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THE INTEGRATION OF ROMANIA INTO THE EUROPEAN UNION MARKET OF SUNFLOWER SEEDS

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Abstract

Sunflower is the most important oil crop practiced in Romania, in terms of the constituent indicators of the primary supply, but also by the fact that sunflower seeds have a surplus trade balance at national level. Culture has a high productive potential, it comes to exploit the existing opportunities on the market, in terms of existing opportunities nationally and internationally. Over time, Romania has been a dynamizing factor of scientific research in the field, highlighting the concerns of researchers from National Institute of Agricultural Research and Development (INCDA) Fundulea for the creation of a quality genetic material. It should be noted that the favorability of sunflower cultivation is quite pronounced at EU level, both due to the pedoclimatic conditions and due to the existing traditions in certain areas (less tradition in the extreme Southern part of the EU), for the practice of other crops providing raw materials for obtaining oil or consumption habits of the population (olive - in the Mediterranean area). The topic of this paper was approachd based on the existing global and continental context for the period 2007-2019. The results showed that in this period 2007-2019, Romania cultivated (on average) 3.81 and 5.39 of the world and European area respectively (966.84 thousand ha compared to 25,325.47 and 16,298.01 thousand ha respectively), achieved 4.62 and 6.79% of the total production (1,919.96 thousand tons compared to 41,548.57 and 28,296.81 thousand tons). The importance on the international market is highlighted by the fact that Romania held 22.52 and 26.97% of the world and continental volume of exports (1,070.99 thousand tons compared to 4,755.42 and 3,971.52 thousand tons), and for imports, the shares were 3.96 and 6.05% (183.47 thousand tons compared to 4,629.84 and 3,220.90 thousand tons respectively). Romania is not an important player in the market of this product at European and global level, especially since sunflower seeds can reduce the deficit of the external trade balance, given the appropriate use of the specific national potential.

Key words**:** *sunflower, export, import, price, total production, yield, cultivated area*

INTRODUCTION

The sunflower culture is distinguished by a fairly significant spread worldwide. Due to the relatively high ecological plasticity of the sunflower, it is grown in large number of countries [4]. The widespread practice of sunflower cultivation worldwide is also influenced by its adaptation to less favorable climate and soil conditions. Drought tolerance and adaptation to a wide variety of soils allows the cultivation of sunflower in many regions of the world [21]. However, the sunflower is a plant sensitive to water stress. Water stress manifests itself as a major limiting factor for sunflower production in arid and semi-arid regions of the world [8]. The sunflower, although it is known as a drought-resistant plant, it greatly reduces its yield on soils without water or in conditions of low atmospheric humidity [15].

As a favorable factor for the practice of sunflower cultivation, the agricultural policy practiced at the level of a region can also be manifested. Thus, in the European Union in 2013, the common agricultural policy included as a priority the increase of vegetable protein production by subsidizing legume crops (including non-genetically modified

soybeans), fodder crops (alfalfa, clover) and oilseeds (sunflower, rapeseed) [14].

Globally, it can be appreciated that sunflower is an important source of oilseeds. Among oilseeds, soybeans are the main product influencing world oilseed production, followed by mustard, rapeseed, cotton, peanuts and sunflower [16]. Sunflower (*Helianthus annuus L.)* is one of the main oil crops, with a production of 40-50 million tons per year [13].

Production results are influenced by a number of technological factors. Thus, one of the key factors in increasing the yield of sunflower and other crops is the use of high-quality seeds, with high biological content and high cultural value, free from diseases and pests [18].

Sunflower is a major oil crop for Romania, it is notable for its versatile importance, manifested in terms of industry, feed, agrotechnical-technological, for export and as a source of profit. According to various studies, sunflower is a nationally important crop. In Romania, the share of cereals in the total sowing area was higher than 65% in 2012. Of the total area of cereals, wheat and corn accounted for 35% and 50%, respectively. Other important crops are sunflower, barley, potatoes and oats [1]. This situation makes our country an important producer worldwide. Thus, in 2016, Romania ranked 5th in the world top of growers [2].

The industrial importance of sunflower seeds is underlined by its use for obtaining mainly edible oil. Edible oil is of good quality [17]. It should be noted that sunflower oil currently accounts for 11% of edible oil worldwide [12]. The processing yield of sunflower seeds is influenced by a number of factors. Thus, the oil content is influenced by the character of the year, the time of sowing, the hybrids used and the interaction of these factors [10]. The quality of the oil is influenced by the ratio between saturated and unsaturated fatty acids [9]. In addition to human consumption of the oil, it can also be used in the manufacture of preserves, soap and the impregnation of certain textiles. The seeds can also be used to obtain biofuel. Food crops, such as sunflowers, are a promising alternative to renewable energy, but their use for biodiesel production could be a threat to the amount of food available for human consumption, especially in developed countries [21]. As a result, sunflower has been recognized as a promising crop for biofuel production [6].

Ethyl alcohol, furfural, etc. can be extracted from the seed husks. or they can also give rise to by-products (cakes, grits).

The agrotechnical-technological importance is highlighted, at least, by the inclusion of the crop in appropriate crops and rotations or by the use of particular soil types. Sunflower has an important role in the crop rotation system [7]. Compared to other crops, sunflower has been shown to be moderately tolerant at salt [5]. The importance as an export item is obvious. Sunflower seeds contribute to the completion of the export of oilseeds, in the context in which it is shown that oilseeds are the subject of international trade being a good deal for exporters [11]. The importance of sunflower seeds is closely linked to its export potential [4]. It is interesting to analyze the way Romania integrates on the community market (U. E.), after the accession to the U.E., aspect with consequences on the subsidization of the producers from the Romanian agriculture, but also through the prism of the import-export operations carried out on the market of this product.

In this context, the research aimed to analyze Romania's sunflower cultivated area, production, trade, price in te period 2007-2019, pointing out the main trends in its position in the European and world market.

MATERIALS AND METHODS

The conception and realization of the study started from the research carried out through the documentation, accessing different databases (FAO and the National Institute of Statistics) [3, 20]. In addition to the documentation, the following were also used: comparison, in time and space, correlation, as well as the percentage method. The indicators used are represented by: harvested area (thousand ha), total production (thousand t),

average production (kg / ha), selling price ($ / t), imports (thousand t) and exports (thousand t), achieving -then correlations between some of them. A dynamic series of 13 terms is presented, in order to remove, as far as possible, the short-term influences of some factors (the climatic factor) on the analyzed phenomena.

The level of indicators is presented for the component states of the European Union, as well as at general community level. Thus, for area, total production and average production, information can be found for: Austria, Bulgaria, Belgium, Czech Republic, Croatia, France, Germany, Greece, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Hungary (in the related tables are presented the general levels of indicators - EU 28 and for the first seven producers, the rest of the countries being included in the category "other countries", except for the average production). The price level is presented for 14 states [21]. With regard to imports and exports, the general Community level (EU 28), the main market players (Bulgaria, France, the Netherlands, Romania, Slovakia Hungary - for exports; France, Germany, Italy, the Netherlands, Portugal, Romania, Spain - on imports) and the category "other countries" (Austria, Belgium, Cyprus, Czech Republic, Croatia, Denmark, Estonia, Finland, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta, United Kingdom, Poland, Slovakia, Slovenia and Sweden).

To highlight the correlation between: (I) surface (x) and total production (y), (II) surface (x) and average yield (y); (III) average yield (x) and total production (y), (IV) total production (x) and export (y), (V) total production (x) and import (y), (VI) export (x) and import (y) at national and UE level. The equation used for the correlation coefficient was:

$$r = \frac{\sum (x_i - \overline{X})(y_i - \overline{Y})}{\sqrt{\left(\sum (x_i - \overline{X})^2\right)\left(\sum (y_i - \overline{Y})^2\right)}},$$

where:

$\overline{X}$ and $\overline{Y}$ - are the averages for samples, average (matrix 1) and average (matrix 2).

In the analysis, the values of the correlation coefficient (r) and of the determination coefficient (R^2 - for the linear function) will be presented, but only at general community level and for Romania.

RESULTS AND DISCUSSIONS

The situation corresponding to the harvested area is presented in Table 1.

Table 1. Harvested area (thousand ha) *

The country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU 28	3,298.96	3,784.80	3,912.34	3,768.29	4,336.44	4,286.36	4,578.37	4,251.64	4,181.97	4,122.43	4,295.97	4,025.65	4,338.74
Bulgaria	602.40	721.69	683.72	729.89	747.13	780.76	878.64	843.64	810.84	817.51	898.84	788.66	815.56
France	519.50	629.74	724.84	694.92	740.72	679.96	770.85	657.29	618.78	536.96	586.23	552.07	603.92
Italy	126.26	114.48	123.80	100.50	118.07	111.68	127.63	111.35	114.45	110.72	114.45	103.87	118.52
Romania	748.54	808.79	761.09	786.06	993.26	1,064.75	1,072.06	998.04	1,009.14	1,038.41	999.16	1,006.99	1,282.70
Slovakia	64.75	74.93	82.94	82.87	88.70	90.12	84.13	76.59	75,40	83.79	87.35	68.80	48.55
Spain	600.87	730.82	851.12	697.90	862.87	753.02	849.10	783.44	738.85	717.67	724.63	691.28	701.77
Hungary	512.87	549.80	535.09	501.51	579.55	615.10	596.89	593.73	611.64	629.68	694.54	616.95	564.11
Other states	123.77	154.55	149.74	174,65	206.15	190.97	199.07	187.56	202.87	187.69	190.77	197.03	203.61

Source: * http://www.fao.org/faostat/fr/#data/QC(10.03.2023) [3].

At EU level, the cultivated area was between 3,298.96 thousand ha, in 2007, and 4,578.37 thousand ha, in 2013. Between 2007 and 2009, there is an upward evolution of the indicator, after which the area fluctuates between 2010 and 2019 (decreases and inherent increases). Romania stands out as the main cultivator (areas that have consistently exceeded the threshold of 748 thousand ha - less than 1,000 thousand ha for the years 2007, 2008, 2009, 2010, 2011, 2014 and 2017 and over 1,000 thousand ha in the case of other years). With a relatively similar situation, there are Bulgaria and Spain (which, however, did not exceed the threshold of 1,000 thousand ha), followed by France

(between 519 and 771 thousand ha), Hungary (from 501.51 to 694.54 thousand ha in 2010 respectively). 2017), Italy (with areas between 100 and 128 thousand ha) and Slovakia (which did not exceed the threshold of 91 thousand ha, but did not fall below 48 thousand ha). The other states cultivated (in total) between 123.77 and 206.15 thousand ha (2007 and 2011).

Total production shows an uneven evolution (Table 2). We are talking about limits of 4,883.61 thousand t and 10,385.77 thousand t, respectively, at the level of 2007 and 2017 respectively. It is observed, consecutive years with similar trends as follows: 2009 and 2010 - decreases, 2013 and 2014 respectively 2016 and 2017 - increases. Romania obtained below 1,000 thousand t only in 2007 (546.92 thousand t), levels between 1,000 and 2,000 thousand t for the years 2008, 2009, 2010, 2011, 2012 and 2015, productions between 2,000 and 3,000 thousand t for the years 2013, 2014, 2016 and 2017, but also over 3,000 thousand t (2018 and 2019).

Table 2. Total production (thousand t)*

The country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU 28	4,883.61	7,215.16	7,062.42	7,021.54	8,499.24	7,116.57	9,152.45	9,242.54	7,846.38	8,708.35	10,385.77	10,003.03	10,281.25
Bulgaria	564.45	1,300.71	1,317.98	1,536.32	1,439.70	1,387.78	1,974.43	2,010.67	1,699.23	1,873.68	2,056.99	1,943.98	1,937.21
France	1,311.27	1,598.27	1,720.15	1,640.83	1,880.70	1,572.95	1,577.69	1,584.19	1,186.91	1,172.41	1,598.97	1,239.08	1,298.14
Greece	19.09	21.47	46.13	116.04	147.66	137.31	172.07	192.23	199.42	186.30	202.90	231.02	298.96
Italy	278.73	260.93	280.20	212.90	274.41	185.49	285.23	250.38	248.01	268.33	243.67	250.46	294.73
Romania	546.92	1,169.94	1,098.05	1,262.93	1,789.33	1,398.20	2,142.09	2,189.31	1,785.77	2,032.34	2,912.74	3,062.69	3,569.15
Spain	733.15	872.69	869.54	887.00	1,090.17	642.02	1,029.40	952.99	769.20	772.18	841.74	960.79	782.29
Slovakia	132.66	192.35	187.24	150.33	200.99	197.23	195.74	200.69	174.29	246.50	218.84	203.83	129.67
Hungary	1,060.46	1,468.10	1,256.18	969.72	1,374.78	1,316.55	1,484.37	1,597.25	1,556.97	1,875.41	2,022.33	1,830.28	1,706.85
Other states	236.88	330.79	286.95	245.47	301.50	279.04	291.43	264.83	226.58	281.20	287.59	280.90	264.25

Source: * http://www.fao.org/faostat/fr/#data/QC(10.03.2023) [3].

The level of the indicator has evolved unevenly, with periods of increase and decrease following one another. Bulgaria presents a situation relatively close to that of Romania (production of less than 1,000 thousand t only in 2007, and the threshold of 2,000 thousand t was exceeded only in 2014 and 2017). Hungary consistently exceeded the threshold of 1,000 thousand t (except for the year 2010 - 969.72 thousand t and respectively the year 2017 - 2,022.33 thousand t). France, another major producer on the Community market, is characterized by total production between 1,000 and 2,000 thousand t. Spain, generally has levels below 1,000 thousand t (except for the years 2011 and 2013 - 1,090.17 and 1,029.40 thousand t respectively). Italy is characterized by total variable productions between 200 and 300 thousand t (except for 2012 - 185.49 thousand t). Slovakia contributed to the establishment of the Community level of the indicator with productions from 129.67 to 246.50 thousand t (2019 and 2016 respectively), while it should be noted the situation of Greece which started from 19.09 thousand t in 2007 and came to exceed 100 thousand t (between 2010 and 2016), respectively 200 thousand t (interval 2017 - 2019). The rest of the sunflower cultivating states obtained annual levels of total production, between 200 and 300 thousand t, except for the years 2008 and 2011 (330.79 and 301.50 thousand t respectively). The evolution of the average production (kg / ha) is shown through Table 3. The indicator is distinguished by its classification in two intervals: between 1,000 and 2,000 kg / ha (2007-2013 and 2015), between 2,000 and 2,500 kg / ha (2014, 2016, 2017, 2018 and 2019, respectively). The evolution over time is upward from 2007 (1,480 kg / ha) to 2011 (1,960 kg / ha), followed by a decrease for 2012 (1,660 kg / ha), increases in 2013 and 2014, followed by decreases in 2015, increases between 2016 and 2018 and at the end there is a decrease for 2019. In Romania, there are the years 2007 (731 kg / ha) and 2018 (3,041 kg / ha), as well as periods with average yields varying between 1,000 and 2,000 kg / ha (years 2008-2013, 2015 and 2016), but also time sequences for which the indicator exceeded 2,000 kg / ha (2014, 2017 and 2019).

Table 3. Average production (kg / ha)*

The country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU 28	1,480	1,906	1,805	1,863	1,960	1,660	1,999	2,174	1,877	2,112	2,418	2,485	2,370
Austria	2,251	2,974	2,745	2,617	2,830	2,271	2,352	2,811	1,997	3,294	2,334	2,836	3,037
Bulgaria	937	1,802	1,928	2,105	1,927	1,778	2,247	2,383	2,096	2,292	2,289	2,465	2,375
Czech Republic	2,129	2,493	2,382	2,111	2,483	2,312	2,200	2,274	2,047	2,852	2,461	2,356	2,435
Croatia	2,634	3,103	3,000	2,339	2,828	2,684	3,200	2,853	2,727	2,747	3,119	2,984	2,962
France	2,524	2,538	2,373	2,361	2,539	2,313	2,047	2,410	1,918	2,183	2,728	2,244	2,150
Germany	2,655	1,964	2,411	1,892	1,985	2,379	2,105	2,300	1,919	2,138	2,200	1,821	2,044
Greece	1,589	1,717	1,968	2,170	2,136	2,237	2,380	2,517	2,122	2,438	2,705	2,800	2,968
Italy	2,208	2,279	2,263	2,118	2,324	1,661	2,235	2,249	2,167	2,424	2,129	2,411	2,487
Poland	1,746	1,785	1,811	1,505	1,866	1,761	1,752	1,709	1,645	1,747	1,925	1,630	1,965
Portugal	800	665	537	544	561	534	639	1,056	1,242	1,441	1,546	1,688	1,660
Romania	731	1,447	1,443	1,607	1,802	1,313	1,998	2,194	1,770	1,957	2,915	3,041	2,783
Slovakia	2,049	2,567	2,257	1,814	2,266	2,189	2,327	2,620	2,311	2,942	2,505	2,963	2,671
Slovenia	1,736	1,617	1,454	2,345	2,610	2,365	1,854	2,091	2,513	2,490	1,753	2,724	2,424
Spain	1,220	1,194	1,022	1,271	1,263	853	1,212	1,216	1,041	1,076	1,162	1,390	1,115
Hungary	2,068	2,670	2,348	1,934	2,372	2,140	2,487	2,690	2,546	2,978	2,912	2,967	3,026

Source: * http://www.fao.org/faostat/fr/#data/QC (10.03.2023) [3].

In the case of sunflower cultivating states, the following aspects are manifested: average yields between 2,000 and 3,000 kg / ha for Austria (except for the years 2015 - 1,997 kg / ha, 2019 - 3,037 kg / ha and 2016 - 3,294 kg / ha), Czech Republic, Croatia (four years with levels above 3,000 kg / ha - 2009, 2008, 2017 and 2013), France (except for 2015 - 1,918 kg / ha), Germany (except for five years with productions that did not reach 2,000 kg / ha - 2008, 2010, 2011, 2015 and 2018, but when the indicator did not fall below 1,800 kg / ha), Greece (except for the first three years when the level of 2,000 kg / ha was not reached), Italy (only in 2012 the indicator was 1,661 kg / ha), Slovakia (with one exception in 2010), Slovenia (five years below 2,000 kg / ha - 2007, 2008, 2009, 2013 and 2017), Hungary (which, however, recorded a level below 2,000 kg / ha - 1,934 in 2010 and one above 3,000 kg / ha - 3,026 in 2019); average yields between 1,000 and 2,000 kg / ha: Poland and Spain (an exception - 853 kg / ha in 2012); yields between 500 and 1,700 kg / ha for Portugal (seven years with levels below 1,000 kg / ha - 2007-2013 and six years above 1,000 kg / ha - 2014-2019). The correlations between area, total production and average production in Romania and in the EU are shown in Table 4. The area and the total production are in a direct correlation, resulting from the values of r (0.8098791 and 0.7562288) and of R^2 for the linear function (0.6559 and 0.5719), aspect highlighted by Figure 1. This direct correlation is not very strong.

Table 4. Values of correlation coefficient (r) anddetermination coefficient (R^2) of surface, total production and average yield*

Correlation	Reference level	r	R^2
Surface (ha) – total production (t)	Romania	0.8098791	0.6559
	EU 28	0.7562288	0.5719
Surface (ha) – average yield (kg/ha)	Romania	0,640222	0.4099
	EU 28	0.512407	0.2626
Average yield (kg/ha) - total production (t)	Romania	0.960473	0.9225
	EU 28	0.9475	0.8978

Source: *own calculation.

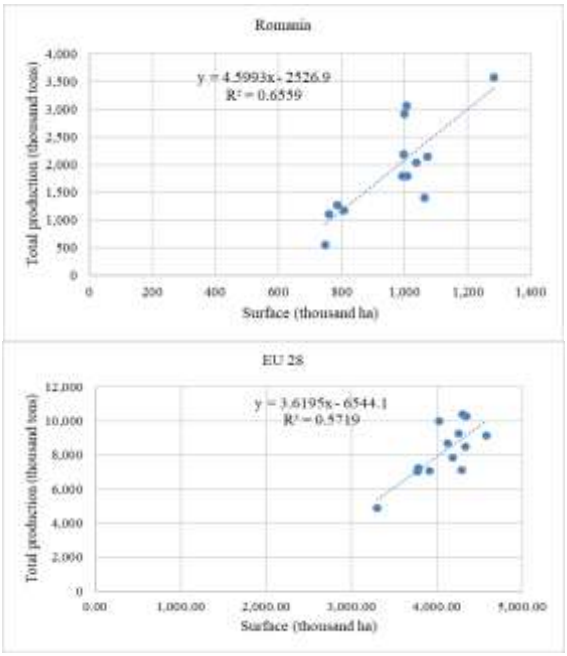

Fig 1. Correlation between surface (thousand ha) and total production (thousand tons) in Romania and in the EU

Source: own calculation.

Between the surface and the average production there are correlation coefficients of 0.640222 and 0.512407, respectively a low dependence between the two aspects. The coefficient of determination R^2 has values of: 0.4099 and 0.2626 (Figure 2). Consequently, a correlation between phenomena is found, but the mathematical model cannot be recommended.

If we analyze the dependence between the average production and the total production, we find the existence of a significant positive correlation (0.960473 and 0.9475). Starting from the values of the coefficients of determination (0.9225 and 0.8978) it is found that the mathematical forecasting model can be recommended for use (Figure 3).

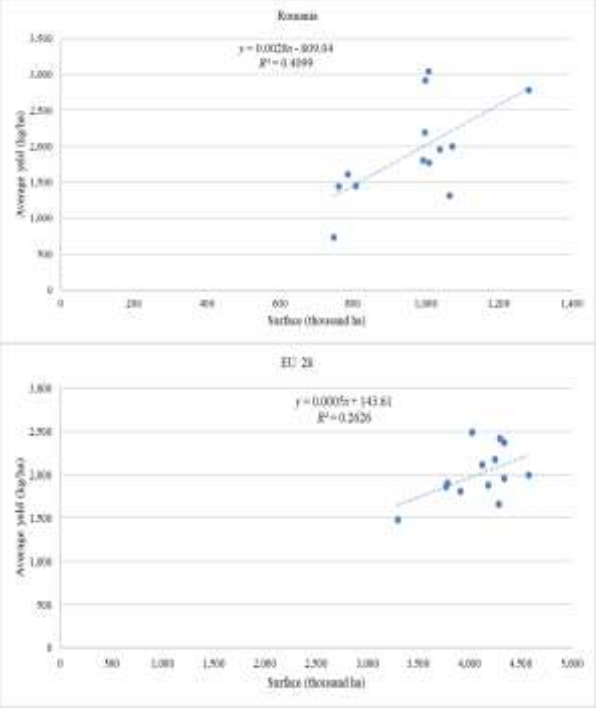

Fig. 2. Correlation between surface (thousand ha) and average yield (kg/ha) in Romania and in the EU
Source: own calculation.

The price level is presented in Table 5. The existence of information for 14 cultivating states is found, with the mention that it discusses the price level at the producer. In the case of Germany, there are no data for the period 2007-2011, for Italy there is information only for 2007, and in Slovenia, for the period 2012-2019 there are no price levels.

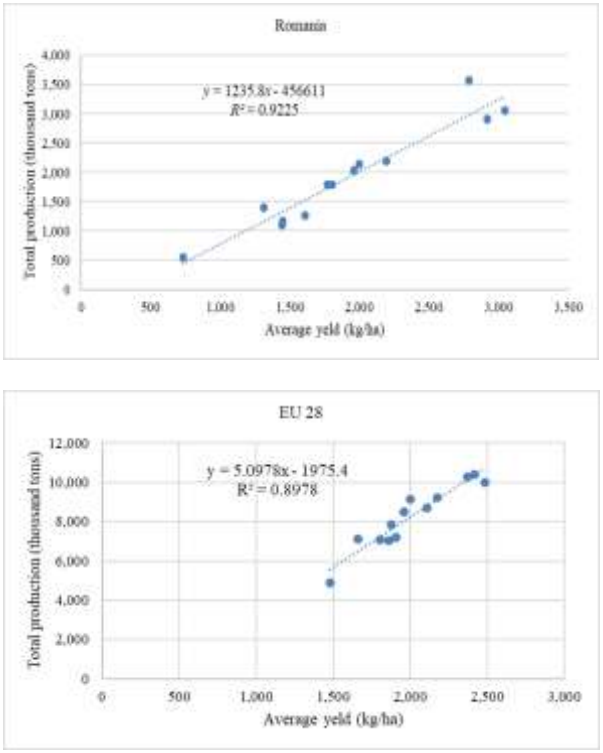

Fig. 3. Correlation between average yield (kg/ha) and total production (thousand tons) in Romania and in the EU
Source: own calculation.

The price variation limits were 216.7 $/t (2009 - Austria) and 718.2 $/t (2008 - Portugal), respectively. It can be seen that 2012 was the most favorable for producers, in terms of the price obtained (levels that exceeded the threshold of 500 $/t, nine states are characterized by values between 500 and 600 $/t, three countries recorded levels over 600 $/t). The year 2009 is characterized by the lowest price levels (only for Greece, the threshold of 400 $/t was exceeded). The evolution of prices is uneven, with inherent variations from one year to another,with tendencies to reduce the levels of the indicator after 2012, which must be analyzed in the context of the increase in total production obtained at Community level.

In Romania, the price varied from 282 $/t, in 2009, to 530.5 $/t in the case of 2012 (total amplitude of variation - 248.5 $/t). Prices charged, at national level, are in line with the trends manifested at Community level (increase from 2007 to 2008, decrease in 2009, increases until 2012, followed by strict decreases of the indicator until 2019).

Romania stands out as a "normal actor" on the community market in terms of price. If we report the situation of Romania at an average annual price level, it can be seen that, in general, we were below the Community average (2007-2010, 2012, 2014-2019), except for 2011 and 2013 when we exceeded the average level (but we were close to it). It is worth noting the totally unfavorable situation specific to 2019, when Romania is characterized by the lowest price level (304.4 $/t), among all EU countries.

The concrete aspects regarding sunflower exports are highlighted in Table 6.

The presentation of the situation of Romanian exports and imports of sunflower is made in the existing situation on the market, at least, European. Romania is the most important producer and exporter of sunflower seeds in the European Union [11].

Table 5. Price level ($/t) *

The country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Austria	446.2	313.5	216.7	524.5	468.4	503.7	391.7	325.1	373.7	333	319.7	294	309.1
Bulgaria	309.3	412.8	272.3	364.2	493.2	552.6	411.9	405.6	395.4	394.2	362.8	343.4	336.3
Czech Republic	367.4	544	371.6	375	578.7	535.2	542.1	406.9	361.5	391.4	382.1	362.4	326
Croatia	518.4	461.2	297.3	451.1	474.4	578.9	339.6	310.7	352.6	324.9	333.1	296.8	289.6
France	558.9	449.5	365.6	559.3	593.7	624.4	481	491.2	433.1	427	400.2	420.6	412
Germany	-	-	-	-	-	506.2	487.3	411.3	353.8	-	334.4	371.5	377.7
Greece	342.2	550.8	514	509.9	590.8	578.2	534.1	464.4	388.2	387.2	395.4	413.3	392
Italy	300.8	-	-	-	-	-	-	-	-	--	-	-	-
Portugal	444.2	718.2	347.3	375.5	444.8	668.1	464.7	437.8	415.9	419	434.9	413.3	413.8
Romania	344.5	444.6	282	374.5	518.3	530.5	477.8	376.2	374.5	372	338.1	334.9	304.4
Slovakia	451.6	395.1	278.9	459.3	495.6	573	430.2	368.9	380.8	358.4	352.1	334.5	342.5
Slovenia	410.6	366.2	347.3	331.1	567.1	-	-	-	-	-	-	-	-
Spain	539.7	567	312.9	484	528.4	642.9	451	407.3	404.1	385.2	372	361.7	353.6
Hungary	465.6	466.9	292.6	434.9	543.4	595.6	446.2	413.8	403.3	375.9	364.4	359.8	346.6

Source: *http://www.fao.org/faostat/fr/#data/PP (10.03.2023) [3].

Table 6. Sunflower export (thousands t) *

The country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU 28	1,932.13	2,163.63	3,141.13	2,738.37	3,497.31	2,982.41	4,111.69	3,618.04	3,096.35	3,094.88	3,361.68	4,074.17	4,291.63
Bulgaria	332.21	466.77	1,008.42	579.66	1,040.71	753.93	1,240.27	875.17	715.51	688.02	784.08	779.43	732.03
France	428.93	279.17	338,34	429.27	390.51	445.61	423.88	441.92	403.52	303.22	350.73	550.98	489.72
Netherlands	47.89	32.82	108.80	78.34	31.95	34.65	61.39	47.84	50.18	106.37	96.50	82.65	40.72
Romania	382.69	471.39	564.24	557.41	1,182.87	653.32	1,420.17	1,321.97	1,099.35	1,183.71	1,334.74	1,704.36	2,046.75
Slovakia	97.06	84.01	108.45	98.48	113.34	228.56	268.92	218.22	167.02	176.21	223.35	229.40	198.35
Hungary	442.40	535.27	732.85	662.39	397.66	600.31	362.57	436.22	376.08	357.19	321.29	439.37	470.83
Other states	200.95	294.20	280.03	332.82	340.27	266.03	334.56	276.70	284.69	280.16	250.99	287.98	313.23

Source: *http://www.fao.org/faostat/fr/#data/TP (10.03.2023) [3].

Exports of sunflower, realized at Community level, registered limits of 1,932.13 and 4,291.63 thousand t respectively in the years 2007 and 2019. The evolution of the indicator was uneven: ascending from 2007 to 2009, fluctuating in the years 2010, 2011, 2012, 2013, descending for the period 2014-2016 and increasing between 2017-2019.

Romania stands out with export levels below 1,000 thousand t in 2007 (382.69 thousand t - the lowest level), 2008, 2009, 2010 and 2012, levels between 1,000 and 2,000 thousand t (2011 and 2013- 2018), and in the case of 2019 the threshold of 2,000 thousand t was exceeded (2,046.75 thousand t - the highest level). For Romania, exports evolved upwards from 2007 to 2011, 2012 showed a decreasing trend, followed by an increase in 2013, then there are decreases specific to 2014 and 2015, and for the period 2016-2019 the trend is upward. Romania represented the main Community exporter in 2011 and during the period 2013-2019, and the rest ranked 2nd in 2008 (after Hungary) and 2012 (after Bulgaria) and 3rd in 2007 (after France and Hungary), respectively. 2009 (after Bulgaria and Hungary) and 2010 respectively (after Hungary and Bulgaria).

Table 7 shows the situation of imports of sunflower seeds at Community level.

The European Union recorded imports of sunflower between 1,700.63 and 4,327.82

thousand t in 2007 and 2019. It is worth noting that two years in which the level of imports did not reach 2,000 thousand t (2007 and 2008), three years with variable levels. between 2,000 and 3,000 thousand t (2010, 2011 and 2012), six years in which imported quantities were between 3,000 and 4,000 thousand t (2009 and the period 2013-2017), and two years when the threshold of 4,000 thousand t is exceeded (2018 and 2019). The indicator evolved upwards between 2007 and 2009, decreased in 2010, after which there were increases until 2013, there are decreases in 2014 and 2015, and for the period 2016-2019 there is an upward trend.

Romania made imports of sunflower during the entire period under analysis (from 66.65 thousand t in the case of 2007 to 325.20 thousand t in 2019).

Table 7. Import of sunflower (thousands t)*

The country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU 28	1,700.63	1,832.55	3,137,61	2,415,36	2,996.48	2,707,32	3,320.39	3,114.03	3,026,35	3,232.29	3,479.47	4,103.98	4,327.83
France	56.30	66.26	329.65	152.26	426.49	142.83	424.79	361.59	252.91	406.00	338.25	276,78	334.15
Germany	243.38	390.16	441,21	478.70	360.77	530,69	501.55	470,31	423.14	356.92	387.84	447.00	448.27
Italy	260.89	230.56	356.17	220.72	228.06	214.62	249.22	176.22	159.74	225.32	222.57	224.01	237.39
Netherlands	355.60	252.96	824.02	555.95	651.88	462,74	635.58	581.97	674.63	543.41	577.99	999.45	664.32
Portugal	60.96	192.13	149.17	147.19	244.87	285.83	311.54	246.88	236.72	201.18	234.39	246.37	261.56
Romania	66.65	89.58	141.06	208.29	237.38	131.29	93.36	118.93	189.25	197.21	277.34	309.53	325.20
Spain	358.97	236.10	404.15	241.99	301.51	476.79	320.25	411.52	376.21	460.23	461.88	412.95	534.87
Other states	297.88	374.80	492.18	410.26	545.52	462.53	784.10	746.61	713.75	842.02	979.21	1,187.89	1,522.07

Source: *http://www.fao.org/faostat/fr/#data/TP (10.03.2023) [3].

The level of imports was below 100 thousand t in 2007, 2008 and 2013, between 100 and 200 thousand t for 2009, 2012, 2014, 2015 and 2016, from 200 to 300 thousand t in 2010 and 2017, and over 300 thousand t in 2018 and 2019. The indicator experienced an upward trend between 2007 and 2011, after which imports decreased in 2012 and 2013, and from 2014 to 2019 the trend was strictly upward. Table 8 shows the correlations between total production, exports and imports.

Table 8. Values of correlation coefficient (r) and determination coefficient (R^2) of total production, exports and imports*

Correlation	Reference level	r	R^2 Linear function
Total production (thousands t) - export (thousands t)	Romania	0.955749	0.9135
	U. E.	0.8557497	0.7323
Total production (thousands t) – import (thousands t)	Romania	0.7914823	0.6264
	U. E.	0.870356	0.7575
Export (thousands t) - import (thousands t)	Romania	0.702616	0.4937
	U. E.	0.928338	0.8618

*own calculation

Between the total production and export, a direct correlation is established which is significant (values of the correlation coefficient of 0.955749 and 0.8557497 for Romania and the EU). The mathematical model used is a convenient one, highlighting a very significant connection between phenomena (R^2 having values of 0.9135 and 0.7323. (Figure 4). The phenomena are more accentuated for Romania compared to the EU.

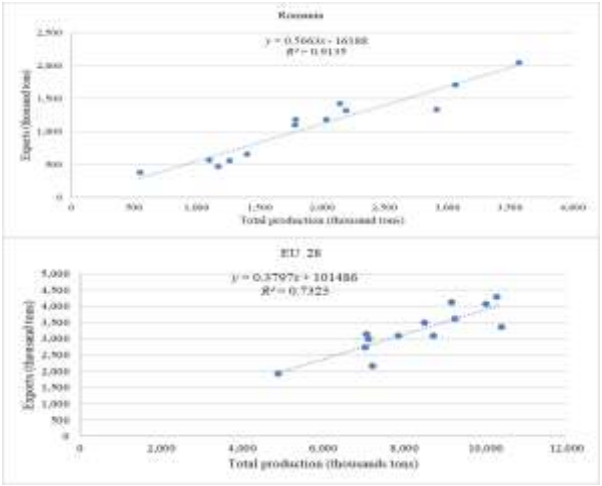

Fig. 4. Correlation between total production (thousand tons) and export (thousand tons), Romania and the EU
Source: own calculation.

The correlation coefficient between the total production and imports, highlights a direct dependence between phenomena, a quite significant one (r has values of 0.7914823 and 0.870356 respectively). The coefficients of determination calculated (R^2), by their values (0.6264 and 0.7575 respectively) underline the links between total production and imports

(Fig. 5). Dependence is stronger in the case of the EU than in the situation of Romania.

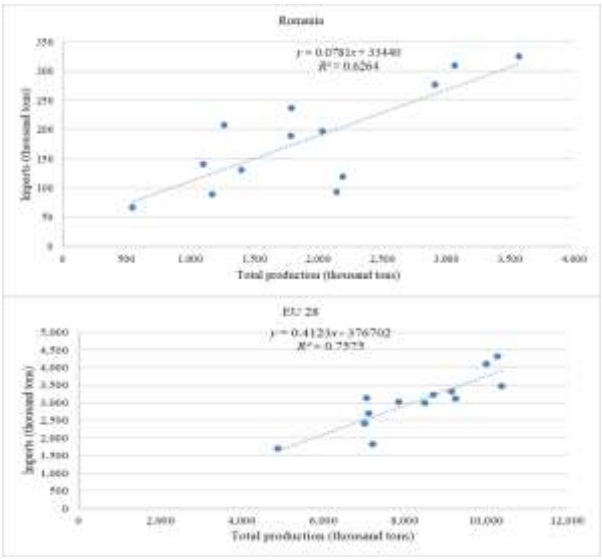

Fig. 5. Correlation between total production (thousand tons) and import (thousand tons) in Romania and in the EU
Source: own calculation.

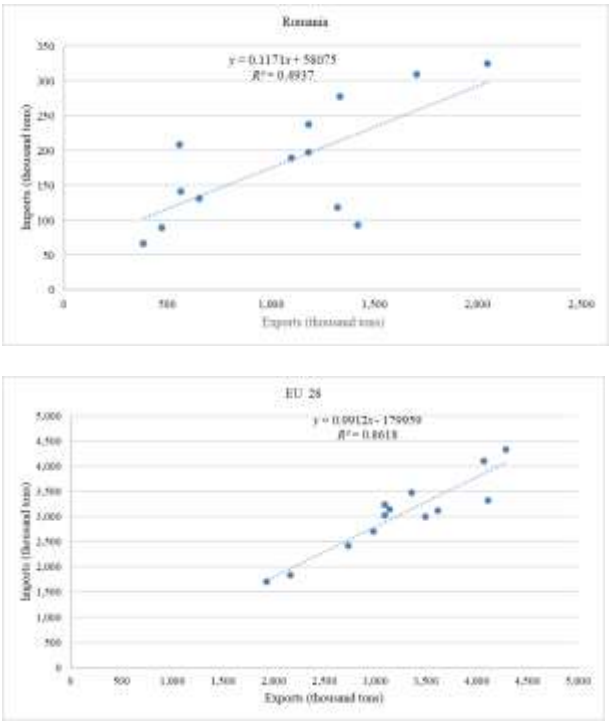

Fig. 6. Correlation between export (thousand tons) and import (thousand tons)
Source: own calculation.

There is a fairly strong link between exports and imports (r has values of 0.702616 and 0.928338 at national and Community level respectively). The linear function, based on the coefficient of determination (R^2 - 0.4937 and 0.8618), can be recommended as a viable mathematical model for the EU (Fig. 6).

CONCLUSIONS

The obtained results pointed out the following conclusions:

In terms of area, Romania is the main cultivator at Community level (1st place - 23.63% in the case of the average period), followed by Spain, Bulgaria, France and Hungary which exceeded the threshold of 500 thousand ha. Compared to the pre-accession period (1995-2006), for Romania there is an increase of about 60 thousand ha of the surface, an increase which is even more accentuated compared to the specific situation of the period 1985-1994 (increase of approximately 470 thousand ha). This aspect was also shown by [19, 20].

Romania is the main Community producer of sunflower (1,919.96 thousand tons - 23.23% of the EU total), followed by Bulgaria, Hungary and France which exceeded the level of 1,000 thousand tons. Compared to the period 1995-2006, at national level, there is an increase of approximately 775 thousand tons, and compared to the period 1985-1994, the increase in production was 2.72 times (706.78 thousand tons) as also attested by [20, 21]. These aspects are related to the potential of the food industry, but also to the possibilities of selling the product on foreign markets.

The improvement of the situation is also manifested for the average production - 1,923 kg/ha compared to 1,440 kg/ha in the period 1985-1994 or compared to the situation of the period 1995-2006 (1,254 kg/ha) as mentioned by [19, 20].

In terms of exports, Romania achieved, on average, 1,070.99 thousand tons, a level that clearly exceeds the specific situations of 1985-1994 and 1995-2006, respectively (200.23 thousand tons and 32.07% of EU exports, respectively). As a result, Romania ranks first in the top of EU exporters for sunflower (we are followed by Bulgaria and Hungary respectively - 768.94 and 471.88 thousand tons respectively).

In terms of imports, Romania ranks 7th in the EU (183.47 thousand tons - 6.05% of the EU total, average for the period). Domestic imports increased about 10 times compared to the pre-accession period (19.02 thousand tons) [20]. However, the trade balance is a surplus, Romania representing an important player on the Community and even world market of sunflower seeds.

Romania can take greater advantage of the opportunities on the international market, but only if it does not discount restrictions on the practice of cultivation and as intensified efforts to capitalize and subsidize producers properly, from plant sector.

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