

STUDY ON THE TRENDS OF MILK PRODUCTION AND DAIRY PRODUCTS AT EUROPEAN AND NATIONAL LEVEL

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Abstract

Production of milk is one of the most problematic sectors of agriculture, both in the EU and in Romania. This paper aims to analyse the evolution of milk production and dairy products at the national and EU level, between 2017 and 2022. The data of the National Institute of Statistics, Eurostat and other public sources were statistically processed for establishing trends at the level of main European milk producers and processors and several countries neighbouring Romania. At the national level, the average quantities of milk collected by the processing units increased slightly from 2017 to 2021, but in 2020 and 2021, the amount of milk has a downward trend. In the first part of 2022, the milk production remained at a low level, only during September-November were higher values recorded than in the same periods of 2020 and 2021. Romania's milk production falls for the second year in a row in 2022, under pressure from rising costs (especially fuel and energy) of the drought that has affected the feed quantity and quality and imposition of prices by large processors.

Key words: dairy products, European Union, milk production, Romania, trend.

INTRODUCTION

Global population growth, increasing pressure on natural resources and global warming, determine a new working context at the national and international level. The increase in world demand for food, the increased degree of urbanization, increasing prices for inputs, the high pressure exercised on water resources and the increase in the vulnerability of crops and animals to climate changes will limit food production. It is predicted that, globally, the demand for food will increase by 70% by 2050, as a result of the increasingly large population. All these aspects will have profound implications on agriculture and rural areas. (FAO, 2011).

Agriculture is a field with considerable potential, occupying, by tradition, an important place in the structure of the Romanian economy. Along with the vegetable sector, the livestock sector represents an important branch of the national economy in general and agriculture in particular, providing raw material

for the food industry and food for the population.

In order to support the growth of the global population, the dairy industry must look to the future and the specialists must cooperate in terms of obtaining better dairy animals and more productive and sustainable dairy farms. This can be achieved using knowledge and technology from fields such as genomics, microbiomics and intelligent dairy farming systems. Future milk production is predicted to reflect sustainable intensification that benefits animals, agro-ecosystems and humanity by producing key nutrients for human consumption (Britt et al., 2018).

The production of milk and dairy products is one of the most problematic sectors of agriculture, both at the EU level and at the national level. Milk and dairy products are important sources of protein, iodine, calcium and several other vitamins and a daily intake is of high importance for many Europeans. To be named a dairy product, food must be produced from the milk of cows, goats, sheep or similar animals. The dairy sector includes food such as

milk, milk powder, cheese, butter and yogurt as well as ice cream (Key et al., 2022).

Milk is a very important food product due to its complex chemical composition, biological value and high digestibility. It contains more than 100 substances needed by the human body: all 20 amino acids, 10 fatty acids, 25 vitamins and 45 mineral elements. This is a product of great socio-economic importance, essential for the physical and intellectual development of the individuals, as well as for maintaining the health of the population (Mihai et al., 2019).

A structural process of transformation is being registered worldwide, as a result of new global challenges with a long-term effect, which require the development of a strategic vision in the field of agriculture.

MATERIALS AND METHODS

Milk and milk product statistics are collected under Decision 97/80/EC implementing Directive 96/16/EC. They cover farm production and utilization of milk (annual), collection (monthly for cows' milk) and production activity by dairies (annual) and statistics on the structure of dairies (every third year). An annual methodological report is also collected (EuroStat, 2023).

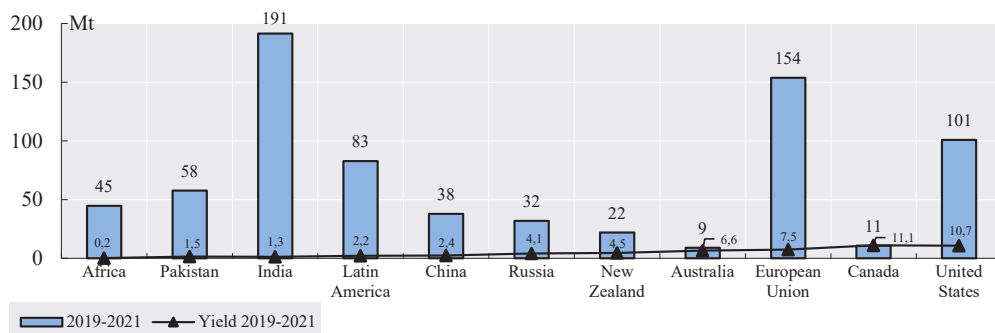
This paper aims to analyze, at the national and European Union (EU) level, the production of milk and dairy products in the period 2017-2022. The data used in this paper represent statistical information presented by specialized national, European or global institutions. All data collected from Eurostat and National

Institute of Statistics databases was studied and rephrased into the tables and figures. There have been used data series regarding livestock, milk production and dairy products in Romania and EU. The purpose of the statistics is to show changes in the size and value of livestock, total production of milk and milk products.

At the European level, the productions were compared with the big milk producers and processors (Germany, France, Holland, Poland and Italy) and with several countries neighboring Romania (Bulgaria, Serbia and Slovakia).

RESULTS AND DISCUSSIONS

Milk and dairy products are vital sources of nutrition and provide livelihoods for millions of people in the dairy value chain across the world. World milk production (roughly 81% cow milk, 15% buffalo milk, and 4% for goat, sheep and camel milk combined) increased by 1.1% to about 887 Mt in 2021, primarily driven by an expansion in output in India and Pakistan due to a continued increase in dairy herd numbers and fodder availability helped by favorable monsoon rains. Milk production in the three major dairy exporters, New Zealand, the United States, and the European Union varied from a marginal to modest increase to a slight decline, respectively. Milk is produced on a large scale in the European Union, contributing around 20.69% to total world production (OECD-FAO, 2021). Under these circumstances, the EU is a major player on the world milk market, as can be seen in Figure 1.



Note: The yield is calculated per milking animal (mainly cows but also buffaloes, camels, sheep and goats)

Figure 1 Milk production and yield in selected countries and regions of the world (OECD-FAO, 2021)

The EU dairy animal herd (cows, goats, and sheep) has declined in recent years as milk yields per animal have improved. In 2020, there were approximately 20 million cows in the EU, each producing an average of 7,300 kg of milk. It is expected that the number of

animals will continue to decrease and dairy cow numbers in the European Union are forecast to fall below 20 million head in 2023, a decline of 1.7 million head since its peak in 2016, and a decrease of 564,000 head since 2021 (Table 1, Figures 2-4).

Table 1. Dynamics of livestock for dairy animals, in UE (thousand heads)

Year	Animal category	Country								
		Slovakia	Bulgaria	Serbia	Romania	Netherlands	Italy	Poland	France	Germany
2017	dairy cows	129.86	260.78	429	1175.4	1665	2040.11	2152.9	3596.84	4199.01
	goats	37.07	256.97	183	1583.3	546	992.08	n	1213	140
	sheep	365.34	1316.78	1704	9981.8	1015	7215.4	n	6877	1579.79
2018	dairy cows	127.87	244.36	423	1158.2	1552	1939.48	2214.1	3554.23	4100.86
	goats	36.91	271.74	196	1539.3	518	986.26	n	1252	146
	sheep	351.12	1350.03	1712	10176.4	743	7179.12	n	7166	1569.9
2019	dairy cows	125.85	226.69	423	1138.8	1590	1875.72	2166.9	3490.81	4011.67
	goats	35.59	228.49	191	1594.8	551	1058.72	49.9	1242	141
	sheep	320.56	1280.98	1642	10358.7	758	7000.85	268.54	7105	1556.5
2020	dairy cows	122.05	241.94	417	1121.9	1569	1871.27	2125.7	3405.68	3921.41
	goats	n	253.4	202	1611.8	557	1065.71	n	1413.98	161
	sheep	n	1307.77	1685	10281.5	710	7034.16	n	6998.71	1483.7
2021	dairy cows	120.07	230.34	408	1081.9	1554	1844.37	2035.2	3322.03	3832.72
	goats	n	215	195	1492.5	575	1060.75	n	1387.77	164
	sheep	n	1199.55	1695	10087.4	729	6728.35	n	6994.63	1508.1
2022	dairy cows	115.95	212.53	374.2	1080.8	1570	1865	2037.28	3230.86	3809.72
	goats	n	184.74	191.7	1504.7	570	1010	n	1310.71	159
	sheep	n	1089.7	1720.83	10442.9	724	6568	n	6597.52	1507.5

n - not available data
(Eurostat, 2023, TAG00014)

In terms dairy cows number, Romania ranks 4th among the compared EU countries, but in terms of the number of goats and sheep, Romania is in first place and the number of sheep even registering an increase in 2022, compared to all previous years.

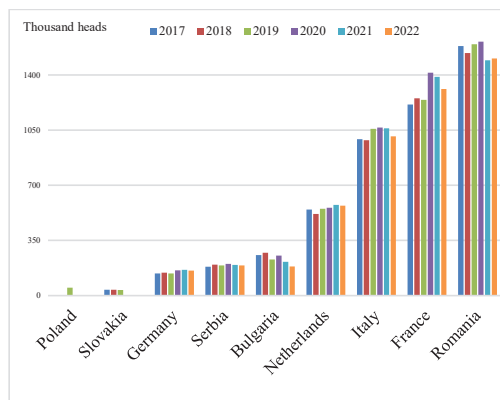


Figure 2. Number of dairy cows in UE

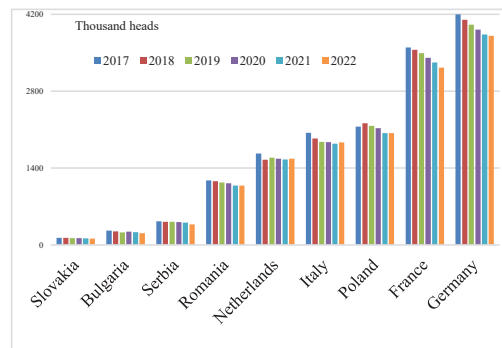


Figure 3. Number of goats in UE

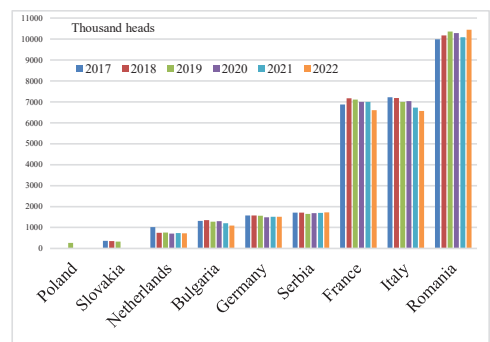


Figure 4. Number of sheep in UE

Milk production on the farm covers milk from cows, ewes, goats and buffaloes (Table 2, Figure 5).

Table 2. Production of milk on farms, in UE (1000 t)

Year	2017	2018	2019	2020	2021
Country					
Slovakia	923.40	917.00	915.70	929.54	914.41
Bulgaria	1 891.47	1 025.20	939.50	1 005.45	953.07
Serbia	1 599.26	1 590.01	1 597.04	1 583.74	1 563.48
Romania	4 439.20	4 443.30	4 339.60	4 362.50	4 299.70
Italy	12 983.23	13 131.64	13 300.10	13 509.51	13 997.97
Poland	13 702.38	14 179.21	14 511.49	14 830.07	14 890.27
Netherlands	14 822.00	14 426.00	14 944.00	14 932.00	14 607.00
France	26 006.31	26 022.50	26 036.29	26 288.53	25 834.00
Germany	32 614.17	33 109.66	33 102.57	33 188.09	32 531.56

(EuroStat, 2023)

At the EU level, Germany produces the largest amount of milk, at the farm level, closely followed by France.

The Netherlands, a large producer of milk as well, is on the 3rd place in this top, with a production of approx. 50% of that of Germany. In Romania, milk production is decreasing in the 5 years presented, reaching 4299700 tons in 2021, i.e. about 12.5% of Germany's production.

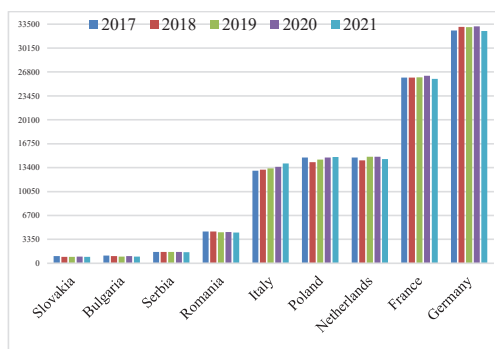


Figure 5. Dynamics of total milk production on farms, in UE (1000 t)

Figure 6 shows the value of cow milk production in the European Union from 2017 to 2022. In 2022, the EU cow milk production was approximately 143.9 million metric tons, decreasing from about 157.5 million tons in 2020, when it had a maximum in the 5 years analyzed.

The trend of such a steep decrease at the EU level can be attributed to the fact that United Kingdom cow's milk production is no longer taken into account (Shahbandeh, 2023)

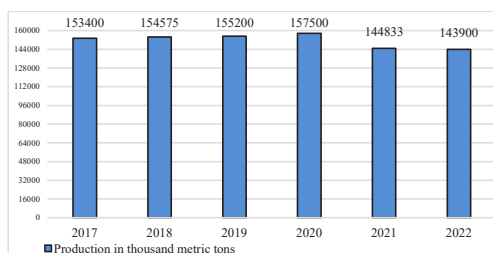


Figure 6. Cow milk production in the EU, between 2017-2022

Cow milk production (1000 t) in the under discussion EU countries is shown in the Table 3 and Figure 7.

Table 3. Production of cow's milk on farms, in UE

Year	2017	2018	2019	2020	2021
Country					
Bulgaria	968.00	898.77	822.00	882.00	836.00
Slovakia	911.73	904.62	904.26	917.69	902.64
Serbia	1 550.70	1 537.38	1 553.84	1 539.45	1 517.69
Romania	3 797.70	3 797.60	3 663.20	3 679.60	3 637.00
Italy	12 198.88	12 339.75	12 494.40	12 712.48	13 202.45
Netherlands	14 501.00	14 090.00	14 555.00	14 522.00	14 217.00
Poland	13 694.00	14 171.00	14 503.00	14 503.00	14 881.00
France	25 055.20 (p)	25 055.10 (p)	25 062.00	25 234.84	24 778.84
Germany	32 598.20	33 086.81	33 080.18	33 164.91	32 506.91

(EuroStat, 2023)

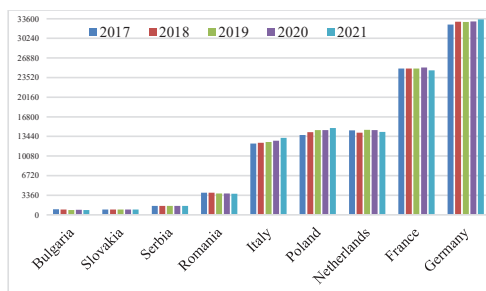


Figure 7. Dynamics of cow's milk production on farms, in UE (1000 t)

Cow's milk production has a linear trend in Slovakia, Serbia and the Netherlands, slight decreases are recorded in Bulgaria, Romania and France, and increases in production are recorded in Italy, Poland and Germany.

In Table 4, Figure 8, data covers cow's milk collected (1000 t) in UE, in farms, by approved dairies. A distinction should be made between "milk collected by dairies" and "milk production on the farm". Milk collection is only a part of the total use of milk production on the farm. The other part of the use of milk produced on the farm generally includes

domestic consumption, direct sale and cattle feed (Eurostat, 2023; INSS, 2017-2022)

Table 4. The quantities of cow's milk collected by processing units, in UE

Year	2017	2018	2019	2020	2021
Country					
Bulgaria	592.49	648.88	658.77	694.18	679.86
Slovakia	825.89	818.22	814.73	833.79	822.96
Serbia	862.87	866.97	873.95	907.65	891.88
Romania	1 028.33	1 109.31 (p)	1 122.33 (p)	1 134.98 (p)	1 125.66 (p)
Poland	11 647.89	11 945.62	12 174.96	12 457.39	12 515.42
Italy	11 902.24	12 078.75 (p)	11 965.01 (p)	11 894.79 (p)	13 842.83
Netherlands	14 295.98	13 888.88	13 881.98	13 986.68	13 683.48
France	24 629.49 (p)	24 542.54 (p)	24 526.38 (p)	24 682.21 (p)	24 198.75 (p)
Germany	31 937.83	32 498.94	32 442.21	32 548.98	31 942.32

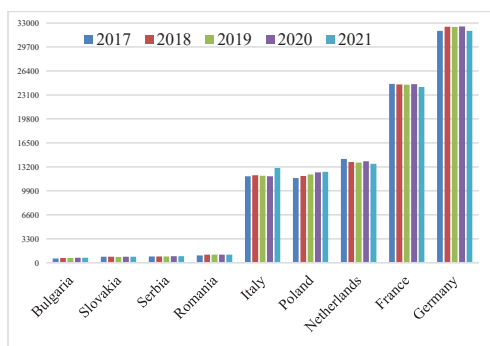


Figure 8. Dynamics of cow's milk collected, during 2017-2022, in EU (1000 t)

Correlated with the evolution of cow's milk production, it is to a certain extent the collection of milk by the processing units. In countries where the evolution of cow's milk production has a linear aspect (Slovakia and Serbia), the linearity of its collection is also observed. Also, where there is an increase in production, there is also an increase in the amount of collected milk (Italy, Poland). Although the production of cow's milk was linear, in the Netherlands or even increasing in

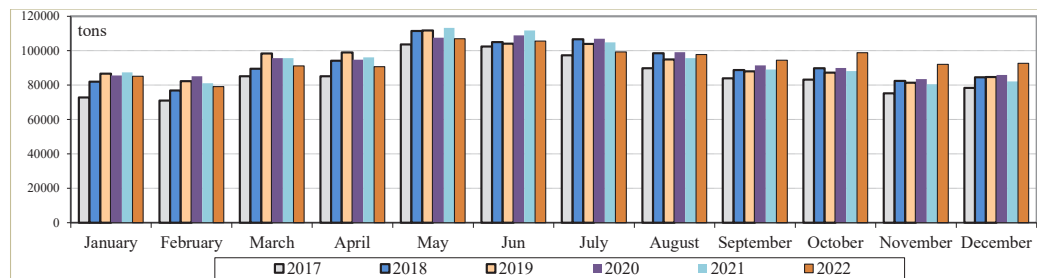


Figure 9. Dynamics of cow's milk collected, during 2017-2022, in Romania

Germany, in these countries there is a tendency to decrease the collection of milk. In Romania, although the production of cow's milk is decreasing, the collection it has an increasing trend.

For a better observation of the evolution of the amount of milk collected (1000 t) by the processing units in Romania, for the 2017-2022 period, the data from the National Institute of Statistics, were used (Table 5 and Figure 9).

In 2018 compared to 2017, the amount of cow's milk collected by processing units increased by 81,941 tons (+8.0%). In 2019 compared to 2018, the amount of cow's milk collected by processing units increased by 12556 tons (+1.1%). In 2020, compared to 2019, the amount of cow's milk collected by processing units increased by 12,572 tons (+1.1%). In the period 2021 compared to the period 2020, the amount of cow's milk collected by the processing units decreased by 9238 tons (-0.8%). In the period 2022 compared to the period 2021, the amount of cow's milk collected by processing units increased by 8138 tons (+0.7%).

Table 5. The quantities of cow's milk collected between 2017-2022, in Romania

Period	2017	2018	2019	2020	2021	2022
UM	tons					
January	72819	81986	86720	85641	87405	85123
February	71081	76835	82336	85122	81083	79120
March	85207	89502	98315	95737	95704	91187
April	85103	94161	98912	94834	96117	90770
May	103657	111428	111765	107611	113342	106880
June	102440	105017	104156	108979	111706	105594
July	97295	106679	103947	106965	104863	99341
August	89851	98552	94953	99082	95660	97837
September	83982	88802	87975	91522	89092	94464
October	83246	89843	87255	89988	88129	98828
November	75272	82368	81349	83537	80437	92023
December	78381	84597	84644	85881	82124	92631
Annual average	85694.5	92480.83	93527.25	94574.92	93805.17	94483.17
Annual total	1028334	1109770	1122327	1134899	1125662	1133798

In Romania, the average quantities of milk collected by the processing units increased slightly from 2017 to 2021 from 85694.5 to 93805.17 (8.64 %).

Even if compared to the years 2017, 2018 and 2019 in 2020 and 2021 there is an increase in milk production, the amount of milk produced has a downward trend. In the first part of 2022, the amount of milk remained at a low level, only in September, October and November registering higher values than in the same periods of 2020 and 2021.

There was made an analysis of the quantities of some dairy products (cheese, butter, drinking milk and cream) obtained in EU, in the period 2017-2022. No data were available regarding the production of drinking milk and cream for the Netherlands.

As expected, the large milk-producing countries also have the largest production of dairy products. Thus, Italy, Poland, France and Germany have the largest quantities of cheese, butter and cream. Also, at the level of these countries, the largest quantities of milk are consumed (Tables 6-9, Figures 10-13).

Several cheese types belong to database named "cheese". Data presented in Table 6 relate to all seven cheese types with different moisture contents and compositions (EuroStat, 2023).

Table 6. Production of cheese (1000 t)

Year	2017	2018	2019	2020	2021
Country					
Slovakia	48.31	42.72	43.38	43.29	44.34
Serbia	59.89	53.18	n	53.37	53.38
Romania	91.07	96.24	96.48	97.36	98.82
Bulgaria	89.48	91.98	99.95	103.39	101.46
Poland	848.63	855.59	867.95	893.78	919.71
Netherlands	896.08	982.08	953.26	999.68	984.05
Italy	1 261.13	1 308.03	1 327.38	1 344.69	1 374.23
France	1 919.57	1 997.76	1 983.29	1 862.18	1 865.96
Germany	2 216.55	2 245.88	2 297.48	2 355.12	2 368.98

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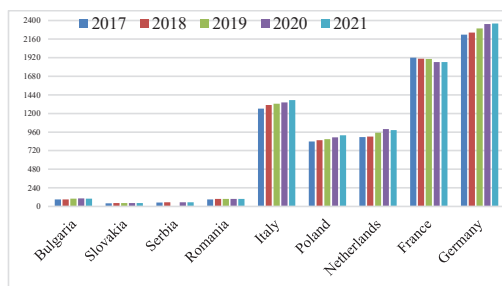


Figure 10. The dynamics of cheese production in the EU (1000 t)

Slovakia, Serbia and Romania showed a small increase in cheese production in the analyzed years, while Bulgaria (+10%), Poland, Italy, Holland and Germany (+6.5%) showed obvious increases. France is the only country observed, which showed a decrease of approximately 1%. Data concern the total production of butter and other yellow fat dairy products are presented in Table 7 and Figure 11.

Table 7. Production of butter, in EU (1000 t)

Year	2017	2018	2019	2020	2021
Country					
Bulgaria	1.06	1.07	1.09	1.03	1.26
Serbia	3.97	4.17	n	5.35	5.28
Romania	12.11	18.87	8.86	10.22	9.48
Slovakia	n	18.12	18.06	11.08	18.72
Italy	91.22	97.48	94.03	92.25	94.15
Netherlands	248.08	247.08	229.53	228.71	201.86
Poland	213.72	222.66	224.45	243.39	232.17
France	412.72	417.41	419.22	417.54	418.54
Germany	488.11	474.88	498.65	497.38	461.68

n - not available data (EuroStat, 2023, TAG00038)

For the production of butter and dairy products based on yellow fat, Bulgaria have very low values, and, together with Slovakia they show no changes throughout the 5 years analyzed. France (-2.14%) and Germany (-5%) showed reductions in butter production. The Netherlands and Romania had significant reductions of 19% and 21% respectively.

The only countries taken into account that showed an increase in butter production were Serbia (+8.5%), Italy (+3.2%) and Poland (+33%).

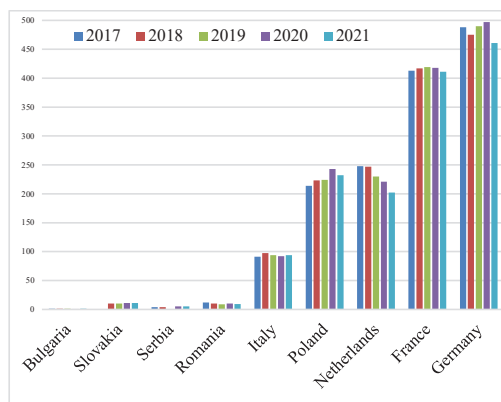


Figure 11. Dynamics of butter production, in EU (1000 t)

Data concerning drinking milk production are presented in Table 8 and Figure 12. Decreases in drinking milk production are observed in Serbia, Slovakia, France and Germany. Bulgaria, Romania and Poland show increases in this production.

Table 8. Drinking milk production, in EU (1000 t)

Year	2017	2018	2019	2020	2021
Country					
Bulgaria	66.11	74.97	74.90	76.11	77.28
Serbia	225.27	228.90	289.73	234.68	288.97
Slovakia	248.43	242.92	227.58	255.18	243.94
Romania	289.96	306.22	331.34	358.07	387.21
Poland	1 732.69	1 776.88	1 891.90	1 986.72	1 958.32
Italy	2 459.83	2 469.58	2 298.86	2 313.83	2 481.46
France	3 229.51	3 182.61	3 087.98	3 067.96	2 882.19
Germany	4 743.28	4 646.12	4 522.96	4 566.07	4 379.69

(Eurostat, 2023, APRO_MK_COLA)

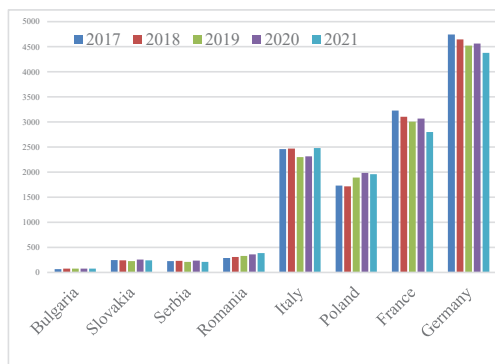


Figure 12. Dynamics of drinking milk production, in EU (1000 t)

In Table 9 and Figure 13 are presented the data related to the production of cream.

Table 9. Cream for direct consumption (1000 t)

Year	2017	2018	2019	2020	2021
Country					
Bulgaria	2.34	2.76	2.79	2.87	3.80
Slovakia	30.46	28.38	27.72	29.63	32.06
Serbia	28.21	27.42	29.04	32.37	32.86
Romania	66.46	66.43	68.12	68.32	67.75
Italy	132.12	141.48	136.12	135.75	149.83
Poland	264.80	262.15	254.52	259.43	259.89
Germany	577.99	552.21	554.41	529.98	544.39
France	502.89	503.07	514.13	535.13	547.67

(EuroStat, 2023, APRO_MK_COLA)

Increases in the amount of cream produced in the EU were registered in all the countries observed, with the exception of Germany,

which recorded a decrease of 5.71%, thus being surpassed by France, whose production increased by about 9%.

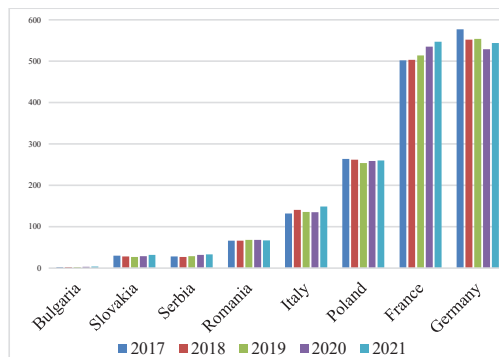


Figure 13. Dynamics of cream production, in EU (1000 t)

In order to be able to discuss the 2017-2022 evolution of the production of dairy products in Romania, there were used the data provided by National Institute of Statistics (Table 10).

Table 10. Production of dairy products, in Romania, in 2017-2022 (tons)

Year	Drinking milk	Cream for consumption	Butter	Cheese
2017	76489	15880	3221	20437
2018	306221	66887	10881	94285
2019	331344	68114	10653	96717
2020	358072	68320	12163	97292
2021	387208	67751	11198	98514
2022	370120	64978	10483	101972

Data on dairy production values collected from INSS may differ slightly from Eurostat databases, due to monthly/annual data revision and rounding.

In 2018, compared to 2017, there were increases of 17,248 tons of drinking milk production (+6.0%) and 3,214 tons of cheeses (+3.5%). The production of butter decreased by 1226 tons (-10.1%), and the consumption of cream remained approximately the same as in 2017.

In 2019, compared to 2018, increases in production were recorded in: drinking milk with 25,123 tons (+8.2%), cheeses with 2,432 tons (+2.6%) and cream for consumption with 1,227 tons (+1, 8%). Butter production decreased by 228 tons (-2.1%).

In 2020, compared to 2019, there were increases in the production of all dairy products under observation. Thus, for butter the increase was by 1510 tons (+14.2%), for drinking milk with 26728 tons (+8.1%), for cheeses with 575 tons (+0.6%) and for cream with 206 tons (+0.3%)

In 2021, production decreased in butter by 965 tons (-7.9%) and in cream by 569 tons (-0.8%). However, increases in production were recorded for drinking milk by 29,136 tons (+8.1%) and cheeses by 1,222 tons (+1.3%).

Cheese production increased in 2022 by 3458 tons (+3.5%). There were decreases in butter production by 715 tons (-6.4%), drinking milk by 17088 tons (-4.4%) and cream for consumption by 2773 tons (-4.1%).

CONCLUSIONS

The European Union is a major producer of milk and milk products as part of the common market organization (CMO). Milk production takes place in all EU countries and represents a significant proportion of the value of EU agricultural production. In the EU, total milk production is estimated at around 155 million tons per year. The main producers are Germany, France, Poland, the Netherlands, Italy and Ireland. Together, they account for almost 70% of EU milk production.

Dairy cow numbers vary enormously between European countries, as do yields. However, as the dairy sector develops across the EU, yield variations and technical disparities have narrowed. Less advanced manufacturers are quickly catching up with those who restructured and modernized before them.

Together with the decrease in the herds of cows and goats in Romania, the total amount of milk produced by dairy animals also decreased, the increase in herds of sheep (by 4.61%) failing to compensate for this decrease.

Romania's milk production falls for the second year in a row in 2022, also under pressure from rising costs (especially fuel and energy) of the drought that has affected the quantity and quality of feed and the pressure of large processors to impose prices.

However, the quantities of milk collected by milk processing factories had an increasing trend. This also led to the manifestation of a general tendency of increasing in the production of dairy products.

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