports	15.7	21.7	31.1	34.6	34.0	26.6	22.4	21.2	27.5	30.2	33.2
Beginning stocks	11.0	11.8	10.2	11.0	12.7	15.5	11.3	19.0	14.5	16.7	16.7
Ending stocks	11.8	10.2	11.0	12.7	15.5	11.3	19.0	11.9	15.5	16.7	16.7
of which intervention	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: the wheat marketing year is July/June

TABLE 9.4 EU common wheat market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**131.1**	**125.9**	**136.2**	**149.7**	**152.5**	**135.0**	**143.1**	**129.7**	**143.4**	**148.1**	**153.2**
of which EU-15	95.7	92.7	96.8	106.4	107.8	89.5	96.5	87.2	97.9	99.6	101.6
of which EU-N13	35.4	33.2	39.4	43.3	44.7	45.4	46.6	42.5	45.5	48.5	51.6
Consumption	**120.8**	**110.6**	**107.3**	**118.2**	**121.5**	**117.7**	**117.7**	**120.8**	**119.3**	**122.1**	**124.0**
of which EU-15	100.8	91.8	88.5	98.1	100.9	97.5	97.4	100.3	99.0	101.3	103.0
of which EU-N13	20.0	18.8	18.8	20.1	20.5	20.2	20.2	20.5	20.3	20.7	21.0
of which food and industrial	61.4	61.3	60.4	61.5	61.5	61.2	60.8	61.6	62.0	63.2	63.9
of which feed	54.9	45.0	42.6	52.4	55.5	52.0	52.2	54.0	52.0	53.7	54.9
of which bioenergy	4.6	4.3	4.4	4.4	4.5	4.5	4.7	5.2	5.2	5.2	5.2
Imports	5.4	3.8	1.8	2.9	4.1	3.3	4.0	4.0	3.1	2.9	2.8
Exports	14.3	20.3	30.0	33.3	32.8	25.2	21.3	20.0	26.3	29.0	32.0
Beginning stocks	9.6	11.0	9.7	10.5	11.5	13.8	9.2	17.3	12.9	15.0	15.0
Ending stocks	11.0	9.7	10.5	11.5	13.8	9.2	17.3	10.2	13.8	15.0	15.0
of which intervention	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yield	**5.5**	**5.4**	**5.8**	**6.1**	**6.3**	**5.6**	**6.1**	**5.7**	**6.0**	**6.2**	**6.4**
of which EU-15	6.4	6.4	6.8	7.1	7.2	6.1	6.8	6.4	6.8	6.9	7.0
of which EU-N13	4.1	3.8	4.3	4.6	4.7	4.7	5.1	4.6	4.8	5.1	5.4
EU price in EUR/t	**204**	**251**	**197**	**179**	**160**	**166**	**162**	**181**	**177**	**179**	**180**
World price in EUR/t	**219**	**231**	**240**	**205**	**194**	**176**	**187**	**193**	**206**	**197**	**195**
World price in USD/t	305	297	318	272	215	194	211	229	233	234	234
EU intervention price in EUR/t	**101**	**101**	**101**	**101**	**101**	**101**	**101**	**101**	**101**	**101**	**101**

Note: the common wheat marketing year is July/June

TABLE 9.5 EU durum wheat market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**8.6**	**8.4**	**8.0**	**7.7**	**8.4**	**9.7**	**9.4**	**8.6**	**8.5**	**8.5**	**8.4**
of which EU-15	8.3	8.2	7.9	7.5	8.1	9.2	9.0	8.2	8.3	8.2	8.1
of which EU-N13	0.3	0.2	0.2	0.2	0.3	0.5	0.4	0.4	0.2	0.3	0.3
Consumption	**9.6**	**8.9**	**8.7**	**8.7**	**9.2**	**9.5**	**10.2**	**9.5**	**9.4**	**9.5**	**9.6**
of which EU-15	7.7	7.0	6.8	6.8	7.3	7.6	8.3	7.6	7.4	7.5	7.5
of which EU-N13	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.1
of which food and industrial	9.4	8.7	8.6	8.6	8.7	8.9	9.4	8.7	9.0	9.1	9.2
of which feed	0.2	0.2	0.1	0.1	0.5	0.7	0.9	0.9	0.4	0.4	0.4
of which bioenergy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Imports	1.7	1.5	1.9	2.8	2.5	1.7	1.5	2.1	2.1	2.3	2.4
Exports	1.4	1.4	1.1	1.2	1.2	1.4	1.1	1.2	1.2	1.2	1.2
Beginning stocks	1.5	0.8	0.4	0.6	1.2	1.7	2.1	1.7	1.7	1.7	1.7
Ending stocks	0.8	0.4	0.6	1.2	1.7	2.1	1.7	1.7	1.7	1.7	1.7
Yield	**3.4**	**3.2**	**3.4**	**3.4**	**3.4**	**3.5**	**3.5**	**3.5**	**3.5**	**3.6**	**3.7**
of which EU-15	3.4	3.2	3.4	3.3	3.4	3.4	3.5	3.5	3.5	3.6	3.7
of which EU-N13	4.0	2.9	3.7	4.1	4.4	4.8	4.2	3.8	3.7	3.8	3.9

Note: the durum wheat marketing year is July/June

TABLE 9.6 EU barley market balance sheet (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**51.9**	**55.0**	**61.1**	**60.7**	**61.9**	**60.0**	**59.1**	**56.9**	**61.5**	**61.4**	**61.4**
of which EU-15	41.6	44.4	49.9	48.8	50.5	48.4	47.4	46.3	49.7	49.5	49.3
of which EU-N13	10.3	10.6	11.2	11.9	11.5	11.5	11.7	10.5	11.8	11.9	12.0
Consumption	**48.4**	**49.7**	**49.0**	**48.3**	**48.7**	**53.7**	**52.0**	**48.2**	**50.9**	**50.8**	**50.9**
of which EU-15	38.1	39.3	38.8	37.8	38.5	42.5	41.1	37.8	39.7	39.6	39.7
of which EU-N13	10.3	10.5	10.2	10.5	10.3	11.1	10.8	10.4	11.2	11.2	11.2
of which food and industrial	12.0	12.2	12.0	12.0	12.0	12.1	12.2	11.6	12.2	12.2	12.3
of which feed	36.1	37.2	36.6	35.9	36.3	41.2	39.3	36.1	38.1	37.9	37.9
of which bioenergy	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.6	0.6	0.7
Imports	0.4	0.1	0.0	0.1	0.3	0.4	0.5	0.5	0.4	0.3	0.3
Exports	5.7	7.8	8.8	12.7	14.2	8.7	9.0	8.0	10.2	10.8	11.3
Beginning stocks	9.4	7.6	5.1	8.5	8.4	7.7	5.6	4.3	6.2	8.8	8.4
Ending stocks	7.6	5.1	8.5	8.4	7.7	5.6	4.3	5.5	7.0	8.9	7.9
of which intervention	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yield	**4.4**	**4.4**	**4.9**	**4.9**	**5.1**	**4.9**	**4.9**	**4.5**	**5.0**	**5.1**	**5.2**
of which EU-15	4.6	4.7	5.2	5.1	5.4	5.1	5.1	4.8	5.2	5.3	5.4
of which EU-N13	3.5	3.4	4.1	4.1	4.1	4.1	4.4	3.7	4.2	4.4	4.6
EU price in EUR/t	**199**	**224**	**175**	**168**	**153**	**140**	**157**	**175**	**156**	**165**	**168**
World price in EUR/t	**195**	**231**	**185**	**156**	**159**	**143**	**148**	**148**	**146**	**155**	**157**
World price in USD/t	272	297	246	207	176	158	167	175	164	184	190

Note: the barley marketing year is July/June

TABLE 9.7 EU maize market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**70.7**	**59.6**	**67.0**	**78.0**	**59.3**	**63.1**	**65.8**	**62.1**	**63.9**	**66.0**	**68.0**
of which EU-15	41.8	39.4	38.2	43.9	34.3	31.9	34.0	29.7	34.4	34.6	34.8
of which EU-N13	29.0	20.2	28.9	34.1	25.0	31.2	31.8	32.4	29.5	31.4	33.3
Consumption	**71.4**	**75.3**	**78.5**	**77.7**	**74.4**	**71.1**	**76.1**	**79.7**	**79.9**	**81.1**	**82.5**
of which EU-15	54.7	57.2	60.3	59.9	57.0	53.3	58.6	61.0	61.1	61.9	62.8
of which EU-N13	16.7	18.2	18.2	17.9	17.5	17.8	17.6	18.7	18.7	19.2	19.6
of which food and industrial	14.3	15.1	13.1	12.7	12.5	12.0	12.7	11.3	13.2	14.0	14.7
of which feed	54.4	57.2	61.2	60.4	57.3	53.1	57.2	61.9	59.7	60.2	60.9
of which bioenergy	2.7	3.0	4.3	4.7	4.7	6.0	6.2	6.5	6.9	6.9	6.9
Imports	6.3	11.0	15.0	9.4	13.3	13.6	17.8	16.0	17.9	17.0	16.3
Exports	3.5	1.8	3.1	4.0	2.2	2.7	1.8	2.5	1.9	1.9	1.9
Beginning stocks	14.0	16.2	9.6	10.0	15.7	11.6	14.5	20.1	16.0	16.0	16.0
Ending stocks	16.2	9.6	10.0	15.7	11.6	14.5	20.1	16.0	16.0	16.0	16.0
of which intervention	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yield	**7.6**	**6.1**	**6.9**	**8.1**	**6.4**	**7.4**	**7.9**	**7.6**	**7.5**	**7.9**	**8.2**
of which EU-15	10.3	9.3	8.9	10.5	9.2	9.4	10.1	8.8	9.9	10.1	10.3
of which EU-N13	5.5	3.6	5.3	6.3	4.5	6.0	6.3	6.7	5.9	6.3	6.8
EU price in EUR/t	**206**	**236**	**177**	**154**	**158**	**166**	**154**	**161**	**156**	**166**	**169**
World price in EUR/t	**205**	**233**	**153**	**129**	**148**	**140**	**131**	**134**	**149**	**147**	**145**
World price in USD/t	285	299	203	172	164	156	148	159	168	175	174

Note: the maize marketing year is July/June

TABLE 9.8 EU coarse grains market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**152.7**	**147.1**	**163.3**	**173.7**	**153.6**	**154.7**	**157.2**	**148.5**	**158.6**	**160.9**	**163.1**
of which EU-15	98.8	101.1	107.7	111.4	102.5	97.3	97.9	91.1	101.9	101.9	102.0
of which EU-N13	53.9	46.0	55.7	62.3	51.0	57.4	59.3	57.4	56.7	58.9	61.1
Consumption	**150.3**	**157.9**	**161.2**	**158.6**	**156.1**	**159.7**	**161.8**	**159.5**	**164.0**	**165.6**	**167.3**
of which EU-15	115.9	121.3	124.6	122.4	120.5	122.0	125.2	123.1	125.8	126.5	127.2
of which EU-N13	34.4	36.6	36.6	36.2	35.6	37.7	36.6	36.4	38.3	39.2	40.1
of which food and industrial	34.5	35.5	33.2	32.8	32.5	31.9	32.9	32.0	33.8	34.7	35.3
of which feed	112.0	118.0	122.3	119.9	117.4	120.1	120.9	119.5	121.4	122.0	123.1
of which bioenergy	3.9	4.4	5.7	5.9	6.3	7.7	7.9	8.0	8.9	9.0	9.0
Imports	7.2	11.6	15.5	9.9	14.0	14.4	18.9	17.0	18.7	17.8	17.1
Exports	9.5	9.9	12.4	17.1	16.9	11.6	11.1	10.9	12.5	12.9	13.4
Beginning stocks	28.4	28.4	19.3	24.6	32.4	27.0	24.6	27.8	25.1	27.7	27.3
Ending stocks	28.4	19.3	24.6	32.4	27.0	24.6	27.8	22.9	25.9	27.9	26.7
of which intervention	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: the coarse grains marketing year is July/June

TABLE 9.9 EU other cereals* market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**30.1**	**32.5**	**35.2**	**35.0**	**32.3**	**31.6**	**32.3**	**29.5**	**33.2**	**33.5**	**33.7**
of which EU-15	15.5	17.3	19.6	18.7	17.7	17.0	16.5	15.0	17.8	17.9	17.9
of which EU-N13	14.6	15.2	15.6	16.3	14.6	14.6	15.8	14.5	15.4	15.6	15.8
Consumption	**30.6**	**32.8**	**33.7**	**32.6**	**32.9**	**35.0**	**33.7**	**31.6**	**33.3**	**33.8**	**34.0**
of which EU-15	23.2	24.8	25.5	24.7	25.0	26.2	25.5	24.3	24.9	24.9	24.7
of which EU-N13	7.4	8.0	8.2	7.9	7.9	8.7	8.2	7.4	8.4	8.8	9.3
of which food and industrial	8.2	8.2	8.1	8.1	7.9	7.9	8.0	9.0	8.4	8.5	8.3
of which feed	21.5	23.6	24.5	23.6	23.8	25.8	24.4	21.5	23.5	23.8	24.3
of which bioenergy	0.9	1.0	1.1	1.0	1.2	1.3	1.3	1.1	1.4	1.4	1.4
Imports	0.5	0.6	0.4	0.4	0.4	0.4	0.6	0.5	0.5	0.5	0.5
Exports	0.2	0.2	0.5	0.4	0.4	0.2	0.3	0.4	0.4	0.2	0.2
Yield	**3.2**	**3.4**	**3.6**	**3.8**	**3.6**	**3.6**	**3.6**	**3.3**	**3.7**	**3.8**	**3.9**
Beginning stocks	4.9	4.7	4.7	6.1	8.4	7.7	4.5	3.4	2.8	2.9	2.8
Ending stocks	4.7	4.7	6.1	8.4	7.7	4.5	3.4	1.4	2.9	2.9	2.8

* Rye, oats and other cereals
Note: the other cereals marketing year is July/June

TABLE 9.10 EU rice balance (million t milled equivalent)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**1.8**	**1.8**	**1.7**	**1.7**	**1.8**	**1.8**	**1.7**	**1.8**	**1.7**	**1.7**	**1.7**
of which EU-15	1.7	1.8	1.7	1.6	1.7	1.7	1.7	1.7	1.7	1.6	1.6
of which EU-N13	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Consumption	**2.4**	**2.5**	**2.5**	**2.7**	**2.8**	**2.7**	**2.8**	**2.7**	**2.7**	**2.8**	**2.8**
of which EU-15	1.9	2.0	2.0	2.2	2.3	2.2	2.3	2.1	2.1	2.2	2.2
of which EU-N13	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
Imports	0.8	0.9	0.9	1.2	1.4	1.2	1.3	1.2	1.2	1.3	1.4
Exports	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3
Beginning stocks	0.5	0.5	0.5	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.6
Ending stocks	0.5	0.5	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6
Yield	**3.7**	**4.0**	**4.0**	**3.9**	**4.1**	**4.0**	**4.0**	**4.0**	**4.0**	**4.1**	**4.1**
EU price in EUR/t *	618	593	511	578	596	613	621	621	597	666	689
World price in EUR/t	406	458	402	327	356	367	365	348	351	371	380
World price in USD/t	565	588	534	435	395	407	412	412	396	442	458

* in milled equivalent
Note: the rice marketing year is September/August

TABLE 9.11 EU oilseed* (grains and beans) market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**29.0**	**27.4**	**31.5**	**35.4**	**32.1**	**31.3**	**34.9**	**32.2**	**34.3**	**35.9**	**37.3**
of which EU-15	17.7	17.5	18.0	20.2	18.7	16.7	18.2	16.4	18.3	18.9	19.3
of which EU-N13	11.3	9.9	13.5	15.2	13.4	14.6	16.7	15.8	16.0	17.0	18.0
Rapeseed	19.2	19.2	21.0	24.3	21.8	20.1	22.0	19.7	22.0	22.5	22.8
Sunflower seed	8.6	7.2	9.3	9.3	7.9	8.7	10.4	9.7	9.4	10.0	10.6
Soya beans	1.2	1.0	1.2	1.8	2.4	2.5	2.6	2.8	2.9	3.4	3.8
Consumption	**44.5**	**44.7**	**48.3**	**49.9**	**50.7**	**50.3**	**53.1**	**51.6**	**52.9**	**54.5**	**56.6**
of which EU-15	37.5	37.7	39.8	40.5	41.9	41.5	43.4	42.5	43.8	45.0	46.7
of which EU-N13	7.0	7.0	8.5	9.4	8.8	8.7	9.7	9.1	9.1	9.5	9.9
of which crushing	40.6	40.9	44.7	45.8	46.4	45.6	48.6	47.1	48.4	49.8	51.7
Imports	16.6	16.7	18.1	16.4	19.4	19.7	19.3	20.3	19.1	19.3	20.1
Exports	0.9	0.6	1.1	1.3	0.9	0.9	1.0	1.0	0.8	0.7	0.7
Beginning stocks	3.5	3.7	2.4	2.6	3.2	3.1	2.9	3.0	2.9	2.5	2.4
Ending stocks	3.7	2.4	2.6	3.2	3.1	2.9	3.0	3.0	2.7	2.5	2.3
EU price in EUR/t (rapeseed)	462	475	382	351	370	393	397	386	415	426	441
World price in EUR/t (soya bean)	443	438	404	369	364	391	354	333	357	364	376
World price in USD/t (soya bean)	562	551	521	407	396	404	400	394	403	433	452

* Rapeseed, soya bean, sunflower seed and groundnuts
Note: the oilseed marketing year is July/June

TABLE 9.12 EU oilseed meal* market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**25.2**	**25.7**	**28.1**	**28.3**	**29.2**	**28.7**	**30.6**	**30.1**	**30.3**	**31.3**	**32.6**
of which EU-15	21.6	22.0	23.6	23.4	24.5	24.0	25.4	25.2	25.5	26.3	27.4
of which EU-N13	3.6	3.7	4.4	4.9	4.7	4.6	5.2	4.9	4.8	5.0	5.2
Consumption	**48.9**	**45.7**	**49.4**	**49.6**	**52.0**	**49.8**	**52.0**	**51.8**	**52.2**	**53.4**	**55.2**
of which EU-15	40.3	37.2	40.8	41.0	43.3	40.9	42.9	42.7	43.1	44.3	45.9
of which EU-N13	8.6	8.6	8.6	8.6	8.8	9.0	9.1	9.1	9.1	9.2	9.3
Imports	24.9	21.1	22.1	22.3	23.8	22.2	22.7	22.7	23.1	23.3	23.6
Exports	1.2	1.1	0.9	1.0	1.0	1.1	1.3	1.0	1.2	1.1	1.0
Beginning stocks	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Ending stocks	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
EU price in EUR/t (soya meal)	390	428	424	380	355	360	356	342	367	376	390
World price in EUR/t	304	386	365	282	295	282	275	264	284	291	301
World price in USD/t	423	496	484	375	328	312	311	313	320	346	363

* Rapeseed- soya bean-, sunflower seed- and groundnut-based protein meals
Note: the oilseed meal marketing year is July/June

TABLE 9.13 EU oilseed oil* market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**14.3**	**14.2**	**15.6**	**16.2**	**15.9**	**15.7**	**17.0**	**16.1**	**16.7**	**17.1**	**17.7**
of which EU-15	11.6	11.6	12.4	12.6	12.6	12.4	13.3	12.6	13.3	13.5	14.0
of which EU-N13	2.6	2.6	3.2	3.5	3.3	3.3	3.7	3.4	3.4	3.6	3.7
Consumption	**15.4**	**14.1**	**15.4**	**16.1**	**16.2**	**16.1**	**17.7**	**16.4**	**17.1**	**17.7**	**18.2**
of which EU-15	12.8	11.7	12.6	13.3	13.4	13.3	14.9	13.6	14.2	14.7	15.2
of which EU-N13	2.5	2.4	2.8	2.8	2.8	2.8	2.8	2.8	2.9	2.9	3.0
Imports	2.1	1.6	1.6	1.6	2.0	2.2	2.2	1.9	2.1	2.1	2.2
Exports	1.0	1.7	1.5	1.7	1.7	1.7	1.5	1.6	1.7	1.7	1.7
Beginning stocks	0.8	0.8	0.8	1.1	1.1	1.0	1.1	1.0	0.9	0.9	0.9
Ending stocks	0.8	0.8	1.1	1.1	1.0	1.1	1.0	1.0	0.9	0.9	0.9
EU price in EUR/t (rapeseed oil)	962	918	731	669	710	786	748	728	756	767	773
World price in EUR/t (vegetable oil)	842	782	689	555	667	721	719	700	725	752	753
World price in USD/t (vegetable oil)	1172	1005	915	737	740	798	813	829	817	895	906

* Rapeseed- soya bean-, sunflower seed- and groundnut-based oils.
Note: the oilseed meal marketing year is July/June

TABLE 9.14 EU vegetable oil* market balance (million t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**14.3**	**14.4**	**15.7**	**16.3**	**16.0**	**15.8**	**17.0**	**16.2**	**16.8**	**17.2**	**17.8**
of which EU-15	11.7	11.7	12.5	12.7	12.7	12.5	13.4	12.7	13.4	13.6	14.1
of which EU-N13	2.6	2.6	3.2	3.5	3.3	3.3	3.7	3.4	3.4	3.6	3.7
Consumption	**21.8**	**21.5**	**23.5**	**24.1**	**24.5**	**24.0**	**26.1**	**24.6**	**25.1**	**25.4**	**25.5**
of which EU-15	18.9	18.7	20.4	20.9	21.3	20.9	23.0	21.5	21.9	22.1	22.1
of which EU-N13	2.9	2.8	3.1	3.2	3.2	3.1	3.1	3.1	3.2	3.3	3.3
of which food and other use	13.0	12.7	14.1	13.4	14.1	13.8	15.9	14.2	14.4	15.2	15.5
of which bioenergy	8.7	8.7	9.5	10.7	10.4	10.2	10.3	10.5	10.7	10.2	9.9
Imports	8.7	9.0	9.8	9.8	10.3	10.2	10.7	10.3	10.2	9.9	9.5
Exports	1.3	1.9	1.6	1.9	1.8	1.9	1.7	1.8	1.9	1.9	1.9
Beginning stocks	1.2	1.2	1.2	1.6	1.6	1.5	1.5	1.4	1.3	1.3	1.3
Ending stocks	1.2	1.2	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.3

* Rapeseed- soya bean-, sunflower seed- and groundnut-based oils plus cottonseed oil, palm oil, palm kernel oil and coconut oil
Note: the oilseed meal marketing year is July/June

TABLE 9.15 EU oilseed yields (t/ha)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Rapeseed	**2.8**	**3.1**	**3.1**	**3.6**	**3.4**	**3.1**	**3.3**	**2.9**	**3.2**	**3.4**	**3.4**
of which EU-15	3.3	3.4	3.4	3.9	3.7	3.2	3.5	3.1	3.6	3.7	3.7
of which EU-N13	2.2	2.4	2.8	3.2	2.9	3.0	2.9	2.6	2.8	2.9	3.0
Sunflower seed	**2.0**	**1.7**	**2.0**	**2.2**	**1.9**	**2.1**	**2.5**	**2.3**	**2.2**	**2.3**	**2.4**
of which EU-15	1.9	1.6	1.7	1.8	1.6	1.7	2.0	1.8	1.8	1.8	1.8
of which EU-N13	2.0	1.7	2.2	2.4	2.1	2.3	2.7	2.6	2.5	2.6	2.7
Soya beans	**2.8**	**2.2**	**2.6**	**3.2**	**2.7**	**3.0**	**2.8**	**3.0**	**2.9**	**2.9**	**3.0**
of which EU-15	3.2	2.8	3.0	3.6	3.2	3.3	3.1	3.3	3.3	3.3	3.3
of which EU-N13	2.2	1.6	2.0	2.6	1.9	2.5	2.3	2.6	2.4	2.4	2.5

TABLE 9.16 EU area under arable crops (million ha)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Cereals	**56.7**	**57.6**	**57.6**	**57.9**	**57.3**	**56.8**	**55.5**	**55.1**	**56.3**	**55.7**	**55.2**
of which EU-15	34.5	34.9	34.9	35.2	34.7	34.4	33.7	33.1	34.1	33.7	33.4
of which EU-N13	22.2	22.8	22.7	22.8	22.6	22.4	21.8	22.0	22.2	22.0	21.9
Common wheat	23.7	23.3	23.4	24.4	24.3	24.3	23.4	22.9	23.8	23.9	24.1
Durum wheat	2.5	2.6	2.4	2.3	2.4	2.8	2.7	2.5	2.5	2.4	2.3
Barley	11.9	12.5	12.4	12.4	12.2	12.3	12.0	12.5	12.4	12.1	11.8
Maize	9.3	9.8	9.8	9.6	9.3	8.5	8.4	8.2	8.5	8.4	8.3
Rye	2.2	2.4	2.7	2.2	2.0	1.9	2.0	2.0	2.2	2.1	2.0
Other cereals	7.1	7.1	7.0	7.0	7.1	7.0	7.0	7.1	6.9	6.8	6.7
Rice	**0.5**	**0.5**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**
Oilseeds	**11.6**	**11.0**	**11.8**	**11.5**	**11.6**	**11.5**	**11.9**	**12.0**	**12.0**	**12.2**	**12.3**
of which EU-15	6.2	6.0	6.3	6.1	6.1	5.9	5.9	6.0	6.0	6.0	6.0
of which EU-N13	5.4	4.9	5.5	5.5	5.5	5.6	6.0	6.0	6.0	6.2	6.4
Rapeseed	6.7	6.2	6.7	6.7	6.5	6.5	6.7	6.9	6.8	6.7	6.6
Sunflower seed	4.4	4.3	4.6	4.3	4.2	4.1	4.2	4.2	4.2	4.3	4.4
Soya beans	0.4	0.4	0.5	0.6	0.9	0.8	1.0	0.9	1.0	1.2	1.3
Sugar beet	1.6	1.7	1.6	1.6	1.4	1.5	1.8	1.7	1.7	1.6	1.6
Roots and tubers	1.9	1.8	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.4	1.3
Pulses	1.6	1.4	1.3	1.5	2.1	2.4	2.6	2.4	2.5	2.6	2.7
other arable crops	2.0	3.3	3.4	4.7	4.6	5.0	5.6	6.4	5.2	5.3	5.1
Fodder (green maize, temp. grassland etc.)	22.2	21.1	21.6	20.8	21.0	20.9	21.1	21.0	21.1	21.3	21.6
Utilised arable area	**98.1**	**98.4**	**99.4**	**100.2**	**100.1**	**100.0**	**100.4**	**100.6**	**100.6**	**100.5**	**100.3**
set-aside and fallow land	7.9	7.8	7.0	6.8	6.7	6.6	6.6	6.6	6.4	5.9	5.5
Share of fallow land	*8.0%*	*7.9%*	*7.0%*	*6.8%*	*6.7%*	*6.6%*	*6.6%*	*6.5%*	*6.3%*	*5.9%*	*5.5%*
Total arable area	**106.0**	**106.1**	**106.4**	**107.1**	**106.8**	**106.7**	**107.0**	**107.1**	**107.0**	**106.5**	**105.8**
Permanent grassland	61.6	60.5	60.0	59.6	60.5	60.5	60.0	59.6	59.4	58.9	58.5
Share of permanent grassland in UAA	*34.4%*	*33.9%*	*33.7%*	*33.4%*	*33.8%*	*33.8%*	*33.6%*	*33.4%*	*33.4%*	*33.3%*	*33.3%*
Orchards and others	11.7	11.6	11.7	11.7	11.7	11.6	11.6	11.5	11.5	11.3	11.2
Total utilised agricultural area	**179.4**	**178.2**	**178.1**	**178.4**	**179.0**	**178.8**	**178.5**	**178.3**	**177.8**	**176.7**	**175.5**

TABLE 9.17 EU biofuels market balance sheet (million t oil equivalent)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**11.7**	**12.2**	**13.1**	**14.3**	**14.2**	**14.2**	**14.4**	**14.9**	**15.3**	**15.1**	**15.6**
Ethanol	3.2	3.3	3.5	3.5	3.6	3.7	3.8	4.0	4.2	4.3	4.6
...based on wheat	1.0	0.9	0.9	1.0	1.1	1.1	1.1	1.3	1.3	1.2	1.3
...based on maize	1.1	1.3	1.4	1.4	1.4	1.4	1.4	1.5	1.6	1.6	1.6
...based on other cereals	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
...based on sugar beet and molasses	0.8	0.8	0.9	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.0
...advanced	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4
Biodiesel	8.5	8.9	9.6	10.8	10.6	10.5	10.6	10.9	11.1	10.9	11.0
...based on rape oils	4.7	4.7	5.3	5.8	5.6	5.4	5.4	5.6	5.7	5.5	5.6
...based on palm oils	2.1	2.1	2.1	2.6	2.6	2.6	2.5	2.5	2.7	2.4	2.2
...based on other vegetable oils	0.6	0.6	0.6	0.8	0.7	0.8	0.8	0.8	0.8	0.7	0.7
...based on waste oils	1.0	1.4	1.5	1.6	1.7	1.7	1.8	1.8	1.9	2.0	2.0
...other advanced	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.6
Consumption	**15.0**	**15.4**	**14.6**	**15.2**	**15.3**	**31.7**	**16.4**	**16.4**	**17.0**	**16.6**	**16.5**
Ethanol for fuel	2.8	2.7	2.7	2.9	2.9	2.9	3.0	3.0	3.2	3.3	3.3
non fuel use of ethanol	*1.3*	*1.4*	*1.4*	*1.3*	*1.3*	*1.3*	*1.2*	*1.3*	*1.3*	*1.3*	*1.3*
Biodiesel	10.9	11.3	10.4	10.9	11.0	11.1	12.1	12.2	12.5	12.0	11.9
Net trade	**-3.6**	**-2.9**	**-1.4**	**-1.0**	**-1.1**	**-0.9**	**-2.7**	**-2.3**	**-1.8**	**-1.4**	**-1.0**
Ethanol imports	1.0	0.8	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.3
Ethanol exports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Biodiesel imports	2.7	2.4	0.9	0.6	0.8	0.7	2.6	2.5	2.2	1.9	1.6
Biodiesel exports	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.6	0.8	0.8	0.8
Gasoline consumption	92.7	86.9	84.4	84.1	82.8	82.2	82.0	82.5	82.2	73.9	64.8
Diesel consumption	188.4	184.1	185.5	189.5	194.6	200.4	199.9	201.3	200.6	181.0	159.2
Biofuels energy share	**5.3**	**5.8**	**5.5**	**5.7**	**5.7**	**5.7**	**6.1**	**6.1**	**6.3**	**7.0**	**8.2**
Energy share: 1st-generation	4.5	4.7	4.3	4.5	4.4	4.4	4.7	4.7	4.8	5.1	5.5
Energy share: based on waste oils	0.4	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.9	1.2
Energy share: other advanced	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Energy share: Ethanol in Gasoline	3.1	3.2	3.3	3.5	3.6	3.7	3.7	3.7	3.9	4.5	5.2
Energy share: Biodiesel in Diesel	5.8	6.2	5.6	5.8	5.7	5.6	6.1	6.1	6.3	6.7	7.5
Ethanol producer price in EUR/hl	58	60	58	50	47	51	55	55	59	64	69
Biodiesel producer price in EUR/hl	96	92	85	72	72	79	81	79	81	78	83

Note: the biofuel marketing year is October/September

TABLE 9.18 EU sugar market balance (million t white sugar equivalent)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Sugar beet production (million t)	**125.0**	**114.1**	**109.0**	**131.0**	**101.9**	**112.4**	**142.8**	**126.2**	**124.4**	**125.4**	**126.9**
of which EU-15	104.7	93.5	88.8	106.7	84.6	89.0	117.0	104.4	101.9	102.8	104.2
of which EU-N13	20.3	20.6	20.2	24.3	17.3	23.4	25.8	21.8	22.5	22.6	22.8
of which for ethanol	12.7	12.3	12.6	12.7	12.7	13.6	14.2	14.8	14.4	14.5	14.6
of which processed for sugar	112.3	101.8	96.4	118.4	89.2	98.8	128.6	111.3	110.0	110.9	112.3
Sugar production*	***18.9***	***17.5***	***16.7***	***19.5***	***14.9***	***16.8***	***21.1***	***18.6***	***18.4***	***18.8***	***19.3***
Sugar quota	13.5	13.5	13.5	13.5	13.5	13.5	0.0	0.0	0.0	0.0	0.0
of which EU-15	15.6	14.2	13.5	15.8	12.3	13.3	17.3	15.2	15.0	15.3	15.8
of which EU-N13	3.3	3.3	3.2	3.7	2.6	3.5	3.9	3.4	3.4	3.5	3.5
Consumption	**19.0**	**19.0**	**19.1**	**19.4**	**18.5**	**17.7**	**18.6**	**18.5**	**18.3**	**18.0**	**17.7**
Imports	3.3	3.6	3.1	2.7	2.9	2.4	1.3	1.3	1.5	1.5	1.2
Exports	2.1	1.3	1.4	1.4	1.4	1.3	3.3	2.1	1.8	2.2	2.8
Beginning stocks**	1.2	2.4	3.2	2.6	4.0	1.9	2.2	2.7	1.9	1.8	1.9
Ending stocks**	2.4	3.2	2.6	4.0	1.9	2.2	2.7	1.9	1.7	1.8	1.9
EU white sugar price in EUR/t	679	722	602	432	430	488	386	389	403	394	401
World white sugar price in EUR/t	440	392	344	283	416	429	314	307	358	358	363
World white sugar price in USD/t	612	504	457	376	462	475	392	417	404	426	437

* Sugar production is adjusted for carry forward quantities and does not include ethanol feedstock quantities.
** Stocks include carry forward quantities.
Note: the sugar marketing year is October/September

TABLE 9.19 EU isoglucose market balance (million t white sugar equivalent)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Isoglucose production	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.6**	**0.6**	**0.8**	**0.9**	**1.0**
of which EU-15	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2
of which EU-N13	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.7	0.8
Isoglucose quota	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Isoglucose consumption	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.6**	**0.6**	**0.7**	**0.9**	**1.0**
share in Sweetener use (%)	*3.6*	*3.5*	*3.5*	*3.3*	*3.4*	*3.7*	*2.9*	*3.0*	*3.8*	*4.6*	*5.3*
Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exports	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0

Note: the isoglucose marketing year is October/September

TABLE 9.20 EU milk market balance

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Dairy cows (million heads)	**23.1**	**23.0**	**23.3**	**23.3**	**23.4**	**23.3**	**23.1**	**23.0**	**22.8**	**22.3**	**21.9**
of which EU-15	17.4	17.6	17.8	17.9	18.1	18.1	17.9	17.9	17.8	17.7	17.6
of which EU-N13	5.6	5.5	5.4	5.4	5.2	5.2	5.1	5.1	4.9	4.6	4.3
Milk yield (kg/cow)	**6 464**	**6 496**	**6 489**	**6 737**	**6 861**	**6 894**	**7 082**	**7 151**	**7 341**	**7 783**	**8 240**
of which EU-15	7 137	7 082	7 040	7 272	7 358	7 374	7 568	7 636	7 784	8 130	8 482
of which EU-N13	4 388	4 621	4 684	4 951	5 134	5 209	5 376	5 452	5 742	6 457	7 255
Dairy cow milk production (million t)	**149.0**	**149.7**	**150.9**	**157.1**	**160.3**	**160.5**	**163.2**	**164.4**	**167.3**	**173.9**	**180.6**
of which EU-15	124.2	124.3	125.4	130.4	133.5	133.7	135.8	136.6	138.9	144.1	149.3
of which EU-N13	24.8	25.4	25.5	26.6	26.8	26.9	27.4	27.8	28.4	29.9	31.4
Total cow milk production (million t)	**152.4**	**152.7**	**153.9**	**159.7**	**162.9**	**162.9**	**165.6**	**166.6**	**169.4**	**175.8**	**182.2**
of which EU-15	124.5	124.5	125.7	130.7	133.8	133.9	136.0	136.8	139.1	144.3	149.5
of which EU-N13	27.9	28.2	28.3	29.0	29.2	29.0	29.6	29.8	30.3	31.5	32.7
Delivered to dairies (million t)	**140.6**	**141.0**	**141.9**	**148.9**	**152.8**	**153.4**	**156.3**	**157.5**	**160.5**	**167.7**	**175.1**
of which EU-15	121.4	121.0	122.0	127.4	130.9	131.2	133.4	134.2	136.6	141.9	147.2
of which EU-N13	19.2	20.0	19.9	21.5	21.9	22.2	22.9	23.3	23.9	25.8	27.9
On-farm use and direct sales (million t)	11.8	11.7	12.0	10.8	10.1	9.5	9.3	9.1	8.9	8.1	7.1
of which EU-15	3.1	3.6	3.6	3.3	2.9	2.7	2.6	2.6	2.5	2.4	2.3
of which EU-N13	8.7	8.2	8.4	7.5	7.3	6.8	6.7	6.5	6.4	5.7	4.9
Delivery ratio (%)	**92.3**	**92.3**	**92.2**	**93.2**	**93.8**	**94.2**	**94.4**	**94.5**	**94.7**	**95.4**	**96.1**
of which EU-15	97.5	97.1	97.1	97.5	97.9	98.0	98.1	98.1	98.2	98.4	98.5
of which EU-N13	68.8	71.0	70.2	74.1	75.1	76.5	77.4	78.0	78.9	81.9	85.1
Fat content of milk (%)	4.0	4.0	4.0	4.0	4.0	4.1	4.1	4.0	4.0	4.1	4.1
Non-fat solid content of milk (%)	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.4	9.4
EU milk producer price in EUR/t (real fat content)	340	327	365	372	308	284	349	336	343	359	391

TABLE 9.21 EU fresh dairy products market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**46 812**	**46 706**	**46 816**	**46 480**	**46 809**	**46 290**	**46 237**	**46 096**	**45 974**	**45 867**	**45 611**
of which EU-15	40 572	40 428	40 431	40 058	40 194	39 639	39 443	39 167	38 877	38 429	38 111
of which EU-N13	6 240	6 279	6 385	6 422	6 615	6 651	6 793	6 929	7 097	7 439	7 500
of which fresh milk	31 851	31 733	31 790	31 366	31 275	30 703	30 585	30 372	30 093	29 556	29 308
of which cream	2 419	2 516	2 583	2 639	2 741	2 750	2 781	2 827	2 876	2 977	3 076
of which yogurt	8 203	8 129	8 077	7 967	8 056	7 954	7 945	7 976	8 014	8 041	8 051
Net trade	**388**	**573**	**641**	**791**	**950**	**1 153**	**1 108**	**1 168**	**1 203**	**1 532**	**1 475**
Consumption	**46 423**	**46 134**	**46 175**	**45 689**	**45 859**	**45 136**	**45 129**	**44 928**	**44 771**	**44 335**	**44 136**
of which fresh milk	31 706	31 371	31 459	30 808	30 596	29 871	29 851	29 601	29 285	28 718	28 422
of which cream	2 315	2 427	2 482	2 520	2 625	2 606	2 607	2 657	2 693	2 769	2 841
of which yogurt	8 175	8 065	8 000	7 907	8 000	7 899	7 866	7 879	7 903	7 919	7 919
per capita consumption (kg)	**81.9**	**81.4**	**81.0**	**80.1**	**80.2**	**78.3**	**78.0**	**77.2**	**76.2**	**74.7**	**74.0**
of which EU-15	103.5	102.8	102.2	100.9	100.9	98.4	97.9	96.7	95.3	93.0	91.7
of which EU-N13	48.7	48.1	49.3	48.0	48.0	49.2	49.7	51.2	53.0	56.1	59.1
of which fresh milk	56.9	56.5	56.1	55.2	54.8	53.1	52.7	52.0	51.1	49.7	49.0
of which cream	3.8	4.0	4.1	4.2	4.2	4.1	4.1	4.2	4.2	4.3	4.3
of which yogurt	13.3	13.1	13.0	12.8	12.8	12.5	12.4	12.4	12.3	12.2	12.1

TABLE 9.22 EU cheese market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**9 391**	**9 605**	**9 367**	**9 554**	**9 866**	**10 024**	**10 217**	**10 416**	**10 754**	**11 176**	**11 528**
of which EU-15	8 105	8 233	7 971	8 143	8 397	8 490	8 621	8 786	9 080	9 385	9 604
of which EU-N13	1 286	1 371	1 396	1 411	1 469	1 534	1 596	1 630	1 674	1 791	1 924
Consumption	**8 793**	**8 914**	**8 655**	**8 864**	**9 179**	**9 355**	**9 505**	**9 614**	**9 853**	**10 173**	**10 341**
of which EU-15	7 532	7 635	7 353	7 526	7 753	7 842	7 949	8 008	8 148	8 349	8 467
of which EU-N13	1 260	1 279	1 302	1 339	1 426	1 513	1 557	1 606	1 706	1 824	1 873
per capita consumption (kg)	**17.4**	**17.7**	**17.1**	**17.5**	**18.0**	**18.3**	**18.6**	**18.7**	**19.1**	**19.7**	**20.0**
of which EU-15	18.9	19.1	18.3	18.7	19.2	19.3	19.5	19.6	19.8	20.1	20.3
of which EU-N13	12.0	12.2	12.4	12.8	13.6	14.5	15.0	15.5	16.5	17.9	18.8
Imports	74	77	75	77	61	71	60	60	59	60	61
Exports	672	768	786	721	719	800	830	842	935	1 064	1 249
EU market price in EUR/t (Cheddar)	**3 179**	**3 399**	**3 661**	**3 765**	**3 096**	**2 860**	**3 392**	**3 300**	**3 512**	**3 579**	**3 751**
World market price in EUR/t	**3 103**	**2 976**	**3 299**	**3 368**	**3 007**	**2 791**	**3 406**	**3 124**	**3 490**	**3 499**	**3 645**
World market price in USD/t	4 319	3 823	4 381	4 474	3 336	3 090	3 848	3 700	3 935	4 164	4 388

TABLE 9.23 EU butter market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**2 102**	**2 165**	**2 124**	**2 239**	**2 309**	**2 339**	**2 331**	**2 332**	**2 384**	**2 493**	**2 601**
of which EU-15	1 875	1 915	1 874	1 978	2 032	2 041	2 028	2 028	2 065	2 136	2 197
of which EU-N13	227	250	250	261	277	299	303	304	319	357	404
Consumption	**1 981**	**2 054**	**2 034**	**2 100**	**2 130**	**4 331**	**2 175**	**2 187**	**2 216**	**2 287**	**2 359**
of which EU-15	1 736	1 781	1 749	1 806	1 806	1 824	1 853	1 862	1 877	1 919	1 960
of which EU-N13	245	273	285	294	324	332	322	325	340	369	399
per capita consumption (kg)	**3.9**	**4.1**	**4.0**	**4.1**	**4.2**	**8.5**	**4.2**	**4.3**	**4.3**	**4.4**	**4.6**
of which EU-15	4.4	4.5	4.4	4.5	4.5	4.5	4.5	4.5	4.6	4.6	4.7
of which EU-N13	2.3	2.6	2.7	2.8	3.1	3.2	3.1	3.1	3.3	3.6	4.0
Imports	32	33	21	25	3	3	3	8	12	15	15
Exports	124	124	116	135	172	206	168	160	180	221	258
Ending Stocks	**80**	**100**	**95**	**125**	**135**	**115**	**106**	**100**	**100**	**100**	**100**
of which private	80	100	95	125	135	115	105	100	100	100	100
of which intervention	0	0	0	0	0	0	1	0	0	0	0
EU market price in EUR/t (EU-15)	**3 797**	**3 062**	**3 869**	**3 418**	**3 020**	**3 230**	**5 091**	**5 145**	**4 382**	**4 177**	**4 023**
World market price in EUR/t	**3 222**	**2 583**	**3 023**	**2 825**	**2 869**	**2 937**	**4 748**	**4 181**	**3 949**	**3 811**	**3 761**
World market price in USD/t	4 485	3 318	4 015	3 753	3 183	3 251	5 364	4 950	4 454	4 535	4 527
EU intervention price in EUR/t	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**	**2 218**

TABLE 9.24 EU SMP market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**1 096**	**1 107**	**1 109**	**1 457**	**1 537**	**1 569**	**1 530**	**1 536**	**1 577**	**1 699**	**1 820**
of which EU-15	954	951	959	1 235	1 324	1 351	1 328	1 334	1 367	1 445	1 508
of which EU-N13	142	156	150	222	213	218	202	203	210	254	312
Consumption	**689**	**675**	**697**	**722**	**740**	**776**	**797**	**830**	**809**	**858**	**916**
of which EU-15	602	587	579	616	628	653	634	647	633	664	702
of which EU-N13	87	88	119	105	111	123	163	182	175	193	213
Imports	0	2	5	2	3	4	2	2	2	2	2
Exports	515	520	407	648	692	575	781	804	815	843	907
Ending Stocks	**157**	**70**	**80**	**170**	**279**	**501**	**456**	**361**	**110**	**110**	**110**
of which private	107	70	80	170	250	150	80	195	110	110	110
of which intervention	50	0	0	0	29	351	376	166	0	0	0
EU market price in EUR/t (EU-15)	**2 369**	**2 345**	**3 011**	**2 691**	**1 856**	**1 791**	**1 772**	**1 480**	**1 981**	**2 237**	**2 645**
World market price in EUR/t	**2 629**	**2 461**	**3 312**	**2 825**	**1 951**	**1 802**	**1 813**	**1 754**	**2 009**	**2 253**	**2 668**
World market price in USD/t	3 660	3 163	4 399	3 753	2 165	1 994	2 048	2 077	2 265	2 680	3 211

TABLE 9.25 EU WMP market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**682**	**649**	**724**	**756**	**676**	**730**	**776**	**727**	**726**	**747**	**774**
of which EU-15	630	594	666	695	624	682	732	688	688	709	736
of which EU-N13	52	55	57	61	52	47	44	39	38	38	38
Consumption	**296**	**266**	**353**	**368**	**280**	**354**	**384**	**375**	**382**	**403**	**425**
of which EU-15	261	231	310	330	247	319	349	343	349	365	381
of which EU-N13	35	35	42	38	33	36	35	31	33	38	44
Imports	2	3	3	1	4	6	2	2	4	4	4
Exports	388	386	374	390	400	381	394	354	349	348	353
EU market price in EUR/t (EU-15)	**2 995**	**2 735**	**3 526**	**3 051**	**2 393**	**2 352**	**2 921**	**2 650**	**2 958**	**3 170**	**3 463**
World market price in EUR/t	**2 786**	**2 517**	**3 537**	**2 836**	**2 229**	**2 190**	**2 739**	**2 500**	**2 779**	**2 971**	**3 250**
World market price in USD/t	3 878	3 234	4 698	3 768	2 474	2 424	3 095	2 961	3 134	3 536	3 912

TABLE 9.26 EU whey market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**1 746**	**1 865**	**1 919**	**1 854**	**1 903**	**1 806**	**1 902**	**1 941**	**1 991**	**2 049**	**2 114**
of which EU-15	1 539	1 622	1 654	1 605	1 634	1 561	1 654	1 687	1 728	1 769	1 816
of which EU-N13	207	243	265	250	269	245	248	254	264	280	299
Consumption	**1 289**	**1 381**	**1 411**	**1 359**	**1 372**	**1 262**	**1 351**	**1 378**	**1 390**	**1 401**	**1 402**
Imports	4	7	8	8	7	10	15	15	4	4	4
Exports	461	492	516	504	538	553	566	578	605	652	717
EU market price in EUR/t	**896**	**962**	**1 017**	**964**	**755**	**708**	**866**	**800**	**872**	**983**	**1 131**
World market price in EUR/t	**928**	**988**	**1 035**	**988**	**791**	**681**	**902**	**825**	**867**	**1 052**	**1 197**
World market price in USD/t	1 292	1 269	1 375	1 312	877	754	1 019	976	977	1 252	1 441

TABLE 9.27 EU beef and veal meat market balance (1 000 t c.w.e.)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Total number cows (million head)	**35.2**	**35.1**	**35.2**	**35.4**	**35.7**	**35.6**	**35.4**	**35.2**	**34.9**	**34.2**	**33.5**
of which dairy cows	23.1	23.0	23.3	23.3	23.4	23.3	23.1	23.0	22.8	22.3	21.9
of which suckler cows	12.2	12.0	11.9	12.0	12.3	12.3	12.3	12.2	12.1	11.8	11.6
Gross Indigenous Production	**8 183**	**7 855**	**7 488**	**7 655**	**7 835**	**8 070**	**8 107**	**8 236**	**8 132**	**7 852**	**7 738**
of which EU-15	7 268	6 975	6 654	6 756	6 870	7 040	7 026	7 132	7 052	6 801	6 718
of which EU-N13	916	880	834	899	965	1 031	1 081	1 104	1 080	1 051	1 020
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	147	159	109	114	178	219	238	242	238	219	200
Net Production	**8 036**	**7 697**	**7 379**	**7 541**	**7 657**	**7 852**	**7 869**	**7 994**	**7 894**	**7 633**	**7 538**
Consumption	**7 995**	**7 761**	**7 523**	**7 641**	**7 743**	**7 907**	**7 884**	**8 044**	**7 967**	**7 756**	**7 664**
of which EU-15	7 441	7 268	7 089	7 139	7 235	7 349	7 305	7 459	7 377	7 176	7 094
of which EU-N13	554	493	434	502	508	557	579	585	589	580	570
per capita cons. (kg r.w.e.)*	**11.1**	**10.8**	**10.4**	**10.5**	**10.6**	**10.8**	**10.8**	**11.0**	**10.8**	**10.5**	**10.4**
of which EU-15	13.1	12.7	12.4	12.4	12.5	12.7	12.5	12.7	12.5	12.1	11.9
of which EU-N13	3.7	3.3	2.9	3.4	3.4	3.7	3.9	3.9	4.0	4.0	4.0
Imports (meat)	287	275	304	308	300	304	285	303	315	341	350
Exports (meat)	327	210	160	208	211	249	271	250	243	217	227
Net trade (meat)	**41**	**-65**	**-143**	**-100**	**-89**	**-55**	**-14**	**-53**	**-72**	**-124**	**-124**
EU market price in EUR/t	**3 521**	**3 838**	**3 816**	**3 676**	**3 772**	**3 675**	**3 797**	**3 836**	**3 685**	**3 496**	**3 535**
World market price in EUR/t (BR)	**3 460**	**3 496**	**3 257**	**3 399**	**3 722**	**3 466**	**3 582**	**3 247**	**3 054**	**2 959**	**2 980**
World market price in USD/t (BR)	4 816	4 492	4 326	4 515	4 130	3 836	4 047	3 967	3 444	3 521	3 587

* r.w.e. = retail weight equivalent; Coefficient to transform carcass weight into retail weight is 0.7 for beef and veal.

TABLE 9.28 EU sheep and goat meat market balance (1 000 t c.w.e.)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Gross Indigenous Production	**944**	**910**	**900**	**899**	**907**	**914**	**922**	**902**	**908**	**927**	**949**
of which EU-15	822	791	782	776	790	785	795	783	788	797	809
of which EU-N13	122	119	118	123	117	129	127	119	120	130	140
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	22	27	34	36	38	52	50	40	40	35	25
Net Production	**922**	**883**	**866**	**863**	**869**	**862**	**872**	**862**	**868**	**892**	**924**
Consumption	**1 129**	**1 049**	**1 029**	**1 019**	**1 052**	**1 046**	**1 010**	**1 007**	**1 029**	**1 076**	**1 108**
of which EU-15	1 037	961	946	935	973	962	928	926	947	997	1 030
of which EU-N13	92	88	83	84	79	84	82	81	81	80	78
per capita cons. (kg r.w.e.)*	**2.0**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.7**	**1.7**	**1.8**	**1.8**	**1.9**
of which EU-15	2.3	2.1	2.1	2.0	2.1	2.1	2.0	2.0	2.0	2.1	2.2
of which EU-N13	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Imports (meat)	222	190	200	189	202	203	173	175	189	216	220
Exports (meat)	15	25	36	32	20	19	34	29	28	31	35
Net trade (meat)	**-207**	**-166**	**-164**	**-157**	**-183**	**-184**	**-139**	**-146**	**-161**	**-184**	**-185**
EU market price in EUR/t	**4 978**	**4 980**	**4 889**	**5 080**	**5 097**	**4 938**	**4 987**	**5 602**	**5 255**	**5 254**	**5 169**
World market price in EUR/t	**3 529**	**4 010**	**2 929**	**3 406**	**3 310**	**3 214**	**3 519**	**3 463**	**3 227**	**3 247**	**3 225**
World market price in USD/t	4 912	5 152	3 890	4 525	3 672	3 558	3 975	4 466	3 640	3 863	3 881

* r.w.e. = retail weight equivalent; Coefficient to transform carcass weight into retail weight is 0.88 for sheep and goat meat.

TABLE 9.29 EU pigmeat market balance (1 000 t c.w.e.)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Gross Indigenous Production	**23 251**	**22 750**	**22 581**	**22 772**	**23 464**	**23 884**	**23 668**	**24 031**	**23 809**	**23 751**	**23 604**
of which EU-15	19 805	19 533	19 479	19 489	20 095	20 407	20 244	20 494	20 355	20 161	19 985
of which EU-N13	3 446	3 217	3 102	3 283	3 368	3 478	3 423	3 537	3 454	3 590	3 619
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	62	36	26	35	21	10	13	17	20	20	20
Net Production	**23 189**	**22 714**	**22 555**	**22 737**	**23 443**	**23 875**	**23 655**	**24 015**	**23 789**	**23 731**	**23 584**
Consumption	**21 018**	**20 543**	**20 333**	**20 803**	**21 237**	**21 073**	**21 102**	**21 399**	**21 301**	**21 161**	**20 961**
of which EU-15	16 460	16 249	16 236	16 350	16 563	16 329	16 276	16 446	16 440	16 407	16 306
of which EU-N13	4 558	4 294	4 097	4 453	4 673	4 744	4 826	4 953	4 861	4 754	4 655
per capita cons. (kg r.w.e.)*	**32.5**	**31.8**	**31.3**	**32.0**	**32.5**	**32.2**	**32.1**	**32.5**	**32.2**	**31.9**	**31.6**
of which EU-15	32.2	31.7	31.6	31.6	31.9	31.3	31.1	31.3	31.1	30.8	30.5
of which EU-N13	33.7	31.8	30.4	33.1	34.9	35.5	36.2	37.2	36.7	36.5	36.4
Imports (meat)	18	20	16	14	11	12	14	16	24	34	44
Exports (meat)	2 189	2 191	2 239	1 948	2 218	2 814	2 567	2 631	2 512	2 605	2 667
Net trade (meat)	**2 171**	**2 171**	**2 222**	**1 934**	**2 207**	**2 802**	**2 553**	**2 616**	**2 488**	**2 571**	**2 623**
EU market price in EUR/t	**1 532**	**1 705**	**1 753**	**1 564**	**1 396**	**1 460**	**1 653**	**1 398**	**1 526**	**1 529**	**1 536**
Brazilian producer price in EUR/t	**1 148**	**1 075**	**1 164**	**1 297**	**1 012**	**973**	**1 136**	**872**	**1 023**	**1 046**	**1 050**
Brazilian producer price in USD/t	1 597	1 381	1 546	1 723	1 123	1 078	1 283	1 032	1 154	1 245	1 264
US market price in EUR/t	**1 454**	**1 451**	**1 477**	**1 752**	**1 386**	**1 277**	**1 368**	**1 134**	**1 311**	**1 287**	**1 306**
US market price in USD/t	2 024	1 864	1 961	2 328	1 538	1 413	1 546	1 343	1 479	1 531	1 571

* r.w.e. = retail weight equivalent; Coefficient to transform carcass weight into retail weight is 0.78 for pigmeat.

TABLE 9.30 EU poultry meat market balance (1 000 t c.w.e.)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Gross Indigenous Production	**12 382**	**12 717**	**12 804**	**13 263**	**13 787**	**14 494**	**14 571**	**14 889**	**14 985**	**15 228**	**15 475**
of which EU-15	9 721	9 855	9 852	10 090	10 317	10 691	10 677	10 800	10 808	10 887	10 966
of which EU-N13	2 661	2 862	2 952	3 173	3 470	3 803	3 893	4 089	4 177	4 341	4 509
Consumption	**11 922**	**12 233**	**12 285**	**12 719**	**13 254**	**13 829**	**13 818**	**14 074**	**14 300**	**14 415**	**14 554**
of which EU-15	9 574	9 796	9 842	10 207	10 614	11 018	11 009	11 234	11 451	11 534	11 645
of which EU-N13	2 349	2 438	2 443	2 512	2 640	2 810	2 809	2 840	2 848	2 880	2 910
per capita cons. (kg r.w.e.)*	**20.8**	**21.3**	**21.4**	**22.0**	**22.9**	**23.8**	**23.7**	**24.1**	**24.4**	**24.5**	**24.8**
of which EU-15	21.1	21.6	21.6	22.3	23.1	23.8	23.7	24.1	24.4	24.4	24.6
of which EU-N13	19.6	20.4	20.5	21.1	22.2	23.7	23.7	24.1	24.2	24.9	25.7
Imports (meat)	831	841	792	821	855	882	789	766	920	949	950
Exports (meat)	1 290	1 325	1 311	1 365	1 388	1 548	1 542	1 580	1 605	1 763	1 871
Net trade (meat)	**459**	**483**	**520**	**544**	**533**	**665**	**752**	**815**	**685**	**814**	**920**
EU market price in EUR/t	**1 865**	**1 912**	**1 950**	**1 910**	**1 875**	**1 779**	**1 819**	**1 913**	**1 888**	**1 869**	**1 858**
World market price in EUR/t	**1 496**	**1 503**	**1 516**	**1 460**	**1 480**	**1 384**	**1 463**	**1 340**	**1 424**	**1 410**	**1 404**
World market price in USD/t	2 083	1 931	2 014	1 940	1 642	1 532	1 653	1 546	1 606	1 678	1 690

* r.w.e. = retail weight equivalent; Coefficient to transform carcass weight into retail weight is 0.88 for poultry meat.

TABLE 9.31 Aggregate EU meat market balance (1 000 t c.w.e.)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Gross Indigenous Production	**44 760**	**44 232**	**43 773**	**44 589**	**45 992**	**47 362**	**47 267**	**48 057**	**47 834**	**47 758**	**47 765**
of which EU-15	37 616	37 154	36 767	37 112	38 072	38 922	38 742	39 208	39 002	38 646	38 478
of which EU-N13	7 144	7 078	7 006	7 477	7 921	8 440	8 525	8 849	8 831	9 112	9 288
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	231	221	168	186	236	281	302	299	298	274	245
Net Production	**44 529**	**44 010**	**43 605**	**44 403**	**45 756**	**47 082**	**46 966**	**47 759**	**47 536**	**47 485**	**47 521**
Consumption	**42 065**	**41 586**	**41 169**	**42 182**	**43 285**	**43 854**	**43 815**	**44 525**	**44 596**	**44 408**	**44 288**
of which EU-15	34 512	34 273	34 112	34 630	35 385	35 659	35 519	36 065	36 216	36 113	36 075
of which EU-N13	7 553	7 313	7 057	7 552	7 900	8 195	8 297	8 460	8 381	8 295	8 213
per capita cons. (kg r.w.e.)*	**66.4**	**65.7**	**64.9**	**66.3**	**67.9**	**68.6**	**68.4**	**69.3**	**69.2**	**68.8**	**68.7**
of which EU-15	68.7	68.2	67.6	68.4	69.6	69.9	69.4	70.2	70.1	69.5	69.1
of which EU-N13	57.8	56.2	54.5	58.3	61.1	63.6	64.5	65.9	65.6	66.0	66.8
of which beef and veal meat	11.1	10.8	10.4	10.5	10.6	10.8	10.8	11.0	10.8	10.5	10.4
of which sheep and goat meat	2.0	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.8	1.8	1.9
of which pigmeat	32.5	31.8	31.3	32.0	32.5	32.2	32.1	32.5	32.2	31.9	31.6
of which poultry meat	20.8	21.3	21.4	22.0	22.9	23.8	23.7	24.1	24.4	24.5	24.8
Imports (meat)	1 358	1 326	1 311	1 332	1 368	1 402	1 262	1 258	1 448	1 540	1 564
Exports (meat)	3 821	3 750	3 746	3 553	3 837	4 629	4 414	4 490	4 388	4 616	4 799
Net trade (meat)	**2 463**	**2 424**	**2 435**	**2 222**	**2 469**	**3 227**	**3 152**	**3 232**	**2 940**	**3 076**	**3 235**

* r.w.e. = retail weight equivalent; Coefficients to transform carcass weight into retail weight are 0.7 for beef and veal, 0.78 for pigmeat and 0.88 for both poultry meat and sheep and goat meat.

TABLE 9.32 EU egg market balance (1 000 t)*

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	**6 433**	**6 240**	**6 509**	**6 509**	**6 695**	**6 758**	**6 755**	**6 932**	**7 063**	**7 395**	**7 700**
of which EU-15	4 990	4 885	5 121	5 094	5 266	5 307	5 257	5 393	5 457	5 626	5 766
of which EU-N13	1 443	1 355	1 388	1 414	1 430	1 451	1 499	1 538	1 606	1 768	1 934
Total use	**6 239**	**6 093**	**6 309**	**6 289**	**6 435**	**6 529**	**6 567**	**6 735**	**6 850**	**7 141**	**7 406**
of which EU-15	5 026	4 904	5 070	5 032	5 170	5 258	5 288	5 450	5 550	5 815	6 061
of which EU-N13	1 212	1 189	1 239	1 257	1 265	1 272	1 279	1 286	1 300	1 326	1 345
per capita consumption (kg)	**12.4**	**12.1**	**12.5**	**12.4**	**12.6**	**12.8**	**12.8**	**13.1**	**13.3**	**13.8**	**14.3**
of which EU-15	12.6	12.3	12.6	12.5	12.8	12.9	13.0	13.3	13.5	14.0	14.5
of which EU-N13	11.5	11.3	11.8	12.0	12.1	12.2	12.3	12.4	12.6	13.0	13.5
Imports	23	40	20	14	19	17	22	22	23	24	26
Exports	217	186	220	233	280	246	210	218	235	278	320

* Eggs for consumption.

TABLE 9.33 EU apples market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Gross production	11 844	11 098	12 076	12 896	12 768	12 540	9 999	12 767	12 459	12 461	12 437
Losses and feed use	848	712	786	820	814	798	637	866	739	839	688
EU usable production	10 997	10 386	11 290	12 075	11 954	11 742	9 362	11 901	11 719	11 622	11 749
Production (fresh)	7 716	7 113	7 728	7 936	8 353	8 014	6 762	7 888	7 996	8 202	8 400
Consumption (fresh)	6 725	6 157	6 699	6 555	7 218	6 969	6 576	6 732	6 768	6 841	6 900
per capita (kg)	13.4	12.2	13.3	12.9	14.2	13.7	12.9	13.1	13.1	13.1	13.2
Exports (fresh)	1 516	1 564	1 605	1 782	1 586	1 476	737	1 557	1 653	1 848	1 900
Imports (fresh)	525	608	576	401	451	431	551	401	425	413	400
EU production (for processing)	3 281	3 273	3 562	4 139	3 601	3 728	2 600	4 013	3 724	3 544	3 349
Consumption (processing)	4 056	3 842	4 222	3 854	3 989	3 921	3 667	3 956	3 825	3 562	3 300
per capita (kg)	8.1	7.6	8.4	7.6	7.8	7.7	7.2	7.7	7.4	6.8	6.3
Exports (processed)	333	380	415	1 154	595	709	503	900	734	799	849
Imports (processed)	1 108	949	1 074	869	982	902	1 570	843	835	818	800
Area (million ha)	548	559	537	525	538	520	521	522	514	493	472
Yield (t/ha)	21.6	19.9	22.5	24.6	23.7	24.1	19.2	24.4	24.2	25.3	26.4

Note: the apples marketing year is August/July

TABLE 9.34 EU peaches and nectarines market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production (total)		3 791	3 735	4 260	4 184	3 984	4 219	4 172	4 194	4 142	4 082
Production (fresh)		2 960	3 085	3 439	3 476	3 318	3 489	3 450	3 488	3 435	3 376
Apparent consumption (fresh)		2 626	2 810	3 108	3 208	3 123	3 265	3 294	3 278	3 220	3 156
per capita (kg)		5.2	5.6	6.1	6.3	6.1	6.4	6.4	6.4	6.2	6.1
Imports (fresh)		32	32	26	28	31	27	33	30	30	30
Exports (fresh)		366	308	357	297	226	251	188	240	245	250
Production (for processing)		831	650	821	707	667	730	722	706	706	706
Apparent consumption (processed)		724	558	711	585	541	618	612	609	599	587
per capita (kg)		1.4	1.1	1.4	1.1	1.1	1.2	1.2	1.2	1.2	1.1
Imports (processed*)		22	18	19	16	17	18	18	18	18	18
Exports (processed*)		129	111	130	138	142	130	128	127	126	125
Area (million ha)		249	246	243	246	243	248	248	247	238	229
Yield (t/ha)		15.2	15.2	17.5	17.0	16.4	17.0	16.8	17.0	17.4	17.9

* fresh equivalent

TABLE 9.35 EU tomatoes market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production (total)	15 626	15 191	14 534	16 692	17 766	18 005	17 637	16 386	17 481	17 744	17 991
Production (fresh)	6 814	6 555	6 895	6 802	7 281	7 124	7 006	6 986	7 027	6 912	6 797
Consumption (fresh)	7 077	6 735	6 972	6 988	7 560	7 490	7 444	7 423	7 435	7 292	7 147
per capita (kg)	14.1	13.4	13.8	13.8	14.9	14.7	14.6	14.5	14.4	14.0	13.6
Imports (fresh)	465	445	441	488	481	525	569	572	568	559	550
Exports (fresh)	201	265	364	301	202	159	132	135	160	179	200
Production (for processing)	8 812	8 637	7 639	9 890	10 485	10 882	10 631	9 400	10 454	10 832	11 194
Consumption (processed)	9 315	9 060	7 333	9 927	10 629	11 212	10 315	9 581	10 493	10 801	11 094
per capita (kg)	18.5	18.0	14.5	19.6	20.9	22.0	20.2	18.7	20.4	20.8	21.2
Imports (processed*)	2 813	2 621	2 171	2 280	2 537	2 966	2 245	2 358	2 584	2 592	2 600
Exports (processed*)	2 310	2 198	2 477	2 243	2 393	2 636	2 561	2 177	2 545	2 623	2 700

* fresh equivalent

TABLE 9.36 EU olive oil market balance (1 000 t)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Production	2 396	1 463	2 483	1 435	2 324	1 758	2 176	2 255	2 196	2 371	2 493
of which ES+PT	1 691	677	1 873	903	1 512	1 356	1 386	1 730	1 528	1 680	1 764
of which IT+EL	694	773	596	522	795	377	775	510	652	673	708
Consumption	1 780	1 601	1 731	1 572	1 619	1 409	1 674	1 632	1 648	1 686	1 725
of which ES-IT-EL-PT	1 462	1 291	1 386	1 236	1 265	1 053	1 316	1 287	1 265	1 210	1 155
of which other EU	318	310	345	335	354	355	358	346	383	477	570
per capita ES-IT-EL-PT (kg)	11.4	10.0	10.8	9.6	9.9	8.2	10.3	10.1	9.9	9.6	9.2
per capita other EU (kg)	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.2	1.5
Imports	97	153	53	225	98	91	166	100	56	87	122
Exports	553	489	601	508	573	558	555	590	654	772	890

Note: the olive oil marketing year is October/September

TABLE 9.37 EU wine market balance (million hectolitres)

	2011	2012	2013	2014	2015	2016	2017	2018	2020	2025	2030
Vinified production (1000 hl)	158	151	169	156	169	171	138	168	166	166	165
of which 5 main producer MS	141	137	152	141	154	156	118	151	149	150	149
other EU MS	17	14	17	14	15	14	16	18	17	16	16
Domestic use	151	148	148	151	158	155	146	155	156	154	151
Human consumption	126	131	128	131	132	132	131	131	133	132	131
per capita (l)	25.0	25.9	25.2	25.8	25.9	25.8	25.5	26.0	25.9	25.6	25.3
Other uses	24	17	20	20	26	23	15	24	22	21	20
Imports	14	15	14	14	14	14	14	14	14	15	15
Exports	24	21	21	22	22	24	24	24	25	27	29
Area (million ha)	3	3	3	3	3	3	3	3	3	3	3
Yield (hl/ha)	50	45	55	53	55	55	44	55	55	57	58
Total Ending Stocks	157	153	167	163	167	172	154	158	157	155	155
Variation in stocks (million hl)	-2	-4	14	-4	3	5	-18	4	-1	0	0

Note: the wine marketing year is August/July

DISCLAIMER:

While all efforts are made to reach sound market and income prospects, uncertainties remain.

This publication does not necessarily reflect the official opinion of the European Commission.

https://ec.europa.eu/agri-outlook

#AgriOutlook