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LAND USE FOR CEREALS, OILSEEDS AND PROTEIN CROPS IN THE EUROPEAN UNION

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Abstract

Land use in the EU for cereals, oilseeds and protein crops was studied in the period 2018-2025 based on Eurostat data aiming to identify the trends, similarities and differences among the member states as a reflection how cultivated areas are involved by structure and orientation to stimulate agricultural production. Growth rate, structural index, trend equations, R square, comparison and graphical illustration represent the methodological approach. The results pointed out that the utilized agricultural land (UAA) increased by 0.82% reaching 160.56 Mill. ha, of which six countries keep 68.2%: France, Spain, Germany, Poland, Italy and Romania in which UAA is over 10 Mill. ha. The EU arable land accounts for 99.01 Mill. ha, by 1.81% smaller and having a share of 60.5% in UAA. France, Spain, Germany and Poland account for 52.9% in arable land, having each more than 10 Mill. ha. In 2025, the EU arable land is destined for two groups of crops: cereals 50.2 Mill. ha (52.5%) and oilseeds and protein crops 13.1 Mill. ha (13.9), summing 66.5%. In case of cereals, the largest arable land is allotted to soft wheat (42.1%), barley (20.5%) and grain maize (17.4%) totaling 80%. In case of oilseeds and protein crops, the highest share in arable land is kept by rape (45.1%), sunflower (35.3%) and soybean (7.9%), summing 88.3%. Smaller land surfaces are covered by other crops from these two groups in order to sustain the diversity of domestic production, to cover market needs and stimulate export. All these reflect the role of these crops in the EU vision for developing a sustainable agriculture assuring food security, animal feeding, renewable energy, industry processing and environment protection.

Key words**:** *land use, UAA, arable land, cereals, oilseeds and protein crops, EU*

INTRODUCTION

Land is our most precious capital because is our home, provides food for sustaining our life and also other useful resources, offers habitat for various plant and animal species, stores water and carbon and their cycle in nature, regulates climate, assures wealth, has an economic, social, historical and cultural importance in the development of each nation [15]. Land use is limited by its surface and for this reason its objectives must be balanced between the most beneficial utilizations under the maintenance of environment quality and preservation of land resources and biodiversity [40]. The primary purposes of the land use regard establishing settlements, attaining commercial aims, industrial goals, agricultural products, transportation and recreation tourism.

In consequence, the primary category of land use are: crop land for agriculture, grassland for animals, wetlands, forests land, terrain for setting up settlements and other types [42].

The utilization of land by humans could lead to soil alteration, to the change its destination to another, as it happens in case of the expansion of the urban and semi-urban areas diminishing the agriculture land in the rural areas by crop land abandonment, deforestation, reforestation, investments in transport infrastructure etc. Even farmers could change the land destination from a grassland to a crop land. The changes made by humans have a

negative impact on carbon cycle, climate change and biodiversity [17, 24].

Land use is very important for agriculture because it could offer space for cultivating crops and other plants and breeding animals for assuring food for humans and forages for animal feeding. More than this it provides raw materials for industrial purposes [16].

All these have shown the influence of land use on ecosystems, environment sustainability and biodiversity maintenance, and also the derived challenges and opportunities in adopting land use beneficial practices [1]. The agricultural land-use system is centered on land use including all the activities that humans make and the results of their efforts not only in the field of food security but also on mitigating climate change [2]. The EU is an important "player" in the world's land use for agriculture and not only. Of its total area accounting for 4,225,104 km^2, 4,101,431 km^2, that is 97.07% is land [14]. Agricultural land in the EU covers 160.55 million ha, representing 39% of the EU surface. Because agriculture is very important for assuring food security, sustainable development and environment protection, land use is a key factor in planning the cultivated areas with various crops and production management. Therefore, land use plays a specific social, economic and environment role in connection to soil protection and productivity, nature and biodiversity preservation and the prevention and mitigation of climate change influence.

Having in mind these aspects presented above, and continuing the previous researches, the study aimed to analyze the EU land use for cereals and oilseeds and protein crops in the period 2018-2025 based on Eurostat data for identifying the tendencies, differences and similarities among the member states to further understand how cultivated areas are involved in the future orientation to stimulate agricultural production in accordance with the change in consumer's demand.

MATERIALS AND METHODS

First of all, this paper started with the study of the literature in the field in order to have an image on the scientific knowledge framework on the topic especially in the last decade.

The main data source was Eurostat including various websites to identify and collect the information necessary to build a statistical presentation on the topic in the period 2018-2025. In a few cases, Eurostat displayed updated data only till 2022.

The following land indicators have been taken into account:

-Utilized agricultural land (UAA) at the EU level and in the main member states with the largest UAA for which the share was calculated in total EU utilized land;

-Arable land at the EU level and in the main countries which have the largest arable surface, and for which it was determined the corresponding share;

-Arable land destined for two groups of crops:

(a) Cereals as a whole and also by category of cereals: soft wheat, durum, rye, barley, oat, grain maize, triticale and other cereals;

(b) Oilseeds and protein crops as a whole and by category: field peas, broad bean, lupins, rapeseeds, sunflower seeds, linseeds, soybean.

-Forecast of land use for Cereals in the year 2026 and forecast of land use for Oilseeds and protein crops for the years 2025 and 2026.

The countries utilizing the largest land surface have been identified for each crop.

The applied methodology included: dynamic analysis, growth rate, structural index, trend line and regression equations, R square, forecast, descriptive statistics, comparison and graphical illustration. The results were accompanied by comments and the main conclusions were drawn and synthesized at the end.

RESULTS AND DISCUSSIONS

EU land surface and its primary land uses

Of its land surface accounting for 4,101,431 km^2, the EU has the following primary land uses: agricultural land 39.1%, forestry area 35.9%, unused and abandoned terrains 14.8%, services and residential surfaces 5.7%, areas with a deep environmental impact 3.9% and fishing 0.6%.

EU agricultural land

The EU agricultural land accounts for 160.55 million ha representing 3.4% of the global agricultural area, 7% of the global crop land and 1.61% of grasslands [39].

The EU countries with the largest agricultural land are: France 17.58 million ha, Spain 16.09 million ha, Germany 10.18 million ha, Poland 8.9 million ha, Romania 8.02 million and Italy 7.61 million ha [41].

The agricultural land per inhabitant in the EU is 0.37 ha [39].

EU -Utilized agricultural land (UAA)

The UAA in the EU 27 was 157.2 million ha in the year 2024. This figure reflects a slight decline of 0.64% compared to 159.24 million ha in the year 2018 (Figure 1).

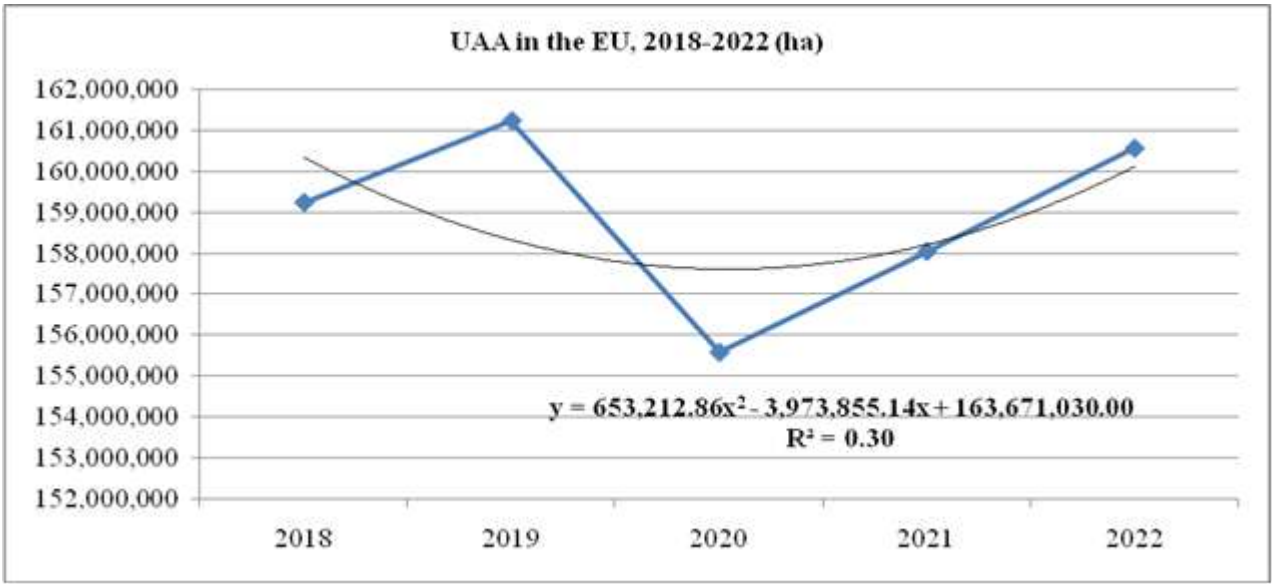

Fig.1. The dynamics of utilized agricultural land UAA at the EU level, 2018-2022 (ha)
Source: Own design and calculation based on the data from Eurostat [13].

The R square shows that 30% of the variation of UAA was determined by time and the remaining of by other factors. The downward variation in the year 2020, accounting for - 5.64 million ha compared to 2019 when the UAA was 161.23 million ha, was caused by climate change. Then, UAA restarted to grow.

The UAA varies from a member state to another depending on the local peculiarities and characteristics of land in relationship with its use in agriculture and crop type, the surface of the territory of each country, the relief forms, soil type, quality and fertility and climate conditions.

In the year 2022, the countries with the largest UAA, in the decreasing order of their share in the EU UAA were: France 17.80%, Spain 15.37%, Germany 10.33%, Poland 8.835, Italy 9.06% and Romania 7.89%. All these six countries accounts for 68.28% in the EU UAA and each utilizes more than 12. million ha.

However, it deserves to be specified that these six countries are followed by other three member states with a lower weight: Greece 3.34%, Hungary 3.16% and Bulgaria 3.12% (Figure 2).

Taking into account the UAA in each country, it was proceeded to a classification of the EU countries in four categories: over 10 Million ha, 5 to 10 Million ha, 1 to 5 Million ha and below 1 Million ha. The results are presented in Table 1.

The land utilization include: "arable land, permanent crops and grasslands and kitchen gardens"[13].

In the EU, these categories represent: arable land 62.4%, permanent grasslands 30.5%, and permanent crops 7.1% (Fig. 3).

The land use by category is deeply influenced by geographical region, soil type, structure, quality and fertility and climate conditions which are very different from a country to another and from a region to another of the EU member states, but this affirmation is also available at the global level.

In addition, land use is closely connected to its efficiency which depends of a large range of factors such as: number of farms and their specialization, farms size (physical in ha and economic in standard output-euro), labor force and its productivity, farmers' age, training level and experience, technical equipment for working land and technologies applied [23].

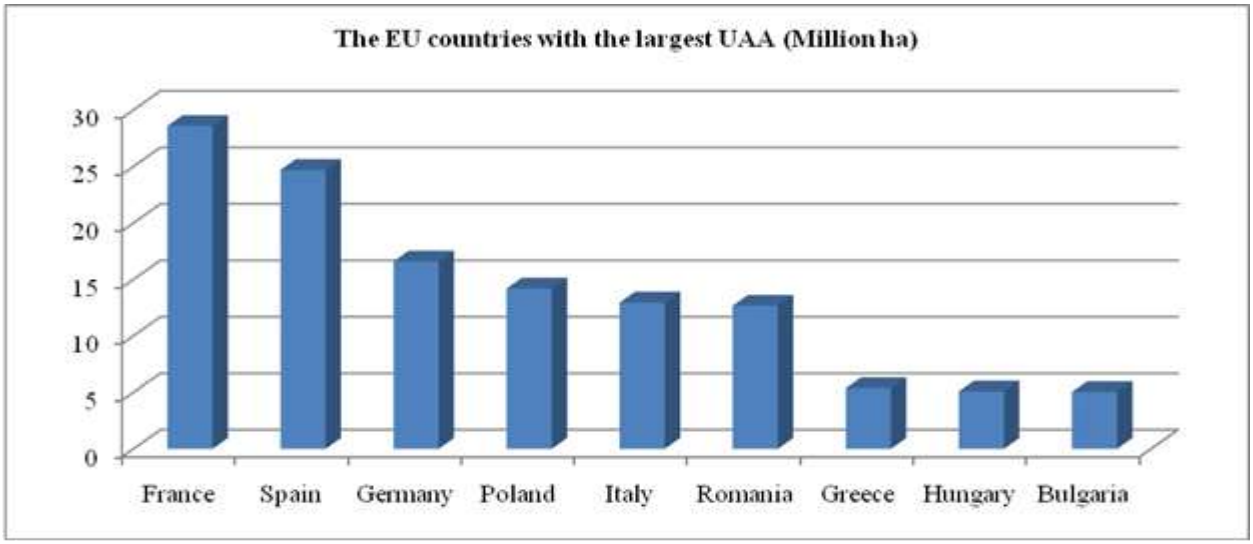

Fig. 2. The EU countries with the largest UAA in 2022 (Million ha)
Source: Own design based on the data from Eurostat [13].

Table 1. Classification of the EU member states based on UAA in 2022 (Million ha)

Over 10 Million ha		5 - 10 Million ha		1 -5 Million ha				Below 1 Million ha	
1.France	28.58	1.Greece	5.37	1.Ireland	4.34	7.Finland	2.26	1.Estonia	0.98
2.Spain	24.69	2.Hungary	5.08	2.Portugal	3.95	8.Latvia	1.97	2.Slovenia	0.47
3.Germany	16.59	3.Bulgaria	5.02	3.Czechia	3.53	9.Slovakia	1.84	3.Luxemburg	0.13
4.Poland	14.19			4.Sweden	2.99	10.Netherlands	1.80	4.Cyprus	0.12
5.Italy	12.95			5.Lithuania	2.91	11.Croatia	1.44	5.Malta	0.10
6.Romania	12.67			6.Denmark	2.62	12.Austria	1.36		
						13.Belgium	1.36		

Source: Own conception based on the data from Eurostat [13].

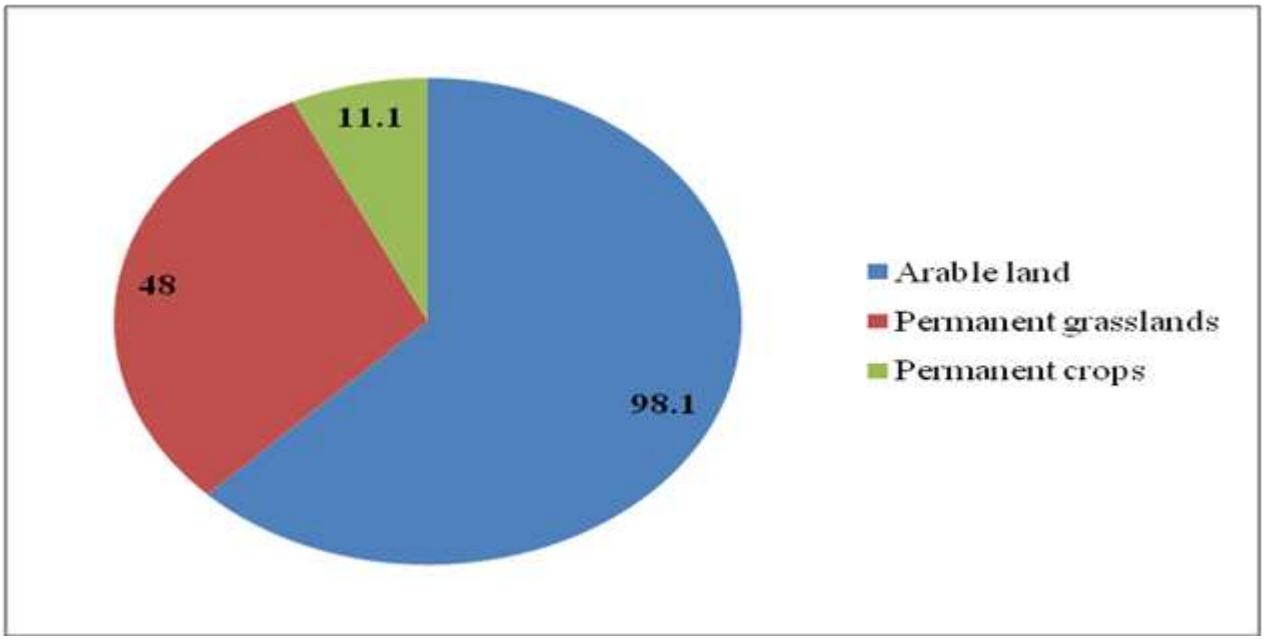

Fig. 3. The land use in the EU agriculture by category (million ha)
Source: Own design based on the data from Eurostat, [13].

The largest UAA is in the following countries: France, Spain, Germany, Poland, Romania, Italy, many of them having the largest surface area [27].

In a few countries such as: France, Austria, Hungary, Poland, Greece, Netherlands, Italy, Portugal, the UAA registered a slight declining trend on the reason that the new technologies applied using precision agriculture are more efficient assuring higher yields [37].

Another important aspect is how much of the surface of a country is utilized for agriculture. From this point of view, from the 27 EU member states, only 10 have an UAA accounting for more than 50% of the country area. In the decreasing order, it is about: Denmark, Ireland, Hungary, Romania, Netherlands, France, Luxembourg, Belgium, Poland and Lithuania [39].

Arable land

Agricultural land in the EU is utilized as follows: arable land for agricultural multi-crops, permanents crops (orchards and vineyards), permanent grasslands (meadows and pastures), kitchen gardens and temporarily fallow.

In the year 2022, the EU arable land accounted for 97,226,840 ha , being by 1.81% smaller than in the year 2018 when it was 99,017,780 ha (Figure 4).

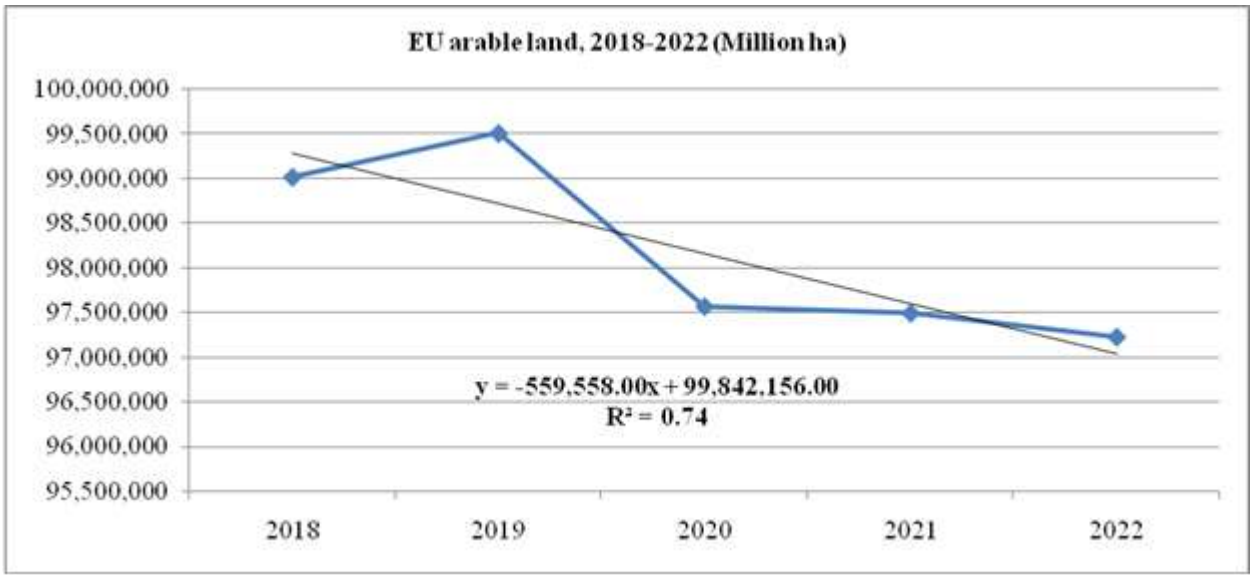

Fig. 4. The dynamics of utilized agricultural land UAA at the EU level, 2018-2022 (ha)
Source: Own design and calculation based on the data from Eurostat [12, 13].

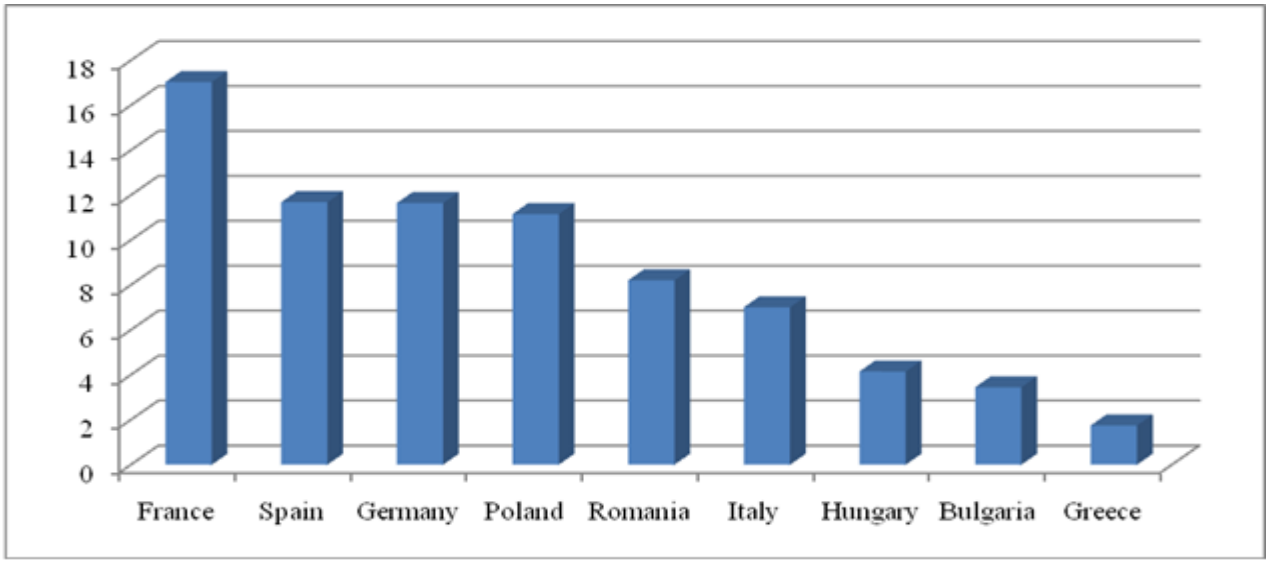

Fig. 5. The EU countries with the largest arable land in 2022 (Million ha)
Source: Own design based on the data from Eurostat [12, 13].

The R square value reflects that 74% of the variation of the EU arable land depended on time and 26% was caused by the variation of other factors.

In the decreasing order of their share in the EU level, the main countries having the largest arable land are: France 17.53%, Spain 12.02%, Germany 11.98% and Poland 11.48%, each country having more than 11 million ha arable land. Summing their shares, it resulted 41.53% These countries are followed by other five countries whose share is the following one: Romania 8.44%, Italy 7.21%, Hungary 4.27%, Bulgaria 3.55%, Greece 1.80%, summing 25.27%, and if we add this percentage to the one achieved by the 5 countries mentioned above, it results that nine EU countries keep 66.8% of the EU arable land, and each has over 1.75 million ha (Figure 5).

The arable land in the EU UAA decreased from 62.18% in 2018 to 60.5% in 2022, reflecting less 1.68 percentage points.

Based on their arable land surface, the EU countries were classified into four groups as shown in Table 2.

Table 2. Classification of the EU member states based on arable land in 2022 (Million ha)

Over 10 Million ha		5 - 10 Million ha		1 -5 Million ha				Below 1 Million ha	
1.France	17.04	1.Hungary	4.15	1.Czechia	2.38	7.Austria	1.32	1. Portugal	0.93
2.Spain	11.69	2.Bulgaria	3.45	2.Denmark	2.99	8.Slovakia	1.32	2.Belgium	0.86
3.Germany	11.65	3.Greece	1.75	3.Lithuania	2.29	9.Netherlands	1.00	3. Croatia	0.85
4.Poland	11.11			4.Finland	2.24			4.Estonia	0.69
5.Romania	8.21			5. Sweden	2.24			5.Ireland	0.44
6.Italy	7.01			6.Latvia	1.35			6. Slovenia	0.17
								7.Cyprus	0.09
								8.Luxemburg	0.06
								9.Malta	0.007

Source: Own conception based on the data from Eurostat [12].

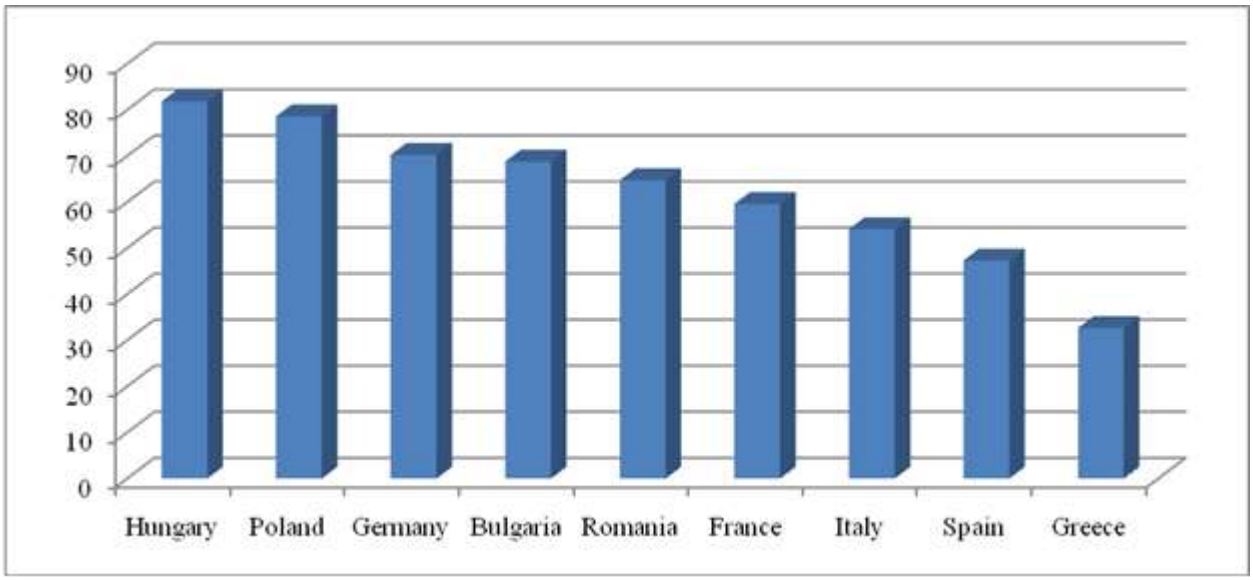

Fig. 6. The share in UAA of EU countries with the largest arable land in 2022 (%)
Source: Own design based on the data from Eurostat [12, 13].

The share of arable land in UAA

The weight of arable land in UAA is a very important aspect regarding the crop cultivation and depends on the relief of each countries, soil type, its fertility and climate factors. Figure 6 presents the share of arable land in the nine EU countries with the largest arable surface.

Based on this criterion, we may observe important changes regarding their ranking, as follows: Hungary 81.85%, Poland 78.63%, Germany 70.24%, Bulgaria 68.81%, Romania 64.76%, France 59.60%, Italy 54.13%, Spain 47.34%, Greece 32.67%. The figures show how much of arable land of UAA could be used

for crop cultivation and how much remain from the UAA for other purposes.

EU Land use for the main groups of crops

The crop land in the EU accounted for 110.78 million ha in the year 2021 and in 2024, it measured 94 million ha, being by 15.15% smaller.

The largest cropland is in the following countries: France, Spain, Germany, Poland, Italy, Romania, and also in Hungary, Bulgaria, Greece and Sweden, all these member states summing 92% of the EU cropland.

Two important groups of crops are cultivated in the EU: Cereals and Oilseeds and protein crops for which is reserved an important part of arable land [7, 8].

Land use for cereals

In the year 2025, arable land for cultivating cereals registered 50,247 thousand ha compared to 51,914 thousand ha in 2018, meaning a decrease by 3.3% [5]. As a result, the share of the land used for cereals in arable land declined from 52.42% in 2018 to 52.57% in 2025, reflecting -0.89 pp less (Figure 7).

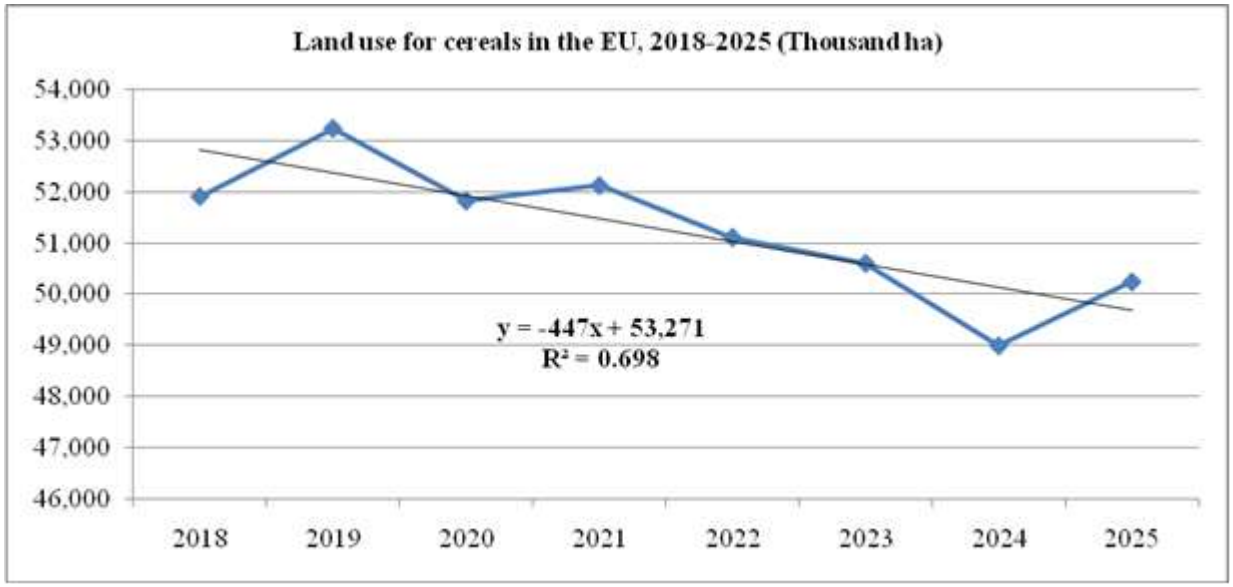

Fig. 7. The dynamics of the land use for cereals in the EU, 2018-2025 (Thousand ha)
Source: Own design based on the data from Eurostat [7, 8].

Figure 7 reflects a downward trend starting from 2020 and a slight increase starting from 2024 to 2025. The value of R square shows that 69.8% of the variation depended on time and 30.1% depended of other factors.

Based on the regression equation, the forecast for 2026 is 49,800 thousand ha, a surface which will be by 0.9% smaller than the level attained in 2025.

Land used for oilseeds and protein crops increased from 11,774 thousand ha in 2018 to 13,096 thousand ha in 2024. For the year 2025, there were not available data yet in Eurostat data base. In 2022, this share accounted for 11.89% in arable land compared to 11.89% in 2018, which means +2.06 pp (Figure 8).

This reflects the importance given by the EU to oilseeds crops and protein crops which have the role to produce protein for improving the diets for humans and partially replace the meat, to assure meal for animal feeding, for producing renewable energy (biofuels) and for protecting environment. All these will increase the domestic production and decrease the EU's imports.

In this case, the coefficient of determination, R^2, reflected that 65.7% of the land used for Oilseeds and protein crops was influence by time and 34.3% of the variation was caused by other factors.

Keeping in mind the regression equation, it was calculated the forecast of 13,375 thousand ha for the year 2025 and 13,653 for the year 2026.

Summing the arable land used for Cereals with the arable land utilized for Oilseeds and protein crops in each year of the analyzed period 2018-2026, the results reflect that while the land used for cereals will decline to 49,800 thousand ha in the year 2026, the land utilized for oilseeds

and protein crops will grow and reach 13,653 thousand ha.

But, summing the shares of the land use in the arable land for each group of crops and in every year till 2022, for which we had available data, we will notice an increased share to 66.51% in 2022 compared to 64.31% in 2018, meaning a surplus of +2.2pp (Fig. 9).

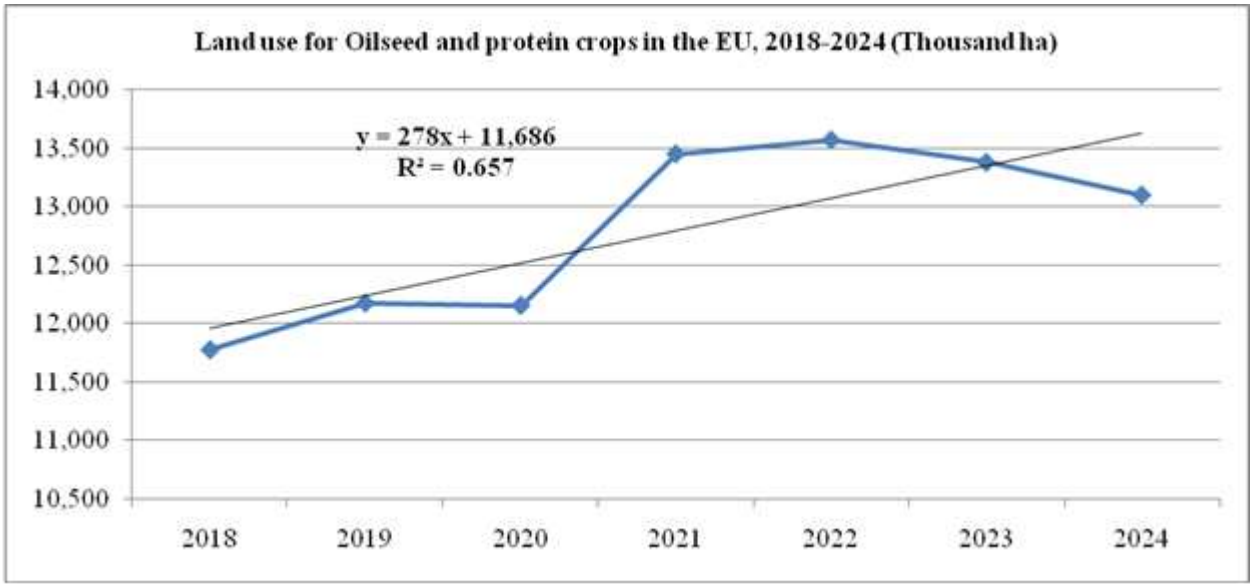

Fig. 8. The dynamics of the land use for oilseeds and protein crops in the EU, 2018-2025 (Thousand ha)
Source: Own design based on the data from Eurostat [9, 10, 11].
Note: For the year 2025-No available data.

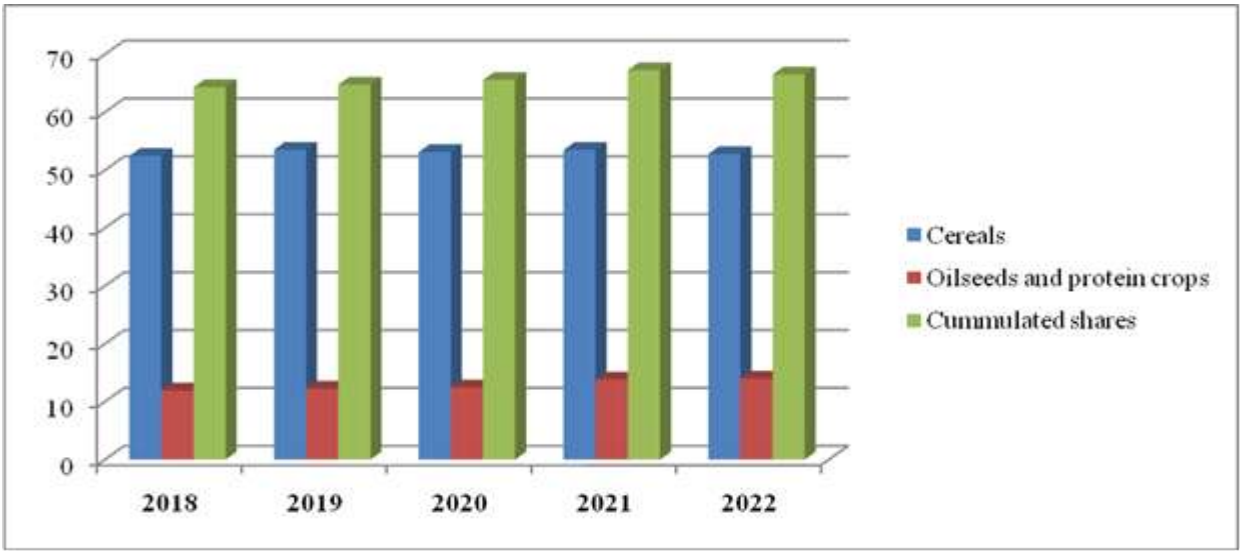

Fig. 9. The shares of land use for cereals and the shares for land use for oilseeds and protein crops, and the cumulated shares in the EU's arable land, 2018-2022 (%)
Source: Own calculations.

Land use by cereals type

In the EU**,** the land use for the cereals group differs from a cereal to another depending on its importance in relation to the market demand. Three cereals occupy the largest cultivated area: soft wheat, barley and grain maize. In case of soft wheat, the land use accounted for 21,173 thousand ha in 2025, being by 0.5% smaller than in the year 2018 when it was 21,277 thousand ha. In case of barley, the land utilized in 2025 was 10,286 thousand ha by 7.8% smaller than 11,145 thousand ha in the year 2018. Grain maize was cultivated on 8,767 thousand ha in 2025, by 6.26% larger area than 8,252 thousand ha in the year 2018 (Figure 10).

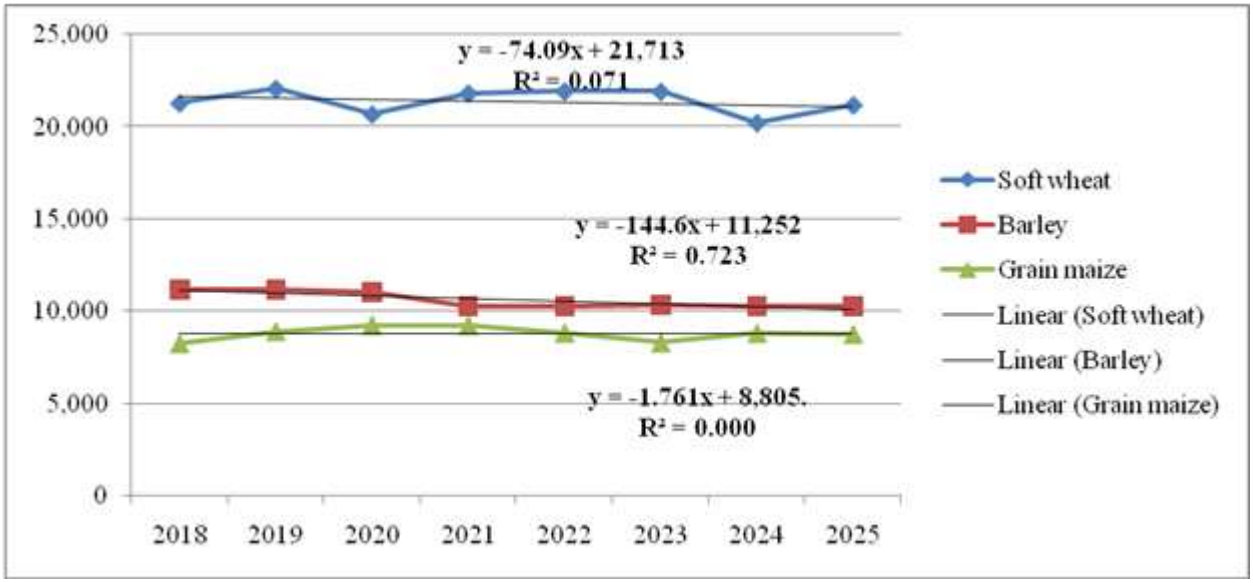

Fig. 10. Dynamics of the EU land use for the main cereals: soft wheat, barley and grain maize, 2018-2025 (Thousand ha)
Source: Own design based on the data from Eurostat [7, 8].

Figure 10 shows relative variations regarding land use for the three cereals and R square value is practically insignificant for soft wheat and grain maize, but only in case of barley it reflects that the variations depended 72% on time and 28% on the change of other factors.
Based on the regression equations, it was established that in the year 2026, the land use for soft wheat will be 21,098.91 thousand ha, for barley 10,141.4 thousand ha and for grain maize 8,765.23 thousand ha.
For the total land covered with all the cereals the forecast for 2026 is 49,800 thousand ha.
The description statistics for the EU land utilized by cereal crop in the period 2018-2025 is presented in Table 3.

Table 3. Description statistics for the EU land utilized by cereal crop in the period 2018-2025 (Thousand ha)

	Mean	St. Dev.	Kurtosis	Skewness	Minimum	Maximum	CV %
Soft wheat	21,379.75	678.49	-0.582	-0.799	20,195	22,068	3.17
Durum	2,230.8	131.76	0.492	0.880	2,082	2,481	5.90
Rye	1,905.87	155.67	0.105	0.967	1,750	2,191	8.16
Barley	10,601.5	416,39	-2.112	0.056	10,268	11,145	3.92
Oat	2,460.5	104.73	-1.606	-0.390	2,305	2,570	4.24
Grain maize	8,798	372.70	-0.725	-0.368	8,252	9,254	4.23
Sorghum	170.25	32.33	-0.001	0.655	127	228	18.78
Triticale	2,594	131.93	0.113	-0.455	2,360	2,754	5.08
Other cereals	1,130.62	273.65	-1.369	0.388	813	1,541	24.20
Total cereals	51,529	1,309.86	0.182	-0.335	48,999	53,242	2.54

Source: Own calculations.

The coefficient of variation is very low for almost all the cereals, except Sorghum where CV is 18.78% reflecting a greater dispersion of the data around the mean and also in case of other cereals, CV is equal to 24.20% showing a high variation, therefore a lower precision of the estimate.
Studying the land use by type of cereals in the period 2018-2025, it is found that the weight of the largest surfaces is allotted to three cereals in 2025: 42.1% for soft wheat, 20.5% for barley and 17.4% for grain maize, summing 80%. The difference of 20% of land being utilized for durum, triticale, oat, rye and sorghum etc. The land use for cereals compiles with the cereals utilizations for animal feed,

human consumption and for biofuel and other purposes (Table 4).

Table 4. The share of land use by type of cereal in the EU surface used for cereals, 2018-2025 (%)

	Soft wheat	Durum	Rye	Barley	Oat	Grain maize	Sorghum	Triticale	Others
2018	**40.9**	4.8	3.7	**21.5**	4.9	**15.9**	0.3	5.0	3.0
2019	**41.4**	4.0	4.1	**20.9**	4.5	**15.7**	0.4	5.2	2.7
2020	**39.8**	4.1	4.0	**21.2**	5.0	**17.9**	0.4	5.3	2.3
2021	**41.8**	4.3	3.7	**20.0**	4.9	**17.7**	0.3	5.1	2.2
2022	**42.9**	4.5	3.4	**20.1**	4.6	**17.3**	0.3	5.2	2.2
2023	**43.3**	4.6	3.7	**20.5**	4.6	**16.4**	0.3	5.0	1.6
2024	**41.2**	4.2	3.5	**21.1**	5.1	**18.0**	0.5	4.8	1.6
2025	**42.1**	4.3	3.5	**20.5**	4.9	**17.4**	0.3	5.0	2.0

Source: Own calculations based on the data from Eurostat [9].

However, a relative decline was notice for soft wheat and barley, and a slight increase for grain maize.

Durum is in a slight decline, rye as well and all the other cereals oat, sorghum and triticale look to maintain their shares.

Maize and wheat are among the most cultivated cereals in the world. The EU is placed on the 4th position for the cultivated land with these two crops. The top rank in the EU for the area covered by maize is kept by Romania [28].

Barley is another important cereal in the EU because its multi-purposes such as feed-stuffs for animal raising (pigs, poultry, horses) especially in France, Netherlands, Germany and Romania. It is also used for manufacturing industry for producing beer and alcohol and other food products. Also, farmers cultivate it because it is harvested before wheat and brings the first net return from winter crops [29].

Sorghum is the 5th cereal in the world, after maize, wheat, rice and barley grace to its role in animal feeding, but also for food consumption and industrial purposes, a special attention being given to biomass for biofuel. It is suitable for arid zones and it production costs per ha are much smaller than in case of maize. It is also friendly with the environment [32, 33, 35, 36].

Sorghum is considered a miracle cereal crop for the geographic zones with specific conditions in terms of low precipitations and high temperatures and droughts as it happened in many EU countries during the last decade and especially in Romania. In Dobrogea region, year by year agriculture was affected by high heat waves, lack of rainfalls and snows, long and severe droughts. Under these conditions, sorghum could be successfully used as a complementary crop for maize, farmers adopting adapted technologies like: early sowing, resistant varieties to drought and of high potential production [18, 20, 21].

In 2025, the EU countries with the largest land use by cereal type, in the decreasing order, are:

-***Soft wheat*** (thousand ha): France (4,632), Germany (2,839), Poland (2,453), Romania (2,042), Spain (1,773);

-***Durum:*** Italy (1,289).

-***Barley:*** Spain (2,313), France (1,744), Germany (1,577), Poland (756), Romania (529);

-***Rye:*** Poland (700), Germany (550).

-***Triticale***: Poland (1,216), France (302), Spain (253).

-***Oat:*** Poland (508), Spain (492), Finland (321);

-***Grain maize***: Romania (2,259, (France (1,535), Poland (1,150), Hungary (893),Bulgaria (543), Germany (451);

-***Sorghum***: France (72), Italy (41), Romania (8).

Land use by oilseeds and protein crops type

The oilseeds crops are cultivated for seeds, oil and for producing food and biofuel and other industrial products, and also meals for animal feeding [34].

They have special agronomical qualities in the sense that: they are good precursor plants for winter cereals and hoeing crops, being successfully utilized in crop rotation for weed control. They also have a high profitability bringing high net return to farmers. They respond very well as a feed-back to the increased demand for bioenergy and biofuels.

For this reason, the EU sustains the cultivation of these crops and also for their protein content which is so much requested coming from plants and less from animal origin [31, 9, 11].
According to the European Commission renewable Energy Directive 28/2009/, these crops are suitable for producing biofuels (bioethanol and biodiesel). They emit less than 35-40% greenhouse emissions with a positive effect on the environment and on the reduction of imports.
Biodiesel is mainly produced from rape oil, 84%, then 13% from sunflower oil and 3 % from soybean oil [26].
Rape, sunflower and soybean are suitable to be cultivated in Romania where they achieved good productions in the favorable years and also using adapted technologies to high temperatures and droughts in the non favorable climatic years [25, 30, 22].
The decision to cultivate a crop of another belongs to the farmer as an expression of knowledge, soil acreage, technologies applied and climate conditions, experience in agribusiness, financial resources, awareness of risks and opportunities, expectations of the decision drawn in terms of income and profit and subsidies to improve the financial results in close relationship with the market demand [3].
In the EU**,** the land use for the oilseeds and protein crops differs from a plant to another depending on its importance in relation to the market demand. Three oilseeds and protein crops which cover the largest cultivated area are rapeseed, sunflower and soybean.
In the year 2024, the land use for rapeseed accounted for 5,911 thousand ha, being by15.47% higher than 5,119 thousand ha in the year 2018.
In case of sunflower, the land utilized in 2024 was 4,619 thousand ha by 6.47 higher than 4,338 thousand ha in the year 2018. Soybean was cultivated on 1,024 thousand ha thousand ha in 2024, by 12.77% larger than 908 thousand ha in the year 2018 (Figure 11).

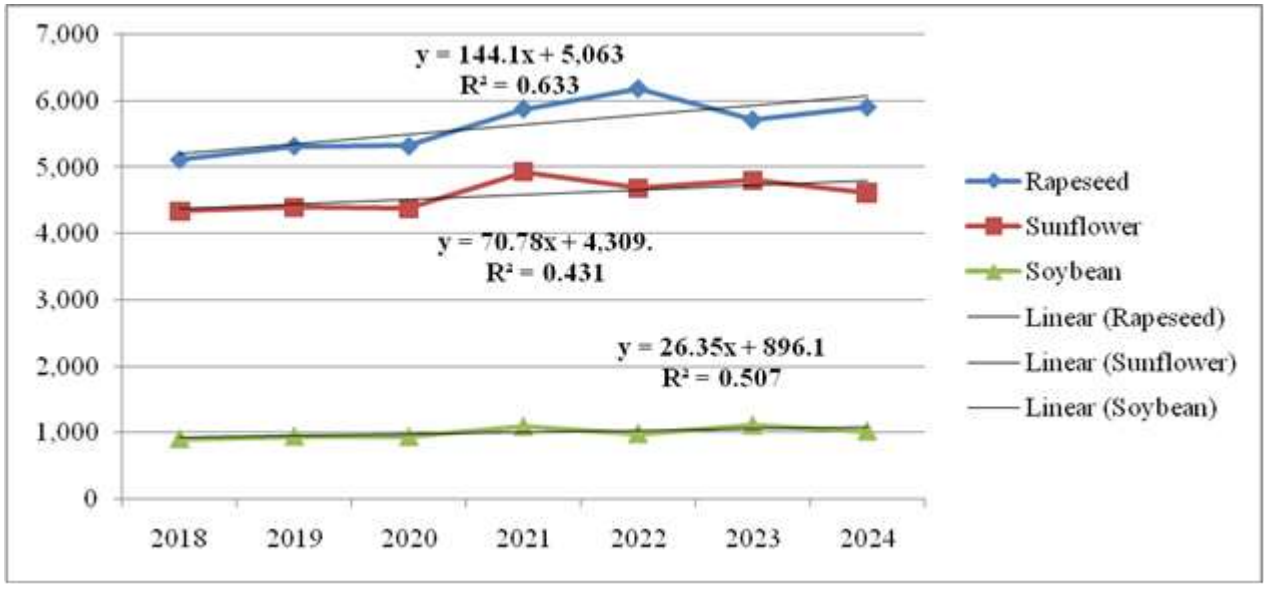

Fig.11. The dynamics of the EU land use for the main oilseeds and protein crops, 2018-2024 (Thousand ha)
Source: Own calculations based on the data from Eurostat [4].

From Figure 11, R square reflects that the variation in land use was determined by time in a higher proportion in case of rape seed 63.3%, in 50.7% in case of soybean and in 43.1% in case of sunflower, the difference of variation being caused by other factors.
The regression equations provided the necessary information to estimate the forecast for the year 2025, for which in Eurostat the data are missing. Therefore, in 2025, it expected as land use to be
6,055.1 thousand ha for rapeseed, 4,689.78 thousand ha for sunflower and 1,050.35 thousand ha for soybean. Also, for the next year 2026, the forecast is: 6,199.2 thousand ha for rapeseed, 4,760.56 thousand ha for sunflower and 1,076.70 thousand ha for soybean.

The description statistics for the land utilization in the EU for the oilseeds and protein crops in the period 2018-2024 is shown in Table 5.

Table 5. Description statistics for the land utilization in the EU for the oilseeds and protein crops in the period 2018-2024 (Thousand ha)

	Mean	St. Dev.	Kurtosis	Skewness	Minimum	Maximum	CV %
Field peas	845.42	99.50	-0.833	1.186	776	998	11.76
Broad bean	459.14	30.44	-0.181	-0.502	409	500	6.60
Lupins	214.42	26.90	0.947	0.281	174	260	12.54
Rapeseed	5,639.42	391.04	-1.482	0.0062	5,119	6,193	7.75
Sunflower	4,592.85	232.86	-1.603	0.274	4,338	4,934	5.07
Linseed	48.42	7.43	0.895	0.907	40	62	15.34
Soybean	1,001.42	79.94	-1.453	0.476	908	1,115	7.98
Total oilseed and protein crops	12,796.85	739.42	-2.183	-0.367	11,774	13,567	5.77

Source: Own calculation.

The coefficient of variation reflects a small share of standard deviation in the mean level, therefore it is a precise distribution of the estimates around the mean.

In the studied period, 2018-2024, it was noticed that the share of land use for oilseeds and proteins crops increased. By crop type, the situation is a little different. The highest share of land use in arable land belongs to rape 45.1% in 2024 compared to 43.5% in 2018 (+1.6 pp), with a slight ascending trend in the period. Sunflower recorded a slight decline from 36.8% in 2018 to 35,3% in 2024 meaning by - 1.15 pp. Finally, soybean registered a slight growth of 0.5 pp from 7.4% in 2018 to 7.9% in 2024. The other crops have the following status: broad bean remain constant for 3.5%, lupins increased its share from 1.5% to 1.7% (+0.2 pp), and linseed stagnated on 0.3%. The structure of the land utilized for these crops is in accordance with the EU policy for assuring more protein of vegetal origin and reduce meat, more feed for animals and raw materials for industry [38] (Table 6).

Table 6. The share of land use by type of oilseeds and protein crops in the EU surface used for these crops, 2018-2024 (%)

	Field peas	Broad bean	Lupins	Rapeseed	Sunflower seeds	Linseed	Soybean
2018	7.0	3.5	1.5	**43.5**	**36.8**	0.3	**7.4**
2019	6.5	3.7	1.9	**43.7**	**36.1**	0.4	**7.7**
2020	6.4	3.9	1.7	**43.8**	**35.9**	0.5	**7.8**
2021	5.8	3.2	1.9	**43.8**	**36.7**	0.4	**8.2**
2022	7.2	3.5	1.5	**45.6**	**34.5**	0.4	**7.2**
2023	7.5	3.7	1.5	**42.7**	**35.9**	0.3	**8.4**
2024	6.2	3.5	1.7	**45.1**	**35.3**	0.3	**7.9**

Source: Own calculations based on the data from Eurostat [4].

In 2025, the EU countries with the largest land use by oilseeds and protein crops, in the decreasing order, are:

-***Field peas*** (Thousand ha): Spain (145), France (112), Germany (108), Romania (88);

-***Broad bean***: France (88), Lithuania (72), Germany (60), Spain (24);

-***Lupins***: Poland (155), Germany (27), Greece (13), Romania (8);

-***Rapeseeds***: France (1,287), Germany (1,114), Poland (1,029), Romania (702);

-***Sunflower seeds***: Romania (1,120), Bulgaria (874), France (785), Spain (731), Hungary (668);

-***Linseeds:*** France (23);

-***Soybean***: Italy (330), France (165), Romania (142).

The new EU policy orientation for the future land use for cereals and oilseeds and protein crops

Being aware that land is a limited resource, consumers' demand is continuously changing and climate factors have become more aggressive, the EU has renewed its strategy orientation, as mentioned in the EU agricultural outlook 2024-35 [6], being focused on the following aspects in the future:
(i) the assurance of the population requirements for high quality food and in a sufficient amount for a healthy diet based especially on plant-based protein,
(ii) the assurance of the animals' needs for feed for growing and fattening and for carrying out and better and higher productions,
(iii) providing more raw materials for industrial processing into oil, biofuels and other useful products.
The use of the land in agriculture involves risks and uncertainties linked to climate conditions and that is why the EU policy promotes a sustainable land management.
The limited area must be compensated by a balanced structure of crops in cropland and a higher productivity under the land preservation, environment protection, diminishing meat production and consumption by replacing the protein of animal origin with plant-based protein which could provide a healthier green food for the population.
In this context, the actual goals of the EU agro-food strategy provides:
- to continue to assure agri-food self-sufficiency;
-to decrease meat production especially beef and pork;
- to encourage poultry sector;
-to sustain the protein production provided by protein crops for a healthier green diet for the population;
-to continue to be a net agro-food exporter contributing to the global food security.
To attain these objectives, agriculture should be sustained to grow its performance in close relationship with environment sustainability.
In the perspective of the year 2035, land use will be oriented to the following directions:
- the expand of surfaces cultivated with soybean, other oilseeds and pulses;
-to diminish the areas covered by cereals for feed;
-to reduce the land use for rapeseeds for biofuel;
-to maintain the land surface with permanent grasslands and fallow;
-to extend the land use for permanent crops.
These changes in the EU land use management is justified by the fact that in the year 2035, it is expected as yields of cereals, oilseeds plants and protein crops to grow grace to the development of precision agriculture, digitalization, improved soil fertility and quality and reduced farm inputs [6].

CONCLUSIONS

The aim of this study was to research the land use in the EU for cereals, oilseeds and protein crops in the period 2018-2025 using the data provided by Eurostat data. In fact, there were identified the trends, similarities and differences among the member states as a reflection how cultivated areas are involved by structure and orientation to stimulate agricultural production. The methodological approach consisted of: growth rate, structural index, trend equations, R square, forecast, comparison, tabular presentation and graphical illustration.
The results pointed out that the utilized agricultural land (UAA) increased by 0.82% reaching 160.56 Mill. ha, of which six countries: France, Spain, Germany, Poland, Italy and Romania keep 68.2%, in which UAA is over 10 Million ha.
The EU arable land accounts for 99.01 Million ha, by 1.81% smaller and having a share of 60.5% in UAA.
France, Spain, Germany and Poland account for 52.9% in arable land, having more than 10 Million ha each.
In 2025, the EU arable land distributed for two groups of crops looked as follows: cereals 50.2 Million ha (52.5%) and oilseeds and protein crops 13.1 Million ha (13.9%), summing 66.5%.
In case of cereals, the largest arable land belongs to soft wheat (42.1%), barley (20.5%) and grain maize (17.4%) totaling 80%.

In case of oilseeds and protein crops, the highest share in arable land is kept by rape (45.1%), sunflower (35.3%) and soybean (7.9%), summing 88.3%.

Other crops from these two groups used smaller land surfaces in order to sustain the diversity of domestic production, to cover market needs and stimulate export.

All these reflect the EU vision concerning the role of these crops for developing a sustainable agriculture assuring food security, animal feeding, renewable energy, industry processing and environment protection.

To attain its goals by the year 2035, the EU new land use management provides that soybean, other oilseeds and pulses to be cultivated on larger land areas, while the land allotted for cereals for feed and rapeseeds for biofuel to decrease; land with permanent grasslands and fallow to be maintained at the actual level, but permanents crops to benefit of a larger land surface.

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