UNION ZUR FÖRDERUNG VON OEL- UND PROTEINPFLANZEN E.V.

UFOP Report on Global Market Supply 2019/2020

European and world demand for biomass for the purpose of biofuel production in relation to supply in the food and feedstuff markets

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Sustainable intensification of arable farming ensures food security and climate protection

The Green Deal starts on the land.

The impact of climate change is tangible in many regions of the world, above all in agriculture. Securing supplies of sustainably produced food and renewable feedstocks for material and energetic use is therefore the central challenge and prospect for agriculture. This is UFOP's conception of a sustainable bioeconomy. Biofuels are the most important value-added option and exemplify the requisite additional options for deployment.

A key to sustainable farming lies in accelerating utilization of technological advances in breeding, crop protection and digitisation of agricultural production. Funding policy should foster development of innovations, focusing in particular on maintaining or seeking leadership in export technology development.

The FAO estimates that global grain production (including rice) will reach a new peak of 2.6 billion tonnes in 2019. On the other hand, in many regions, despite low producer prices, scant purchasing power gives rise to pronounced pressure on supply and prices. In the light of global harvest volumes, sufficient food supplies can be secured, even with simultaneous biofuel production from these feedstocks. This is clearly demonstrated in the 4th updated edition of this UFOP report.

Large harvests and stockpiles in many regions of the world compensate for shortfalls elsewhere. Yields are rising in North and South America thanks to technical progress, and in Asia as a result of replanting with new palm oil varieties but also due to new plantations established in the wake of deforestation. The report considers legal issues concerning the compatibility of this phenomenon with international sustainability targets for feedstocks to be counted towards quotas for the European biofuel market. The fundamental problem: sustainability is not reflected in prices paid to producers.

Low or falling prices for cereals, oilseeds, sugar and vegetable oils are caused by global oversupply in terms of purchasing power. At this price level, sustainable agriculture is impossible, even in rural regions of Africa. Seen in this light, arable farming is living on its reserves economically.

The European Union did not succeed in adequately integrating this potential into its climate protection policy when amending the Renewable Energy Directive (RED II). On the contrary, production of renewable feedstocks from cultivated biomass will be gradually reduced, yet sales prospects in new markets are not identified in parallel. What remains is a permanent price pressure recognizable by the negative income trend in agricultural sector.

In contrast, governments from the world's leading agricultural nations in North and South America, as well as in Asia, are promoting energetic use of cultivated biomass as part of their national agricultural, energy and climate protection policies. This becomes apparent in increasing requirements to add biofuels to fuel blends. European policy clearly does not recognise that internationally binding provisions on a level playing field could be created through the statutory sustainability requirements enshrined in the Renewable Energy Directive - RED II (2018/2001/EU) concerning market access to the European Union for biomass feedstocks and biofuels.

European agriculture instead finds itself observing as the future of renewable feedstock cultivation unfolds elsewhere. As a result, Europe is missing out on an opportunity to define sustainability requirements vis-à-vis third countries based on statutory provisions.

Cultivation of oilseeds in the EU is particularly affected because it is also the most important non-GM source of protein for animal nutrition. Conversely, large quantities of soya and thus the corresponding "cultivated areas" are also imported. EU guidelines for calculating the greenhouse gas balance of feedstocks do not take account of this "substitution effect", which is unfortunate as this could boost the competitiveness of biomass feedstocks and biofuels produced in the EU.

Agricultural policy still needs to demonstrate that it can combine the imperatives of economically viable and sustainable cultivation with appropriate policy on agricultural markets and climate protection, as well as opening up sales prospects, inter alia on fuel markets. In this context, ambitious sustainability requirements must be factored in, while also ensuring implementation of these, in particular in third countries. On this issue in particular, UFOP is counting on the Green Deal announced by the new EU Commission and expects policy to be adjusted accordingly.

I am therefore curious to see how the German arable farming strategy will be designed against the backdrop of these market policy conditions and also setting effective economic incentives for the cultivation practice.

» **Wolfgang Vogel**
UFOP Chairman

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Agricultural Market Information Company (AMI)
Department plant production
In Charge: Wienke von Schenck

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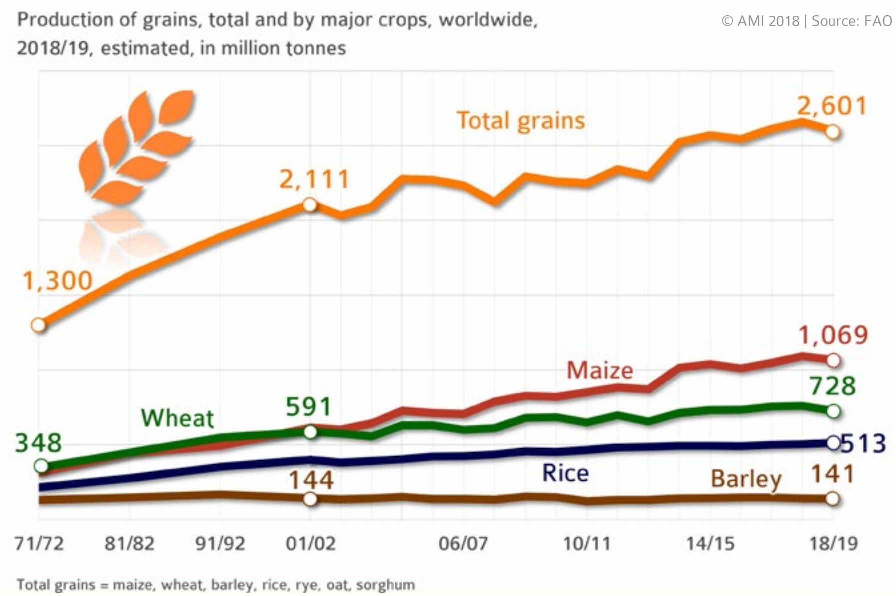
1 Feedstock supply

1.1 How much grain is produced on a global scale?

» 1.1.1 Global grain production

Poor weather conditions occurring both in the northern and southern hemisphere affected global grain production. This especially applies to wheat (-4.2 per cent) and maize (-2.2 per cent). Since these are the world's most important kinds of grain, their decline is reflected in the figures for overall grain production. **Although production fell short of the previous year's by 2.1 per cent, it remained at a level of more than 2.6 billion tonnes.** In general, as a result of progress in plant breeding, expansions in overall area and improvement of agricultural production practices (fertiliser applications, pest and disease control, reduced losses at harvest and in storage), world grain production has continuously increased over the past decades. Since 1971/72 harvest amounts have tripled (maize) or doubled (wheat and rice). Bumper crops in many production regions have led to oversupply on the markets. Maize is the number one grain, underlining its globally growing importance for supply to the feed sector and (US) bioethanol production. Like maize, barley is mainly used as livestock feed. On the other hand, rice and wheat are predominantly consumed in human diets.

Global grain production remains at more than 2.6 billions tonnes

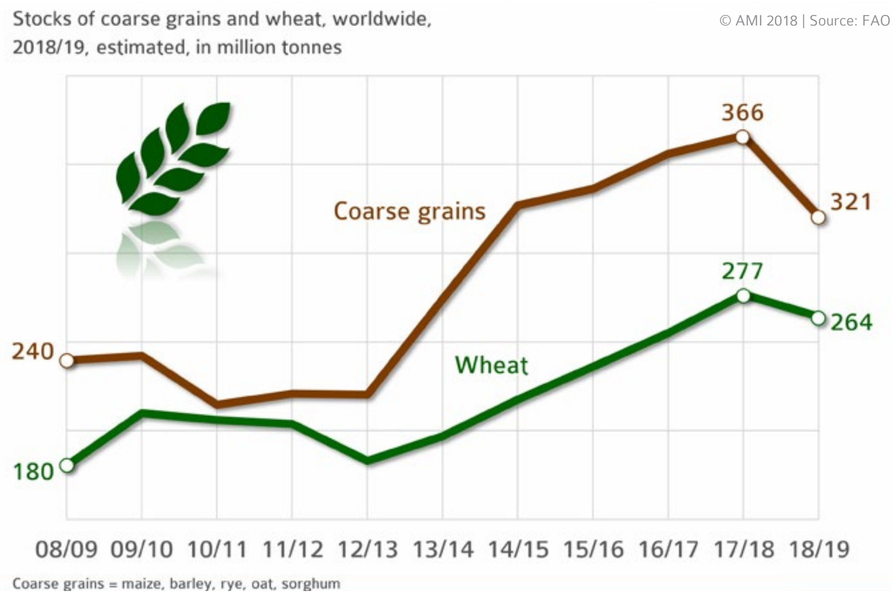


» 1.1.2 Global stocks of grains

Due to significant harvest increases in grain cultivation, world grain stocks have grown considerably. **In most marketing years, production of wheat and coarse grains exceeded consumption.** These stocks that are left at the end of a marketing year are the ending stocks that, as beginning stocks, ensure supply at the beginning of the following marketing year.

Based on smaller harvests of wheat and coarse grains (maize, barley and rye) caused by poor weather and the increase in consumption on a global scale, stocks are expected to decline from their highest level of 643 million tonnes to 585 million tonnes by the end of the 2018/19 marketing year. In other words, 2018/19 output will not be sufficient to cover global demand. **Although this will be at the expense of supplies and lead to a drop in stocks of wheat (-4.7 per cent) and especially coarse grains (-12.3 per cent), overall supply will remain safe with a large surplus into the next crop.**

Large stocks serve as buffer for small harvest amounts



» 1.1.3 Global grain supply

The ratio of supplies to consumption (also called the stock-to-use ratio) is a key figure in estimating supply and, consequently, potential price trends. The decline in grain production in 2018/19 and the slight rise in consumption lead to a decrease in global ending stocks, with the result that the stock-to-use ratio will drop. Nevertheless, supply of wheat and coarse grains, at 35 per cent and 25 per cent respectively of the amounts harvested, is set to remain exceptionally good. This will deter a rise in producer prices right into the following marketing year. **To sum up, from the perspective of farmers grain prices remain too low.**

Supply and demand estimate based on the stock-to-use ratio

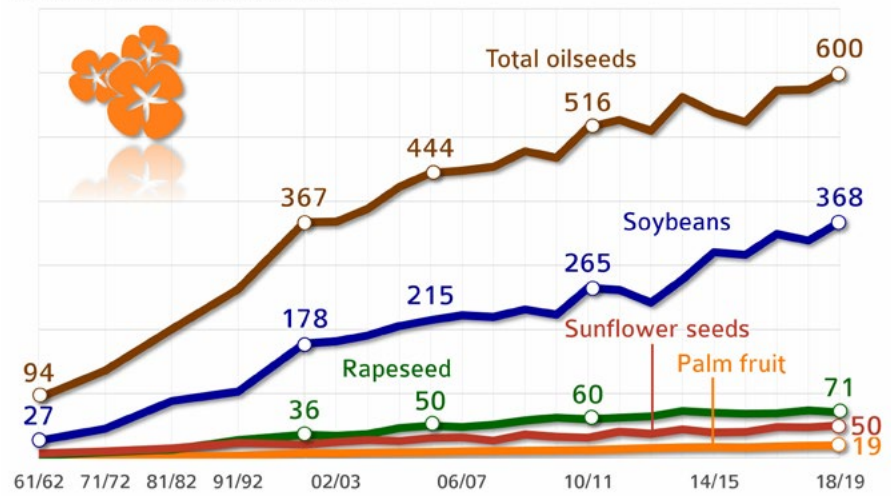
» 1.2.1 Global oilseed production

In the marketing year 2018/19, production of oilseeds is likely to hit almost 600 million tonnes, the largest quantity ever. Global rise in demand for high-quality feed protein has been a key driver of North and South American soybean production for years now and is the main reason for the expansion in cultivation area. On a global scale, soybean is the number one oilseed crop, accounting for more than 60 per cent of world oilseed production.

Oilseed crops differ in oil and protein content as well as fatty acid composition and protein quality, along with their climate and soil requirements. These factors have a determining influence on the price of the oilseed crop in question. This especially applies to protein quality, because soybean is also the most valuable source of protein in terms of quality. **For this reason, rapeseed breeders are working intensively on improving the protein quality of rapeseed.**

Soybeans are the world's no. 1 oilseed crop

Production of oilseed crops, total and by major oilseed crop, worldwide, 2018/19, estimated, in million tonnes



Total oilseeds = soybeans, rapeseed/canola, sunflower seeds, palm fruit, peanuts, coconut, cotton

↳ 1.2.1.1 Composition of oilseed crops

Sunflowers have the highest oil content

Proportion of pure protein and oil in different oilseed crops, in per cent

1.2 How much oilseed and vegetable oil is produced on a global scale?

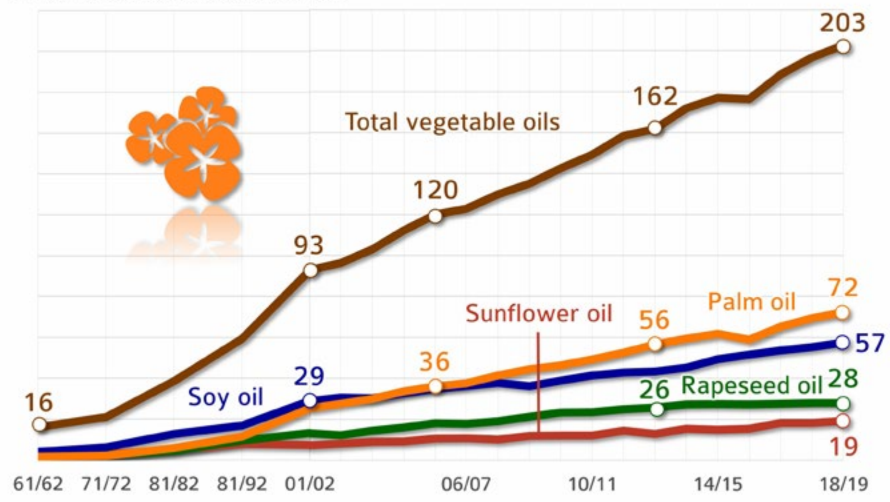
» 1.2.2 Global vegetable oil production

Output of vegetable oil increased rapidly over the past decades. Production of vegetable oil from the eight key oil-yielding crops amounted to approximately 203 million tonnes in the 2018/19 marketing year. This was more than twice the amount at the turn of the millennium. Together, palm and soybean oil, the world's most important oilseed crops, account for 63.5 per cent of global production. Rapeseed oil occupies third place, accounting for almost 14 per cent, followed by sunflower oil with just over 9 per cent of world output. **Vegetable oils are not only used in human diets, but also as a feedstock for transport fuel production and other industrial purposes, such as soaps, surfactants for use in detergent production, operating supplies such as lubricating and hydraulic oils, release agents for industrial uses or base substance for cosmetic products.**

Palm oil strengthens its top position

Production of vegetable oils, total and by major oilseed crop, worldwide, 2018/19, estimated, in million tonnes

© AMI 2018 | Source: USDA



Total vegetable oils = soy oil, rapeseed oil, sunflower oil, palm oil, palm kernel oil, peanut oil, coconut oil, cotton oil

1.2 How much oilseed and vegetable oil is produced on a global scale?

» 1.2.2 Global vegetable oil production

↳ 1.2.2.1 Price development of vegetable oils

The price gap between oilseed rape and palm oil is the largest since 10 years

Monthly wholesale prices, fob oil mill, in EUR per tonnes

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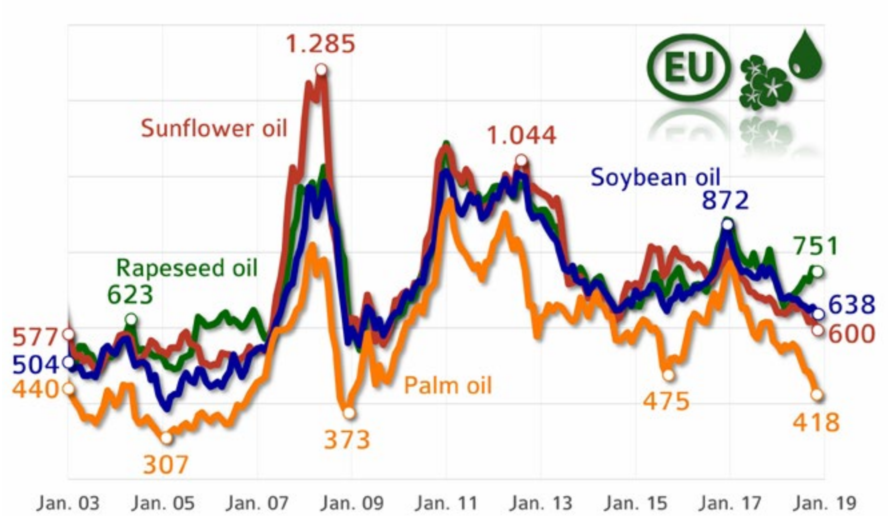


Palm oil: cif

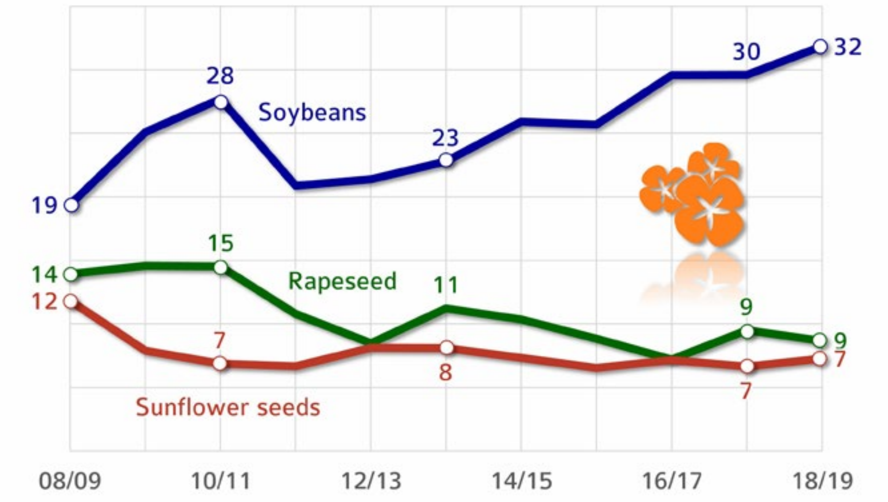
» 1.2.3 Global oilseed supply

The ratio of supplies to consumption (also called the stock-to-use ratio) is a key figure in estimating supply and, consequently, potential price trends. The stock-to-use ratio for rapeseed and sunflowerseed has been in decline for years now. If demand for rapeseed oil for EU biodiesel production were to continue to decline, this trend would intensify, especially in the case of rapeseed. The picture is somewhat different for soybeans. Bumper crops are causing supply and stocks to rise significantly. However, there is also a steady growth in demand for soy protein for animal feed, very especially in China. Due to the positive development of the economy and income in the world's most populous country, purchasing power is increasing and so is demand for meat and, consequently, oilseed meals to feed the growing numbers of livestock. China's growth in demand for soy coincides with bumper crops in the US and Brazil in 2018/19. This correlation generates dynamic changes in price. **However, the dynamics are weakened given the good supply to the market.**

Tight supply of rapeseed and sunflower seed

Stock-to-use ratio of soybeans, rapeseed and sunflowers, worldwide, 2018/19, estimated, in per cent

© AMI 2018 | Source: USDA



1.2 How much oilseed and vegetable oil is produced on a global scale?

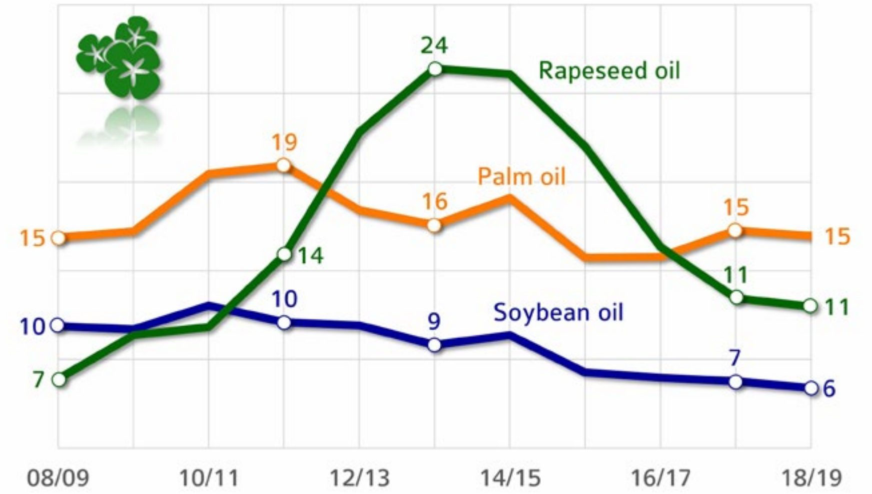
» 1.2.3 Global oilseed supply

↳ 1.2.3.1 Global vegetable oil supply

Rapeseed oil in strong demand

Stock-to-use ratio of rapeseed oil, palm oil and soybean oil, worldwide, 2018/19, estimated, in per cent

© AMI 2018 | Source: USDA

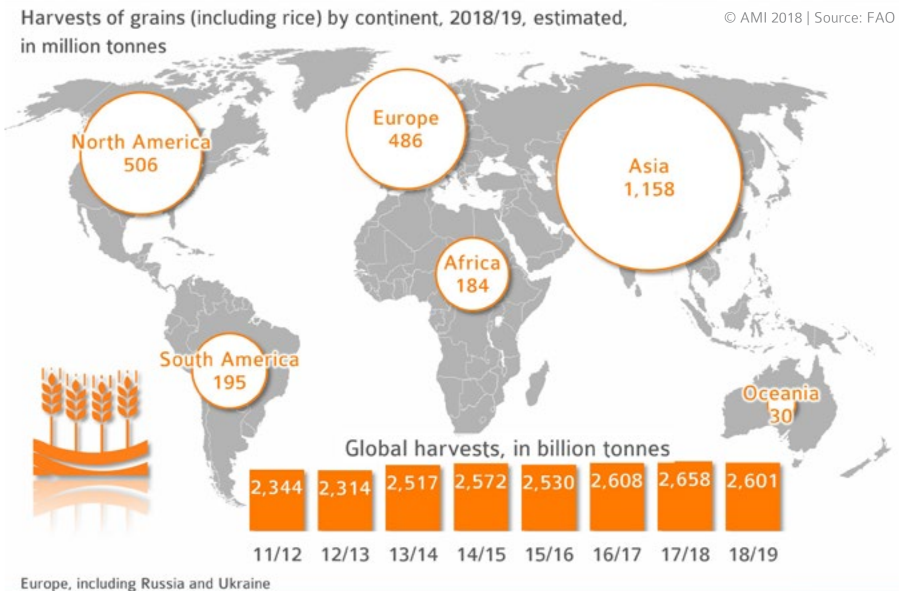


1.3 How much oilseed and grain (including rice) does each continent produce?

» 1.3.1 Production of grain

2018/19 world production of grain (including rice) is set to be slightly lower than it was in the record year of 2017/18. The larger global maize harvest cannot offset the decline in wheat and barley. The harvest was smaller especially in Europe. The Food and Agriculture Organization FAO forecast is for around 2.6 billion tonnes globally. The majority, around 45 per cent, is produced in Asia. The main reason is that Asia is the home of rice production. China is the main country of origin for grain and rice. North America holds second position, headed by the US with more than 448 million tonnes. Whereas marketing grain globally is vital for the economy of countries like the US or Canada, China hardly offers any of its grain on the world market. The country produces most of its agricultural feedstock to cover domestic demand and also needs extensive imports.

Asia is the largest grain producer



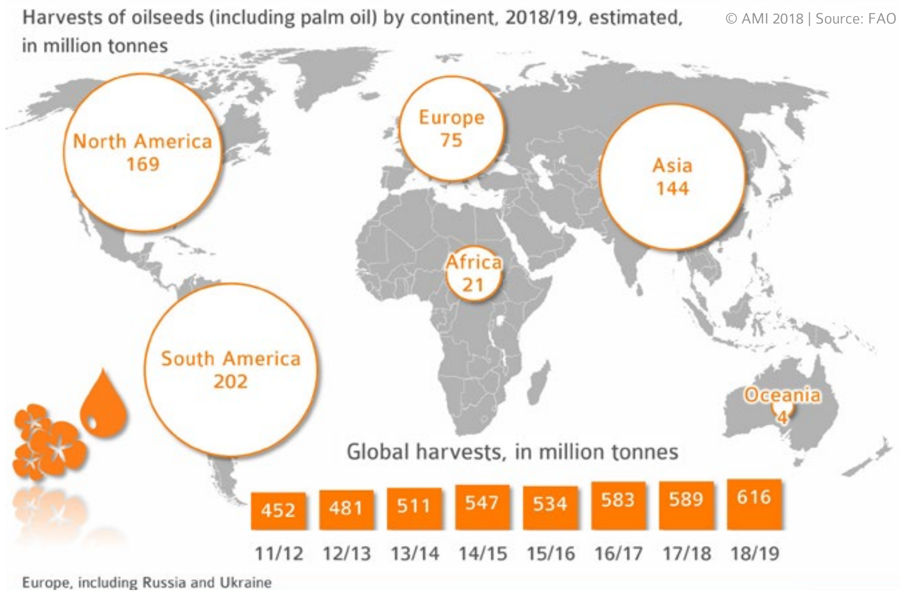
1.3 How much oilseed and grain (including rice) does each continent produce?

» 1.3.2 Production of oilseeds

The output of oilseeds is growing rapidly. The Food and Agriculture Organization FAO estimates global production in 2018/19 at 616 million tonnes. This is up 5 per cent year-on-year and just over 50 per cent from 10 years ago. **The increase is primarily based on growth of output in North and South America (expansion of area planted) and Asia. The world's most important oilseed and palm oil producing regions are more evenly distributed than grain-producing areas are.** The difference is not so much in output as in crops grown: whereas soybean is the most important oilseed crop in South America and the US, rapeseed prevails in Canada and the EU-28 due to climatic conditions. In eastern Europe sunflowers predominate. Asian countries such as China and India produce large amounts of both rapeseed and soybeans. On the other hand, oil palm is the primary oilseed crop in Malaysia and Indonesia.

The US was the world's biggest soybean producer in 2018/19, ahead of Brazil. Canada headed for the first time the list of rapeseed producing countries, just ahead of the EU-28. And the Ukraine harvested the largest quantity of sunflowers.

Oilseed harvests growing steadily



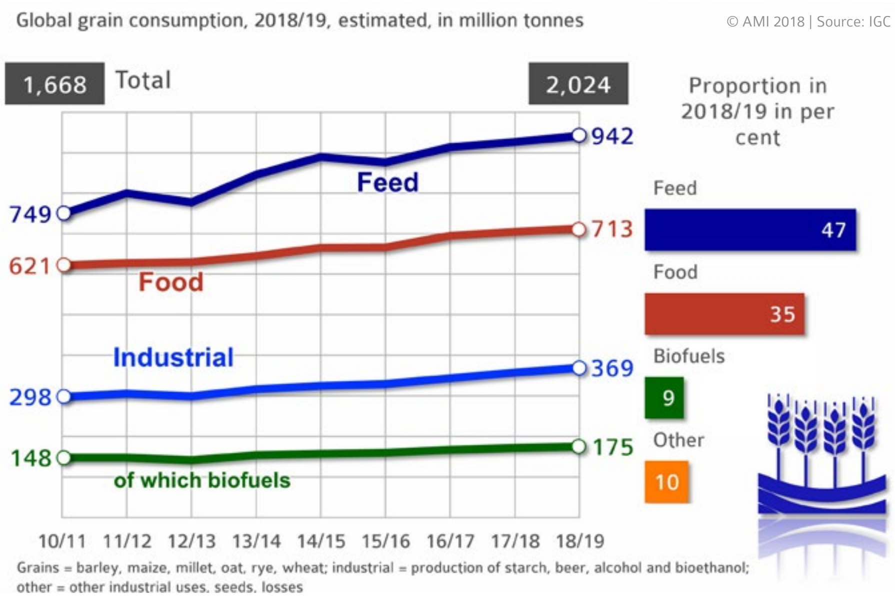
1.4 What products are made from grain?

» 1.4.1 Global use of grains

Global production of grains (excluding rice) in the 2018/19 marketing year amounted to an estimated 2 billion tonnes. The produce is intended for human consumption, but also used as a livestock feed and feedstock in bioethanol production. At 47 per cent, the largest part of the grain harvest goes into feeding troughs, trending upward (up 3 percentage points from the previous year). Although demand for grain for use in transport fuel production has increased slightly, it accounts for less than one tenth of total consumption, the International Grain Council (IGC) has reported. This means that there is enough grain to meet the growing demand for food and feed.

In the US, bioethanol is mostly made from maize. The process generates Dried Distillers Grains with Solubles (DDGS), which is used as a protein feed. One tonne of wheat that is processed into bioethanol produces on average 295 kg of DDGS with a moisture content of 10 per cent. One tonne of maize yields 309 kg of DDGS. When grain prices are high, processing is the first activity to go down, before farmers begin to save on feed. **The high added-value potential in the food markets ensures that grain mostly goes into the production of food when grain prices are high. The biofuels market serves as a "supply buffer" that ensures grain is constantly available for human consumption and feed.**

Grain is mainly used for feed production

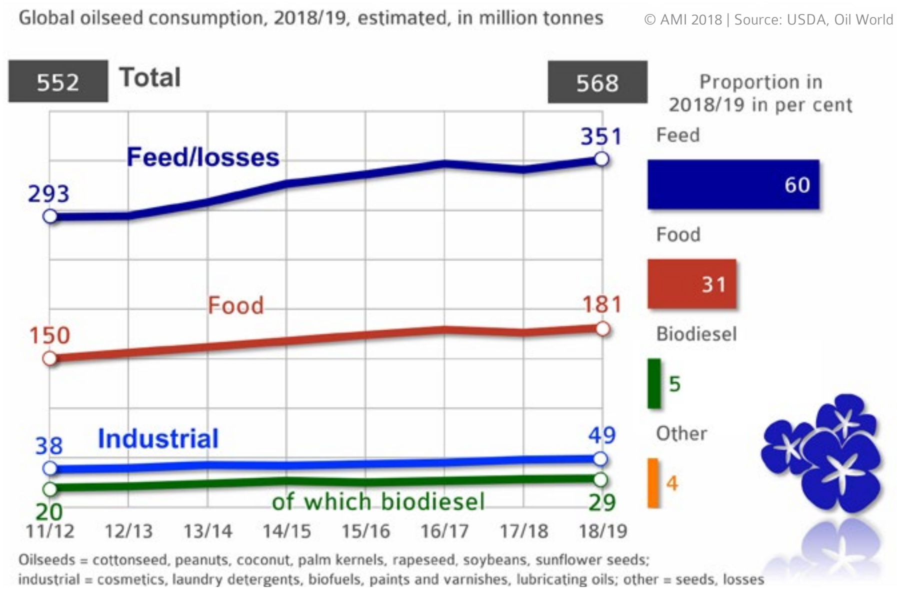


1.5 What products are made from oilseeds?

» 1.5.1 Global use of oilseeds

Oilseeds grown worldwide are pressed to make vegetable oils, generating extraction meal and oilseed cake as joint products of pressing. Vegetable oil can be gained by various chemical and physical methods. Before being pressed, the feedstock is heated to increase oil yield. The meal that remains after pressing is used as a high-protein feed. Consequently, the largest part of the oilseeds – around 60 per cent – goes into feeding troughs and the smaller proportion – around 31 per cent – is used as food. Soybean meal is the number one feed in terms of quantity, with global output amounting to 236 million tonnes. It is followed by rapeseed, which has a share of around 36 million tonnes in global protein supply. **Farmers in the EU-28 only produce GM-free rapeseed. Consequently, rapeseed is by far the most important GM-free source of protein for animal feeding. Therefore, EU-rapeseed meal reduces the corresponding need for soybean imports and the acreage of land that would otherwise be required for soy cultivation.** On that note, the EU Commission explicitly acknowledges the importance of EU-rapeseed production as the primary domestic source of protein. Output of sunflower meal, at 21 million tonnes, is ten times lower than that of soybean meal. Production of oil is much more important with this crop. Any meal produced is also used as animal feed.

Most oilseeds also destined for animal feed

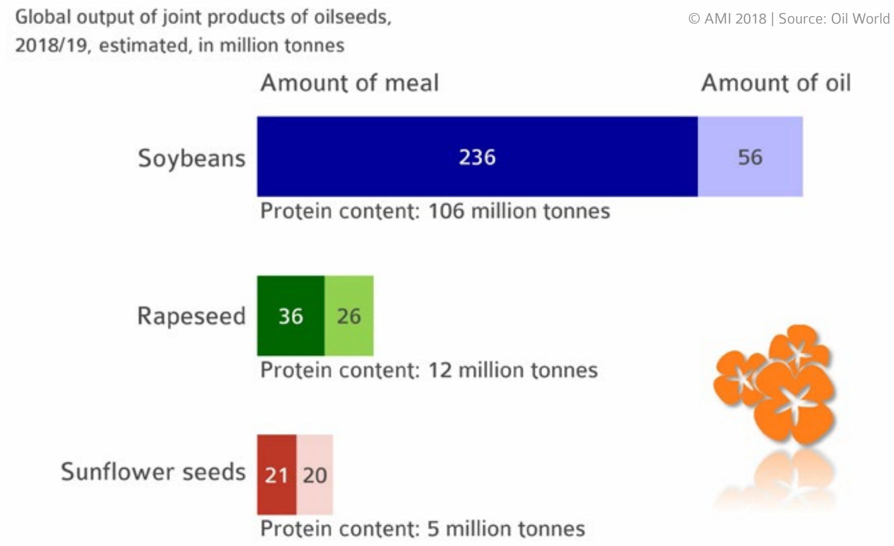


1.5 What products are made from oilseeds?

» **1.5.1 Global use of oilseeds**

↳ 1.5.1.1 Global production of oils and meals

Practical dual use of oilseeds



2 Production of biofuels

2.1 Which countries promote biofuels?

» 2.1.1 Global output of bioethanol

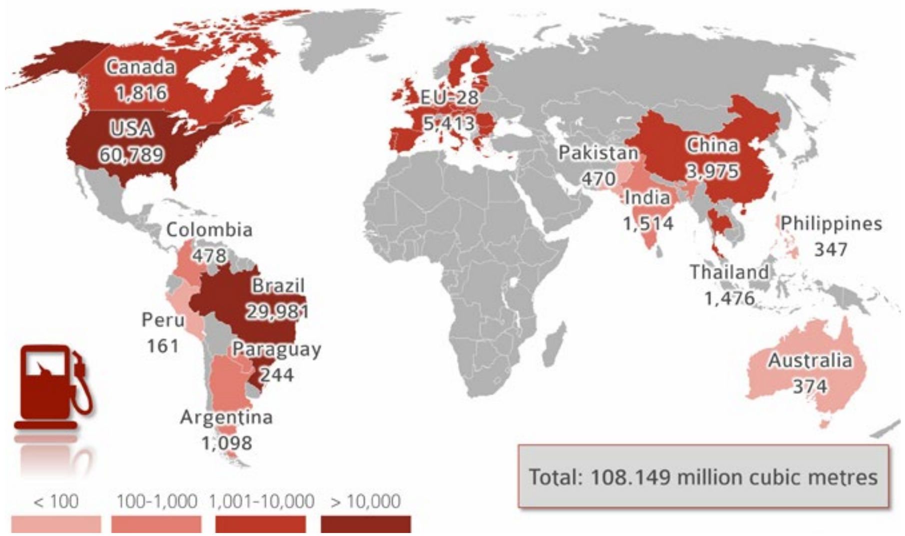
Over recent years, more and more bioethanol plants have been built to save fossil-energy sources and cut down on greenhouse gas emissions. **Politics is a key factor in this by defining blending quota requirements, which exercises a direct influence on the amount of bioethanol produced.** For example, in the US the blending rate was raised from 10 per cent to 15 per cent after the rate of 10 per cent was actually reached. In China, official steps taken to boost grain processing as a means of curbing local surpluses contributed to an increase in bioethanol production. The consumption of grain and sugar for the global production of bioethanol continues to grow, especially outside the US in China and South America. The use of grain (especially maize) as a feedstock is expected to rise by 1.5 per cent to 172.4 million tonnes in 2019/20. According to the FAO, global cereal production (including rice) will hit a new high of 2.60 billion tonnes.

Worldwide 108 (2017: 102.4) million m^3 of bioethanol were produced in 2018. The main producers are by far the US, where about 60.8 million m^3 were produced in 2018, of which 98 per cent corn and 2 per cent on other kinds of biomass. The second largest bioethanol-producing country is Brazil with nearly 30 million m^3 based on sugar from sugar cane. In EU-28, about 5.4 million m^3 of bioethanol were produced from cereals and sugar beet in 2018.

Jumping increase in bioethanol production

Bioethanol production in key countries, in 2018, in 1,000 cubic metres

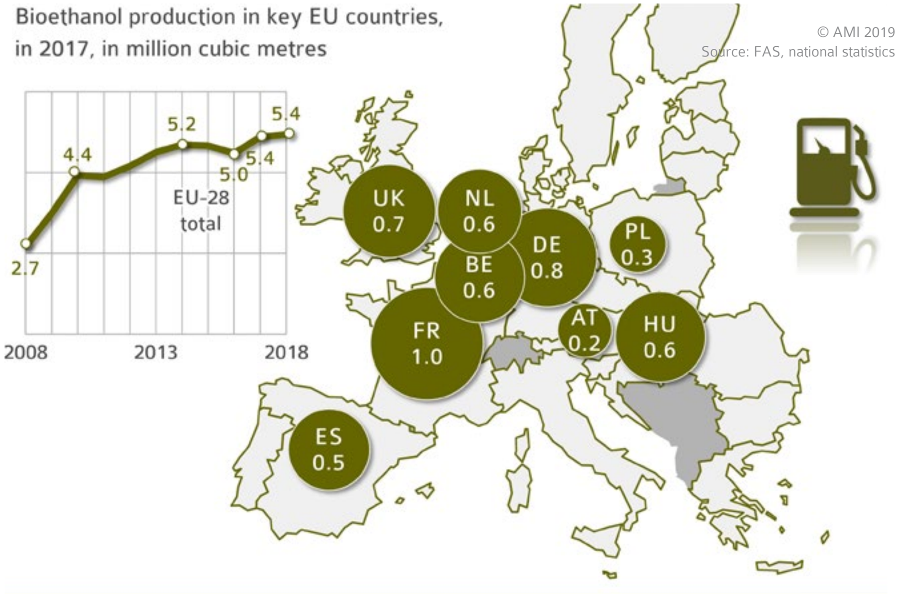
© AMI 2019
Source: RAF, OECD, national Statistics



» 2.1.1 Global output of bioethanol

↳ 2.1.1.1 Key EU-28 bioethanol producers

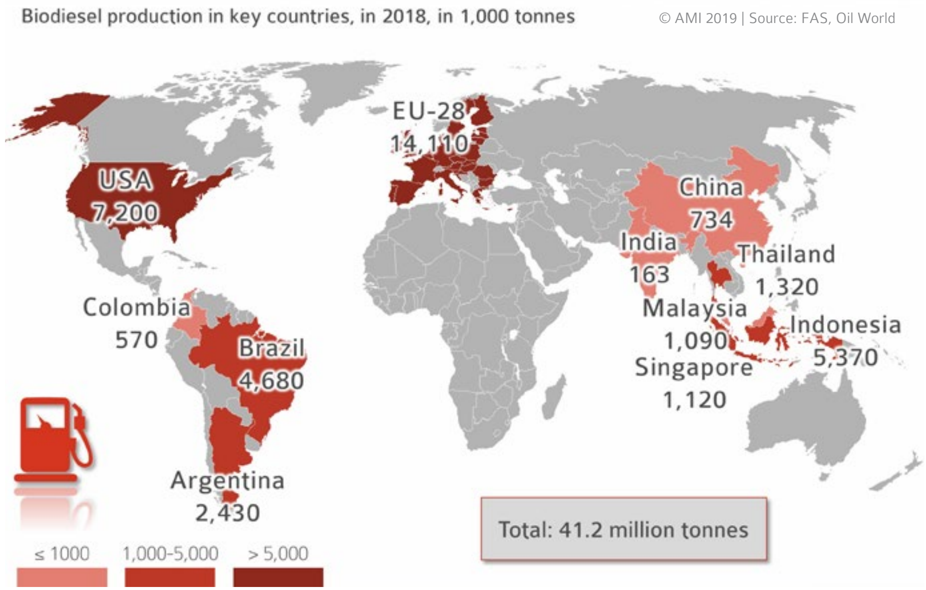
France, Germany and Great Britain account for half of EU bioethanol output



» 2.1.2 Global output of biodiesel

The single most important biodiesel producer is the European Union, which accounted for 34 per cent of global output of 41 million tonnes in 2018. The term "biodiesel" is used in the statistics to refer to biodiesel (FAME = fatty acid methyl ester), hydrogenated vegetable oil (HVO) and biofuels made from vegetable oils in petroleum refineries. Whereas in Europe biodiesel is mainly based on rapeseed oil, soybean oil is the primary source on the American continent. Soybean oil is a by-product of soybean meal production. It is used in biodiesel production in the wake of the steady expansion of soybean area and soy processing to cover demand for soybean meal for animal feeding. The most important biodiesel producers are the EU-28, the US, Brazil and Argentina. The Southeast Asian region has gained more and more importance in the biodiesel market. **In the key palm oil producing countries, Indonesia and Malaysia, biodiesel production is on a steady increase, driven by increasing glut and the associated pressure on prices in the vegetable oil markets.** Contrary to the EU, these countries are raising their domestic blending quota requirements (Indonesia: B20 / B30) to stabilise producer prices and to reduce foreign exchange expenses on oil imports. For the second time, global output of vegetable oils exceeds the level of 200 million tonnes in the 2019/2020 marketing year.

Above-average increase in biodiesel in the EU-28

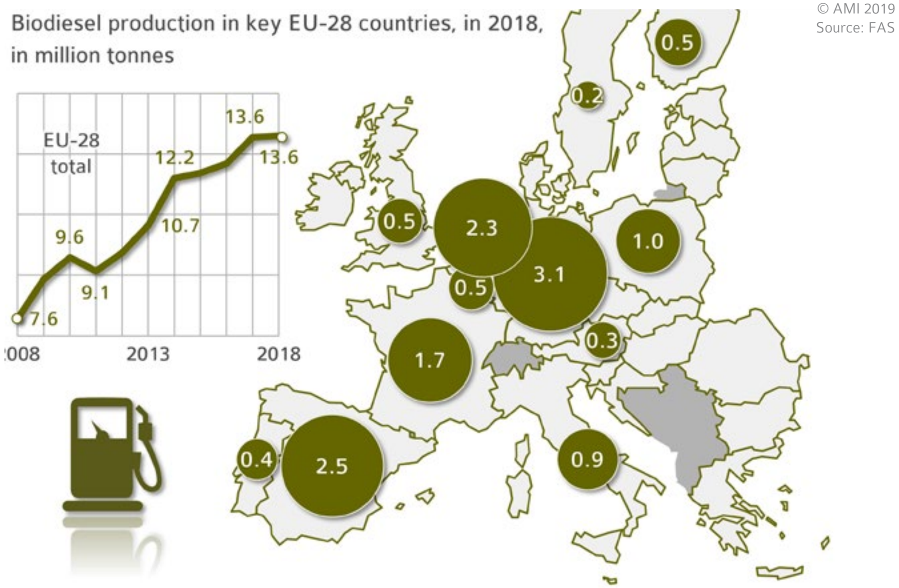


2.1 Which countries promote biofuels?

» 2.1.2 Global output of biodiesel

↳ 2.1.2.1 Key EU-28 biodiesel producers

Germany produces one fourth of EU biodiesel

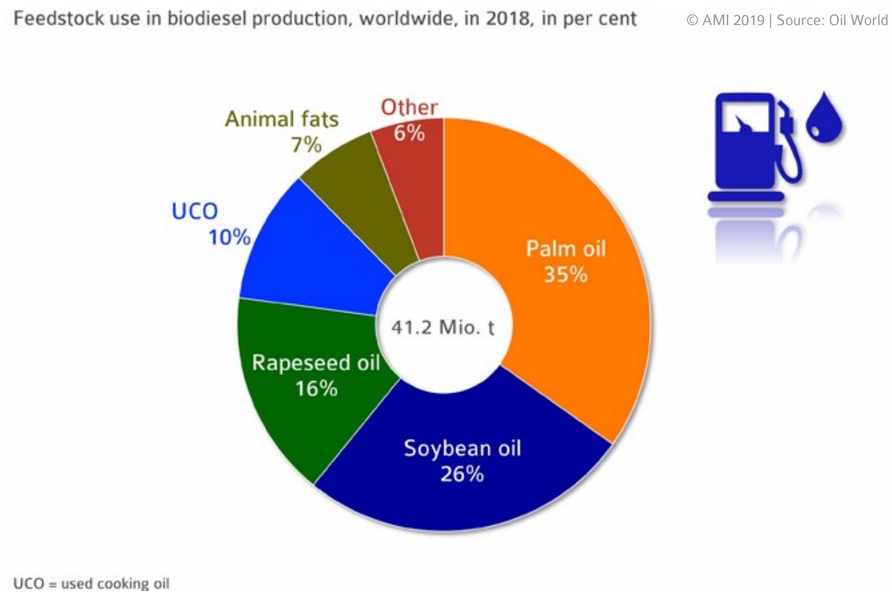


2.2 What feedstocks are used in world biofuels production?

» 2.2.1 Global resource bases for biodiesel

Production of biodiesel, and, consequently, the use of feedstocks has increased all over the world. The percentages of feedstocks used remained virtually unchanged from 2017: 35 per cent palm oil, 26 per cent soybean, 16 per cent rapeseed oil, 11 per cent used cooking fats, 7 per cent animal fats and 6 per cent other fats. **Palm, soybean and rapeseed oil remained the most important feedstock sources.** This will likely change in 2019, because prices for individual feedstock vary quite considerably over 2018. Rapeseed oil is at a high level and cost on average EUR 96 per tonne more in September 2019 than in the previous year. As a result, the gap to soybean, sunflower and palm oil has widened significantly. Biodiesel production from soybean and palm oil is expected to increase in North and South America as well as Southeast Asia. **In the EU 28, the share of biodiesel from waste oils and fats is expected to continue to increase at the expense of rapeseed oil.** Rapeseed oil, however, has the advantage of higher winter quality due to its fatty acid structure. In the winter months, rapeseed oil is the raw material required if biodiesel is produced for the admixture.

Shares of palm oil and the total amount increased



2.3 What feedstocks are used in European biodiesel fuel production?

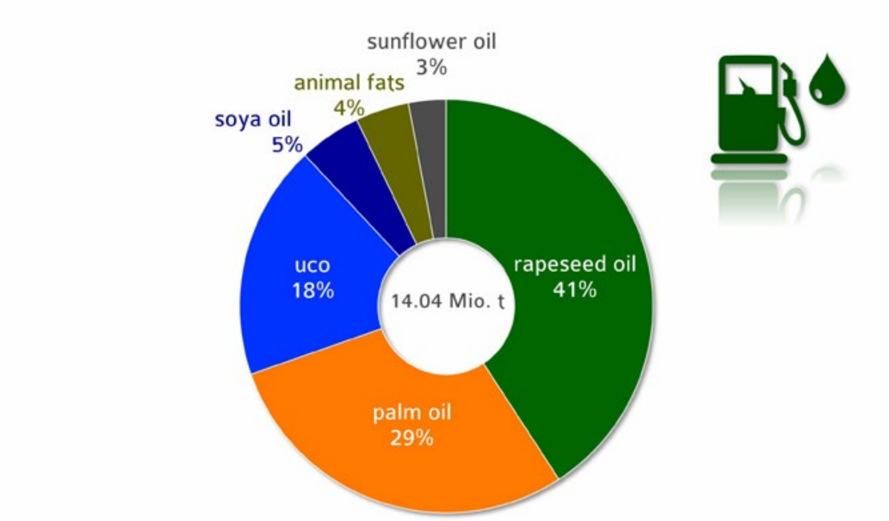
» 2.3.1 Resource bases for biodiesel in the EU-28

Availability and selling prices of vegetable and animal oils and fats have a determining influence on the use of these commodities, including in biodiesel fuel production. **Rapeseed oil is the primary feedstock source for biodiesel production in the European Union, but its share dwindles.** In 2018 it fell to 41 per cent, from 48 per cent in 2016. On the other hand, the use of used cooking oil has increased dramatically as policy continues to promote its use. In the EU, with the exception of Germany, biofuels from waste and residues count double towards national quota obligations (in terms of energy), the purpose being to increase the percentage of renewable energy used in the transport sector to 10 per cent by 2020. This requirement is binding on all member states. By contrast, competition from low-price feedstocks from overseas did not increase in 2018, remaining at 29 per cent. In countries such as Italy, Spain and the Netherlands, imported palm oil is the number one feedstock in biodiesel fuel production, whereas in Germany and France, the prime feedstock is rapeseed oil. **However, it must be noted that the statistical basis for the share of feedstock is very different depending on the "source" and cannot be adopted uncritically.** The new version of the Renewable Energies Directive (2018/2001/EU) will tighten and specify the reporting and documentation requirements. There is no absolute or official data on the share of feedstock of biofuels consumed in the EU.

Rapeseed oil reduced and replaced by used cooking oil

Feedstock use in biodiesel production in the EU-28, in 2018, in per cent

© AMI 2019 | Source: Oil World

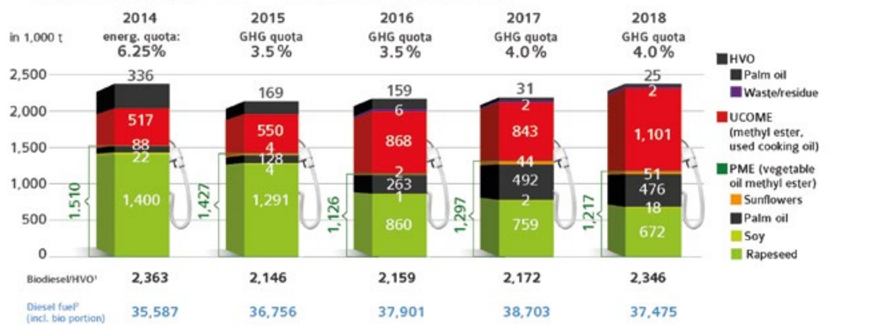


2.4 What feedstocks go into the production of biodiesel used in Germany?

» 2.4.1 Shares of feedstock in biodiesel consumed

In Germany in 2018, just over 2.32 million tonnes of biodiesel were used as a blending component in diesel fuel. This was up nearly 5 per cent year-on-year. This figure reflects the raised energy-related cap on greenhouse gas (GHG) emissions. The cap was raised from 3.5 per cent to 4 per cent in January 2017. **The mineral oil companies bound by the regulations have geared their purchasing strategy to comply with the requirement in the most cost and greenhouse gas-efficient manner.** Providers of feedstock and biofuels compete for the lowest-cost GHG efficiency. The resulting shift to biofuels from used cooking oils became apparent in 2016 and has intensified since then: the quantity used increased by more than 30 percent in 2018 compared to the previous year. Therefore, the share of biodiesel from used edible oils is growing, while the share of biodiesel from rapeseed oil has even decreased by 6 percentage points. This is a result of the advantage these oils have when calculating greenhouse gas emission. These feedstocks, as waste, are accounted for at a „zero" CO_2 greenhouse gas value, whereas vegetable oils are accounted for at the GHG value resulting from their production. **The transition to the green-housegas reduction requirement has led to a higher feedstock efficiency, i.e. manufacturers require less feedstock to meet the obligation. Conversely, the quota on greenhouse gas (GHG) emissions could be raised as a result of the competition for efficiency**, in which case biofuels could make a major contribution immediately towards reducing GHG in the transport sector. The German biofuels industry is therefore calling for a widening of the obligation to reduce greenhouse gas emissions.

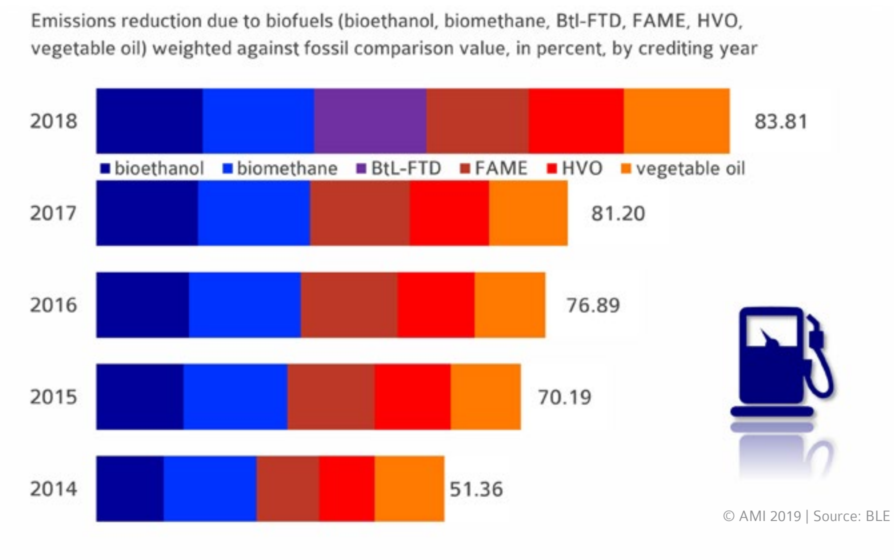
Share of uses cooking fats/oils in biodiesel increases



© AMI 2019 | Source: [1]Federal Office for Agriculture and Food: Evaluation an Progress Report 2018, October 2019; [2]BAFA: Mineral Oil Statistic

» 2.4.2 Greenhouse gas savings

Greenhouse gas savings increase to 84 per cent

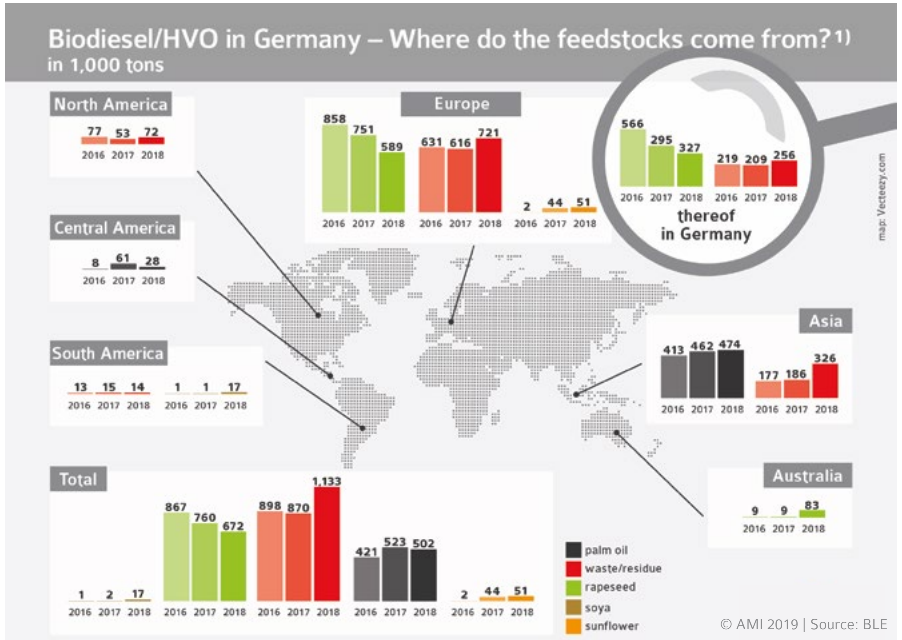


2.5 Where do the feedstocks for biodiesel at German petrol stations come from?

» 2.5.1 Origins of feedstocks for biodiesel used in Germany

In 2018, a total of 2.3 million tonnes of feedstocks were used to produce the biodiesel/HVO/vegetable oil that was placed on the market. **More than a half of it (around 57 per cent) came from Europe, mostly from Germany.** The use of rapeseed oil alone amounted to 589,000 tonnes, most of which was sourced in Europe, except for a small amount that came from Australia. The amount of biodiesel from waste oils (used cooking fats, used deep-frying oils, etc.) has increased by 17 per cent, which is higher than the amount of biodiesel made from rapeseed oil. **The largest amount of imported used cooking oil came from Asia.** Imports of palm oil, mainly from Indonesia and Malaysia, increased slightly, accounting for one fifth of the commodity mix in 2018. Soybean and sunflower play a minor role.

In Germany the biomass used for biofuel production is systematically recorded in high quality in the „Nabisy" database. However, the unique traceability system exclusively centers on biofuels marketed as transport fuels and heating fuels (CHP plants). These sustainable biofuels can then be counted towards the quota of greenhouse gas (GHG) emission reduction. The infographic below, based on data from Nabisy, only shows the part of feedstock origins used in biodiesel and HVO that was imported to Germany or processed for such use in Germany.



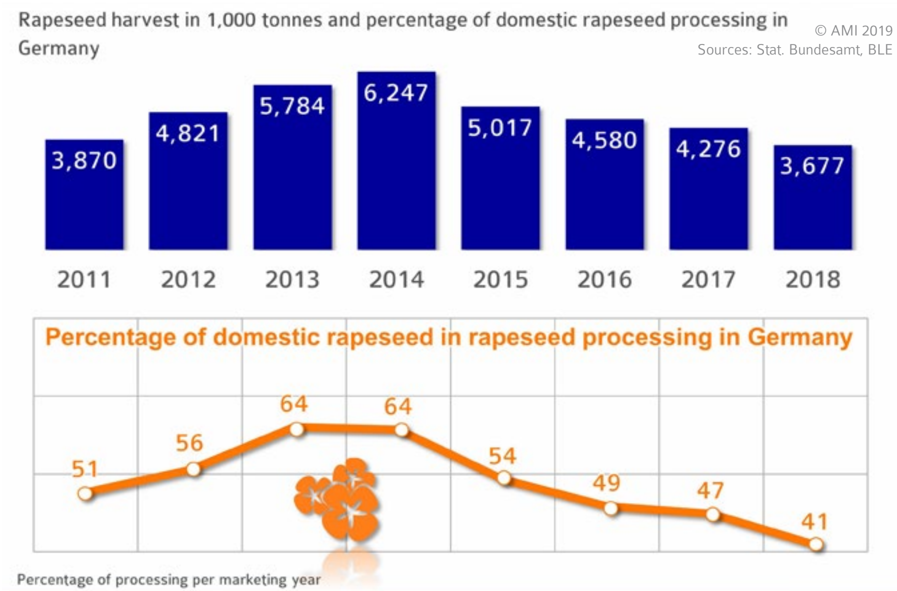
3 Food security

3.1 Is there sufficient rapeseed in Germany?

» 3.1.1 German rapeseed production and level of self-sufficiency

Supply of rapeseed depends foremost on the domestic harvest volume and consumption. One of the world's largest oilseed-processing countries, Germany needs imported oilseeds, mostly rapeseed (approximately 60 per cent), in addition to oilseeds from its domestic crop. In 2018/19, Germany processed 12.6 million tonnes of oilseeds, of which 71 per cent (approximately 8.9 million tonnes) were rapeseed. Like in the previous year, more than 50 per cent of this demand was covered by rapeseed from abroad. A significant amount – almost 740,000 tonnes, or 10 per cent more than in 2017 – came from Ukraine. **The total amount of rapeseed processed in Germany yielded 3.8 million tonnes of rapeseed oil and 5.1 million tonnes of Non-GMO rapeseed meal.** The amount of rapeseed oil is more than needed for the production of food and transport fuels and for uses in the oleochemical industry. About 1 million tonnes of rapeseed oil went to the German food industry, another 1 million tonnes to the engineering sector. More than 860,000 tonnes (net) of rapeseed oil were exported.

Smaller rapeseed harvest reduces share of processing



3.1 Is there sufficient rapeseed in Germany?

» 3.1.1 German rapeseed production and level of self-sufficiency

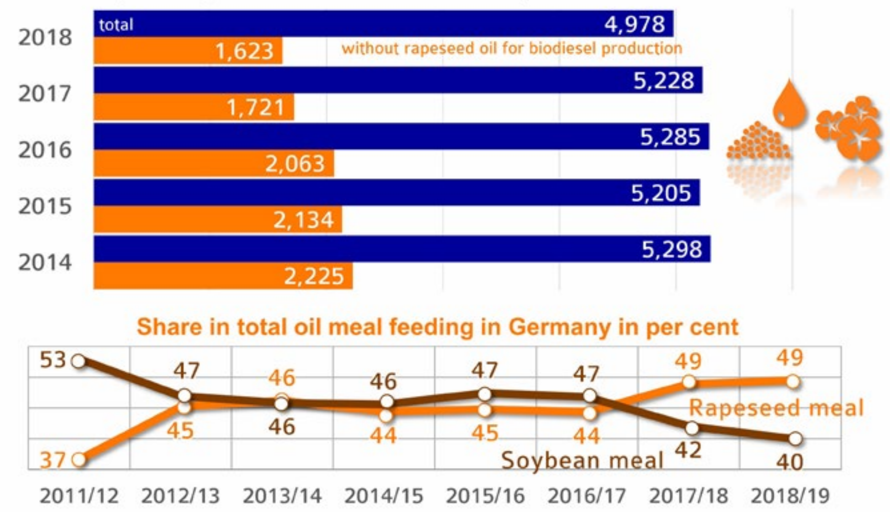
↳ 3.1.1.1 Output of rapeseed meal with and without biodiesel fuel production

The feed market is one of the main beneficiaries of biodiesel production, because rapeseed meal is generated as a by-product of rapeseed oil production. And rapeseed meal is a key feedstuff. German rapeseed processing in 2017 amounted to 9.2 million tonnes, yielding just less than 4 million tonnes of rapeseed oil and 5.2 million tonnes of rapeseed meal. **Since rapeseed is produced in Europe without using genetic manipulation (GM), its by-product, rapeseed meal, is also classified as GMO-free. This classification promotes the use of rapeseed meal mainly in dairy feeding, where it can fully replace soybean meal and the corresponding imports from overseas.** The key factor is demand for dairy products that qualify as "without GM". This means that rapeseed meal also significantly reduces the dependence on imports of GMO soy or GMO soybean meal. Only about one third of the 3,8 million tonnes of rapeseed oil were used for human consumption, whereas 66 per cent were used for technical applications or energy production. If demand for rapeseed oil for use in biodiesel production were to shrink in the future, which would be the case if biodiesel is no longer seen as a contribution towards decarbonising the transport sector, two thirds of today's rapeseed meal production would no longer be available. More soybean imports would be required to fill this gap. In purely arithmetic terms, the rapeseed meal gap in the past year would have amounted to 3.4 million tonnes. **To offset the gap left by rapeseed, soybean meal imports would have had to increase by around 2.7 million tonnes annually – which would have required an additional soybean production area of approximately 1 million hectares.** Consequently, the situation would reverse the trend of promoting domestic GM-free protein sources. It has only been since 2012 that rapeseed meal accounts for half of the meal fed to animals in Germany.

No rapeseed methyl ester – less rapeseed meal

Amount of rapeseed meal generated in German oil mills in 1,000 tonnes; total and – theoretically – if no rapeseed oil was needed for biodiesel production

© AMI 2018 | Source: BLE, AMI



3.2 Why is demand for oilseeds increasing?

» 3.2.1 Global consumption of meat by continent

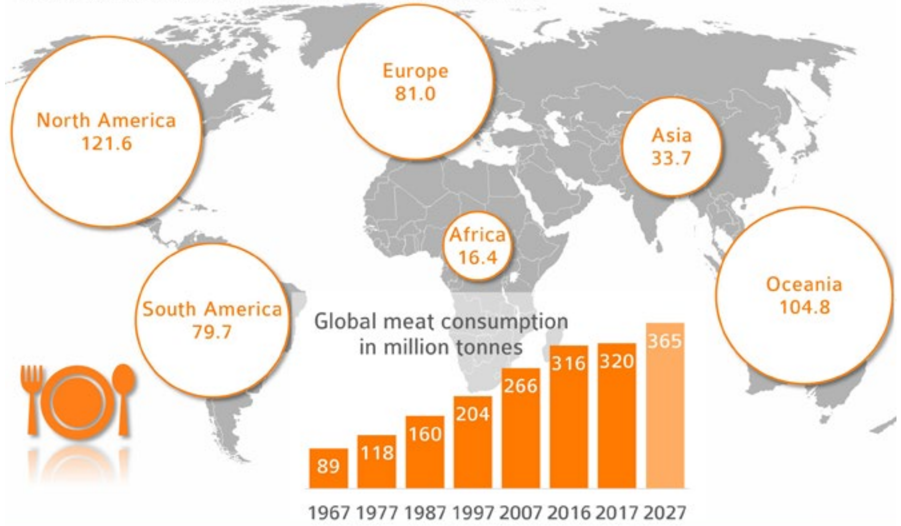
World meat consumption multiplied in the past 60 years to around 320 million tonnes and is set to increase further in the years to come. The rise is not only a result of the growth in the world's population. Meat consumption strongly depends on standard of living, eating habits, and on consumer price levels and macro-economic uncertainties. Compared to other raw materials, meat involves high production costs and is relatively expensive compared to other staple foods. As a result, demand for meat is related to higher incomes and the associated changes in diets that give preference to eating more protein from animal sources.

The growing demand for livestock provokes the need to produce more feed. Alongside grains, soybeans and rapeseed are the main crops used in feeds. Both soybeans and rapeseed are used to make protein feed meal. On a global scale, most soybeans are grown from genetically modified (GM) seed, as is rapeseed in Canada. Because of the global surge in meat consumption, demand for feed protein from oilseeds is set to rise further in future. **The European Union exclusively grows GM-free oilseeds (rapeseed and sunflowers). Since demand for produce declared as "without GM" is growing, production of GM-free products is increasingly based on national or European oilseeds.** This aspect will gain more and more importance as a result of climate protection policy that gears the cultivation of raw materials increasingly to sustainability and greenhouse gas reduction.

Meat consumption on a steady rise

Per capita consumption of meat in 2017, by continent, in kilogram per capita and development of consumption 1967-2027, in million tonnes

© AMI 2018
Source: FAO, UNO



3.2 Why is demand for oilseeds increasing?

» 3.2.2 Blending quotas for biodiesel

On a global scale, the largest driving force promoting biofuels are statutory blending **requirements**. The motivation of the various countries differs greatly. Whereas US and Brazilian interests focus on security of supply in the energy sector and reduction of fuel imports, the EU places great importance on climate protection and an increase in the overall proportion of renewable energy generated. The goals in Asian countries, such as Malaysia, Indonesia and China, but also in Argentina and Brazil, are different again. In these countries, the main objective is to reduce vegetable oil surplus in an effort to stabilise market prices. These countries' national mandates for shares of volume or energy in fossil-energy diesel fuel range from 1 to 30 per cent.

In Germany, the greenhouse gas reduction obligation was introduced for the first time worldwide in 2015. Distributors (i.e. the petroleum companies) must provide evidence of compliance. Bioethanol plays the most important role in the majority of countries that have quota requirements. Again, its use is driven by oversupply in the grain and sugar markets. The biofuel funding policy's aim is not only to contribute to protecting the climate and natural resources, but also to reduce pressure on the market and, consequently, stabilise prices for farmers. The major exporters of agricultural produce in particular can be expected to continue to pursue their previous biofuels policies in the national action plans for decarbonising the transport sector they are required to provide by 2020 (Paris climate protection agreement).

Blending quotas promote use of biofuels

Quotas for ethanol and biodiesel by country, in 2018, in per cent

© AMI 2018 | Source: Biofuels Digest, FAS, Ländermeldungen

E=ethanol, B=biodiesel
Germany: 2018: 4 % GHG reduction; 2020: 6 % GHG reduction
EU-28: 10 % in transport sector by 2020
Norway: reaches 21 % in 2018 overall
Canada: E5-E8.5, B2-B4, depending on state
USA: 7 % overall by 2022
Argentina: E12, B10
Bolivia: E10
Brazil: E28, B10
Chile: E5, B2
Costa Rica: B20
Ecuador: E5, B5
Colombia: E10, B10
Mexico: Monterrey and in Guadlajara E10
Peru: E8, B5

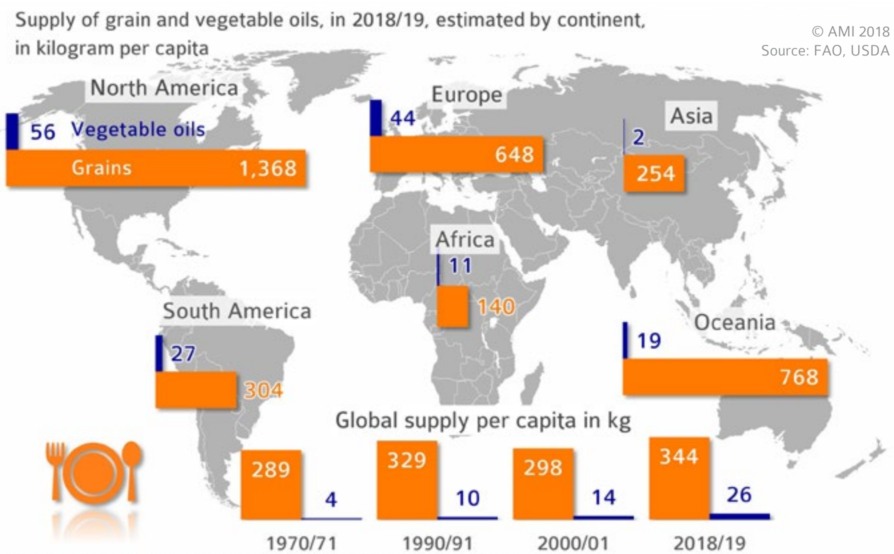
E=ethanol, B=biodiesel
South Africa: 2 % overall
Kenya: E10 in Kisumu, B5
Angola: E10
Nigeria: E10
Malawi: E10
India: E2, B0, 1 (target 2022: E10, B5)
Indonesia: E2, B20 (target 2019: B30)
China: E10 in 10 provinces (target: 15), Shanghai B5
Philippines: E10, B2 (target 2020: E20, B10)
Malaysia: B10
South Korea: B3
Thailand: B10, trucks B20
Australia: New South Wales: E10, Queensland: 4 % overall

3.3 What is the amount of grain/vegetable oil per person?

» 3.3.1 Supply per capita

Over the past 50 years the average per capita supply of the world's growing population of grain and vegetable oils was subject to fluctuations, but trended upward. Estimates for 2018 are 344 kg of grain and 26 kg of vegetable oil. These figures exceed the previous year's total of 364 kg per capita by 6 kg per capita. However, part of this supply is also used in feed production, for transport fuel blends (based on statutory quotas) or other industrial purposes. **In purely arithmetic terms, food supply is sufficient to feed the world's population.** However, there are huge differences between regions. The difference in availability of agricultural feedstocks is primarily a result of distribution issues, rather than a result of global undersupply due to competing fuel and feed uses. Moreover, there are substantial differences in purchasing power in the different countries. This calculation takes into account both the cost of living and rate of inflation in the countries included. However, we still need a comparison between specific shopping baskets and habits of consumption (e.g. cassava, millet in Africa) that would allow us to draw conclusions on per capita purchasing power. The currency to evaluate purchasing power is the international dollar, which has the same purchasing power as the US dollar. The World Bank put the per capita purchasing power in Germany in 2017 at around 51,680 international dollars. In contrast, the purchasing power in Liberia was only 710 international dollars. This means that the existing funds are insufficient for people to buy the amounts of food they need in countries with low purchasing power, although supply of agricultural products is adequate. Whereas in poorer countries of the world food takes up the biggest part of people's incomes, the population in industrial nations only spends a small part of their money on food. The UNO estimated the percentages in 2016 at on average 50 per cent for Africa, 15 per cent for the EU and 6 per cent for the US.

Food production increases with world population



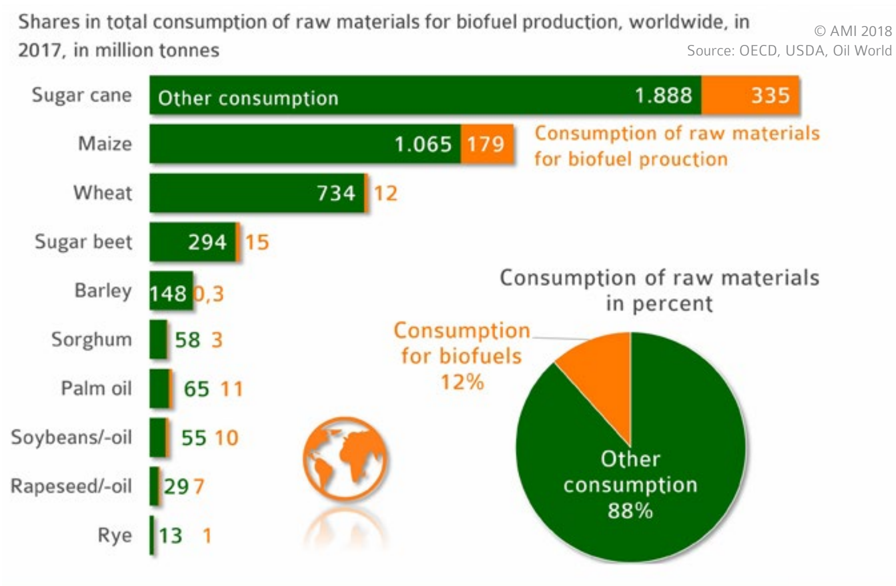
Grains = barley, oat, millet, maize, mixed grain, rice, rye, sorghum, wheat
Vegetable oils = cotton, coconut, olive, palm, palm kernel, peanut, rapeseed, soybean and sunflower oil

3.4 Is there enough food?

» 3.4.1 Use of feedstocks in biofuels production

Charity organizations and environmental associations, and also politicians, challenge – often very effectively – the importance and scope of feedstock production for global biofuels production. The ethical question is whether these feedstocks may be grown and processed for energy purposes. **The fact is that in terms of total world production, the share of agricultural feedstock used in biofuels production is small.** Sugar cane and maize do make up a significant share, but just a small proportion of maize is used in food production. At the same time, the processing of grain into bioethanol yields a considerable amount of Dried Distillers Grains with Solubles (DDGS). This is the equivalent to rapeseed and soybean meal as by-products of processing of oilseed into oil and biodiesel. **Consequently, using agricultural feedstocks for energy purposes can even help to cope with the world's current biggest challenge – to reduce the protein deficit.** The share of agricultural feedstock used in biofuels production amounts to only 12 per cent of global use and ranges from 0.2 to 24 per cent for specific feedstocks. Demand for sugar cane and maize as feedstocks for use in bioethanol production by far outstrips that for vegetable oil feedstocks for use in biodiesel production. The share of wheat and sugar beet is relatively small in terms of quantity. Conversely, this confirms the structural surplus, particularly of carbon hydrates, that exists in the countries where these crops are grown.

Significant use for biofuels production only in the cases of sugar cane and maize



3.5 Why do people starve?

» 3.5.1 The issue of distribution

People in many parts of the world starve or are malnourished although in terms of figures there is adequate supply of the most important staple foods. Along with climate change and natural disasters, wars and forced migration are the main factors stoking hunger in the world. On top of this, international terrorism has become an increasing risk to people's lives and safety in a growing number of countries. The more people are involved in producing food, the more serious the setbacks in food production caused by political crises or conflicts. It is sadly true that to this day more money is spent on maintaining and spreading violence than on peace.

There are also other multiple and complex reasons for the shortage of food, such as climate change, dry spells, unjust distribution and a lack of democratic structures. All these factors prevent economies from booming, farmers from farming in a cost-efficient manner and countries from establishing democratic structures without maladministration or corruption. It is a striking fact that in past famines, it was almost always a combination of war and economic hardship with natural disasters such as dry spells that led to humanitarian emergencies. Countries having no structures for a functioning social system run a much higher risk of famine and malnutrition. Where an appropriate framework is in place, it could be used as a base on which to intensify locally adapted cultivation systems in a sustained manner and, by so doing, create the foundation for supply with food that is equally sustained.

Distribution issue just one of multiple reasons

© AMI 2018
Source: World Bank, USDA

Largest producers of wheat, rye, millet, rice und edible oils in 2017/18, in million tonnes, and 2017 per capita income in international dollars

Country	Food production	Per capita income	Country	Food production	Per capita income
World	1,539	16,906	Japan	10	44,850
China	316	16,760	Ethiopia	9	1,890
India	235	7,060	Uzbekistan	7	7,130
EU-28	173	41,010	Afghanistan	5	2,000
Russia	91	24,890	Republic of Korea	4	38,340
Indonesia	81	11,900	Belarus	3	18,140
USA	74	60,200	Laos	2	6,650
Pakistan	36	5,830	Turkmenistan	1	17,320
Canada	34	46,070	Gambia	0,1	1,670
Bangladesh	34	4,040	Namibia	0,01	10,320
Ukraine	33	8,900	Singapore	<0,01	90,570
Argentina	31	20,270	Qatar	<0,001	128,060

Gross national income (GNI) per capita at purchasing power parity

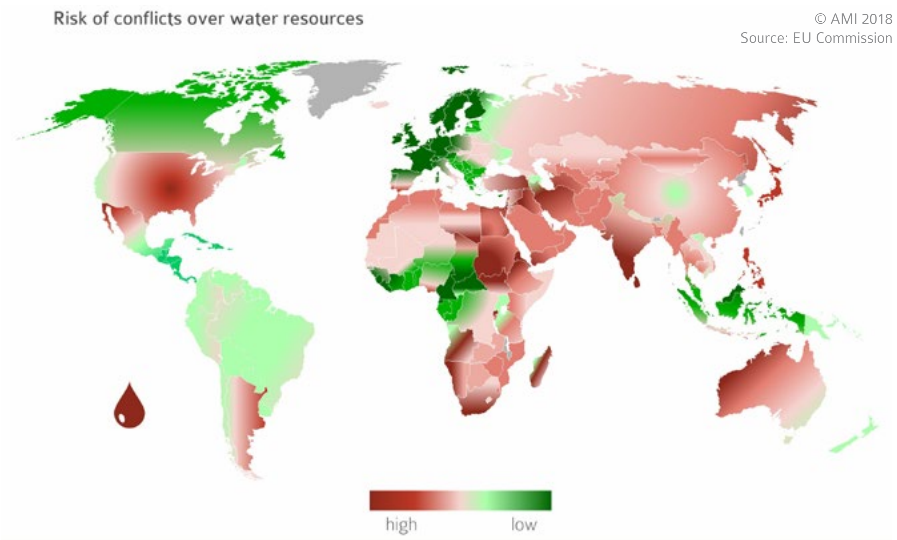
» 3.5.2 Battle for water

Water is indisputably a core essential to life. However, this precious resource is growing scarce. As early as in the 1990s, experts predicted that in the 21st century wars would no longer be waged for oil but for water. And indeed, there have been repeated conflicts over this most coveted resource, especially where countries are forced to share water from the same sea or river.

One of many examples is the political conflict between Israel and its neighbour states, which is exacerbated by disputes over water from the River Jordan. Scientists fear that such conflicts will become more frequent as the climate changes. **Above all, scarce water reserves, high population density, imbalances of political power and climate stressors are the key factors causing water-related tension in these countries.** Global warming and demographic growth in particular are set to lead to a growing scarcity of water, consequently toughening competition for the precious resources. This development will inevitably also increase the risk of conflicts. Such risk could, however, be minimized if the countries affected are well prepared and willing to cooperate.

The hot spots for water conflicts are located in the water catchment area of the River Nile and the areas around the Ganges Delta and Indus River. In Asia the situation is exacerbated by the fact that a lot of water is required in farming, on which people there are extremely dependent economically. Countries bordering with the Euphrates and Tigris rivers are also seen to be particularly vulnerable to water conflicts. The chances are that the Colorado River, which flows through the US and Mexico, and whose waters are fiercely contested even now, could also become another hot spot.

Hot spots of future water conflicts



» 3.5.3 Food availability and climate change

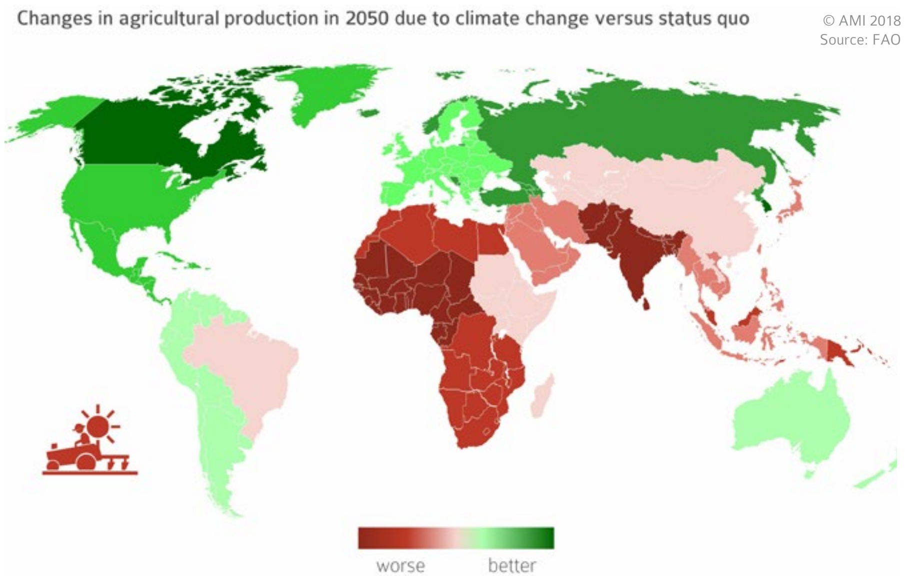
The implications of climate change, which vary locally, will have an impact on agricultural output.

In many regions, the adverse impact of climate change on crop yields and agricultural production could be partially offset by intensifying agricultural land management or expanding agricultural land. At the same time, small family farms have little access to innovative technologies and plant production methods, which makes it harder for them to adapt to a changing climate.

In comparison with the status quo, model calculations project that climate change will cause a falloff in agricultural output in many parts of Africa, the Middle East and India and South and Southeast Asia. By contrast, for countries in more northern latitudes the forecast is that higher temperatures will lead to a rise in agricultural output, for example in Canada and the countries of the Russian Federation.

Differences in access to markets and technologies within and between countries will likely enhance the impacts of climate change and could cause the gulf between industrial and developing countries to widen further.

Changes in production due to climate change



4 Use of land

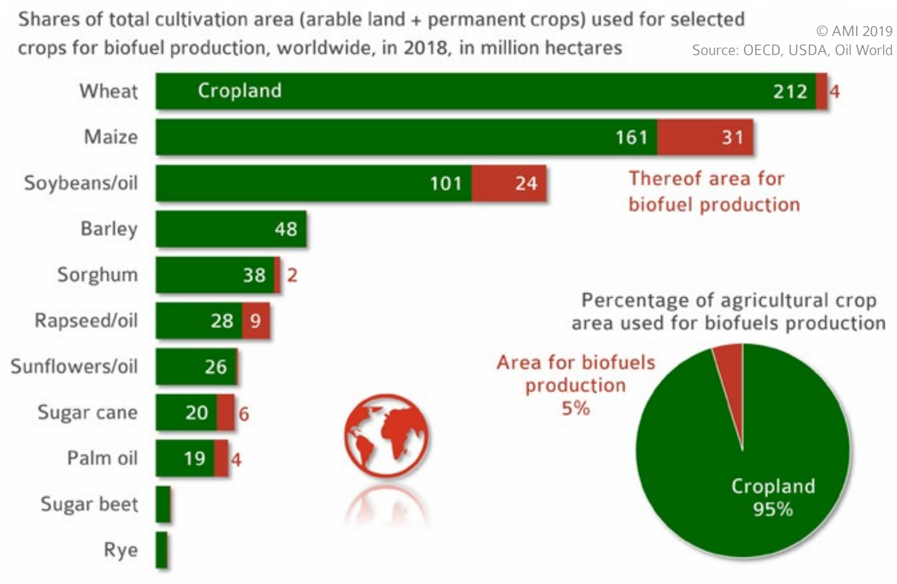
4.1 Does growing energy crops create a lack of land for food crops?

» 4.1.1 Shares of land used for biofuels production

Crop plants are grown on more than 1.56 billion hectares worldwide. These include – among others – grain, oilseeds, protein, sugar and fibre plants, fruits, vegetables, nuts and others. Most of this produce is used as food. Only around 5 per cent go into biofuels production.

At the same time, biofuels production is in most cases very obviously located in places where there is a surplus of feedstock anyway. If the surplus were not used to produce biofuels, it would have to be placed on the global market, where it would weigh heavily on already low feedstock prices. The use in biofuel production reduces the production overhang, generates extra value added and reduces the need for foreign currency for imports of crude or fossil fuels. The latter is primarily a problem in poorer countries. Another advantage is the amount of high-quality protein feed that is generated in biofuel production, demand for which is steadily increasing. The amount and quality of these protein feeds have a strong influence on feedstock prices. Consequently, they also determine the amount of land dedicated to growing the feedstocks. **In other words, biofuels are by no means the price drivers in the commodities markets. If necessary, the feedstocks grown for biofuel production are primarily available for food supply.** In the case of politically subsidized extensification, this option for „buffering" food demand is omitted.

Biofuels take up little space



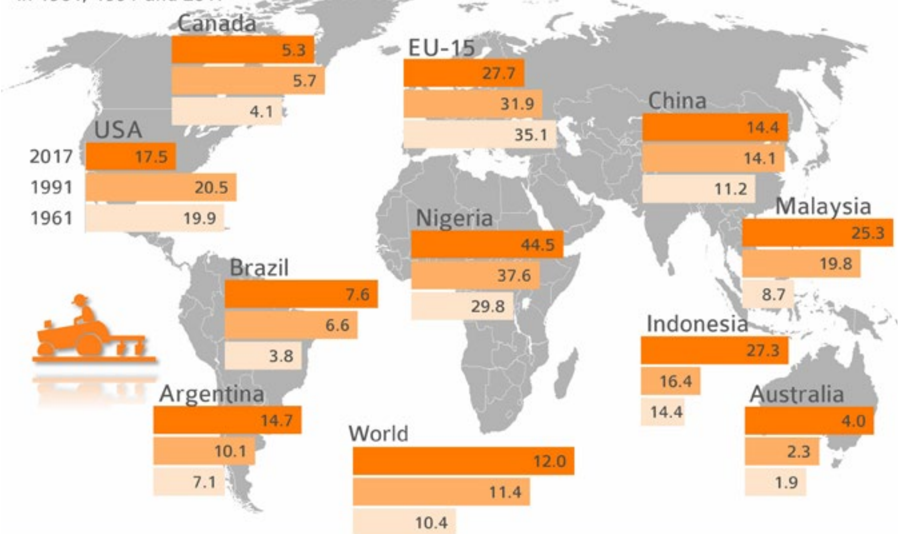
4.1 Does growing energy crops create a lack of land for food crops?

» 4.1.2 Development of cropland

The production of grain and rice more than trippled between 1960 and 2019 from 0,8 billion tonnes to 2.6 billion tonnes, and the output of vegetable oils increased even twenty-fold from 17 million tonnes to 206.5 million tonnes. The conversion of primeval forest and other land required to protect the environment and climate is increasingly meeting with strong public and political resistance. For this reason, there is a need to create sustainability requirements that are binding on all growing areas. Based on these requirements, biomass production must be certified to allow it to be traced to its origin. In the southern hemisphere, the implementation of social standards and the issues of land acquisition and ownership are paramount for sustained biomass production. A stop must be put to illegal clearings of primeval forest or changes in land use to create new palm oil plantations or expand soybean cultivation. **In the revision of the EU RED II, the EU's biofuels policy defines more stringent documentation requirements and greenhouse gas reduction requirements, for the first time also for solid biomass.** At the same time, in light of the changes in land use in South America and Asia (clearing primeval forest), **there are growing calls to develop these system requirements further – irrespective of final use – and lay them down in legislation.** The aim should be to create a level playing field for global fair competition without any environmental or social dumping.

Less land in agricultural use in the northern, increasingly more in the southern hemisphere

Shares of agricultural land and plantations in total land area, in per cent, in 1961, 1991 and 2017



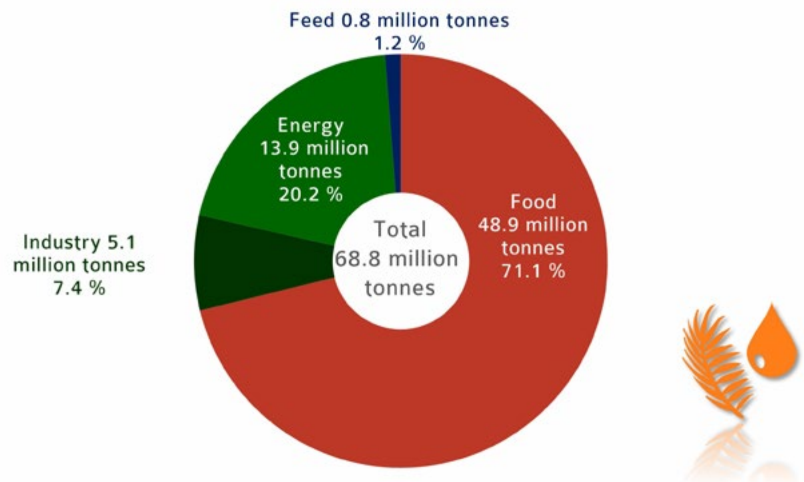
4.2 Is there a limit to the use of palm oil?

» 4.2.1 Global use of palm oil

Oil palm is the single most important oleaginous fruit crop in Southeast Asia, but is also grown to a considerable extent in Colombia and Nigeria. On a global scale, palm oil is the most important vegetable oil with an annual output of more than 70 million tonnes. Like other vegetable oils, it is ideal for a wide range of uses – in food, oleochemical items or as a feedstock for biofuel. Global palm oil consumption in 2018 is estimated at just less than 69 million tonnes. The majority is used as edible oil in Southeast Asia. Food uses account for 71 per cent, energy uses for 20 per cent (e.g. biodiesel) and oleochemical uses for 7 per cent of overall consumption. World palm oil production increases each year due to the expansion in area by clearing primeval forest legally and illegally, replantings and the use of new hybrid varieties with a high yield potential. However, the growth in global demand is lagging behind. This has the result that more and more palm oil surplus is processed into biodiesel in the main palm oil producing countries and governments are raising blending quota requirements step by step. In Indonesia, the quota for non-public transport is already at 20 per cent. By contrast, the EU aims at curbing the use of palm oil in biodiesel. Plans are to end counting palm oil in biofuels in the achievement of EU climate targets. **However, fuels at European petrol stations will not be entirely free of palm oil until 2030. The incorporation rate is to be frozen at the level of 2019 and then gradually reduced from 2023 onwards.** On a global scale, palm oil consumption is likely to increase over the coming years, especially, it can be assumed, in the food sector. At the same time, the individual sectors are poised to make increasing use of palm oil that is certified as sustainable. In the EU-28 today, the percentage of certified palm oil for energy-related uses is one hundred per cent.

Palm oil is primarily food

Shares of various uses of palm oil, worldwide, in 2018, estimated, in million tonnes and per cent



5 Development of prices

5.1 Do biofuels push food prices up?

» 5.1.1 Comparison of prices of bread and grain

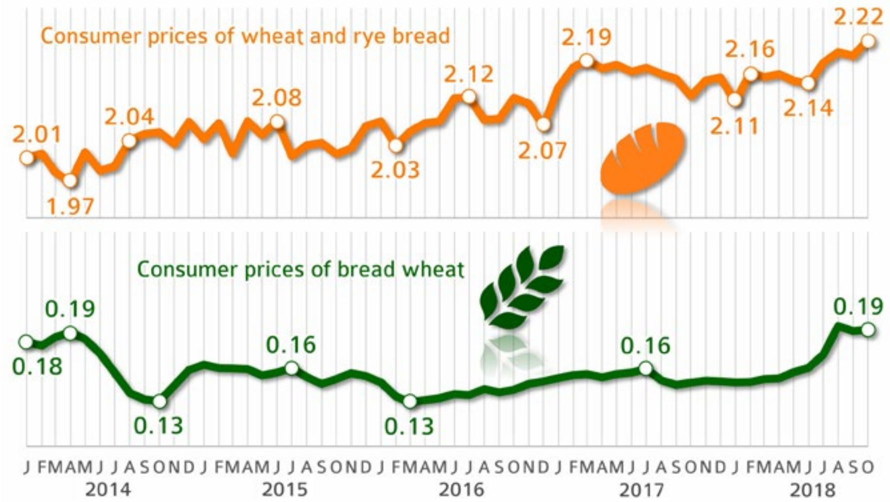
Wheat is used both for food and bioethanol production, with use in transport fuel production currently stagnating. Many people argue that production of biofuels causes a shortage in this feedstock for food production and drives wheat prices. Although prices for wheat and rye bread did increase in the second half of 2018, biofuel production had little to do with the increase. In fact, the rise was prompted by a significant surge in wheat prices in response to smaller harvests. **The main reason for consumer price increases of soft wheat-based products, e.g. wheat-rye bread, has been rising costs for labour, rents, energy etc. The explanation is that raw material only accounts for approximately 15 cents of the costs in a one-kilo loaf of wheat-rye bread.**

The case that the production of biofuels reduces the availability of feedstock for food and drives prices upwards is not only made in industrial countries. The point is also made as an argument against the use of renewables in developing countries. However, the real causes of price increases in these countries are primarily found in government interventions in the markets, high freight costs, poor infrastructure and inadequate market access.

Bread price versus grain price

Consumer prices of wheat and rye bread and ex-farm prices of bread wheat, in Germany, in EUR per kilogram

© AMI 2018 | Quellen: AMI/LK/MIO, AMI Consumer Price Panel



» 5.1.2 Comparison of prices of bioethanol and grain

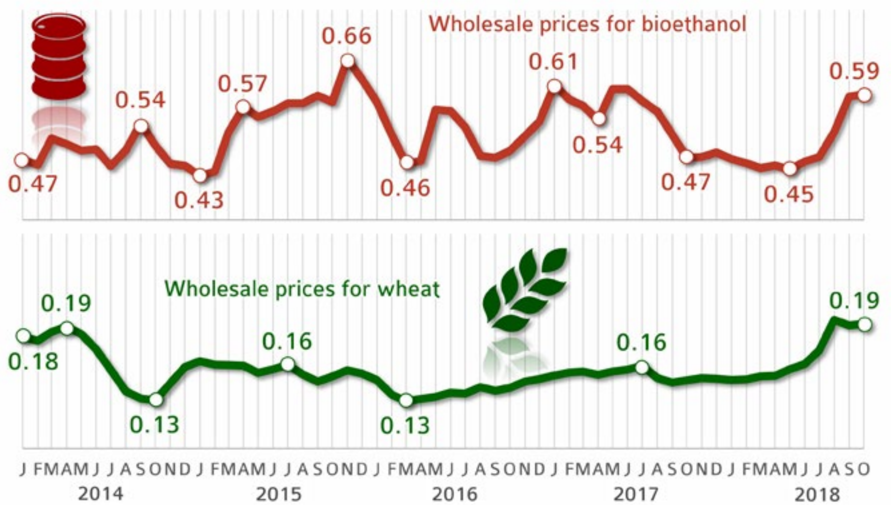
Issues surrounding global nutrition continue to be at the centre of intense discussion, especially since prices for agricultural feedstock and staple foods exploded globally in 2007 and 2008 and prices became volatile as a result. Ongoing famine, hunger and poverty have been closely associated with the way prices for agricultural feedstock have developed in the global market. More specifically, biofuels are often cited as the explanation for the price situation.

According to FAO, suppliers have "responded" with intensification and yield increases. For several years now, bumper crops have led to global oversupply and, as a consequence, a build-up of stocks at high levels. 2018/19 grain harvests are exceptionally small in many parts of the world due to adverse weather conditions. As a consequence, production is unlikely to cover annual demand. **Nevertheless, overabundant stocks will close the gap – there can be no question of grain supplies being short.** As the charts show, the increase in demand for agricultural feedstocks for use in biofuels production only has a minor inflationary impact on prices. Although both wheat and bioethanol prices went up, there is no direct correlation between the two. In the wake of the trade conflict between the US and China and the associated increase in crude oil prices, bioethanol prices increased whereas prices of wheat were driven by harvest losses in Europe. **To sum up, bioethanol does not lead to rising prices of wheat; instead, demand for biofuels stabilizes producer prices, even to the benefit of agriculture in developing countries.**

Biofuel demand has little impact on prices

Wholesale prices for bioethanol (excl. taxes) in EUR per litre and ex-farm prices of wheat in EUR per kilogram, in Germany

© AMI 2018 | Source: AMI/LK/MIO



Lower-quality wheat

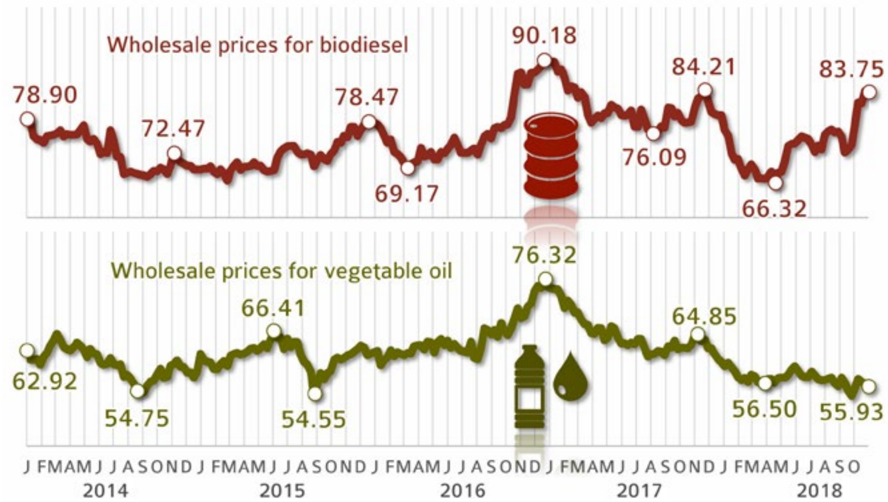
» 5.1.2 Comparison of prices of bioethanol and grain

↳ 5.1.2.1 Comparison of prices of biodiesel and vegetable oil

Biofuels have little influence on commodities

Wholesale prices for biodiesel and vegetable oil (as mean values of rapeseed, soybean, palm and sunflower oil prices), excl. taxes, ex works, in cent/l, in Germany

© AMI 2018
Source: AMI



6 Statistics

6.1 General notes on handling statistics

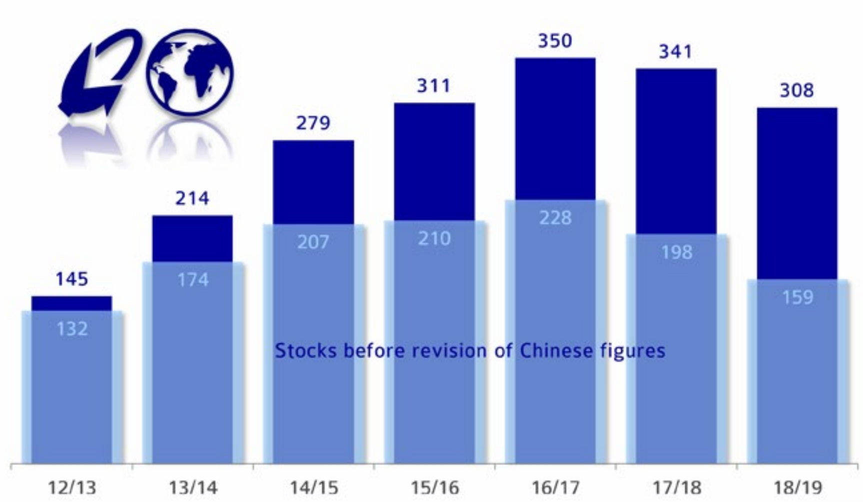
» 6.1.1 Pitfalls of statistics

Each case made should be based on reliable figures, especially in the debate on benchmark decisions about medium and long-term supply with food. However, it isn't as easy as it sounds. Decision-makers frequently act according to the motto: "I don't trust any statistics I didn't falsify myself." How trustworthy is the source? Which intention does the data provider represent with the information given? And even if the information is neutral, the question is, is the glass half full or half empty? Figures can often be interpreted in different ways. And finally, how exact is "exact"? This problem can be seen especially in statements of quantity.

For example, figures relating to production and processing are always fraught with uncertainty. The maize crop outlook for China is a recent example. For many years it was too low, because the assumed acreage it was based on was too small. The figures had to be raised following an agricultural survey. More specifically, the authority in charge revised the ten-year statistics for maize upwards by up to 40 million tonnes per year. At the same time, adjustments of consumption figures have been inadequate. This has led to an unexpected swelling of global maize stocks. Not even the USDA could blind itself to these facts and revised its global supply/demand balance for maize substantially in November 2018.

All figures are relative

Global maize stocks, in million tonnes, before and after revision of the Chinese stock figures, USDA information, 2017/18 estimate, 2018/19 forecast



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USDA	United States Department of Agriculture, Washington D.C. Marktet and trade data, PSD online	https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery www.fas.usda.gov/data
World Bank	The world bank, Washington D.C. database	data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD

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