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ANALYSIS OF FOREIGN TRADE WITH CEREALS IN THE EUROPEAN UNION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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Abstract
In the last period the grain market in the European Union has been tested, the invasion of Russia in Ukraine has affected foreign grain trade in various ways. Ukraine is one of the largest producers of cereals and oleaginous seeds, with the invasion of Russia, the ports of Ukraine on the Black Sea were blocked, it had to be a land alternative, being the majority of cereals produced by Ukraine, through the countries of Poland, Slovakia, Hungary and Romania (all being EU member states with relevant agricultural activity). In the study carried out, the foreign trade with cereals in the European Union will be analyzed in the context of sustainable development, imports, exports and the trade balance of cereals will be analyzed in the context of an agriculture that tends from year to year to be more sustainable, more sustainable with environment. Recently, in the European Union, most agricultural holdings have taken important steps to become more sustainable, they have made investments in the latest generation technologies to reduce the degree of chemistry as well as to reduce the consumption of fossil fuels. Through the analysis carried out, it is desired to provide an overview of foreign grain trade in the wake of the emerging imbalances, but also in the context of sustainable development. Globally, in 2023 – 2024 world grain trade is forecast to decline by around 1.8% from 2022 – 2023, with export forecasts increasing for Turkey and Ukraine, but weaker export prospects for the European Union. This paper aims to analyze the external trade in cereals in the European Union in the period 2004 – 2023, a period of many legislative and operational changes in the agricultural sector in the European Union. The external trade (which includes the value of imports, exports and the trade balance) will be correlated with a number of agricultural indicators such as chemical fertilizer consumption, greenhouse gas emissions and certified organic areas in order to observe the state of EU agriculture in the context of the transition towards sustainable agriculture by reducing the use of chemical fertilizers.
Key words: import, export, trade balance, sustainable development, cereals
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Introduction

Achieving the goals of the global sustainability agenda requires a fundamental transformation of agri-food systems to restore food security, healthy ecosystems and healthy food for future generations (Zinngrebe, 2024).

The European Green Pact, through its Farm to Fork (F2F) strategy, has as its main objective the transition to sustainable agriculture by minimizing chemicalization and agricultural practices with significant negative environmental impacts (Pedersen

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et al.,2024). Specifically, the main F2F targets to be achieved by 2030, which have particular applicability to cereal crops, are: a 50% reduction in pesticide use; a reduction of up to 50% in soil nutrient loss, thereby aiming to reduce soil degradation; a 20% reduction in chemical fertilizers; and an increase to 25% in the total agricultural area devoted to organic farming (Wesseler, 2022).

Producing organic food today is a real challenge, in the context of a growing global population, practicing organic agriculture with low yields and high prices will increase the risk of not ensuring food security and food safety (Eliasson et al., 2022). It is estimated that by the year 2050 the global population will reach 9.7 billion, which calls for a transformation of the agricultural sector, re-establishing higher yields that can sustain a growing population through environmentally friendly agricultural practices (Erekalo et al., 2024).

In the European Union, cereals are grown on half of all active farms, accounting for one third of the agricultural area and a quarter of the value of crop production in the European Union. Worldwide, cereals produced in the European Union account for approximately 20% of the total value of production, and are used mainly for animal feed and human consumption. Wheat and rye are used roughly equally for animal feed and human consumption, whereas maize, barley, sorghum, and triticale are used exclusively for animal feed (Schils et al., 2018). An analysis by the FAO shows that the annual demand for cereals, including both food and non-food consumption, is expected to increase from 2.1 gigatons in 2006 to 3 gigatons in 2050. The increase will be driven by developing countries' consumption through increased cereal imports, with the European Union having the chance to maintain or increase its share of the global cereal trade. Increasing yields will rely mainly on the use of nitrogen and other chemical inputs, with the intensification of the concept of sustainable agriculture being hampered by the lack of open management towards such development, the fear of possible much lower yields per hectare, and in the context of a growing world population that requires food security (Ittersum, 2013).

In the literature according to some studies conducted in the field, a country can face certain challenges in the international market in the context of semi-innovative exports of goods and services (Arghiroiu, 2015). The paper started with the literature review which is very vast, the research topic is often analyzed and highlighted in numerous research studies. For example, in the search engine ScienceDirect for “foreign grain trade” returned 6,100 results, and for “sustainable development” returned over 1 million results. These topics are heterogeneously dispersed across various scientific publications, the authors have generally focused on analyzing foreign trade in various areas but also on environmental sustainability through various practices and methods.

Materials and methods

To analyze external trade in cereals in the context of sustainable development, data series from EUROSTAT, INTERNATIONAL TRADE CENTRE (ITC) and FAO-STAT were analyzed.

In the results part, a quantitative analysis of the external trade in cereals in the European Union in the period 2004 – 2023 was carried out. The analysis consisted in extracting from the ITC data for each EU Member State the value of imports, exports and trade balance.

Next, a quantitative analysis was carried out of a series of agricultural indicators whose evolution or regression may have an impact on the external trade in cereals in the European Union, in the sense that agricultural production may fall and cereal imports may exceed exports, generating a negative trade balance. It has been considered that intensive farming is currently practiced in the European Union, with high productivity based on the use of chemical fertilizers and pesticides but also through a high degree of mechanization (Bais-Moleman, 2019).

Cereal foreign trade

Agriculture is a major sector in the European Union, with a focus on achieving food security by increasing agricultural production in a way that minimizes environmental damage. The European Union is a major producer of cereals and plays an important role at world level, with the EU expected to become the world's largest wheat producer by 2032, overtaking China (OECD-FAO, 2023). The following table will analyze the trend in cereal production in the period 2011 – 2022:

In the graph (Figure 1) we analyzed the cereal production in the period 2011 – 2022 of the European Union where we can observe a fluctuation in production in the analyzed period due to climatic conditions. It is observed that in 2022 cereal production is approximately equal to that of 2011 but there is a decrease by 9% compared to 2021. The year 2022 was a challenging year for the European Union agriculture, the main Member States with significant agricultural activity were affected by drought and numerous uncertainties caused by the Russian invasion of Ukraine. The best agricultural year in terms of overall agricultural production in the period under review was 2014, reaching a production of about 307 million tons, up by 6.8% compared to 2013. The average cereal production in the period under review is about 284 million tons.

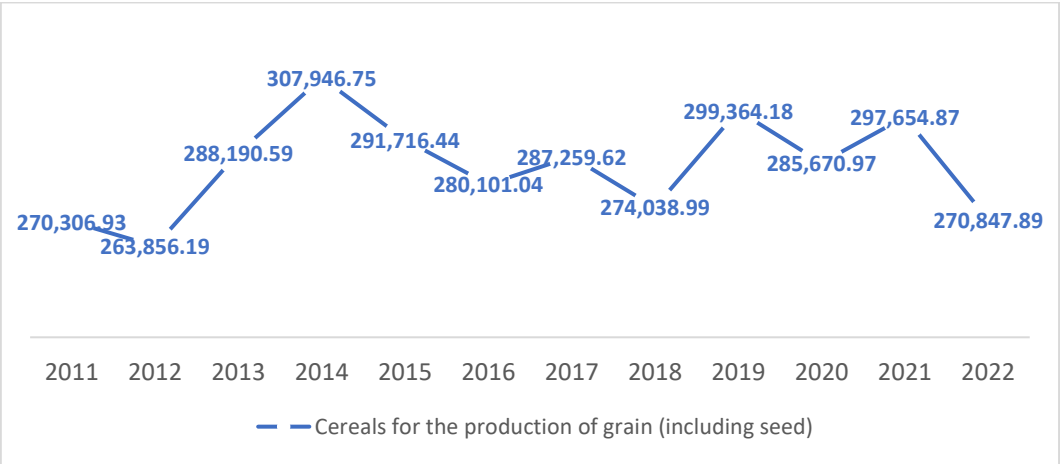

Figure 1. Cereals for the production of grain (1000 tons)
Source: EUROSTAT, edited by the authors

Imports of cereals in European Union

After Russia's invasion of Ukraine in 2022, the European Union eliminated tariffs on Ukrainian grain imports, which led to an oversupply on the EU market. Ukraine being a large producer of cereals, faced problems in exporting its products due to the blockade imposed by Russia in the Black Sea ports (Urak, 2024). The situation has made the EU an accessible transitional export route for Ukrainian grain exports destined mainly for Africa and the Middle East (Fernandes, 2023). After the Russian invasion the EU facilitated the transition of more than 44 million tons of grain via land and river routes, these measures affected the EU domestic grain markets. In 2023 there were numerous protests about the lack of measures to limit Ukrainian grain exports which exponentially affected the EU domestic grain market by significantly reducing grain prices and increasing stocks (Devadoss, 2024). In the following we will analyze the value of grain imports per EU member state and the total value of imports at the global level. At the European level, of interest are the years 2020 and 2023, the period of significant and impactful changes in cereal imports into the Union.

During the analyzed period there is an increase in grain imports by 371%, with a major intensification in the period 2020 – 2023, when Russia invaded Ukraine, which led to the blockade of Ukrainian ports and the inability to trade grain through its own ports. Ukraine chose alternative methods, so that Ukrainian grain transited some EU member countries (e.g. Romania, Poland, Slovakia, etc.) and led to increased imports from the EU. It can be observed that in 2023 the value of EU imports accounted for 18.75% of the total value of world cereal imports, with a slight decrease compared to 2004, when the share of EU imports in total world imports

was 19.87%, the decrease may be influenced by the increased productivity of EU farms, which are able to produce the seeded quantities of cereals that are able to cover the consumption needs.

Table 1. Imports of cereals in European Union (euro thousand)

Importers	2004	2010	2016	2020	2023
World	41.388.051	68.591.408	94.665.650	114.017.890	162.886.463
European Union (EU 27)	8.224.033	12.217.610	16.786.900	19.272.923	30.539.791
Austria	119.993	263.129	430.897	531.419	726.390
Belgium	883.726	1.260.417	1.787.105	1.955.357	2.560.217
Bulgaria	58.397	53.764	62.649	94.028	159.582
Croatia	42.850	23.530	45.023	72.034	154.346
Cyprus	72.498	93.800	92.780	101.819	159.029
Czech Republic	39.489	80.136	130.610	164.616	259.374
Denmark	144.103	169.933	171.516	174.036	228.920
Estonia	17.144	14.449	14.835	18.211	33.405
Finland	42.355	28.871	27.925	35.318	67.212
France	467.283	693.726	901.194	928.025	1.126.059
Germany	723.299	1.784.802	2.461.279	2.956.418	4.192.378
Greece	299.220	312.659	361.394	362.683	528.795
Hungary	72.974	84.282	173.110	202.673	525.245
Ireland	118.496	178.655	252.071	391.377	540.162
Italy	1.638.456	2.042.872	2.811.206	3.156.747	5.291.163
Latvia	12.571	76.493	124.220	193.513	330.619
Lithuania	19.678	38.118	44.673	105.375	181.411
Luxembourg	17.296	22.408	40.320	51.204	72.225
Malta	15.091	22.729	29.013	21.607	34.431
Netherlands	1.168.173	1.776.203	2.266.540	2.825.510	3.736.433
Poland	179.676	245.760	322.080	484.633	716.448
Portugal	491.816	638.475	737.174	772.074	1.338.797
Romania	219.887	239.851	596.449	704.701	701.168
Slovakia	26.907	109.674	77.387	93.156	193.388
Slovenia	63.988	56.306	66.539	77.963	138.925
Spain	1.208.543	1.804.604	2.632.722	2.671.334	6.356.200
Sweden	60.124	101.963	126.192	127.092	187.469

Source: Edited by the authors based on ITC data

Spain, with a population of 48 million and the second largest country in the European Union in terms of surface area, is the world's top cereal importer. This registers an increase in imports between 2004 and 2023 of 526%, with the value of imports increasing sharply in 2023, a year in which the cereal harvest was very poor in the context of the drought that affected the country, and they manage to cover their cereal consumption needs through imports. Italy is the second country in terms of the value of cereal imports, registering an increase of 323% in the period analyzed, a country that is a large consumer of cereals but with medium cereal production possibilities, so that the cereal needs for consumption are met by imports.
Romania records a 319% increase in imports in the analyzed period, with the value of imports in 2023 remaining approximately constant compared to imports in 2020, Romania occupying an important place in terms of cereal cultivation in the European Union, which manages to ensure its own consumption from its own production.
In the context of a transition towards sustainable agriculture, the value of cereal imports into the European Union is expected to increase as a result of the reduction in the use of chemical fertilizers.
The European Union is expected to become the world's biggest wheat importer by 2024, according to the USDA.

Exports of cereals in European Union

The cereals trade currently accounts for about 17% of global consumption. Globally, it is known that America and Europe are trading cereals produced in Asia and Africa, where there is a growing demand for food and feed due to population growth and the expansion of livestock sectors at a faster pace than domestic production. This growth trend is expected to continue over the next decade, with cereal exports increasing by 11% from the reference period to 2032 (OECD-FAO, 2023). In the following, cereal exports by each EU Member State and the value of total world exports are analyzed (Table 2).
Over the period 2004 – 2023, EU cereal exports increased by 416%, influenced by a slight increase in cereal production but also by a concomitant increase in imports, so that EU cereals are destined for Asia and domestic consumption is provided by imports from Ukraine and other countries.
In 2023, EU cereal exports account for about 21% of total world cereal exports, roughly the same share as in 2004 and down by about 2% compared to 2010 and by 1% compared to 2020.
The first place in terms of exports is occupied by France, which exported in 2023 cereals worth 7,634,148 thousand euro, registering an increase in the period analyzed by 93%, France being a country with high agricultural potential, it is ranked first in terms of cereal cultivation, technical plants, livestock breeding and viticulture. France has an agricultural area of about 30 million hectares, of which arable land accounts for about 18.5 million hectares. During the period under review, a

decline in cereal exports can be observed between 2010 and 2016, when there is a slight decrease of 1%.

Table 2. Export of cereals in European Union (euro thousand)

Exporters	2004	2010	2016	2020	2023
World	36.392.126	63.749.663	87.126.837	104.533.553	150.824.103
European Union (EU 27)	7.523.420	14.747.083	19.235.767	23.245.787	31.267.016
Austria	168.511	268.476	376.152	462.481	618.968
Belgium	327.429	411.585	516.221	570.757	602.301
Bulgaria	119.117	547.328	1.030.756	1.169.832	2.127.606
Croatia	6.610	83.994	149.903	321.776	377.003
Cyprus	6	185	107	126	161
Czech Republic	50.460	300.286	603.219	612.994	931.859
Denmark	131.528	411.310	304.291	316.539	466.803
Estonia	827	34.631	106.204	214.063	219.367
Finland	53.968	105.029	118.821	140.456	125.810
France	3.936.845	5.781.920	5.618.399	6.824.817	7.634.148
Germany	1.076.877	2.126.431	2.568.238	2.627.337	3.186.781
Greece	40.561	157.147	200.454	146.763	279.658
Hungary	365.256	1.100.825	1.188.793	1.602.888	1.698.211
Ireland	13.547	22.258	16.358	39.638	62.941
Italy	392.841	649.359	703.739	729.187	1.083.515
Latvia	10.707	211.690	403.383	650.290	791.682
Lithuania	72.819	240.101	593.895	982.158	1.125.501
Luxembourg	7.563	12.841	15.124	16.998	22.305
Malta	6	4.024	5.438	4	2.340
Netherlands	164.801	297.727	441.090	569.894	617.691
Poland	36.192	305.744	1.051.105	1.709.653	3.559.987
Portugal	38.235	34.219	63.792	85.616	197.961
Romania	43.879	882.573	2.102.202	2.143.536	4.124.785
Slovakia	41.576	198.036	350.347	405.565	647.670
Slovenia	2.386	19.361	34.816	71.078	76.464
Spain	286.916	366.798	362.669	484.849	419.563
Sweden	133.958	173.208	310.251	346.491	265.933

Source: Edited by the authors based on ITC data

In second place in terms of cereal exports is Romania, a country with high potential in terms of cereal cultivation, in 2023 it exported cereals worth 4,124,785 thousand euros, the value of exports recorded an impressive increase in the period analyzed of about 94 times compared to 2004. In Romania, agriculture is recording an increase in productivity, with farms recording much higher yields per hectare, which has been made possible by major investments in agricultural technology and an increase in the degree of chemicalization, with farmers investing more and more in a hectare of cultivated land.
In third place is Poland, with the value of exports in 2023 increasing by about 98 times compared to 2004, the increase being mainly influenced by improved yields per harvested hectare but also by an increase in the value of cereal imports, as they choose to sell their grain to other countries and import cereals to cover domestic consumption.
The countries in the bottom three for cereal exports are Cyprus, Malta and Luxembourg, where agriculture is not a core activity due to very small areas of arable land and climatic conditions unsuitable for farming.

Trade balance of cereals in European Union

The European Union is recognized worldwide for its competitiveness, quality and diversification and remains the world's largest trader of agri-food products. The European Union's main exports were cereal preparations, with the top three export destinations in 2023 being the UK, the USA and China. For EU imports, the top three destinations were: Brazil, the United Kingdom and Ukraine according to the European Commission. The table 2 will present the cereal trade balance from 2004 – 2023 for the European Union (Table 3).
The EU cereals trade balance is in surplus, meaning that the EU manages to export more cereals than it imports. The value of the trade balance is decreasing in 2023, because at EU level wheat imports have increased significantly in recent years, but also because of the increase in imports in 2023 due to the war between Ukraine and Russia. The trade balance recorded negative values in the period analyzed only in 2004, 2007 and 2018. The EU member countries with the largest deficits in the cereals trade balance are Spain, Italy and the Netherlands. The first two countries, Spain and Italy, have an average potential in terms of cereal cultivation, as their agriculture is based on other branches, so that their food security relies on imports, resulting in a net trade deficit. If we look at the Netherlands, domestic consumption is predominantly through imports, as it is a small country in terms of size, with a small arable area, but with a population of around 18 million, this means high cereal imports to achieve food security. It can be observed that the cereal trade balance for the three countries mentioned above is in deficit from 2004 to 2023, they have not even recorded a single year in which exports were higher than imports.

Table 3. Trade balance of cereals in European Union (euro thousand)

Trade balance	2004	2010	2016	2020	2023
World	–4.995.925	–4.841.745	–7.538.813	–9.484.337	–12.062.360
European Union (EU 27)	–700.613	2.529.474	2.448.866	3.972.863	727.224
Austria	48.518	5.348	–54.745	–68.938	–107.422
Belgium	–556.297	–848.832	–1.270.884	–1.384.600	–1.957.916
Bulgaria	60.719	493.564	968.108	1.075.804	1.968.024
Croatia	–36.240	60.464	104.880	249.743	222.657
Cyprus	–72.492	–93.615	–92.673	–101.693	–158.868
Czech Republic	10.971	220.150	472.609	448.378	672.485
Denmark	–12.575	241.377	132.775	142.503	237.883
Estonia	–16.317	20.182	91.369	195.852	185.963
Finland	11.613	76.158	90.897	105.138	58.598
France	3.469.562	5.088.194	4.717.205	5.896.792	6.508.088
Germany	353.578	341.628	106.959	–329.081	–1.005.597
Greece	–258.659	–155.512	–160.940	–215.919	–249.137
Hungary	292.282	1.016.543	1.015.683	1.400.215	1.172.967
Ireland	–104.949	–156.397	–235.713	–351.740	–477.221
Italy	–1.245.615	–1.393.513	–2.107.467	–2.427.560	–4.207.648
Latvia	–1.864	135.197	279.163	456.778	461.063
Lithuania	53.141	201.983	549.222	876.783	944.090
Luxembourg	–9.733	–9.567	–25.196	–34.206	–49.920
Malta	–15.085	–18.705	–23.575	–21.603	–32.091
Netherlands	–1.003.371	–1.478.476	–1.825.450	–2.255.616	–3.118.742
Poland	–143.485	59.983	729.026	1.225.021	2.843.539
Portugal	–453.581	–604.256	–673.381	–686.458	–1.140.836
Romania	–176.008	642.722	1.505.752	1.438.834	3.423.617
Slovakia	14.668	88.361	272.959	312.410	454.282
Slovenia	–61.602	–36.945	–31.723	–6.885	–62.460
Spain	–921.627	–1.437.805	–2.270.054	–2.186.484	–5.936.637
Sweden	73.834	71.245	184.059	219.398	78.464

Source: Edited by the authors based on ITC data

The cereals trade balance is clearly in surplus in France, Romania and Poland, countries where the value of cereal exports far exceeds the value of imports, as these three EU Member States are the main cereal producing countries in the European Union, with cereal growing being a traditional and basic activity.

Agriculture and environment in European Union

Chemical fertilizers have been a main product for agriculture to increase soil nutrients and have been used since the middle of the last century. By using chemical fertilizers agricultural yields can increase rapidly and efficiently compared to using organic fertilizers. The overuse of chemical fertilizers can cause major environmental problems such as pronounced soil degradation, air pollution (with NO, N_2O, NO_2) as well as groundwater pollution (Zhao, 2024). Agriculture in the European Union is in a continuous process of change, adapting to new changes in sustainable agricultural practices. The concept of 'organic farming' is relatively new in the European space, with most farmers believing that the transition to organic farming will have a negative impact on farms, the main fear being that the lack of chemicalization may affect the yield per hectare.

Nitrous oxide (N_2O) is expected to increase by 9.20% between 2000 – 2021, a gas generated largely by agricultural fertilizers, and has a global warming potential almost 270 times greater than carbon dioxide. Researchers believe that environmental policies can encourage farmers to adopt sustainable nitrogen use practices through various financial incentive programs.

Emissions of methane from agriculture, a greenhouse gas, decreased by 1.68% during the period under review, after an increase of 10.79% between 2000 – 2010, with methane emissions reaching 284.92 kilotons in 2010.

Pesticides used in agriculture show a slight increase of 2.30% over the period under review, as they play an important role in achieving food security and plant health in the European Union. Overuse can affect water, soil and biodiversity. The European Green Pact aims to reduce the use of hazardous pesticides by up to 50% in the European Union by 2030. In the context of increasing cereal consumption, pesticides have become indispensable in maintaining the health of agricultural cereal crops and agricultural cereal yields (Table 4).

The total consumption of nitrogen used in agriculture is decreasing during the period under review by 7.38%, the period under review being 2000 – 2021. However, the consumption per hectare records an increase from 72 kg/hectare in 2000 to 75 kg/hectare in 2021, which is influenced by the fact that part of the agricultural area has become unproductive with the passage of time, thus generating a higher consumption per hectare in 2021 compared to 2000, but remembering that the amount of total nitrogen used is decreasing. Nitrogen is the nutrient applied at the highest rates in agriculture, it needs to be applied rationally by farmers, and research is being re-launched worldwide to establish a set of maximum amounts of nitrogen for each plant species.

Phosphate used in agriculture has decreased by 20.55% over the period under review and is considered one of the most important macro-elements for increasing the yield and quality of agricultural products. The European Union is dependent on phosphorus imports, and over time the price of phosphorus has been affected by

various factors (world political situation, world crises, etc.), directly affecting the supply chain in the European Union. It is estimated that global phosphorus resources will be depleted in about 50 years, so in the medium and long-term agriculture will have to replace phosphorus use with other more sustainable products.

Table 4. Agriculture and environment in European Union

Indicators	2000	2005	2010	2015	2021
Emissions N_2O from crops in kiloton (nitrous oxide)	57,9407	58,3569	56,7657	63,5770	63,2966
Emissions CH_4 from crops in kiloton (methane)	257,1740	260,1249	284,9270	266,9496	252,8668
Pesticide use in agriculture (tons)	346.096,63	356.589,17	315.314,73	366.379,41	354.082,26
Nitrogen used in agriculture (tons)	10.144.215 (72 kg/ha)	9.776.639 (73 kg/ha)	9.548.776 (74 kg/ha)	10.337.512 (81 kg/ha)	9.396.404 (75 kg/ha)
Phosphate used in agriculture (tons)	3.314.570 (25 kg/ha)	3.036.975 (24 kg/ha)	2.252.587 (18 kg/ha)	2.471.039 (20 kg/ha)	2.633.736 (22 kg/ha)
Potash used in agriculture (tons)	3.647.603 (27 kg/ha)	3.228.844 (25 kg/ha)	2.592.845 (21 kg/ha)	2.692.461 (21 kg/ha)	2.888.591 (23 kg/ha)
Agriculture area under organic farming (1000 ha)	-	5.554,93	8.333,17	10.654,563	15.707,7692
Agriculture area certified organic (1000 ha)	-	2.316,98	3.632,81	6.956,116	10.391,398
Manure applied to soils (tons)	1.182.305	1.139.055	1.119.636	1.107.473	1.072.867

Source: FAOSTAT, edited by the authors

Potassium used in agriculture is decreasing by 20.81% over the period analyzed, helping plants to grow by accelerating photosynthesis, disease resistance, assimilation of proteins needed for growth and resistance to drought and frost.

The agricultural area under organic farming increased 282.77% between 2005 – 2021, with the increase being more pronounced after 2010, when the concept of organic farming began to gain interest in Europe. In 2022 the area farmed organically accounted for 10.5% of all agricultural land, with the rapid expansion being influenced by the targets set by the European Green Pact. According to EUROSTAT data most of the organic land is used for growing arable crops (e.g. cereals).

The certified organic agricultural area shows an increase of 448.48% in the period 2005 – 2021, in 2021 the certified organic area represents about 66.15% of the total organic cultivated area. The main countries with the majority of certified organic land are Spain, France, Italy and Germany.
Manure applied on soils registers a slight decrease in the period 2000 – 2021 by 9.26%, it is considered as an organic fertilizer and its application in optimal quantities does not pollute the soil, groundwater and ensures optimal plant nutrition and is an important prerequisite for sustainable agriculture.

Conclusions

Producing organic food today is a real challenge, in a context where the world's population is constantly growing, practicing organic agriculture with low yields and high prices will increase the risk of not ensuring food security and food safety.
In the European Union, cereals are grown on half of all active farms, accounting for a third of the agricultural area and a quarter of the value of crop production in the European Union. Worldwide, cereals produced in the European Union account for around 20% of the total value of production, mainly used for animal feed and human consumption, making the European Union a major player in the global cereals trade.
In the period 2004 – 2023, there was a 371% increase in cereal imports, with a major intensification in the period 2020 – 2023, when Russia invaded Ukraine, which led to the blockade of Ukrainian ports and the inability to trade cereals through its own ports.
Over the period 2004 – 2023, EU cereal exports increased by 416%, influenced by a slight increase in cereal production but also by a concomitant increase in imports, so that EU cereals are destined for Asia and domestic consumption is provided by imports from Ukraine and other countries.
The EU cereals trade balance is in surplus, meaning that the EU manages to export more cereals than it imports. The value of the trade balance is decreasing in 2023, because at EU level wheat imports have increased significantly in recent years, but also because of the increase in imports in 2023 due to the war between Ukraine and Russia
Over the period 2000 – 2021, N_2O and CH_4 emissions remain roughly constant broadly influenced by the diversification of agriculture and the increase in agricultural chemicalization.
Pesticides used in agriculture show a slight increase of 2.30% over the period 2000 – 2021, as they play an important role in ensuring food security and plant health in the European Union. The decrease according to the study may be due to the fact that in the EU the area certified organic has increased by 448%.
The consumption of nitrogen, potassium and phosphorus has decreased over the period, indicating that the EU's efforts to move towards sustainable agriculture are beginning to bear fruit.

In conclusion, the concept of sustainable agriculture in the European Union is still in its infancy, with the EU taking important steps to develop this concept by: reducing chemicalization, increasing the area under organic farming, reducing greenhouse gas emissions, and making large-scale use of precision farming. At the same time, sustainable development in agriculture is being sought through the introduction of measures to combat climate change, protect natural resources and improve biodiversity in the European Union.

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