

The challenges facing agriculture and the plant science industry in the EU



AgbioInvestor
Agricultural Market Intelligence

Background to the Report

Agriculture is an important element of the overall economic and social structure of the European Union (EU). This report, which has been commissioned by CropLife International, will analyse the current position of agriculture in the EU and the industries which support it, focussing on the following issues:

- Agricultural productivity in comparison to other regions/countries
- Agricultural policy and support – impact of CAP policy reform
- Regulatory environment and its impact on innovation and availability of new technologies for farmers
- EU's reliance on imports from other continents to maintain high-value agricultural production
- EU's dependence on food imports

The report provides an outlook on agriculture in the EU if the current trends continue.

About AgbioInvestor

AgbioInvestor is a private company providing data, analysis and insights into the crop protection, agricultural biotechnology and seeds industries.

For further details of AgbioInvestor please visit: <https://agbioinvestor.com>

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1. Summary

This report highlights the challenges and obstacles facing agriculture in the EU today to sustainably increase agricultural production. It is based on an analysis of existing data and references and notes several major issues.

The political environment in the EU and related regulatory and policy decisions have led to reduced access to modern agricultural tools, such as plant biotechnology and crop protection products, contributing to stagnating agricultural productivity and economic development.

- Global agricultural productivity has increased in many continents due to modern agricultural technology. The USA, Brazil and China have seen drastic increases in agricultural productivity due to the adoption of new technologies, such as plant biotechnology and modern crop protection products. Meanwhile, the EU has seen agricultural productivity stagnate. The continued unpredictable political environment will likely lead to further reductions in the availability of crop protection products and biotech seeds in the region, further hampering farmers' efforts to sustainably increase production.
- The cost of innovation has significantly increased over the past decade¹, while the number of crop protection products has decreased² and GM technology is largely not available in the EU³. This is driven by an EU regulatory system which is increasingly based on perceived hazard rather than risk, and does not provide the predictability that businesses (both farmers and agrichemical companies) require to operate and innovate effectively.
- This situation, including the increased time and cost involved in bringing crop protection products as well as imported or cultivated biotech crops to market, also makes the region less attractive as a focus for private companies' research and development.

- The EU is also falling behind when it comes to using innovative planting systems involving precision agriculture (digital agriculture). Precision farming has the potential to provide more efficient planting of seed and use of crop protection products, resulting in cost savings and productivity gains for the grower⁴.

Discussions on the future of the Common Agricultural Policy (CAP) will likely have an impact on subsidies, farm income and crop output. Ultimately the competitiveness of EU agriculture could suffer if farmers do not have access to modern technology to improve the viability of their business.

- EU farm payments could be reduced as part of the next CAP revision. Not only are there pressures on the budget with the imminent exit of the UK from the EU, but trading partners are also pushing for reduced subsidies. If the EU does opt to reduce the CAP budget, this could reduce farm income and profitability, coupled with a fall in the value of crop output.
- Recent data analysis shows that agricultural output per EUR subsidies remained lower in Europe than in the USA. The data suggest that this is due to the availability of additional technologies in the USA⁵.

Further diversion of regulatory standards between the EU and its key trading partners could have a significant impact on trade. Given the EU is reliant on agricultural imports, any regulatory obstacles could have negative implications for EU consumers and farmers.

- The EU is dependent on imports, especially for feed. While the EU has a positive trade balance for meat, this would not be possible without imported protein-rich feed⁶, as shown by EU Commission statistics. Moreover, the EU has a trade deficit for several crops and relies on imports from other continents for food⁷.

¹ <https://croplife.org/wp-content/uploads/2016/04/Cost-of-CP-report-FINAL.pdf>

² This Report Figure 27: Number Of New Agrochemical Active Ingredients Introduced Globally And Registered In The EU

³ This Report Figure 31: Plant Biotechnology (GM) Seed As Share Of Total Seed Per Region

⁴ OECD: The Next Production Revolution Implications For Governments And Business, 2017

⁵ Data from USDA and Eurostat, Calculated By AgbioInvestor, See Figures 8-12 of this report

⁶ The European Crops Market Observatory (December 2017): EU Protein Balance Sheet

⁷ Eurostat: see Figure 18 of this report

- EU farmers produce fewer row crops⁸ as documented in Eurostat data (2016 vs. 2011) and the trade deficit for fruit and vegetables has become more significant over the past years⁹. Therefore, the EU will continue to rely on imports for food and feed.
- The hazard-based setting of Import Tolerances in the EU is regarded by many as non-compliant with World Trade Organization (WTO) rules and is expected to create trade distortions¹⁰ as well as problems with production processes in countries exporting to the EU. This threatens the trade in arable produce that is required to be imported into the EU to meet food demand.

In conclusion, the adoption of new technologies in the EU has the potential to sustainably improve productivity, safeguard farm businesses and potentially reduce dependence on imports.

By applying a more consistent and predictable decision-making process and a risk-based regulatory system for crop protection products and biotechnology, the EU can meet its production potential for a sustainable future benefiting consumers and farmers in the EU and abroad.

⁸ Eurostat: see this report Figure 13, Figure 14, Figure 15

⁹ Eurostat: see this report Figure 19

¹⁰ World Trade Organization Committee on Sanitary and Phytosanitary Measures (2017): Summary of the meeting of 2-3 November 2017



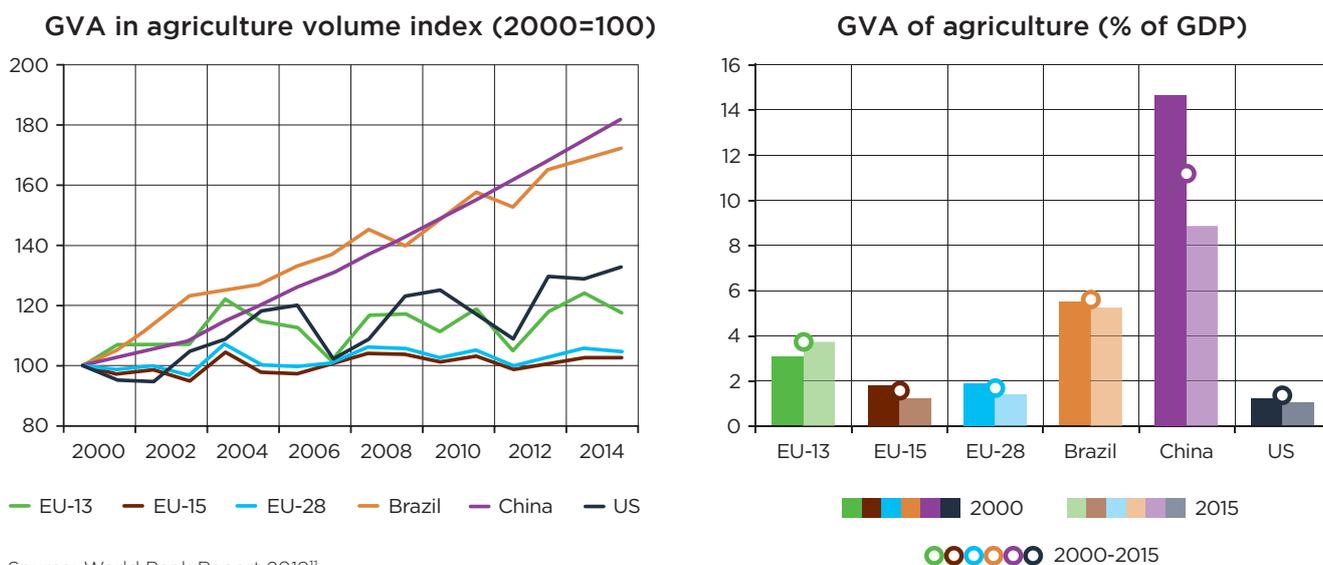
2. EU Agriculture Productivity and Competitiveness

EU GROWTH

Compared to other major agricultural producers, such as China, the US and Brazil, overall agricultural growth in the EU has been stagnating (Figure 1). The share attributable to agriculture in the GDP of the EU-28 is decreasing.

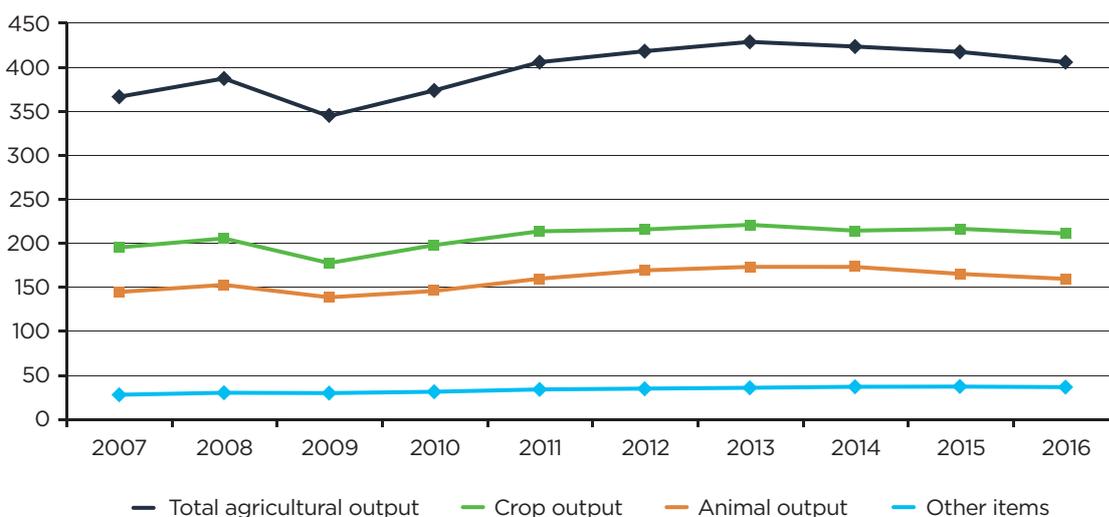
According to Eurostat¹², the economic accounts for agriculture show that total agricultural output in the EU stood at €405.0 billion at basic prices in 2016, down by 2.8% compared to 2015 (Figure 2).

Figure 1: Agricultural Sector Growth (Gross Value Added, GVA)



Source: World Bank Report 2018¹¹
Eurostat, WDI and staff calculations

Figure 2: Agricultural output in the European Union 2007-2016 (in billion Euros)



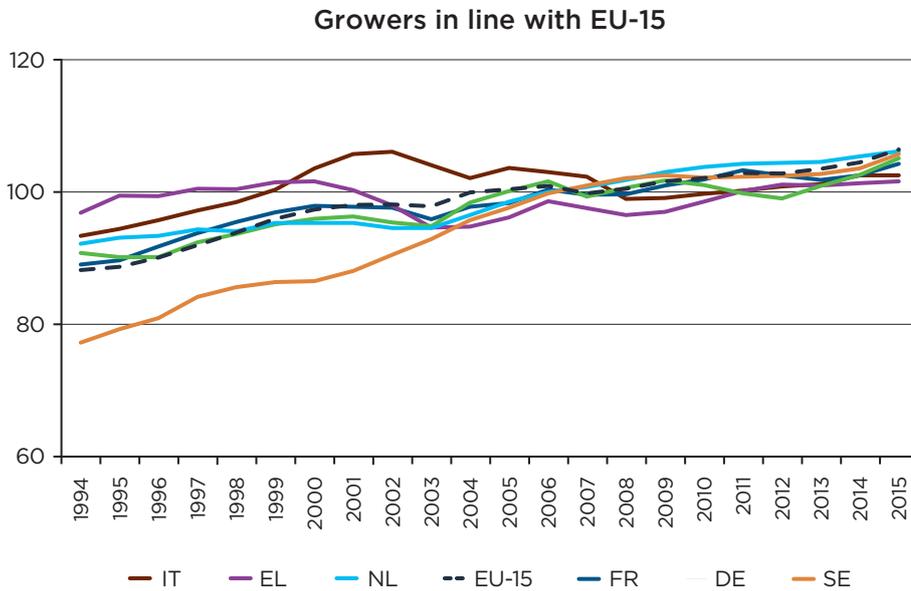
Source: Eurostat

¹¹ World Bank 2018, Thinking CAP: Supporting Agricultural Jobs and Incomes in the EU

¹² Eurostat news release (178/2017): Total agricultural output in the EU down by 2.8%

These findings are confirmed by yet another growth indicator: As stated by the EU Commission¹³, agricultural productivity in Europe measured as total factor productivity (TFP) has also been flat to minimally increasing for several years (Figure 3).

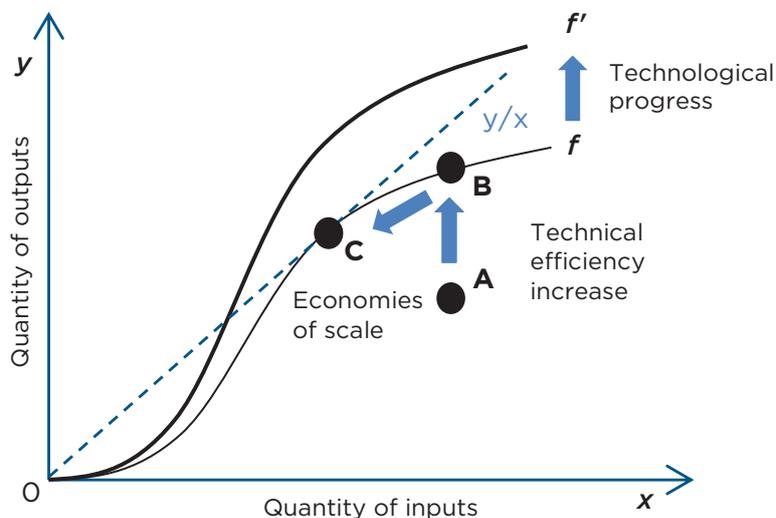
Figure 3: Total Factor Productivity Growth Path for EU-15



Source: EU Commission document

Total factor productivity reveals the joint effects of many factors including new technologies, efficiency gains, economies of scale, managerial skill, and changes in the organisation of production. Figure 4 shows possible pathways to improve productivity: One way is to shift the production frontier upwards by implementing new technologies (f to f'); another way is to increase the technical efficiency by better applying existing technologies (from A to B). Economies of scale refer to optimising the scale of operations to achieve an improved output over input ratio (from B to C). Technological progress is dependent on research and development of new technologies provided by the plant science industry.

Figure 4: Pathways for productivity growth



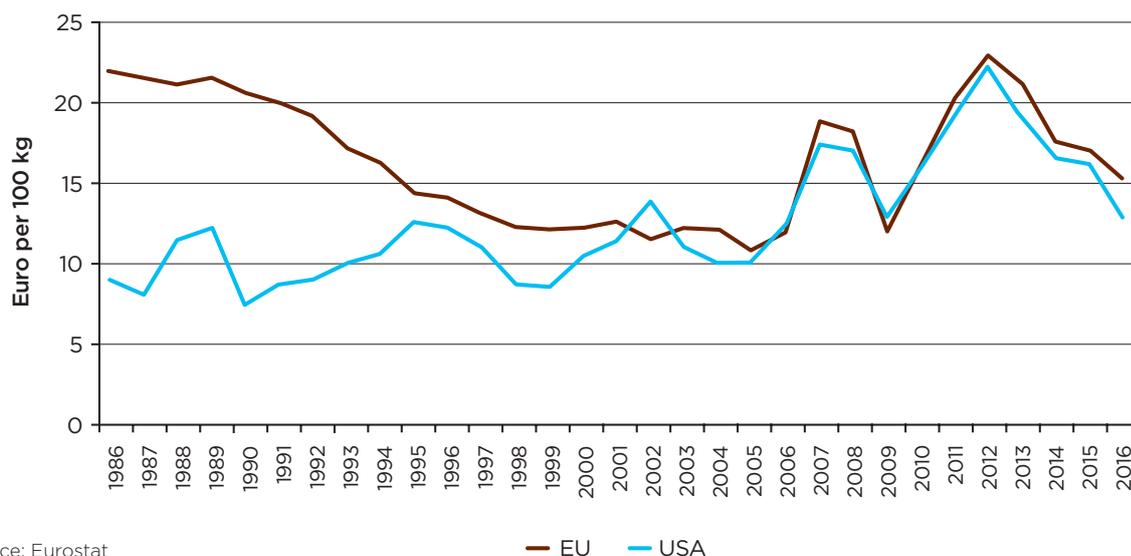
Source: European Commission document

¹³ EU Agricultural Markets Brief No 10 (December 2016): Productivity in EU agriculture; author: EU Commission DG Agriculture and Rural Development

EU COMPETITIVENESS

The impact of the EU's price intervention policy through CAP is outlined in the graph below which shows the actual average market price for cereals in from the EU from 1986 until 2000, versus the US price for wheat. The average market prices for soft wheat in the EU are based on the fourteen countries that reported in Eurostat (EU-15 minus Ireland). As outlined below, EU wheat prices were significantly higher than in the USA up until 1995 (Figure 5) because EU prices were driven by the policy of price intervention (CAP). Prices started to converge when the EU switched its CAP towards direct single payments.

Figure 5: Average Selling Price for Wheat in EU and USA



Source: Eurostat

As discussed above, financial support for growers in the EU switched from the price intervention system to one of direct subsidy payments made directly to the grower. However, this new system offers no direct incentive for yield enhancement or productivity in the arable crop sector.

A number of studies have demonstrated that growth in agricultural output in the EU has slowed significantly over the last decade in comparison to previous periods¹⁴.

In this section of the report we have examined agricultural output in value terms so that output growth can be contrasted with direct farm support.

¹⁴ EU Agricultural Markets Brief No 10 (December 2016): Productivity in EU agriculture; author: EU Commission DG Agriculture and Rural Development?

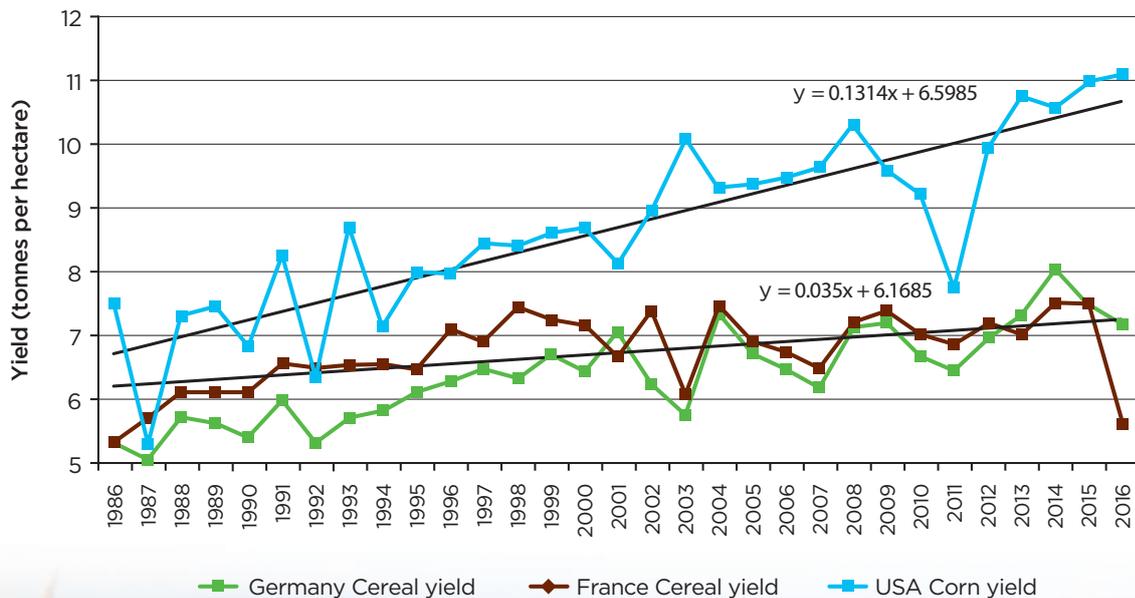
2. EU Agriculture Productivity and Competitiveness

The following graph compares how crop yields have developed for the main grain sectors in the EU and one of its major competitors, the USA (Figure 6). In the case of the USA the main grain crop is corn while in the EU the main grain crop is wheat.

The figure outlines the relative yields of cereals grown in Germany and France between 1986 and 2016. For comparison we have included the equivalent yield of the main grain grown in the USA, corn.

The comparison shows that corn yields in the USA have increased at a rate significantly higher than that of cereals in the two most dominant cereal growing countries in the EU (Figure 6).

Figure 6: Historical yields for key grain crops per region



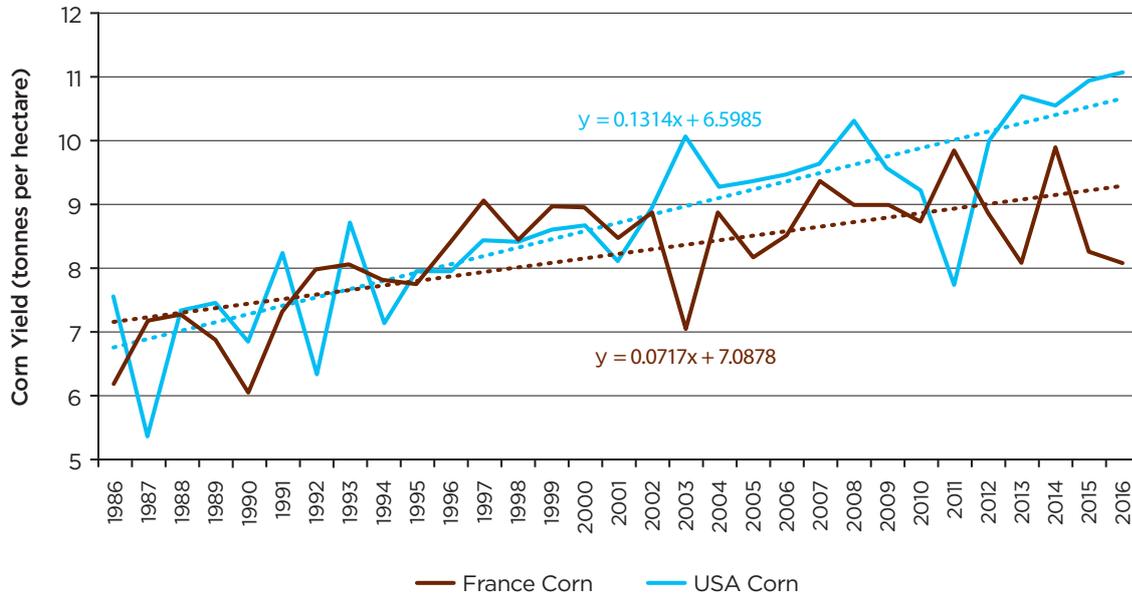
Source: AgbioInvestor based on Eurostat, USDA



A direct comparison between corn for grain yields in the USA versus France reveals a similar pattern with yields for US corn growing at a significantly higher rate than that of French corn (Figure 7).

Over the thirty-year period from 1986 to 2016, growth in historical corn yields in the USA has developed at a rate almost twice that of France.

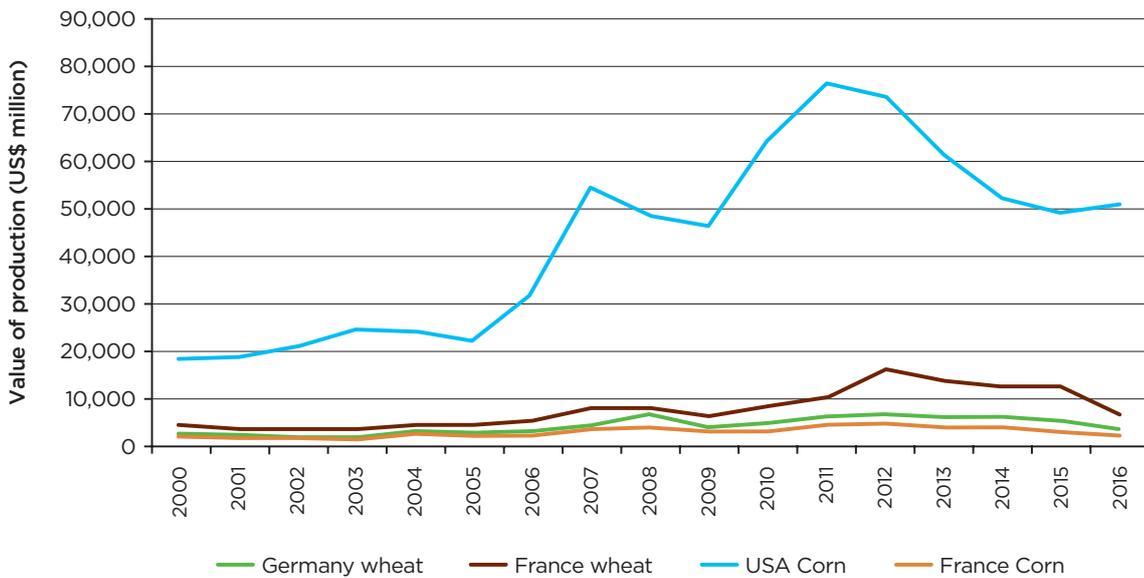
Figure 7: Historical Corn Yields in France and USA



Source: AgbiolInvestor based on Eurostat, USDA

The net impact of the increase in US corn yields has been a significant rise in the value of corn output in the USA (Figure 8).

Figure 8: Value of Crop Output (US\$ million)



Source: Eurostat, USDA

2. EU Agriculture Productivity and Competitiveness

While volatility in crop prices has been a factor in the overall growth in the value of US corn output, new technology in the form of GM seed and precision planting have also contributed to the value development. This technology has been widely accepted by growers in the Americas, however EU policy towards GM technology has been perceived as strongly negative, resulting in growers in the EU not having access to potentially beneficial technology.

The adoption of new technology in the USA versus the EU is an important factor in the development of crop yields, however another major difference between the two competing trade blocks lies in the overall level of financial support made by the two authorities towards agriculture. The USA also has a system of financial support for farmers through direct payments.

As outlined above, the EU moved from a price intervention system towards one of direct support through a number of measures. In 2017 the total sum allocated to the direct payments was €39.66 billion, a value equivalent to 68.9% of the total EU agriculture and rural development program. The EU direct payment system value includes support to all farmers and hence is not designated only at the crop sector; however in comparison, in 1999 the EU devoted €26.9 billion to the support program for plant products compared to €9.6 billion for animal products.

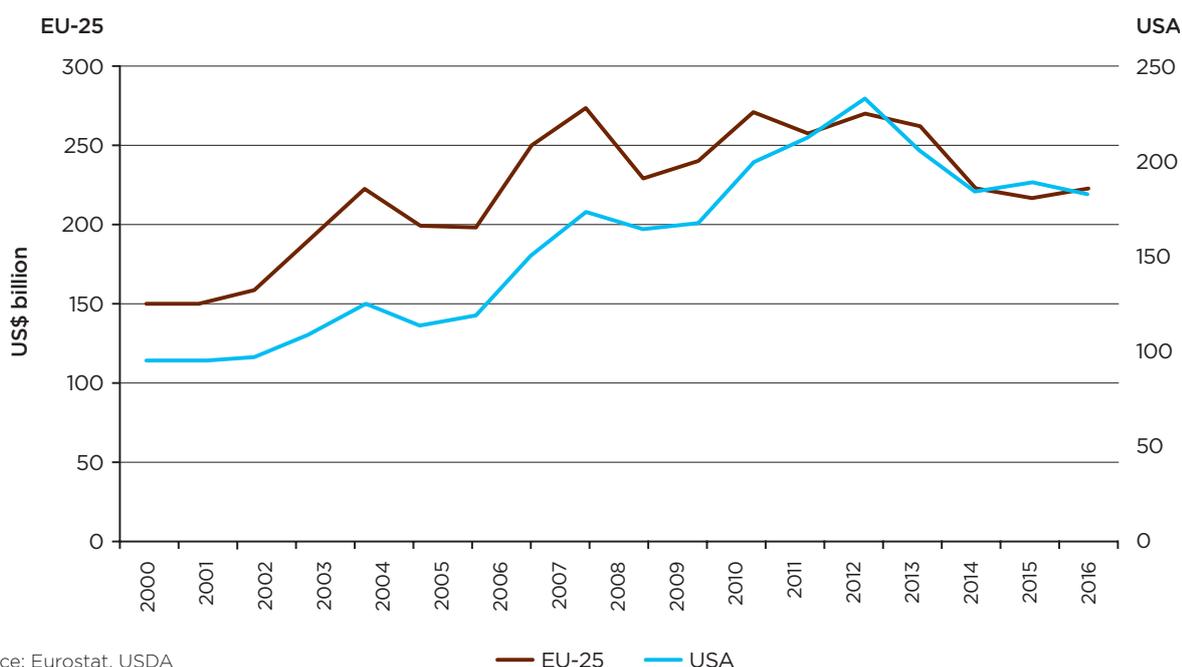
Taking account of the various differences in how the money is allocated, it is clear that the EU budget for farm support, by way of direct payments, significantly exceeds that of the USA.

The disparity in farm support between the EU and the USA does not make itself apparent in the overall economics of farm production between the two blocks. The following analysis examines how the value of overall crop output between the EU-25 and the USA has developed since 2000.

In the following analysis we have compared the value of total crop output in the EU to that of the USA. The EU value of crop output is high due to the significant share of fruit and vegetables.

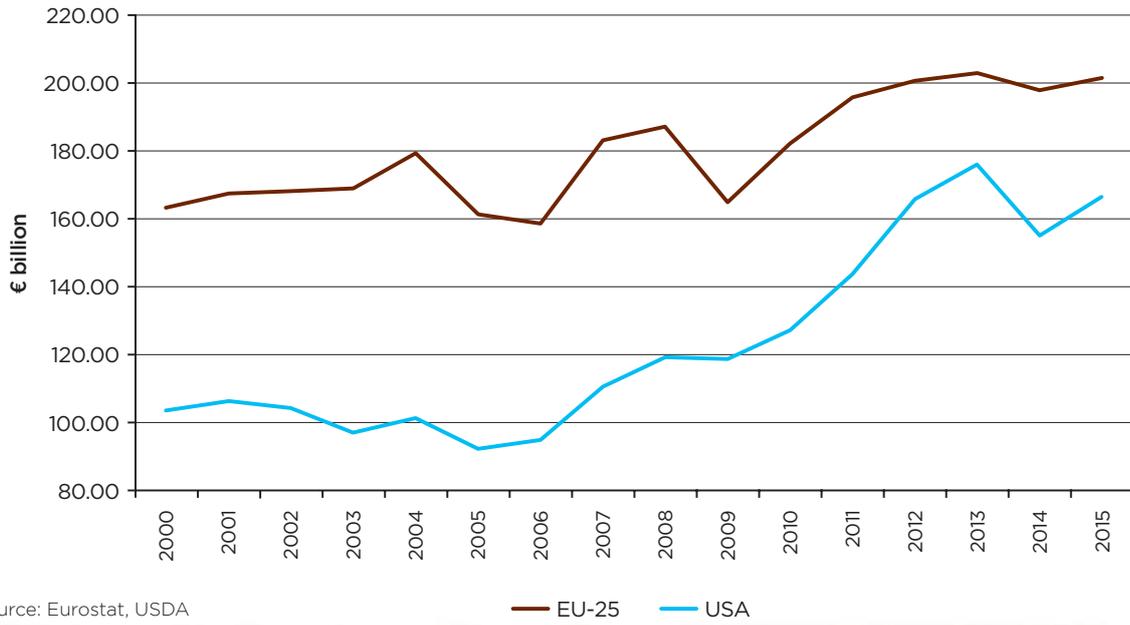
However, over the last sixteen years, the value of crop output in the USA has grown at a rate ahead of that of the EU-25 in US dollar terms (Figure 9). The trend is also apparent when the same data are expressed in Euro terms (Figure 10).

Figure 9: Value of Crop Output including fruit and vegetables (US\$ billion)



Source: Eurostat, USDA

Figure 10: Value of Crop Output including fruit and vegetables (€billion)



2. EU Agriculture Productivity and Competitiveness

In the case of the USA much of the growth in output value has arisen in the period since 2006, a time that coincides with the rapid uptake of GM technology in key crops such as corn, cotton, sugar beet and soybean.

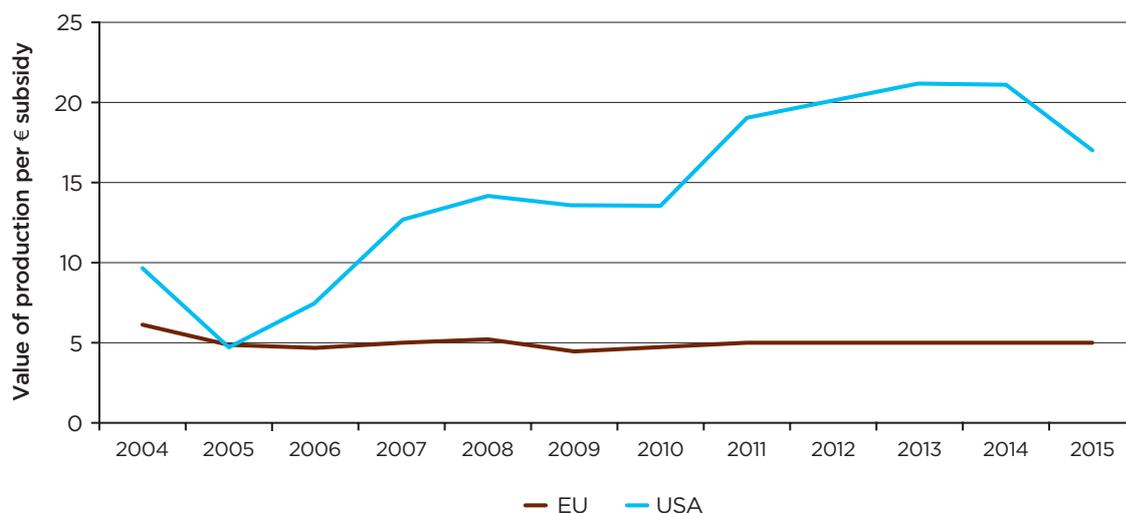
In all these crops, the rate of GM seed uptake in the USA is over 90%. Hence over 90% of the US crops have either in-built herbicide tolerance or insect resistance, or a combination of both. This, coupled with the use of seed treatments with residual insecticides and fungicides, offers a broad spectrum of early season pest, disease and weed control.

By utilising the seed as the means of applying early season plant protection products in conjunction with planting, the grower is able to significantly reduce the number of passes over the field when compared to comparable cropping systems in the USA ten to twenty years ago.

GM seed has the additional advantage of enabling the grower to utilise non-selective herbicides at a much reduced cost base when compared to the use of selective herbicides. This, coupled with the cost savings from the planting of GM seed, is able to offer the prospect of lower input costs.

Comparison of the ratio of the value of crop production (in euro terms) with the overall direct subsidy in euro value for the EU versus the USA reveals a similar pattern with the value of US output per euro of direct aid significantly exceeding the EU equivalent figure since 2004 (Figure 11).

Figure 11: Ratio of value of crop production versus subsidy in Euro terms



Source: AgbioInvestor based on data from EU, USDA

The above analysis shows that for every euro of subsidy paid by the US authorities, the value of production realised has increased with time.

In contrast, in the EU-25 countries there has been no observable increase in the value of crop output despite a high level of direct farm support.

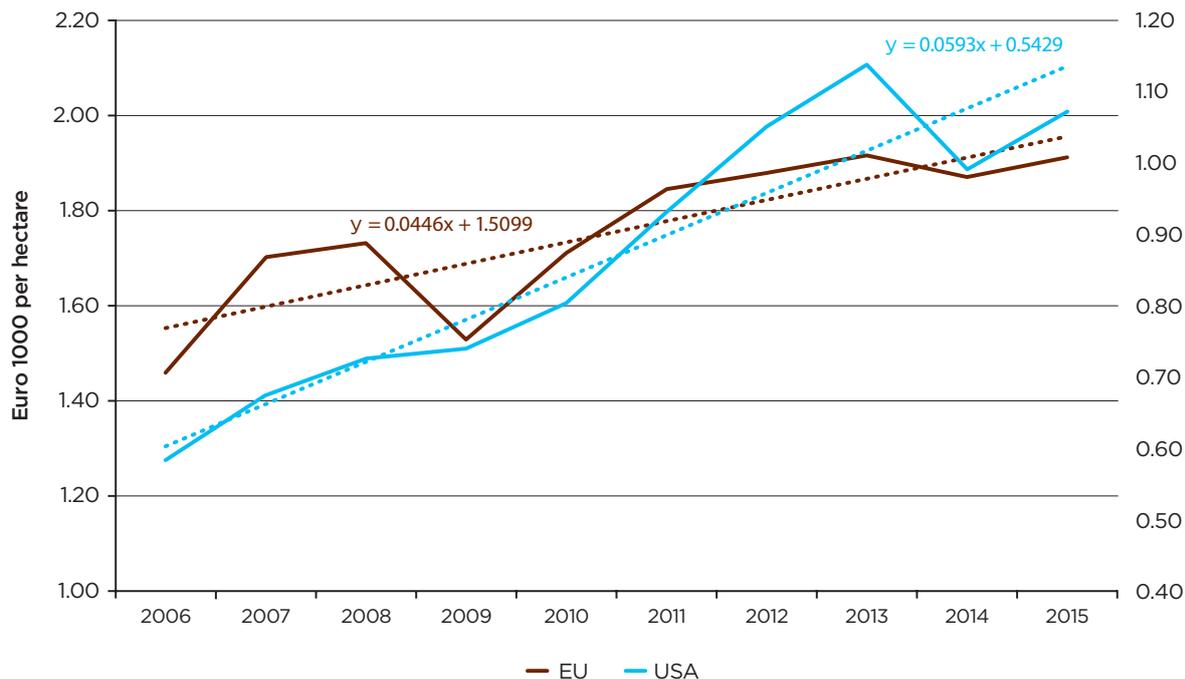
In their investigation into agricultural output, Barath and Ferto¹⁵ demonstrated that total factor productivity (TFP), the ratio of total output to input, in the EU exhibited a slight decrease between 2004 and 2013. In contrast studies by the EU and the USDA have shown marginal to modest growth in TFP in the EU. In our analysis we have focused on the value of crop output using official data from the EU and the USDA, and it is apparent that overall growth in ratio of the value of crop output per Euro of direct subsidy is essentially flat for the EU, whereas the USA exhibits significant growth in value over the same time period.

¹⁵ Barath and Ferto, Productivity and Convergence in European Agriculture. Hungarian Academy of Sciences, 2016

Against a background of a stable arable area in the EU, it is clear that in order to achieve sustained TFP growth in the arable sector, an increase in overall productivity per hectare is required. In the following analysis we have compared the ratio of crop output in value terms to the overall crop area based on arable and permanent crops.

The results of this analysis are shown in Figure 12. Based on this analysis it is apparent that growth in the value of crop production per hectare in the USA, since 2006, has significantly exceeded that of the EU-25.

Figure 12: Ratio of Crop Output value per hectare (Euro 1000 per hectare)



Source: AgbioInvestor, based on EU and USDA data

In their study for the European Commission, Barath and Ferto¹⁶ discussed the importance of new technology applications in achieving higher output per unit area.

As we have shown, one of the main differences between the two trading blocks in the 2006-2015 period has been the adoption of new technology comprising GM seed coupled with seed treatment systems, and precision planting technology in the USA. Except in a few special circumstances these technologies have had only a limited acceptance in the EU.

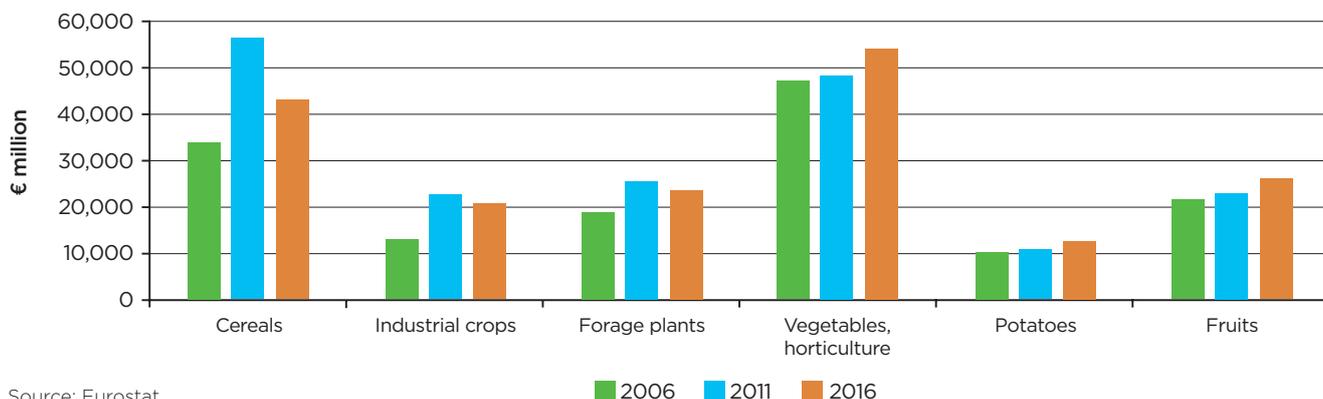
¹⁶ Barath and Ferto, Productivity and Convergence in European Agriculture. Hungarian Academy of Sciences, 2016

3. Crop Production in the EU

VALUE OF CROP PRODUCTION

The overall value of crop production of the EU-28 countries in 2016 was €180.75 billion, excluding the value of wine and olive oil. The value of cereals produced in the EU has declined by 24% since 2011 (Figure 13).

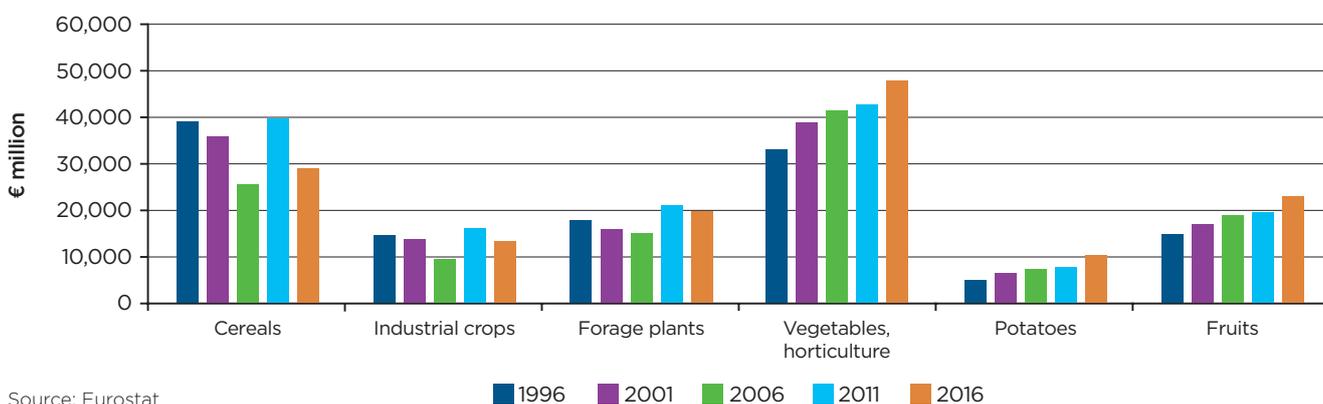
Figure 13: Value of Crop Production in EU-28 (Excluding Wine and Olive Oil) (€ million)



Source: Eurostat

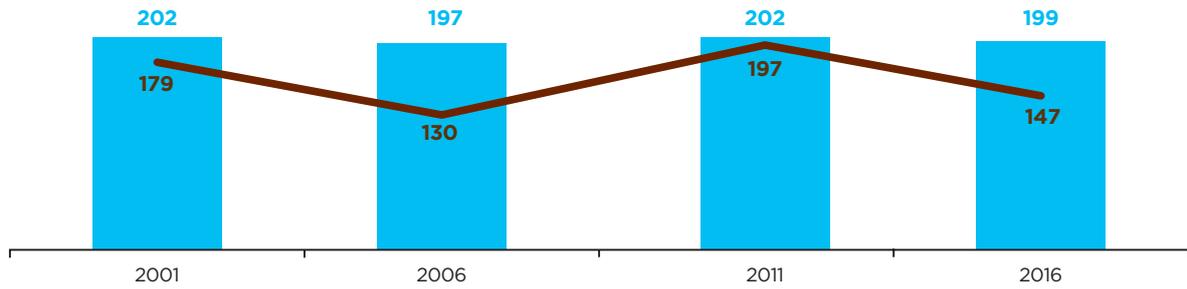
Calculation of long term trends in the value of crop production within the EU based on the 28 countries is not possible due to the limited data available on the various Eastern European countries before accession to the EU. However, based on the available data for the EU-15 countries, a number of trends can be seen (Figure 14). Over the 20-year period from 1996 to 2016, the value of fruit, potatoes, vegetables and horticultural crop output steadily increased within the EU-15. As a result of this trend, the most important crop sector in terms of value is now that of vegetable and horticultural crops, having overtaken cereals by 2001.

Figure 14: Value of Crop Production in EU-15 (Excluding Wine and Olive Oil) (€ million)



Source: Eurostat

Figure 15: Value and Volume of Cereal Production in EU-15 Countries



Source: Eurostat

■ Production (million tonnes) — Euros per tonne

In 1996 the dominant crop sector in terms of value for the EU-15 countries was cereals. Since that time the value of cereal output has fluctuated significantly, however this in part reflects the unit price of cereal production (Figure 15).

While the harvested production level in the EU-15 countries fluctuates around 200 million tonnes, the value of cereal production is much more variable and reflects changes in the price of cereals within the EU and potentially globally. Unfortunately lack of data prevents a similar analysis for vegetables.



COST STRUCTURE FOR FARMS

The cost structure for farms specialising in common wheat production in the EU-28 (Figure 16) shows that while farm receipts have increased for the average EU farm, the net margin for farms specialising in wheat production decreased significantly between 2011 and 2013, whereas costs for crop protection constituted steadily around 30% of the total specific costs.

Farmers in the EU also receive a basic direct payment which on average equates to €267 per hectare through CAP payments. For many farmers this payment is crucial in maintaining an acceptable level of profitability.

Figure 16: Cost Structure for Farms Specialising in Common Wheat Production in the EU-28

€ per hectare		2009	2010	2011	2012	2013
Receipts per hectare		669	946	1029	1196	1060
Specific costs	Seeds	55	59	64	72	76
	Fertilisers	151	138	158	188	194
	Crop protection	90	103	105	116	123
	Water	0	0	1	1	1
	Other specific costs	12	13	13	14	12
	Total	309	314	340	391	405
Crop protection as % of specific costs		29%	33%	31%	30%	30%
Non-specific costs	Motor fuels	58	72	82	93	91
	Upkeep	49	61	56	58	58
	Contract work	44	56	61	61	64
	Energy	8	10	11	12	11
	Other direct costs	60	73	77	83	84
	Total	220	272	286	306	307
Gross margin		140	360	403	499	348
Other farm costs	Depreciation	122	143	149	157	170
	External factors	149	171	174	189	193
Net margin		-131	46	80	153	-15

Source: EU FADN

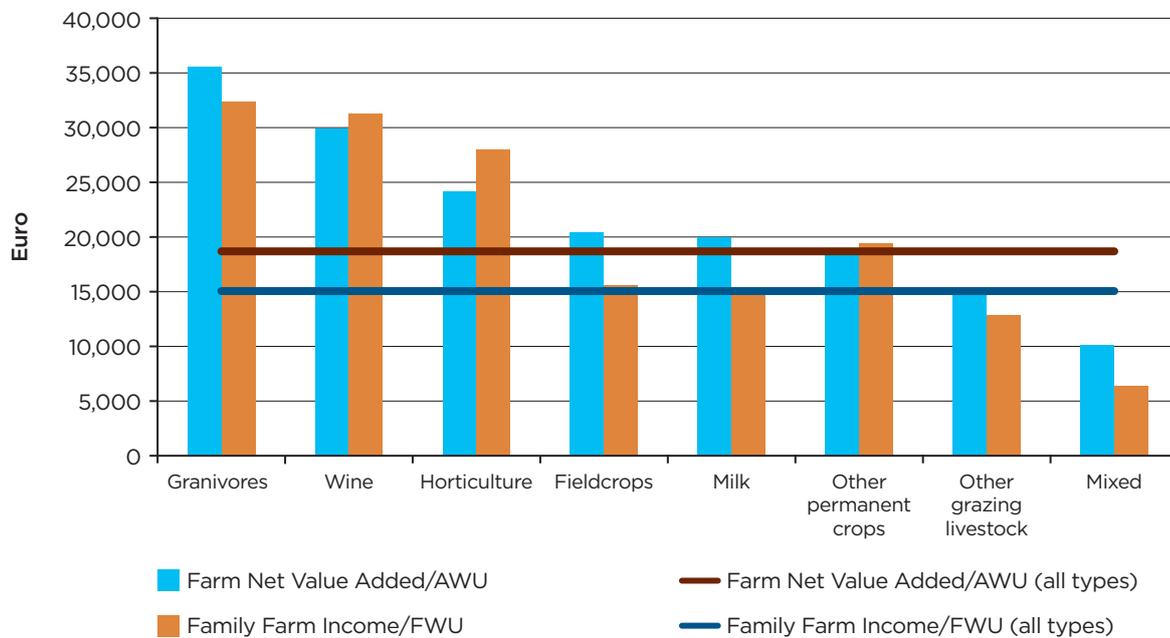
CROP PRODUCTION IN COMPARISON TO OTHER FARM TYPES

A study undertaken on behalf of the European Commission in 2018¹⁷ showed that the biggest farm net value added (FNVA) per agriculture work unit (AWU) was achieved by meat producers (granivores) (Figure 17).

It is important to note that the success of this meat production relies greatly on imports of feed not produced in the EU. Protein plants such as soy are widely used in animal feed and the European Union uses some 45 million metric tons of this annually, according to the EU Market Observatory¹⁸. A third of that figure is met by soy and the vast majority of it is imported from South America.

The import of soybean and soybean products derived from soybean containing GM traits is granted following approval by EU authorities. The average timeline from submission to approval of GM import dossiers has increased substantially in recent years, from under four years on average prior to 2011, to over seven years in 2017 (Source: EuropaBio).

Figure 17: Indicators of Farm Income by Farm Type in 2015, EU-28



Source: Comparison in farmers' incomes in the EU member states (EU DG Agriculture FADN)

¹⁷ <https://ec.europa.eu/agriculture/sites/agriculture/files/statistics/facts-figures/agricultural-farm-income.pdf>

¹⁸ https://ec.europa.eu/agriculture/market-observatory/crops/oilseeds-protein-crops/balance-sheets_en

4. Trade

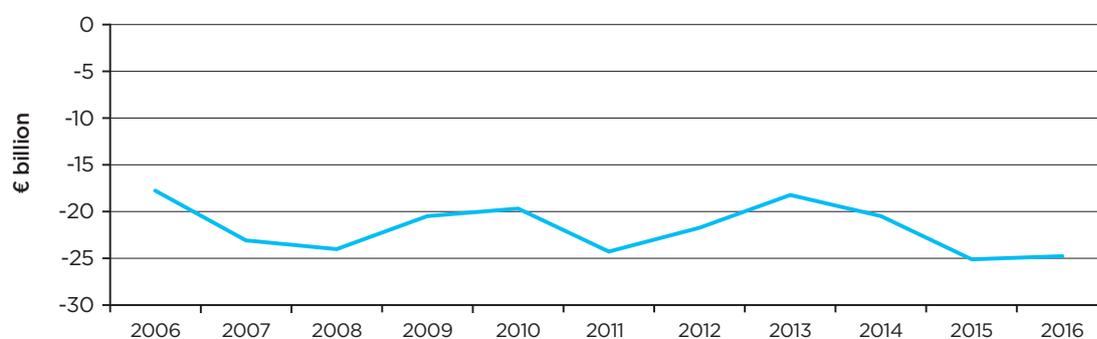
TRADE DEFICIT FOR ARABLE PRODUCE

The EU is not self-sufficient for many foodstuffs and hence remains dependent on imports of a variety of crop produce from other countries. If total food, drinks and tobacco trade is taken into account, then the EU has a positive balance of trade of €6,709 million, much improved from a deficit of €10,742 million in 2006.

However, if only arable produce is assessed (cereals, fruit and vegetables, sugar, coffee/tea/spices, and animal feedstuffs) then in 2016 the EU-28 had a negative balance of trade of €25,041 million (Figure 18), worse than the deficit of €17,786 million in 2006. Figure 19 shows the breakdown of this trade by sector.

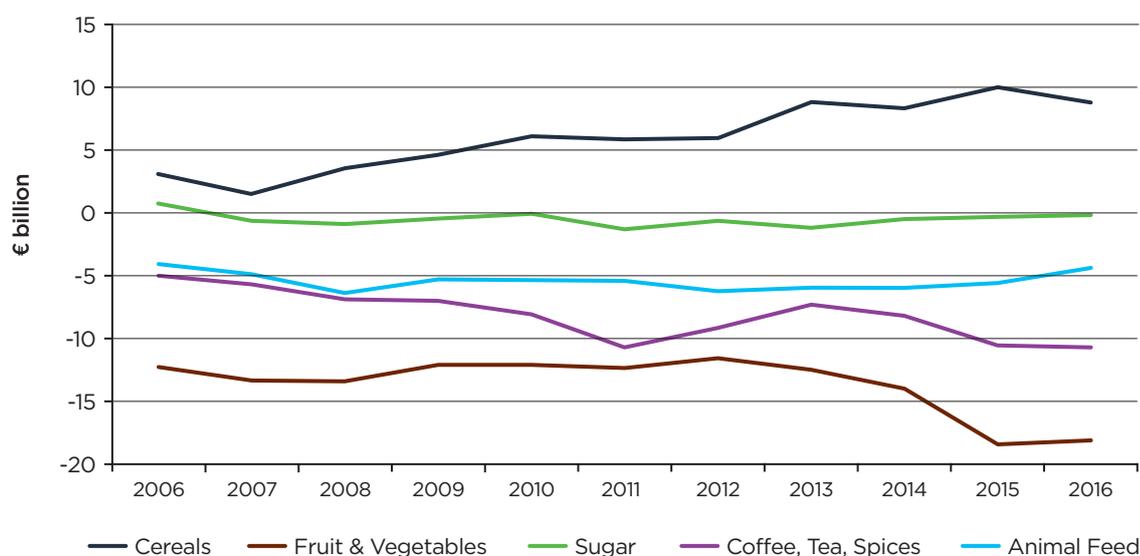
Only in cereals is there a positive balance in trade, with all the other sectors, particularly fruit and vegetables, showing a deficit.

Figure 18: Arable Crop Balance of Trade (€ billion)



Source: Eurostat EU trade since 1988 by SITC

Figure 19: Arable Crop Balance of Trade by Sector (€ billion)



Source: Eurostat

Despite the EU maintaining a positive balance of trade for cereals and rapeseed, imports for specific varieties of these crops are nevertheless required from other regional markets, notably North America and Eastern Europe.

In all of the other major crops which account for a significant share of the agrochemical market, the EU has a trade deficit (Figure 20). This is not surprising for crops such as rice and coffee/tea/spice, cultivation of which would not be supported by the EU climate, however that is not the case for sunflower, maize, soybean and fruit & vegetables.

EU meat production has a dependence on imported feed ingredients and soybean in particular. The total demand for feed protein amounts to around 45 million tonnes of crude protein/year, out of which one third is met by soybean. For this protein source, the EU self-sufficiency is particularly low with only 5% of EU use¹⁹, with the majority of imported soybean coming from countries that have adopted advanced plant science tools, including GM crops. The EU also imports significant quantities of GM maize and canola.

Figure 20: Trade in Major Agricultural Commodities 2016

Commodity	Balance of Trade €m.	Balance of Trade Tonnes m.	Source of Imports (Share of imports in value)
Wheat	4275	27.69	Canada (38.5%), USA (16.7%), Ukraine (14.5%), Russia (8.9%)
Barley	1088	0.38	Ukraine (71.7%), Serbia (5.7%)
Rapeseed	57	0.23	Russia (55.4%), Ukraine (28.6%), China (7.1%), Canada (3.6%)
Sunflower	-599	-3.14	Ukraine (64.2%), Russia (19.5%), Argentina (11.9%)
Rice	-851	-1.68	India (25.4%), Thailand (18.9%), Cambodia (16.9%), Pakistan (12.7%), Indonesia (5.6%)
Sugar	-919	-5.01	Brazil (10.8%), Mauritius (8.1%), China (5.6%), Serbia (4.8%), Mexico (4.2%)
Maize	-1433	-9.67	Ukraine (52.5%), Russia (10.1%), Brazil (9.9%), Canada (6.9%), USA (6.0%)
Soybean	-6285	-18.22	Argentina (47.1%), Brazil (38.0%), Paraguay (7.1%)
Coffee, Tea and Spices	-10927	-4.49	Brazil (13.0%), Vietnam (8.0%), Colombia (3.5%), India (3.4%), Indonesia (3.3%)
Fruit and Vegetables	-18265	-9.39	Turkey (11.3%), USA (11.0%), Brazil (6.1%), South Africa (6.1%), Morocco (5.5%), China (5.2%), Costa Rica (5.0%)
TOTAL	-33859	-23.3	

Source: EU FADN

¹⁹ General Secretariat of the Council (12/02/2018): EU Protein Plan, document 5841/18

IMPACTS OF PLANT SCIENCE REGISTRATION PROCEDURES ON TRADE

It is in the fruit and vegetables sector where the impact of the agrochemical registration procedure in the EU has a significant negative effect. Fruit and vegetables is a very diverse market with a high economic value, incorporating many different types of produce; as a result, the range of agrochemical products on individual crops is relatively limited. A significant number of products previously utilised in these sectors lost their registrations or were not supported in the EU re-registration process.

Since September 2015, minor uses, including crop protection use in specialty crops such as fruit and vegetables, is co-ordinated by the EU Minor Uses Co-ordination facility (MUCF) with crop requirements compiled into the European Minor Uses Database²⁰. As formulated products are registered on a country and crop level, minor uses are also granted on a country and crop basis to meet the needs of the minor and speciality crop producers; often minor use registrations are achieved by extending the registrations to include minor uses.

The EU re-registration process not only impacts EU growers but also growers importing their produce into the EU. One of the prerequisites to authorize a crop protection product in the EU is that potential residues in food and feed resulting from the intended use of the formulated product are covered by Maximum Residue Limits (MRLs). When an authorization in the EU is not renewed, the MRL is lowered to the Limit of Quantification (LOQ). In principle, no residue of the unregistered product is allowed on crops produced in or imported into the EU. This effectively prohibits their use on crops in other world areas to be imported into the EU from trade partner countries.

There is however a system where interested parties, such as trading countries can apply for a modification of the EU-MRL, the so-called Import Tolerance, which is an MRL necessary to facilitate international trade. Once the Import Tolerance is granted, it allows usage of crop protection products not registered in the EU on crops to be sold into the region. However, trade disruptions for substances for which the MRL was lowered to the LOQ can be expected as procedures and timelines for establishing Import Tolerance are currently unclear and purchasing groups are reticent to purchase such produce. As a result, when a substance is not supported in the EU it has an effect on its global usage on all produce that is to be exported to the EU.

Much of this conflict arises from the EU regulatory system for crop protection products being regulated by hazard and the precautionary principle (Regulation EC 1107/2009) and the Residue regulation (Regulation EC 396/2005) following a risk-based approach. Additionally, most third countries have a risk-based regulatory system for authorizing crop protection products, which creates the variation between registered products in the EU and those that can be utilised in trading partners. The WTO Agreement on Sanitary and Phytosanitary Measures (SPS Agreement)²¹ requires the assessment of risk to determine the appropriate level of sanitary or phytosanitary protection.

As the EU is becoming increasingly reliant on the import of animal feedstuffs, fruit and vegetable and coffee/tea/spices, the uncertainty created by the EU regulatory system is seen as restrictive to trade. However, the resulting possible loss of pesticide Maximum Residue Limits (MRLs) has the potential to adversely affect agricultural imports valued at almost €70 billion²². The Bryant Christie study shows that among the most affected commodities are fruits and nuts, but also vegetables (Figure 22). As shown earlier in this report (see Figure 19), the EU relies heavily on imports of fruit and vegetables to satisfy local demand. It remains to be seen how this will develop. However, it is obvious that additional trade barriers are created for agricultural commodities which cannot be produced at the required amount in Europe and will have to be imported.

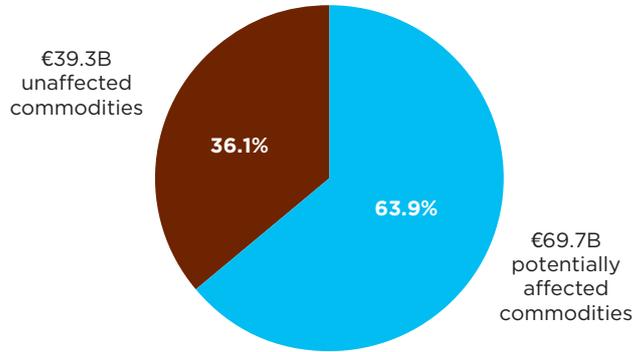
²⁰ <https://www.minoruses.eu/>

²¹ The WTO Agreement on Sanitary and Phytosanitary Measures (SPS Agreement) requires according to Article 5 the assessment of risk to determine the appropriate level of sanitary or phytosanitary protection; https://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm

²² Bryant Christie (2017): Estimation of Potentially Affected Agricultural Imports due to hazard-based criteria in the EU Regulation of Plant Protection Products (http://www.ecpa.eu/reports_infographics/bryant-christie-report-estimation-affected-imports-through-hazard-criteria)

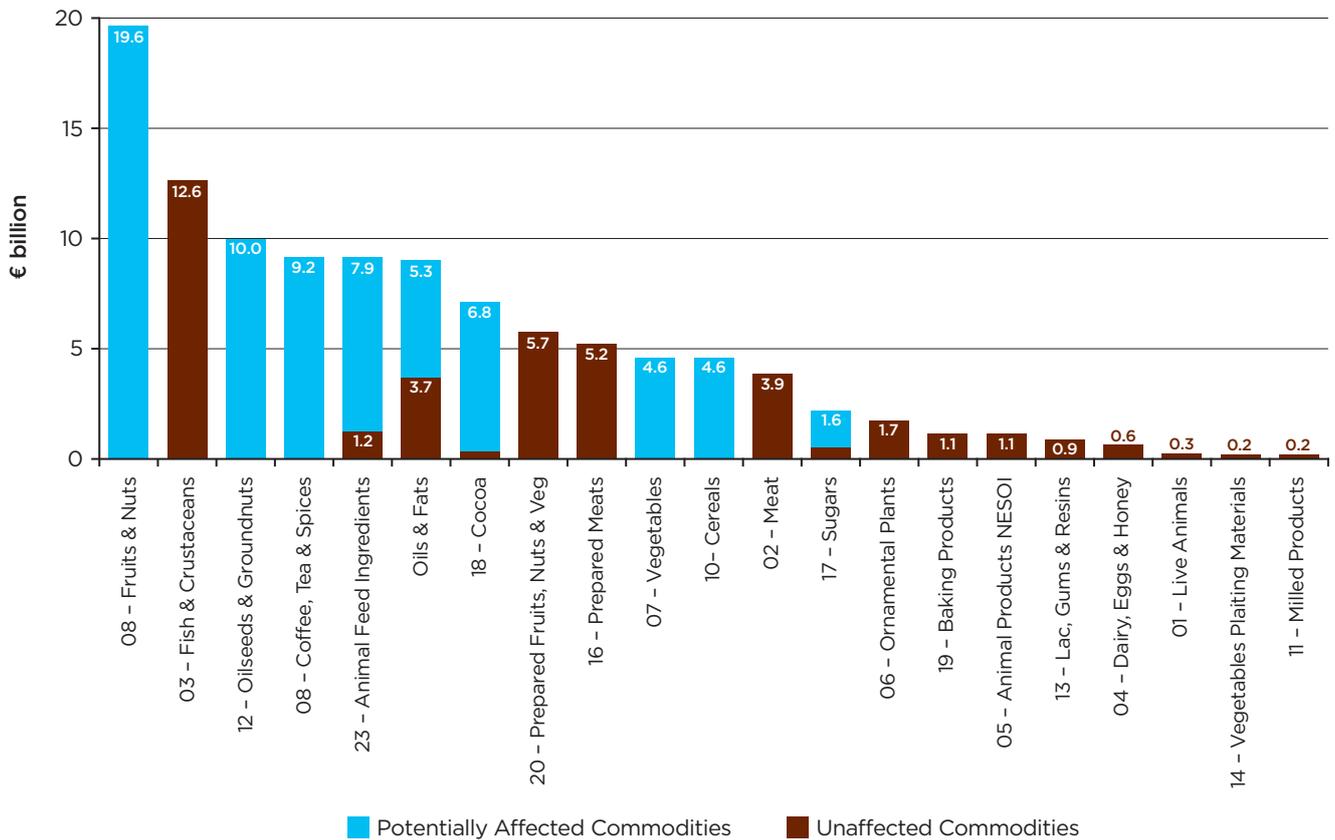
The European Union, through regulations imposing hazard-based cut-offs, exports the agricultural production problems to other continents (Figure 22).

Figure 21: Estimated portion of EU agricultural imports potentially affected by cut-off criteria

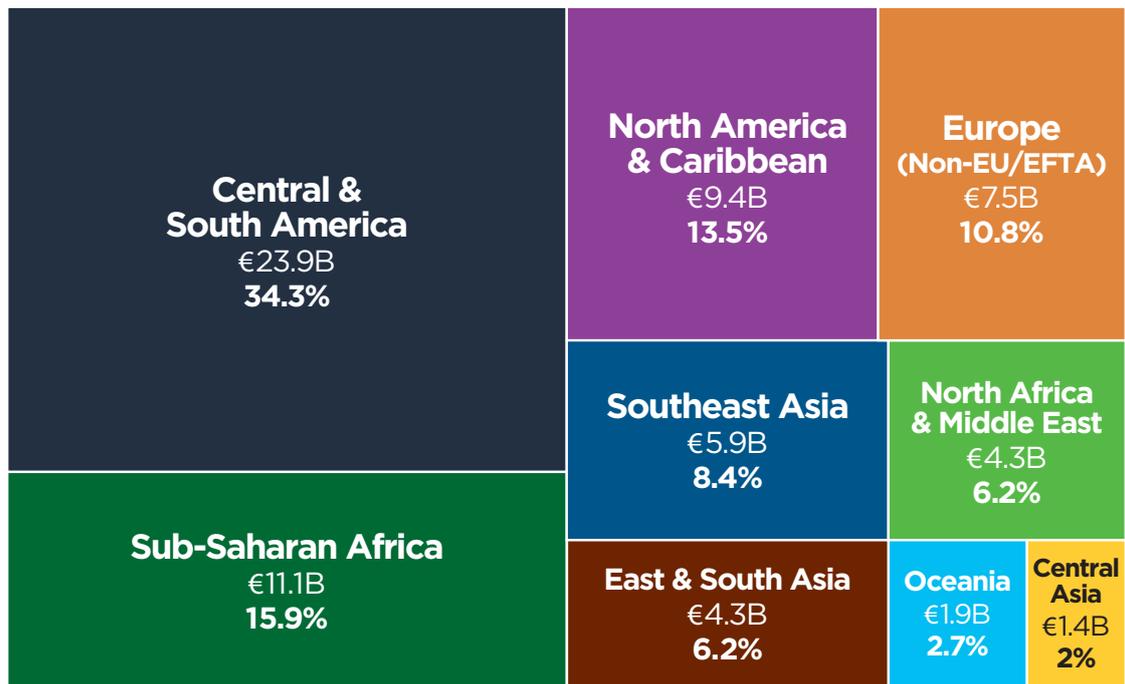


Source: Bryant Christie

Figure 22: All agricultural exports to the EU, by value in 2016



Source: Bryant Christie (2017)

Figure 23: Commodity imports in the European Union by other trade blocks

Source: Bryant Christie

EU legislation for the approval of GM products requires a scientific safety assessment, followed by a Commission authorisation proposal which is then voted on by the EU Member States. While Member States may choose to vote against the opinion of the risk assessor, the European Commission is legally obliged to put authorisation proposals forward to vote, following the EU food safety authority's (EFSA) assessment. Despite these legal requirements, the EU has regularly failed to respect the agreed timelines for authorising products, both in the risk assessment and risk management phase of the approval procedure, resulting in delayed GM product approvals for import. The resulting delays impact farmers in both importing and exporting countries.

Grain shipments to the EU may only contain approved GM varieties, even when such varieties have been fully assessed and deemed safe in other parts of the world. There is a zero tolerance for non-approved events which poses practical problems for grain traders, as traces of GM approved in countries other than the EU may occur in shipments to the EU. Guidelines admitting low level presence of GM approved in the country of cultivation, but not yet in the importing country, are crucial for global trade.

Beyond purely procedural inconsistencies in the application of EU law, the increasing application of the precautionary principle and politicisation of the EU's authorisation processes, is known to hinder the application of plant science innovations in Europe, including the approval of GM crops. One example includes the mandatory application of long term animal feeding trials in the context of GM feed risk assessment, which has been deemed unscientifically justified²³.

As a result of the above inconsistencies between exporting and importing approval systems, the speed of approval in the EU has been slowing down since 2013 (Figure 24).

²³ Devos, Y.; et al.; 2016. Is the mandatory EU requirement for 90-day rodent feeding studies on whole GM food/feed fit for purpose and consistent with animal welfare ethics?; <http://onlinelibrary.wiley.com/doi/10.15252/embr.201642739/full>

Figure 24: Timeline for GM Import Approval

Year	Total Timelines (incl. comitology)	Approved events
2017	7.5 years	11
2016	5.5 years	4
2015	6.5 years	17
2014	n/a	0
2013	4.1 years	5

Source: EuropaBio

TRADE AGREEMENTS

Under the recent trade agreement between the EU and Canada (CETA), both parties have agreed to eliminate more than 90% of tariffs on agricultural produce. The EU quota on the import of Canadian wheat is to be increased from 38,853 tonnes to 100,000 tonnes, and the tariff on these imports removed.

Clearly any agrochemical registration issues will persist, however the greater amount of Canadian wheat likely to reach the EU tariff free is likely to have a further negative impact on internal EU wheat prices and further depress the agricultural economy, with a further knock-on impact on agrochemical purchasing and the appeal of the market to attract R&D.

Trade and regulatory issues due to the UK's exit from the EU have yet to be clarified, however the UK is a major importer of agricultural produce both from the EU and rest of the world, and an important trade partner in agricultural produce for the rest of the EU. Historically, the UK has also been a proponent of science-based decision-making with regard to GM crop import approvals.



5. Lack of New Technologies in the EU

Given the above data demonstrating the competitive disadvantage of farming in Europe, from an economic and political point of view one would assume that the EU should be interested in taking necessary steps to increase agricultural productivity in Europe and reduce its dependence on imports.

However, quite to the contrary, the current political environment in the EU will inevitably lead to a further reduction in availability of crop protection products and seeds. The cost of innovation has significantly increased over the past decade and the number of products in research, and subsequently reaching the market, fell drastically.

The EU regulatory system is increasingly based on hazard and the precautionary principle rather than risk, in contrast to regulatory bodies in other regions. This has resulted in fewer crop protection products and GM seed varieties being available to farmers in the EU, as opposed to other regions such as the USA and Brazil. This situation also makes the region less attractive as a focus for private companies' research and development.

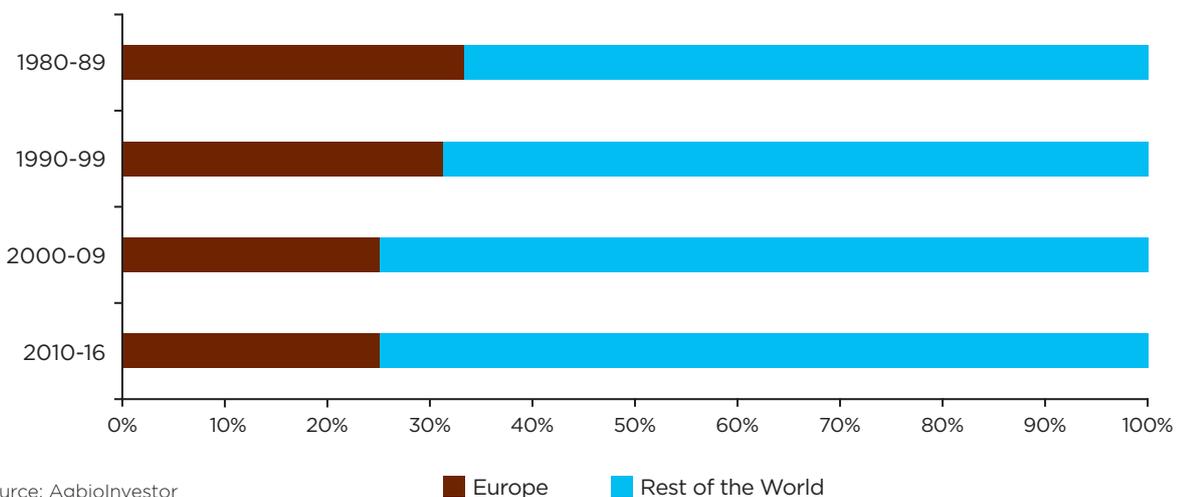
The uptake of innovative planting systems involving precision planting coupled with seed treatment is also lagging in the EU in comparison to the USA.

a) Crop protection regulation

Directive 91/414 introduced a two-tier agrochemical registration and called for the re-registration of all existing agrochemicals. This procedure resulted in many products not being included on Annex 1, either as they could not meet these standards, or that the registrant chose not to meet the cost of undertaking the required studies, and hence the registration lapsed. Directive 91/414 was subsequently replaced by directive 1107/2009, which introduced a registration system based on hazard rather than risk.

This regulation establishes hazard-based 'cut-offs' for certain categories of substances, including carcinogens, mutagens, or reproductive toxicants ('CMR'), as well as substances that are persistent in the environment. Registration in this case has become a yes or no decision precluding any product from the market if it does not meet registration criteria, regardless of the concentration at which the product or any of its metabolites or breakdown products may be encountered by susceptible organisms. The impact of this directive has been to significantly reduce the number of agrochemical active ingredients available to EU farmers, with further reductions expected. This leads to a competitive disadvantage for the European farmer (Figure 25).

Figure 25: Declining share of active ingredients introduced in the EU versus Rest of World



Source: AgbiolInvestor

■ Europe ■ Rest of the World

Over 60% of active substances have not been approved under the current EU approval system (Figure 26). This reduction in product approvals has led to a subsequent restriction of farmer choice.

While the EU has adopted a regulatory system for plant protection products that effectively eliminates many products used safely in other countries, it is apparent that the number of new agrochemical products being introduced into the EU market per year is also declining. The following analysis outlines the number of new plant protection active ingredients introduced globally and in the EU (Figure 27).

Figure 26: Regulatory Status of Active Substances Listed by EU

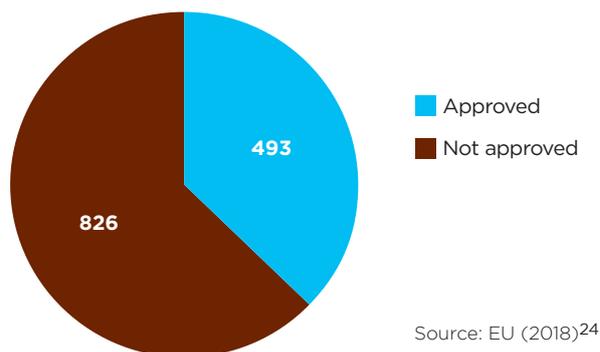
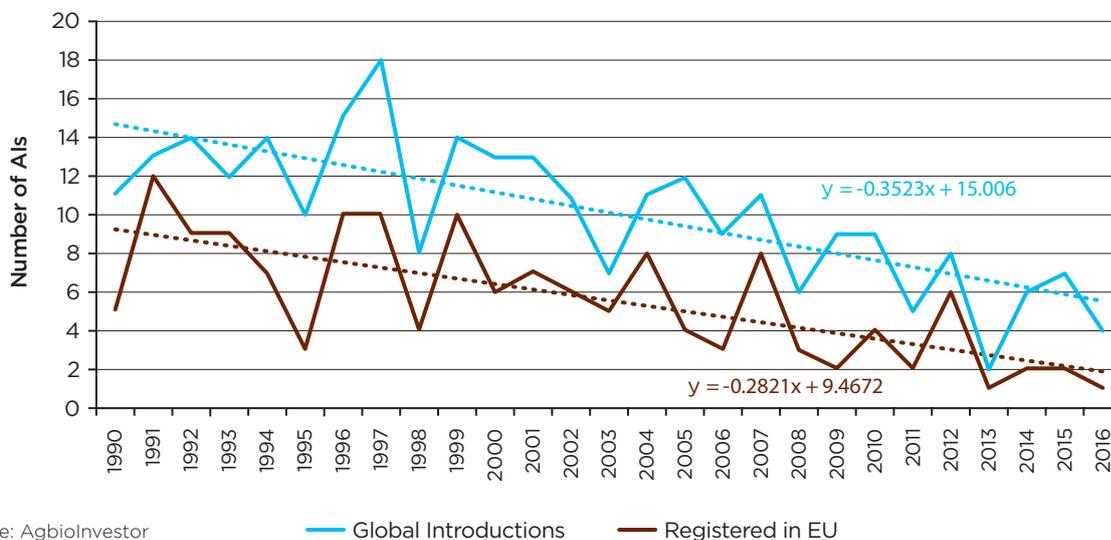


Figure 27: Number of New Agrochemical Active Ingredients Introduced Globally and Registered in the EU



Clearly not all of the new active ingredients introduced will have crop applications in the EU. However, the graph demonstrates that while the rate of new registrations in the EU is lower than the global rate of new product introductions, the actual number of new products reaching the market in the EU is low by historical standards.

This has implications for those crop disease sectors, notably fungal diseases in cereals. Disease resistance in cereals relies on new chemistry being available for growers; for example, without fungicide use in France²⁵, wheat yields would drop by 26%.

²⁴ <http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=activesubstance.selection&language=EN>

²⁵ Blake, Wynn, Maumene and Jørgensen (2011)

b) GM seeds

The European Union has an established legal framework regulating modern biotechnology, and more specifically GMOs. The legal framework covers the protection of human and animal health and the environment through requiring safety assessment of GMOs before being placed on the market. Procedures for risk assessment and authorisation of GMOs are outlined in Directive 2001/18/EC on the deliberate release of GMOs into the environment, Regulation (EC) 1829/2003 on genetically modified food and feed, and Directive (EU) 2015/412, amending Directive 2001/18/EC as regards the possibility for the Member States to restrict or prohibit the cultivation of GMOs in their territory.

These main pieces of legislation are supplemented by other legislation or implementing rules, recommendations and guidelines that help govern specific aspects of GMOs and their use or assessment, including labelling and traceability provisions for GMOs placed on the market²⁶.

Despite the fact the EU has a system in place for GM cultivation and import approvals, the European Court of Justice ruled in 2013 that “*the European Commission has failed to fulfil its obligations*” in the GM authorization process. The Commission then stopped import approvals at the final stage of the process for over one and a half years, but also admitted that EU law “require(s) the Commission to take a final decision”. In January 2016, the European Ombudsman Emily O’Reilly decided that between 2012 and 2014 the Commission repeatedly failed to meet the legally binding deadline for processing GMO import applications and did not make its decisions within a reasonable time.



²⁶ https://ec.europa.eu/food/plant/gmo/legislation_en

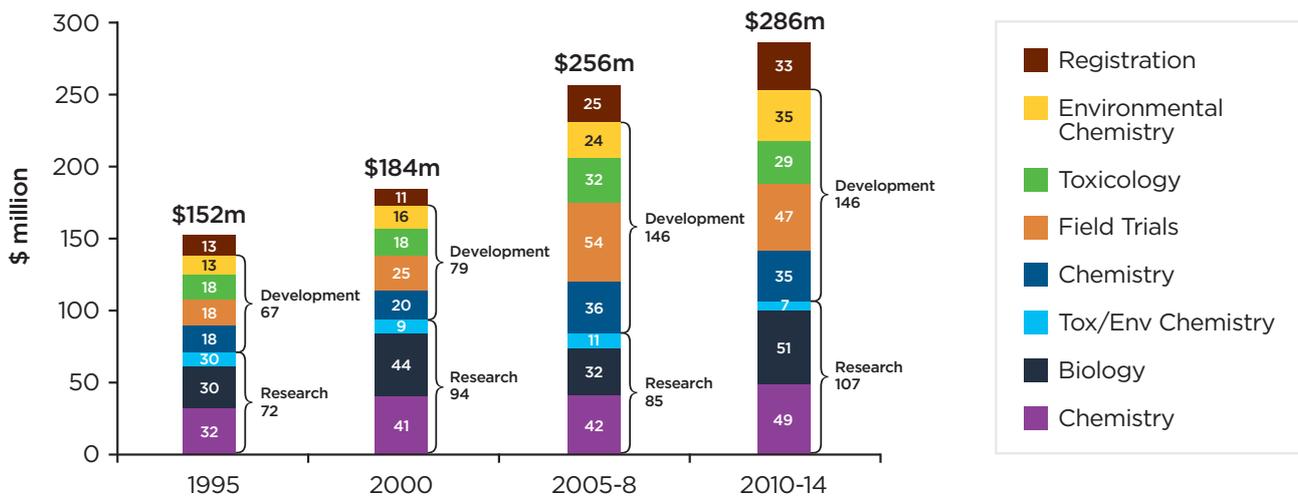
REGULATORY APPROVAL REQUIREMENTS

The regulatory standards to which crop protection products are subjected to have become ever-more demanding with new and more studies required and with increased levels of scrutiny. New analytical methods and techniques permit lower levels of detection and thus increasingly stringent standards. As a result, the absolute costs of registering new products have continuously increased. The total costs of discovering, developing and registering a new active ingredient has almost doubled between 1995 and 2015 to around \$286 million (Figure 28). Furthermore, the time it takes from synthesis to registration has increased from an average of 8.5 years in 1995 to 11.3 years in 2014²⁷.

Companies will as a minimum have a five-year plan in place for investment and business development. Clearly sudden and unexpected political changes in how the EU regulates and supports agriculture can have a detrimental effect on how agricultural supply companies operate in the EU.

Should the political environment develop in a manner that inhibits companies from operating in the EU, companies may reduce their investment in the EU and relocate many of their facilities to other economic regions with growth potential. As outlined above, this has already happened with many plant biotechnology research facilities and agrochemical manufacturing, formulation and packaging facilities being relocated.

Figure 28: Product Development Costs



Source: <https://croplife.org/wp-content/uploads/2016/04/Cost-of-CP-report-FINAL.pdf>

²⁷ <https://croplife.org/wp-content/uploads/2016/04/Cost-of-CP-report-FINAL.pdf>

CROP PROTECTION BENEFITS

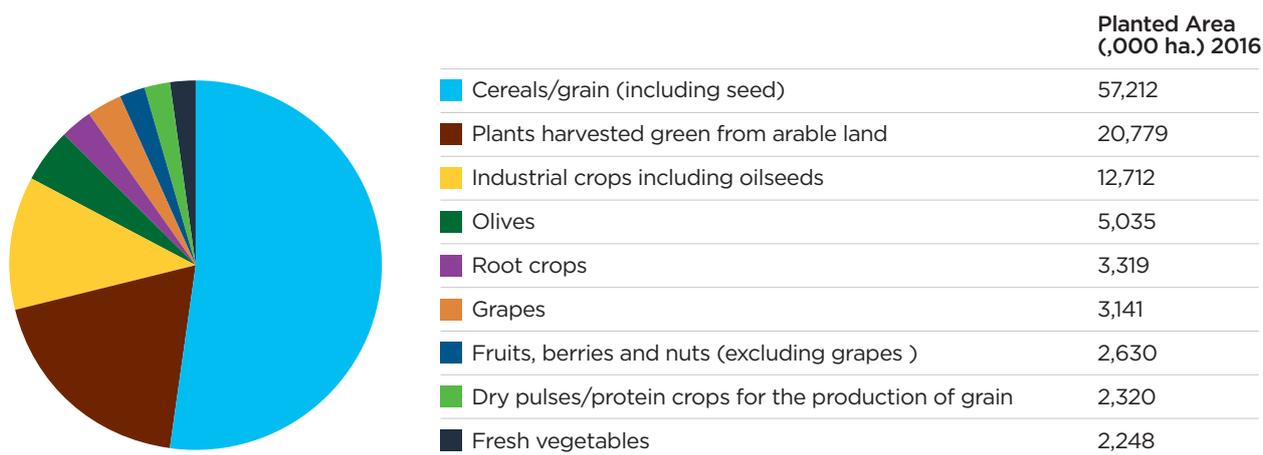
Crop protection products control crop pests, diseases and weeds to protect crop yields. It is estimated that without the use of crop protection current crop losses of 40% due to pests could double. The yield gain with crop protection products was estimated by Oerke²⁸ at a range of 21-53%. A study for France showed that current wheat yields would drop by 26% without crop protection²⁹.

Another study by the International Food Policy Research Center (IFPRI)³⁰ showed that improved weed, insect and disease protection could boost yields by around 15-20% across maize, wheat and rice.

The major crops in Europe are cereals (Figure 29) of which wheat and corn (grain and green) constitute the biggest share in planted areas (Figure 30). Important disease-causing pests to EU agriculture include *Septoria tritici*, which causes widespread yield loss in wheat, and powdery mildew (*Erysiphe necator*), which is an important pest of grapes. Both pests are treated with fungicides which are the most important crop protection product group in the EU.

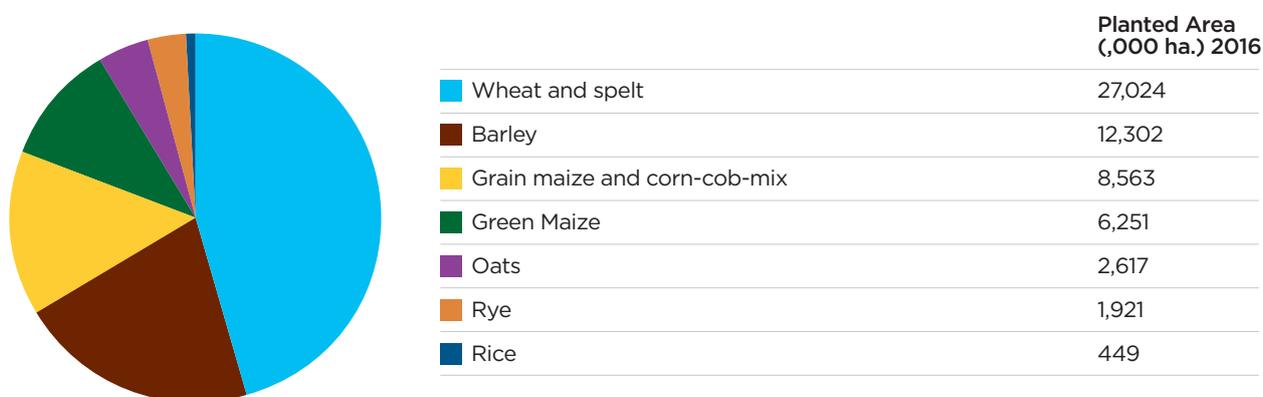
In 2016, France had the biggest share of cereal and green maize cultivation, followed by Germany, Poland and Spain. These four countries in total had a share of > 50% of the total planted areas in the EU-28 in 2016.

Figure 29: Crop Planted Areas for EU-28



Source: Eurostat

Figure 30: Cereal Planted Areas for EU-28



Source: Eurostat

²⁸E.-C. Oerke (2006), Crop losses to pests, Journal of Agricultural Science (2006), 144, 31-43

²⁹Blake, J., S. Wynn, C. Maumene and L.N. Jørgensen. 2011. Evaluation of the benefits provided by the azole class of compounds in wheat, and the effect of losing all azoles on wheat and potato production in Denmark, France and the UK. ADAS

³⁰International Food Policy Research Institute, Agritech Toolbox, <http://apps.harvestchoice.org/agritech-toolbox/>

The major crops in North and Latin America are maize, soybean, sugarcane and fruit and vegetables. Whilst cereals are also important, in many cases the crop protection challenges faced by growers in the Americas are different, and fungicides are not nearly as significant as in Europe. Due to these differences, many of the products developed for the market in the Americas have only limited potential usages in the EU and vice versa.

It is important to maintain a framework which incentivises innovation in Europe in order to sustain agricultural productivity.

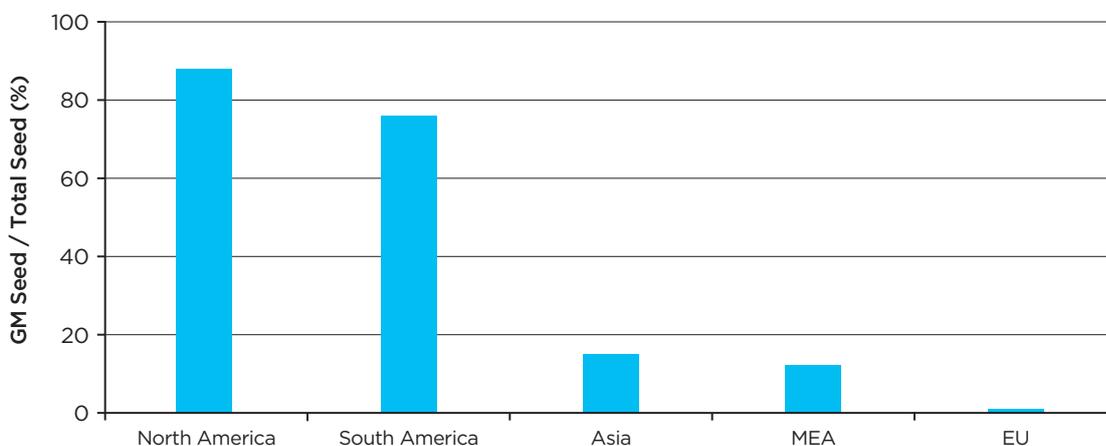
SEED BENEFITS

Seed quality is a key element in crop production and yield. A study by IFPRI which investigated the impact of climate change on crop production showed that maize yields in Western Europe could potentially be increased by around 18% by using no till farming³¹.

A study³² conducted by the ANTAMA Foundation shows the economic, social and environmental benefits of Bt-maize in Spain, where yield increase of 7-11%, quality improvements, reduced input costs, a smaller water footprint and a higher fixation of carbon with important other benefits for biodiversity were demonstrated.

Herbicide tolerant GM crops reduce the need for tillage, using less fuel and keeping carbon in the soil. Unlike other major regional seed markets such as North America or Latin America the proportion of the seed market attributable to genetically modified seed is low in the EU (Figure 31). This reflects the lack of cultivation approvals in the EU.

Figure 31: Plant Biotechnology (GM) Seed as Share of Total Seed per Region



Source: AgbioInvestor

³¹ International Food Policy Research Institute, Agritech Toolbox, <http://apps.harvestchoice.org/agritech-toolbox/>

³² Benefits of Bt maize in Spain (1998-2015): <http://www.europabio.org/agricultural-biotech/publications/benefits-bt-maize-spain-1998-2015-benefits-economic-social-and>

5. Lack of New Technologies in the EU

The limited cultivation of GM seed varieties is due to a number of factors including the lack of cultivation approvals and a *de facto* moratorium on cultivation of GM crops in the EU but also limited cultivation of crops such as cotton, canola, and soybean in the region. Cultivation of GM crops within the EU is restricted to those utilising the Cry1Ab insect resistance gene (MON810 genetic event), which is planted on small areas for the control of European corn borer in Spain, Portugal, Czech Republic and Slovakia. The number of field trials in Europe for GM varieties has decreased by 90% between 2010 and 2016 thereby illustrating the negative trend for GM developments in Europe.

In North America the choice of GM varieties of maize available to growers comprises both herbicide tolerant and insect resistant varieties. In the USA in 2016, 93% of the total planted area comprised varieties containing both herbicide tolerance and insect resistance traits. In addition to maize, GM varieties of sugar beet modified to be tolerant to herbicides are widely used in North America. However, in the EU no GM varieties of sugar beet have been approved for cultivation or made available to growers.

Traditional or conventional plant breeding offers the potential to develop various plant traits and has been used to develop crops tolerant to herbicides that act through inhibition of the enzyme acetolactate synthase. One of the key advantages that GM techniques offers the plant breeder over conventional plant breeding programs is primarily one of focus. GM technology typically involves only a selected number of genes and their associated promoters, while conventional breeding usually involves the whole genome.

As a result, GM technology has enabled breeders to develop desired traits, which includes conferring tolerance to a number of suitable herbicides via the genetic insertion of specific genetic events. In addition, GM technology has allowed crops with tolerances to multiple herbicides with differing modes of action, whereas conventionally bred varieties are unlikely to possess tolerance to more than one herbicidal mode of action.

In addition to the aforementioned benefits, GM crops have been developed with healthier oils and reduced, naturally occurring toxins. In addition to improving resistance to certain pests or weeds and enhanced robustness against diseases, genetic modification can be used to develop drought or water tolerant crops in times of changing climate and offers a host of other promising innovations.



PRECISION FARMING / DIGITAL AGRICULTURE

Precision farming technology, or digital agriculture, is currently undergoing significant uptake in the USA and Brazil, with significant investments having been made by most of the leading crop protection and seed companies. The majority of product use is centred on drones (pest, disease and nutrient identification), mapping (very local plotting of pest, disease and nutrient pressure for further integration with other precision delivery systems), and satellite (very local weather forecasts, guidance systems). Clearly uptake of this technology will continue to benefit software and machinery manufacturers, while for growers use of this technology is primarily driven by potential cost savings, particularly that of fuel or labour, although equipment capital outlays can be high. Adoption in the EU is somewhat behind that of the Americas (and to an extent parts of Asia, notably Japan, China and South Korea).

In North America, particularly in maize cultivation, the adoption of precision planting devices has been enhanced by the availability of GM seed that is tolerant to herbicides and resistant to insect pests. By applying early season seed treatments it has become possible to plant seed that is herbicide tolerant and disease and insect resistant. This has enabled growers to adopt larger seed drills, apply insecticides and fertilisers via the seed drill equipment, scale up the packaging of seed from bags to hoppers, and thereby reduce the number of passes required over the field. Residual seed treatment chemicals used in conjunction with precision planting systems has resulted in the elimination or reduction of early application of crop protection chemicals. As a result, precision planting provides the grower with significant savings in fuel and labour costs and enhances the efficiency of seed application and early season crop protection. The use of precision agricultural devices has also been shown to contribute to a reduction in greenhouse gas emissions and more efficient use of crop inputs³³.

RESEARCH AND DEVELOPMENT IN THE EU

In the seed and crop protection industries, in recent years research and development has become polarised between large multi-national companies and small start-up operations and spin-offs from academia, often supported by venture capital. The key reason for this is the cost of product development and registration, which in many cases is beyond the financial capability of small and medium sized companies, in part due to the high costs associated with regulatory requirements.

In the seeds industry, increasing investment has been made in the development of GM traits and varieties that offer a greater commercial return than conventional seeds. Although the EU claim that cultivation of GM crops is not prohibited, the prevailing political will is such that the vast majority of EU countries have maintained prohibitions on GM crop planting. As such, the only countries currently cultivating GM crops in the EU are Spain, Portugal and Slovakia, and even then, the actual acreage sown is extremely limited.

A further consequence of the EU's attitude towards GM crop cultivation is that the majority of GM crop research is now undertaken in the USA and Canada, with activity also in Brazil, Argentina, Australia and China. Historically the EU had been at the forefront of GM crop research through bodies such as INRA in France and a number of European universities, notably the University of Ghent. However, whether it is actually the case or not, the EU is now perceived as being opposed to GM technology applications in crops, and this in turn has had a negative effect on plant-based GM research in the EU.

³³Precision Agriculture Technologies Positively Contributing to GHG Emissions Mitigation, Farm Productivity and Economics; Balafoutis et al. [https:// www.mdpi.com/2071-1050/9/8/1339/pdf](https://www.mdpi.com/2071-1050/9/8/1339/pdf)

5. Lack of New Technologies in the EU

In contrast, other countries, notably the US, have continued to encourage GM crop research and development; notably in the case of state and local authorities collaborating with local universities to establish Research Triangle Park (RTP) in North Carolina. This Science Park has become home to a wide number of agrochemical companies' GM crop research programmes.

The major EU-based crop protection and seed companies have relocated their biotechnology research and development platforms to the USA. The world's largest crop protection company, Syngenta, has operated its plant biotechnology program at Research Triangle Park (RTP), North Carolina, since 1984. Similarly, Bayer has established the company's North American headquarters at RTP, employing 640 staff. The company has also established a major R&D facility for plant biotechnology research at Morrisville near RTP. This facility has been the subject of a number of major investments by the company in its development program.

During 2001 BASF announced an investment of €700 m. over ten years in BASF Plant Science, the company's plant biotechnology subsidiary. This was followed by the announcement that the company would invest a further €400 m. in plant biotechnology in the period from 2006 to 2008. In 2012, BASF announced that it was relocating the headquarters of BASF Plant Science from Limburgerhof, Germany to the USA. The move resulted in the loss of over 100 EU-based research positions and is commonly cited as being directly attributable to the negative view of plant biotechnology in the EU. The company also announced that it was halting the development and commercialisation of all products targeted solely for cultivation in European markets.

In 2013, after 15 years with only one cultivation approval gained, Monsanto announced that the company would not be pursuing cultivation approvals for biotech crops in Europe, with the emphasis for the seed business there switching entirely to conventional seed.

As a result of these moves, GM crop development in the EU is limited to a number of small R&D programs carried out predominantly by SMEs, with the bulk of GM crop R&D investment targeted at the Americas.

As outlined above, the current registration system for pesticide approval in the EU is radically different from other major competing countries. If this trend continues then the danger is that the EU becomes considered as a region with a negative ethos towards agrochemicals. In turn this could create a situation, similar to that of GM crop research, where the industry majors decide to relocate their R&D efforts to other regions.

In turn this could lead to a loss of EU-based R&D jobs, reduced opportunities for new graduate employment and a loss in revenue for organisations, such as universities that are involved in collaborative research programs.

In summation, a variety of EU regulations and policies have significantly restricted the availability of crop input technology in member states in comparison to competing agricultural trade blocks such as NAFTA. This lack of technology extends to the availability of crop protection products, and except in one instance, GM crop technology is not available to EU farmers. A lack of development in new technologies such as precision planting has also resulted in a reduced level of adoption compared to other markets. These issues put EU farmers at a competitive disadvantage to producers in other markets.

6. Agriculture Subsidies and Reduced Farm Profitability

Agriculture is subsidised in all major economies and in most countries in the latter stages of economic development. China operates a system of price support that seeks to boost production and offset a rapidly expanding food import bill to feed a growing population. India operates a central crop purchasing system with guaranteed prices. Brazil operates a rescue mechanism to support farmers in times of economic stress.

Agriculture in the EU had previously developed in this manner, and as such has become the subject of scrutiny by the WTO. This led to various alterations to agricultural support within the bloc in an effort to balance the need for support of the agricultural economy within the EU whilst allowing agriculture to develop in emerging countries. The Common Agricultural Policy (CAP) in the EU was introduced in 1962 and since then has been reviewed several times, moving towards de-coupling subsidies from production and a system of direct farm support through the 'Single Farm Payment' system and a reduction in direct price support.

These reforms had a negative impact on the farm economy, although this was mitigated by slower adoption in some EU states, and more importantly, volatility in crop prices worldwide, with grain prices increasing significantly in 2008 and between 2011 and 2013.

A combination of the rising CAP budget, higher crop yields worldwide creating excess production, and lower crop prices resulted in yet more reform of the CAP, which came into effect in 2015. These reforms also addressed disparities in farm subsidy within the EU, between the original member states in the EU-15, and the more recent accession countries in Central Europe in the new EU-13. Farm subsidy received by the major farmers in the EU-15 was reduced, whilst that to the new member states was improved. Importantly, the reforms introduced:

1. 'Ecological Focus Areas' with larger farms having to remove 5% of land from production (effectively re-introducing set-aside); some protein crops were permitted to be cultivated on this land, but these could not receive any inputs.
2. 'Crop diversification', with larger farms having to cultivate at least three different crops.

These reforms had a negative impact on farm profitability. In some cases, further investment was required to purchase the infrastructure required to cultivate a third crop, and the acreage reduction had a further negative impact on crop production.

The greatest impact from the adoption of the single farm payment system and the decoupling of subsidies from production is that farmers are no longer buffered by subsidy payments from the impact of changes in crop prices. As the subsidy is paid regardless, this now has little impact on which crops are selected for cultivation.

Like any business, the most profitable option is sought within the limitations of what it is possible to cultivate based on infrastructure, weather and geography, often to the detriment of more northern farmers in the EU where crop options are more limited.

The overall impact from this alteration in subsidies over the years is a reduction in farm profitability, which makes further scrutiny of variable costs inevitable. Most crop inputs fall within this variable cost analysis.

REDUCTION OF CAP PAYMENTS

The EU's CAP system is coming under political review with proposals for significant reductions in CAP support for farmers. If implemented it would have a considerable impact on grower profitability in many countries in the EU. Any reduction in grower profitability is likely to result in attempts to save costs through cutting back on arable farm inputs, such as fertiliser, agrochemical and seed.

When faced with similar issues in the past, growers have reduced costs by using less expensive agrochemical products and reducing agrochemical application rates. As a result, growers would be more likely to adopt off-patent older chemistry in preference to more recently introduced products.

In turn this would make the EU market even less attractive for R&D investment in the region by agrochemical companies. Using off-patent chemistry also carries with it the danger of greater incidence of pest and disease resistance and in some cases greater environmental impact.

This proposal coupled with a reduction in the availability of crop protection products would place EU growers at a significant disadvantage compared to growers in competing agricultural bodies. Eventually this could be expected to have a negative impact on yield, resulting in a greater need for imports of crops, further depressing the EU balance of trade in arable products.

Although the EU devotes almost €40 billion by way of direct payment support to the farming community, this expenditure has had only a minimal effect on the development of crop output. In particular growth in grain yields in the EU has lagged behind that of the US. In turn this has meant that growth in the value of crop output in the EU is also behind that of the USA. The other key feature of farm economics in the EU is that farm profitability in several cases is dependent on the direct farm payment subsidy. Hence any proposed measures designed to reduce the direct payment subsidy, in the absence of a significant rise in global crop prices, will have a distinct negative effect on farm profitability in the EU.



7. Outlook to 2030

As the EU itself states, *“Farmers provide a stable food supply, produced in a sustainable way at affordable prices for more than 500 million Europeans. The European Union’s farm policy ensures a decent standard of living for farmers, at the same time as setting requirements for animal health and welfare, environmental protection and food safety. Sustainable rural development completes the picture of the EU’s common agricultural policy (CAP).”*

However, based on the EU’s own data, long term farming profitability is only currently attainable by financial support in the form of subsidy from the EU. According to the EU, 22 million farmers and agricultural workers are employed in the agri-food sector, making it one of the most significant economic sectors in the EU. Around 44 million jobs in food processing, food retail and food services depend on agriculture.

Since the agricultural subsidy in the EU has been dissociated from yield, and the ‘single farm payment’ system introduced, the impact of subsidy on production has been reduced. When the economics of crop production are assessed the subsidy no longer comes into account, as the payment is received regardless. As a result, a farmer’s decision on how to operate is made based on costs and potential income, directly affected by crop prices.

Between 2010 and 2014, global agriculture experienced a boom period, primarily due to rising crop prices. A situation of improving crop prices was further driven by several poor harvests in the Americas, while at the same time financial markets increased investment in commodities in response to sustained high oil prices.

At present this scenario seems unlikely to be repeated due to the prevailing low oil price, which has been impacted by shale gas as well as other alternatives. Crop yields in the Americas now appear to be much more stable, with the adoption of GM crops resulting in a significant improvement in the quality of seed that provides sustained yields even in years of poor weather and growing conditions. Whilst this is a phenomenon in the Americas, crop commodities are traded on a global basis so production in the Americas has a direct impact on crop prices in the EU.

The 2015 CAP reforms further limited farm support in the EU-15, with larger farms suffering a reduction as subsidies were normalised between the EU-15 and new EU-13. Farm income was further reduced by the removal of land from production due to the imposition of ‘Ecological focus areas’, whilst the third crop cultivated under ‘Crop diversity’ requirements may also be of lower profitability than the major crops traditionally cultivated.

According to the most recent information available, the EU devotes around €59 billion to support agriculture. These funds are made available through direct farm support payments and rural infrastructure programs.

Political pressure to reduce this level of support has increased over the years, with the expansion of the EU support for new member states placing further stress on the system. As a result, farm support in the EU-15 is likely to be further eroded, whilst any significant improvement in crop prices seems unlikely. Without a change in either of these two major factors then the depressed nature of EU agriculture is likely to continue.

It is evident that the changes in subsidy regimes and the crop diversification programme are having an impact on the type of agriculture practiced in the EU. As the profitability of row crop production declines, it appears there is a trend toward more speciality crop production, including cultivation in glasshouses and under plastic. Clearly there is a need for increased production of fruits and vegetables in the EU, as shown by the trade analysis above, although cereals remain the largest arable crop export from the EU, which could be affected by this trend.

7. Outlook to 2030

It is unlikely that the intensive cultivation practices utilised in the EU for row crop production will alter, as machinery and infrastructure is set up for this type of farming. Particularly in Northern Europe, there will always be a need for disease control, which will sustain this form of cultivation.

The trend toward speciality crop production will provide increased challenges for crop protection, whilst cultivation under glass provides a ready market for biological solutions. A shortage of crop protection solutions for the fruit and vegetable sectors has been shown, a situation that has arisen due to the re-registration procedure in the EU resulting in a number of broad spectrum products previously used in the sector losing their registrations. The 'minor use' programme is currently sustaining some product choice in the sector, however with a regulatory system based on hazard, 72 products being candidates for substitution, and many existing products now approaching 10-year review under the new hazard-based criteria, it is most likely that the number of active ingredients available to farmers will be further reduced.

Whilst farm policy is pushing cultivation in the EU toward speciality crops, agrochemical registration policy is removing the tools required for economical cultivation³⁴.

In arable products, with the exception of small grain cereals and rapeseed, the EU is reliant on imports from trading partners around the world.

It is still possible that crop yields could improve in some of the new EU member states in Central Europe, however as economies improve in these countries it is also likely that consumption will also increase. Over the next 10 to 15 years it is likely that the EU balance of trade in arable products will become even more negative, putting pressure on agriculture in trading partner countries to feed the EU. However, as stated above, and in the Bryant Christie report, the EU hazard-based agrochemical registration system (including product substitution and re-registration), and the MRL system puts demands on farmers in these countries which they may not want to bear; particularly if alternative markets can be found for their produce.

These developments may limit the availability of required imports or result in the EU having to pay a premium price for produce that meets internal regulations. This questions the long-term availability and economics of food and feed supply in the EU.

The EU Joint Research Center (JRC) report³⁵ puts forward four different scenarios as to how food supply in the EU may develop. The current system, which is unlikely to change in the next 10 to 15 years, is a mixture of each scenario. From an EU perspective, the potential for self-sufficiency is probably an unattainable goal, as there are commodities widely consumed in the EU that cannot be produced in the region. As a result, food supply is likely to rely on the 'global food' and 'partnership food' scenarios, which rely on imports. However, EU regulation limiting how this food may be produced challenges the global cooperation and global regulation required for the success of these scenarios.

It is evident that the EU is the source of high quality agricultural produce, however it is difficult to export this profitably if world market prices which exist at present, persist for some time. The cost base for production in the EU is not assisted by the high degree of regulation that covers food production within the region.

³⁴Bryant Christie (2017): Estimation of Potentially Affected Agricultural Imports due to hazard-based criteria in the EU Regulation of Plant Protection Products (http://www.ecpa.eu/reports_infographics/bryant-christie-report-estimation-affected-imports-through-hazard-criteria)

³⁵Publications Office of the European Union (2016): Delivering on EU Food Safety and Nutrition in 2050. Future challenges and policy preparedness. An EU JRC (Joint Research Center) report, commissioned by DG SANTE.

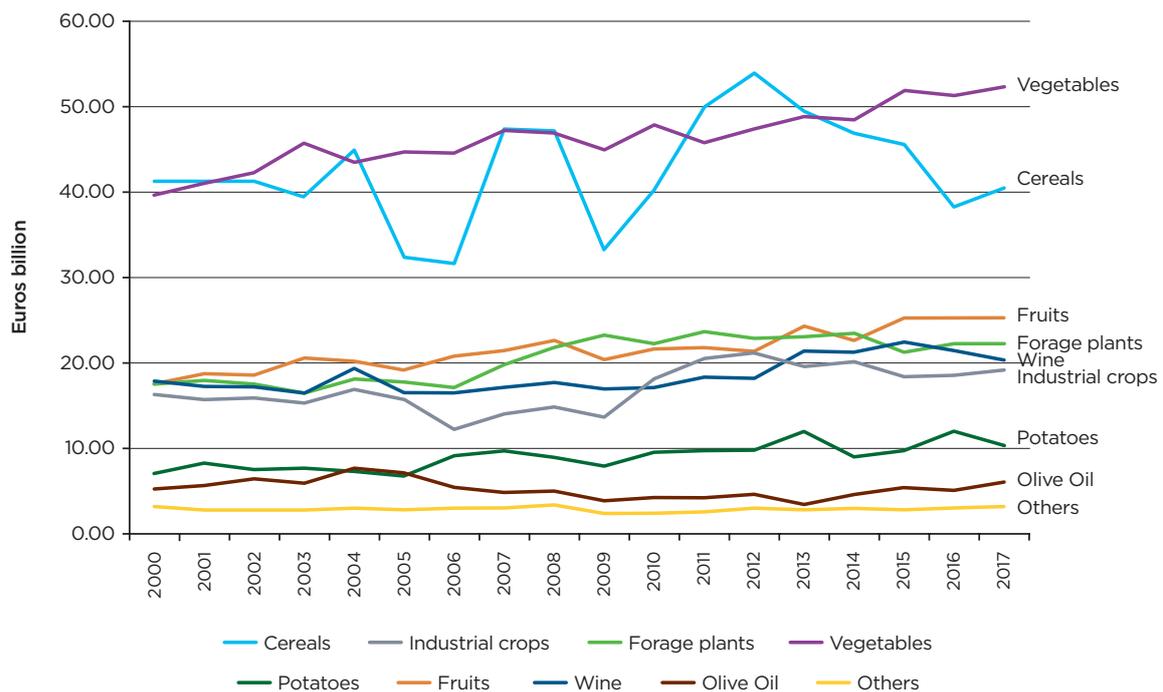
The EU excels in the export of higher value processed products such as wine, whisky, confectionery and dairy products, but is less competitive in basic agricultural produce. The commodity nature of this results in markets driven by price and volume, where it is difficult to differentiate by quality other than in exceptional circumstances. Again, regulation limits the potential to compete on a price basis with farmers in other markets who have access to technologies that enable the reduction of the cost of production.

Although the market for these high valued products is attractive, there is only limited potential for the majority of cereal and vegetable growers to switch to these sectors. One of the main obstacles to such a transition is financial. It is self-evident that any such move would require considerable capital investment by the grower. This expenditure would involve not only replacement machinery, buildings (in the case of livestock) and also potentially much greater labour input. As noted previously, arable farmers operating mainly in the cereal sector are already operating close to breakeven situation financially, hence significant financial aid would be needed for such a move.

The other main factor inhibiting EU growers switching from cereals to other crops such as vine and vegetables is climatic and soil type. For many growers in Northern Europe this type of change is simply not feasible under current climatic conditions.

Figure 32 outlines the value of EU-25 crop output by crop sector since 2000.

Figure 32: EU-25 Crop Output Value by Sector



In terms of growth rate the sectors that have shown the highest rate of change are:

Figure 33: EU-25 Crop Sector Output Value (Euros billion)

	2000	2017	% Change between 2017/2000
Cereals	41.1	40.30	-0.12
Industrial crops	16.1	19.00	0.98
Forage plants	17.4	22.00	1.39
Vegetables	39.5	52.30	1.66
Potatoes	6.8	10.20	2.41
Fruits	17.3	25.10	2.21
Wine	17.8	20.40	0.81
Olive Oil	5.1	6.00	0.96

Source: EuropaBio

The crop sectors that have grown the highest in terms of value are potatoes, fruit and vegetables. It is arguable that this improvement has come about from price rises and higher human consumption of vegetables. In contrast to these sectors, the cereal sector value has actually declined over the last seventeen years.

The dilemma facing the EU is not only low farm profitability but also problems in structural allocation. At the moment direct subsidy is not targeted at a particular crop sector and should the EU move to place less emphasis on cereal production with a view to increasing crop output in other sectors then the EU would have to financially incentivise this diversification. In addition the EU would have to accept significant reductions in cereal exports and potentially resort to higher levels of imported cereal crops from other regions to supplement the shortfall in domestic production. This situation would not be helped if structural moves towards intensive livestock production and products from the livestock industry are considered by the EU. Such a move would significantly alter the dynamics of grain utilisation in the EU.

Against a background of low crop commodity crop prices globally, there seems to be little prospect of any significant improvement in the financial situation of growers in the arable sector in the EU in the next decade. In the USA and other regions, crop output has increased against a similar background. The main differences between the EU and the USA in particular, lies in the adoption of new technologies for growers. This applies not only to seed developments but also the adoption of a more pragmatic approach to new technology in the USA and other countries such as Brazil and China. In the crop sector, the EU is not as competitive as the USA and other regions. The simplest remedy for the EU is to increase crop output on a hectare basis. In other words, yields will have to improve from the EU to remain competitive. In turn this means that the EU will have to adopt a far more flexible attitude to new technology.

The static nature of the agricultural and agrochemical markets in the EU-15, and a too stringent and un-scientific regulatory system, result in the region becoming less attractive as a focus for research and development of new technologies to assist agricultural production, and as a result, all the major agrochemical companies have their GM seed operations headquartered in the USA.

It is evident that the market growth potential and regulatory systems make development of new agricultural technologies more attractive for markets outside the EU. This is demonstrated by the slowdown in the registration of new agrochemical active ingredients in the EU, the non-acceptance of GM technology, imposition of regulation on the biologicals sector and the reduced scope of precision farming in the EU in comparison with that in the Americas.

EU agriculture flourished under the original CAP, which promoted productivity, however under WTO regulations it is not possible to revert to this system. Many other countries, notably the USA, operate some form of financial support for the farming sector, be it either rescue payments in times of crisis, or floor price maintenance. The shift in EU subsidy to rural support does not provide the necessary incentive to farmers to drive production to address the negative trade balance in arable produce in the EU or to invest in new technologies, even if they are available. In the case of the USA, where total value of direct farm support is considerably less than the EU, productivity gains have been achieved through investment in research and the adoption of new technology.

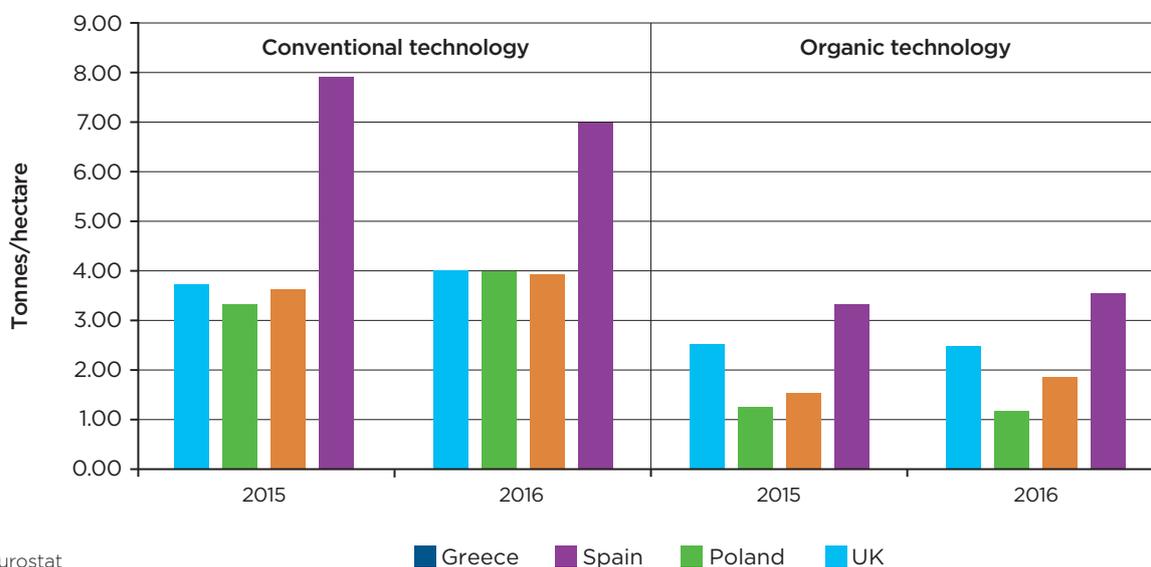
The current regulatory system, based on hazard, has thus created several issues, such as slowing the rate of new products available to EU farmers, while at the same time limiting the technologies that can be used in produce destined for export to the EU and dis-incentivising the plant science industry, including seed and agrochemical companies, to develop new technologies required in the EU market.

A return to a scientifically-based, risk-regulated, registration system would bring the EU back into line with its major trading partners, promoting easier trade in agricultural produce, and making the EU more attractive as a focus for R&D to deliver the technologies required by the farmers in the region.

Alternative technologies to conventional crop protection do exist. For example, for many organic farming offers the prospect of crop production without the use of chemical fertilisers or agrochemicals. Comprehensive reliable data in the EU for organic cereal production is not available, however data for organic cereal production in a number of countries including Poland, Spain, Greece and the UK is recorded. The following chart outlines cereal production yields in these countries using conventional technology versus organic technology (Figure 34).

Without exception, organic farming technology is considerably less efficient in cereal production than non-organic means. Clearly widespread adoption of organic technology in the EU would lead to a major shortfall in EU cereal production necessitating significant imports of cereal products into the EU to make up the shortfall.

Figure 34: Cereal Production in EU countries using Conventional versus Organic technology (t/ha)



Source: Eurostat

Conventional plant breeding is less efficient than GM technology in the creation of crops with enhanced traits such as herbicide tolerance, insect and disease resistance and drought tolerance. Other technologies include biopesticides or biological products for pest control, Bt bacteria, plant extracts, plant derived products and pheromones. The value of the market for biopesticides, including fermentation based products, in 2016 is of the order of \$2.3 billion, equivalent to 4.2 % of the conventional agrochemical crop protection market. (Source: AgbiInvestor).

Although the biopesticide sector has attracted a significant level of investment from several of the major seed and agrochemical companies, and has exhibited growth in recent years, the overall use and hence market opportunities for biopesticides is restricted by their attributes of slow to kill, cost, difficulties of production, lack of appropriate formulations, and reputation based on previous poor performance of biopesticides³⁶.

Currently there are no indications of biopesticides with broad spectrum control of weeds, insects and diseases in the developmental pipeline for those companies involved in the sector. However, there are several products within this category that have good properties when used in closed environments such as horticulture under glass. In addition many biopesticides can be used in conjunction with conventional chemical crop protection products in resistance management programmes and as control agents for specific pest situations.

It is clear from the above that efficient production of crops requires the application of input technology for nutrition, crop health and viability. Currently Europe is lagging behind other regions, notably the USA in the use of new technology and this is impacting development of crop yields. In addition to this, EU agriculture is heavily subsidised with direct subsidy payments being made to growers regardless of output or efficiency.

As it currently stands, agriculture in the EU is facing a number of challenges that are likely to directly impact crop production and consumer choice for food, which include:

- **Measures to reduce financial support for agriculture**
- **Political obstruction in regulatory decisions, including plant protection and GM crops**
- **Impact of a hazard-based and increasingly precautionary approval systems on trade**
- **Technology changes**
 - **Reduced number of plant protection products**
 - **Limited number of new products arising from R&D**
 - **Lack of GM technology**
 - **Limited involvement in precision agriculture**

The above issues are likely to present considerable challenges for the grower and result in a continued low rate of agricultural productivity in Europe in comparison to key competing regions.

³⁶ Travis R. Glare, Roma L. Gwynn, Maria E. Moran-Diez (2016): Development of Biopesticides and Future Opportunities. Microbial-Based Biopesticides pp 211-221

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