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EWES AND GOATS' CONTRIBUTION TO THE EU-28 MILK PRODUCTION IN THE PERIOD 2010-2018

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Abstract

The paper analyzed the trends and relationships in the EU ewes and goats livestock and milk output in the period 2010-2018 based on Eurostat Data using the fixed basis index, descriptive statistics, average yearly growth rate, Bravais- Pearson correlation coefficients, determination coefficient and regression models. The results attested the important contribution given by the two species to the EU milk sector in order to diversify cheese varieties and stimulate consumption and export. While sheep livestock declined in general, and the goats population increased, ewes and goats' milk delivered to dairy industry increased. In the decreasing order, the main EU countries raising sheep are Spain, Romania, Greece, Italy and France, and the main countries growing goats are Greece, Spain, Romania, France, Italy and Netherlands. Raw milk production increased in case of the both species in many countries. Ewe milk is mainly produced in Greece, Spain, Italy and France, while goat milk is especially produced in France, Spain, Netherlands and Greece. The diverse policies, management and marketing and production performance from a country to another pointed out the need to improve farmers skills in resources, livestock and production management, to encourage them to join in associations to benefit of low-price inputs and a direct access to market. The coupled aids financed by the EU are incentives to sustain sheep and goat farming and dairy sector, farmers' income, the valorization of the natural resources, the development of the disadvantaged rural and peri-urban areas, animal health and welfare, environment quality and biodiversity, and the offer of organic dairy products to consumers.

Key words**:** *sheep and goats livestock, milk output, trends, relationships, European Union*

INTRODUCTION

Sheep and goats are an important resource for the development of sustainable animal production, for maintaining the specificity of the landscapes, for valorizing the plains, hilly and mountain resources, for assuring pastures and meadows management and land management to combat forest fires, for valorizing the cultural heritage in producing traditional products, for preserving the environment and biodiversity under the climate change, for tourism and rural tourism development, for assuring a better living standard for the rural population.

More than this the EU regulations issued during the last decade were destined to sustain farmers facing high costs to continue their profession and assure them incomes mainly in the disadvantaged, fragile rural and peri-urban areas, to assure animal health and welfare, to preserve the autochtonuous breeds and transhumance specific to these species, to stimulate the increase of livestock as long as since 1980 this lost about 25 million heads and increase production with a benefic impact on consumption of healthy meat and dairy products [3, 7, 13, 22, 27].

The attractiveness of the sheep and goat farming is justified by its advantages among which the most important are: the capability

to adapt to various farming systems: extensive, semi-intensive, intensive and mixed, the ability to valorize the resources of grasslands, the fast and earlier rotation of live animals because of the specificity of reproductive activity, high breed diversity and genetic potential, the need of low capital goods (sheds, equipment etc.), low production cost compared to dairy farming, high-quality meat and dairy products [5, 18, 19, 20, 21].

The higher and higher interest for goats milk and especially cheese has led to a high growth in goats population which exceeds one billion at the global level. That's way in the EU, goats milk production and cheese-making are supported either in the traditional on-farm processing and in the industrialized sector, assuring high quality products and the best organized market for selling them [16, 17].

In 2015, the EU-28 had 98,587.99 thousand sheep and goats, of which sheep 87.32%.

Of the total number of animal farms existing in the EU, 850,000 (14%) are dealing with sheep growing, while 450,000 farms (7%) are raising goats. The average flock size is 113 sheep and 26 goats, but it varies from a country to another depending on farm and breed structure, market requirements, specializations and traditions.

Sheep and goats are grown for their economic importance in agriculture and rural areas for producing high value animal products with lower costs than dairy cows: meat, milk, cheese, and also wool and skins whose marketing could assure revenues for producers.

As self-sufficiency is lower than 100 dues to the decline in livestock caused by the infectious diseases and decoupled premium for sheep and goats, for covering the market needs, the EU is obliged to import sheep and goats mainly from New Zealand and Australia [1].

Sheep and goats meat is about 2% of the EU meat production, but in UK, Ireland and Greece it represents larger percentages varying between 8% and over 50 %.

Sheep and goats' milk accounts for about 3% of the EU milk output and delivered to dairies as dairy cows are the main supplier. The main milk producing countries in the EU are: Greece, Spain, France, Romania and Italy. Cheese, which is the principal product achieved of sheep and goats' milk, accounts for 9% in total cheese production and the main cheese producing member states are Spain, Italy, France and Greece [6, 33].

In this context, the purpose of the paper was to analyze the trends in the EU sheep and goats milk output delivered to dairies in the EU in close relationship with the dynamics of livestock in the period 2010-2018.

The expectations are that the measures taken by the EU Commission in 2014 sustained the sheep and goat sector for maintaining the traditional culture in eco-friendly sheep and goats farming, the beauty of the landscapes, for encouraging the young farmers to develop business in this sector and reduce migration, for satisfying better consumer's preferences for local natural products like milk and cheese.

MATERIALS AND METHODS

The paper analyzed separately the sheep and goats livestock, and also raw milk delivered to dairies by ewes and goats in the main countries growing these two species and giving an important contribution to the EU milk production.

The data were collected from Eurostat Data base both for livestock and milk production for the period 2010-2018.

The used methods in this study have been: (i)the fixed basis index, (ii)comparison method, (iii)descriptive statistics regarding: mean, standard deviation, coefficient of variation, (iv) average annual growth rate, (v) Bravais-Pearson coefficients of correlations, (vi) regression equations and (vii) coefficient of determination.

The results were graphically illustrated and included in tables and commented, and finally the conclusions ended this research work emphasizing the main aspects found.

RESULTS AND DISCUSSIONS

Sheep Population

According to the Eurostat Data updated at 18.05.2020, the sheep livestock in the EU-28

in the year 2015 accounted for 86,088.12 thousand heads. Unfortunately, for the year 2018 the data are not still updated, except for the countries which reported the situation.

The most important EU countries raising sheep are: Spain, Romania, Greece, Italy, France, Portugal and Bulgaria. Other countries such as: Croatia, Austria, Slovakia and Cyprus are growing a smaller number of sheep. In 2018, all these countries together had 53,754 thousand sheep (Fig.1).

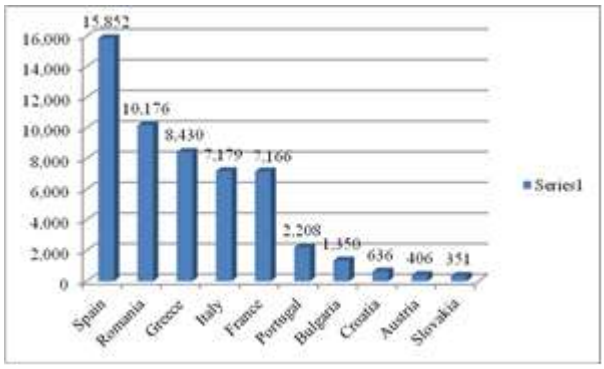

Fig.1. Sheep livestock in the main EU growing countries in 2018 (Thousand heads)
Source: Own design based on the data from Eurostat, 2020 [11].

The evolution of sheep population in the main EU raising countries in the period 2010-2018 was different from a country to another reflecting either a decreasing trend or an increasing one. The statistics showed that the sheep livestock registered a decreasing trend in the analyzed period in the following countries: in Spain by 14.6% from 18.5 million heads in 2010 to 15.85 million in 2018; in Greece by 14% from 9.79 million heads in 2010 to 8.43 million in 2018; in Italy by 9.2% from 7.9 million to 7.18 million, in France by 10% from 7.95 million to 7.15 million, in Portugal by 1% from 2.22 million in 2010 to 2.20 million in 2018, in Bulgaria by 1.4% from 1.36 million to 1.35 million, and in Slovakia by 11 % from 394 thousand heads in 2010 to 351 thousand heads in 2018.

In other countries the sheep population increased as follows: in Romania by 20.89 % from 8,41 million heads in 2010 to 10.18 million in 2018, in Croatia by 0.9% from 630 thousand heads to 636 thousand heads, and in Austria by 13.4% from 358 to 406 thousand heads (Table 1).

Table 1. Dynamics of sheep population in the main EU raising countries, 2010-2018 (Million heads)

	Spain	Romania	Greece	Italy	France	Portugal	Bulgaria	Croatia	Austria	Slovakia	Cyprus
2010	18.5	8.4	9.8	7.9	7.9	2.2	1.4	0.63	0.35	0.39	0.33
2011	17.0	8.5	9.7	7.9	7.6	2.2	1.4	0.63	0.36	0.39	0.35
2012	16.3	8.8	9.2	7.0	7.4	2.1	1.3	0.67	0.36	0.41	0.35
2013	16.1	9.1	9.3	7.2	7.2	2.1	1.3	0.62	0.35	0.40	0.31
2014	15.4	9.5	9.1	7.1	7.1	2.0	1.3	0.60	0.35	0.39	0.32
2015	16.0	9.8	8.8	7.1	7.0	2.0	1.3	0.60	0.35	0.38	0.32
2016	15.9	9.9	8.7	7.3	7.1	2.2	1.3	0.62	0.38	0.37	ND
2017	15.9	10.	8.6	7.2	6.8	2.2	1.3	0.63	0.40	0.37	ND
2018	15.8	10.2	8.4	7.2	7.1	2.2	1.3	0.63	0.41	0.35	ND
2018/ 2010 %	85.4	120.8	85.7	90.8	90.0	100	98.6%	109.0	113.4	99.0	-

Source: Own calculation based on Eurostat Data base, 2020 [11].
ND - No data.

The statistical parameters for sheep livestock in the top five EU countries are presented in Table 2. The mean sheep livestock in each country is representative, reflecting a homogenous population as long as the values of the variation coefficient is smaller than 10%.

In Spain, Greece, Italy and France the sheep population declined by a little more than 1% yearly.

Romania registered a high annual growth rate, + 2.31%, as sheep growing was encouraged by the transitory aid offered by the Romanian Government for sheep identification and registration for the farms with more than 50 female sheep of one year old, according to the EU Regulation No. 1307/2013 and the coupled aid from European Agriculture Guarantee Fund (EAGF) for the farms with 150-500 sheep [8, 9, 15, 24, 31].

Table 2. Statistical parameters: mean, standard deviation, variation coefficient and average annual growth rate for sheep livestock in the top five EU countries

	Spain	Romania	Greece	Italy	France
Mean (Thousand heads)	16,369.88	9,364.66	9,091.40	7,337.11	7,294.11
St. Dev.	923.53	656.34	490.21	338.89	327.95
Coefficient of variation (%)	5.64	7.00	5.39	4.62	4.49
Average annual growth rate in the period 2010-2018 (%)	-1.62	+2.31	-1.55	-1.02	-1.11

Source: Own calculations.

Goats population

In 2015, according to Eurostat, there were 12,499.17 thousand goats. For the year 2018, it is not yet displayed the goat livestock. However, the existing data reflect that the EU countries where goats are raised are: Greece, Spain, Romania, France, Italy, Netherlands, Portugal and Bulgaria. Smaller flocks are also grown in Cyprus, Germany, Austria, Croatia and Belgium. All these countries together had 11,608 thousand goats in 2018 (Fig.2).

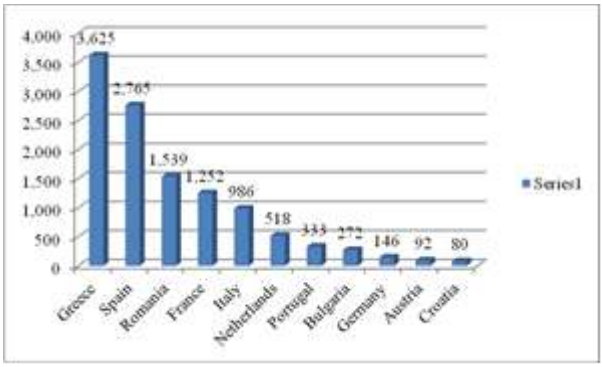

Fig.2. Goats livestock in the main EU growing countries in 2018 (Thousand heads)
Source: Own design based on the data from Eurostat, 2020 [10].

In the period 2010-2019, the evolution of the goats population varied from a country to another.

The following countries registered an increasing trend of the number of goats: by 24 % in Romania from 1,241 thousand heads in 2020 to 1.539 thousand heads in 2018, in Italy by 0.3 % from 983 thousand heads to 986 thousand heads, in Netherlands by 37.4 % from 377 thousand heads to 518 thousand heads, in Austria by 27.7 % from 72 thousand heads to 92 thousand heads and in Croatia by 6.6% from 75 to 80 thousand heads. In other countries the number of goats declined as follows: by 18.76% in Greece from 4,462 thousand heads in 2010 to 3,625 thousand heads in 2018, by 3.5% in Spain from 2,904 to 2,765 thousand heads, in France by 13.6% from 1,448 to 1,252 thousand heads, in Portugal by 20.5% from 419 to 333 thousand heads, in Bulgaria by 23.6% from 356 to 272 thousand heads, and in Germany by 2.7% from 150 to 146 thousand heads (Table 3).

Table 3. Dynamics of goats population in the main EU raising countries, 2010-2018 (Million heads)

	Greece	Spain	Romania	France	Italy	Netherlands	Portugal	Bulgaria	Cyprus	Germany	Austria	Croatia
2010	4.4	2.9	1.2	1.4	0.9	0.4	0.4	0.3	0.3	0.1	0.07	0.07
2011	4.3	2.7	1.2	1.4	0.9	0.4	0.4	0.3	0.3	0.2	0.07	0.07
2012	4.3	2.6	1.3	1.3	0.9	0.4	0.4	0.3	0.3	0.2	0.07	0.07
2013	4.4	2.6	1.3	1.3	1.0	0.4	0.4	0.2	0.2	0.1	0.07	0.07
2014	4.2	2.7	1.4	1.3	0.9	0.4	0.4	0.3	0.2	0.1	0.07	0.06
2015	4.0	2.8	1.4	1.3	1.0	0.5	0.4	0.3	0.2	0.1	0.07	0.06
2016	3.9	3.1	1.5	1.2	1.0	0.5	0.3	0.2	ND	0.1	0.09	0.08
2017	3.8	3.1	1.5	1.2	1.0	0.5	0.3	0.2	ND	0.1	0.09	0.08
2018	3.6	2.8	1.5	1.2	1.0	0.5	0.3	0.3	ND	0.1	0.09	0.08
2018/ 2010 %	81.24	96.5	124.0	86.4	100.3	137.4	79.5	76.4	-	97.3	127.7	106.6

Source: Own calculation based on Eurostat Data base, 2020 [10]. Note: ND- No data.

The statistical parameters for goats' livestock in the top six EU countries are shown in Table 4. The mean sheep livestock in each country is representative, reflecting a homogenous population as long as the values

of the variation coefficient is smaller than 10%. The values of the variation coefficients below 10% reflect that in case of Greece, Spain, Romania, France and Italy the goats' population is homogenous, therefore, the means are representative, while in Netherlands where CV% is 13.52 % this reflects that the population of goats is relatively homogenous and the mean is relatively representative.

The annual growth rate was negative in case of Greece, Spain, France and Italy, while in Romania and Netherlands it had positive values, the annual increase being more than double in Netherlands compared to Romania. The incentives to stimulated the development of goats' sector in Romania came partially as a transitory aid from the Government and as a coupled aid from European Agriculture Guarantee Fund (EAGF) for the farms with 50-500 female and male goats [9, 15, 30, 32].

Table 4. Statistical parameters: mean, standard deviation, variation coefficient and average annual growth rate for goats' livestock in the top six EU countries

	Greece	Spain	Romania	France	Italy	Netherlands
Mean (Thousand heads)	4,110	2,807	1,382	1,287.55	968.22	450.88
St. Dev.	295.71	174.35	119.11	80.79	37.73	60.96
Coefficient of variation (%)	7.19	5.25	8.61	6.27	3.89	13.52
Average annual growth rate in the period 2010-2018 (%)	-2.08	-0.38	+2.66	-1.51	-0.03	+4.55

Source: Own calculation.

Ewes' milk production. The countries which produce the highest ewe milk output are Greece, Spain, Italy and France. In another group are included Cyprus, Portugal, Bulgaria and Romania, followed by Slovakia, Austria and Croatia which bring a smaller contribution to the EU ewe milk production (Fig.3).

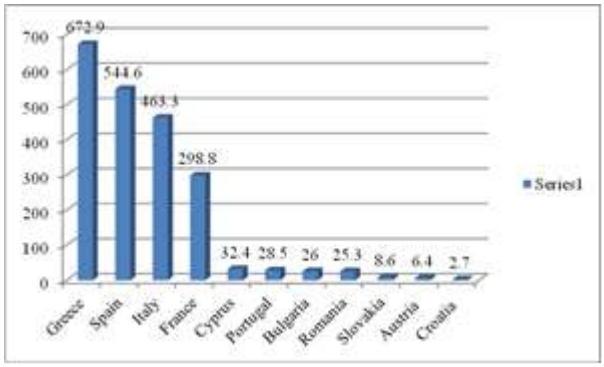

Fig.3.Ewes' milk production in 2018 in the main producing EU countries (Thousand tons)
Source: Own design based on the data Eurostat, Data Base, 2020 [12].

Looking at Fig.1, we may easily notice that in 2018, all these 11 countries produced together 2,109.5 thousand tons milk, of which 93.8 % that is 1.979.6 thousand tones is achieved by four countries: Greece, Spain, Italy and France, meaning 15.23 times more than all the other 7 countries.

Milk produced by ewes and delivered to dairies increased in almost producing countries, except Bulgaria and Croatia.

The milk output growth in the period 2010-2018 was: + 77.2 % in Cyprus, +72.4% in Austria, + 62.5% in Slovakia, + 53.9% in Romania, + 44.1 in Spain, +22.4% in Greece, + 22.3 % in Portugal, +12.4% in France, + 7.2 % in Italy (Table 5).

From an economic point of view, sheep are grown in the EU for milk, meat, and in a few member states for wool.

Milk is important for producing cheese and meat has become also important during the last years due to high demand on the Arab market [2, 4, 23, 25, 26].

The statistical parameters for ewes' milk in the top five EU countries raising sheep reflect a high production performance in Greece, Spain, Italy and France, varying between 566.97 thousand tons per year in Greece and 277.09 thousand tons per year in France.

Table 5. Dynamics of ewes' milk production in the main EU producing countries, 2010-2018 (Thousand tons)

	Greece	Spain	Italy	France	Cyprus	Portugal	Bulgaria	Romania	Slovakia	Austria	Croatia
2010	549.7	378.0	432.2	265.9	18.3	23.3	30.2	16.4	5.3	3.7	2.8
2011	518.6	368.7	419.5	272.1	18.6	21.7	23.4	14.3	4.8	3.9	2.8
2012	496.3	363.5	406.2	269.7	18.1	24.3	25.2	15.8	5.1	4.7	2.9
2013	519.5	368.4	383.8	262.8	16.4	24.2	25.1	18.1	5.6	4.6	2.7
2014	540.4	456.7	372.5	266.0	22.1	23.9	26.1	27.3	7.3	4.2	3.0
2015	548.3	538.2	397.5	271.1	23.6	26.4	19.5	29.7	6.6	5.4	2.8
2016	606.2	539.4	424.8	292.5	28.8	28.3	22.5	32.8	7.1	4.7	3.1
2017	650.9	514.2	427.4	294.8	32.3	28.4	36.3	29.8	6.9	5.8	2.8
2018	672.9	544.6	463.3	298.8	32.4	28.5	26	25.3	8.6	6.4	2.7
2018/ 2010 %	122.4	144.1	107.2	112.4	177.2	122.3	86.1	153.9	162.5	172.4	98.5

Source: Own calculations based on the data from Eurostat, Data Base, 2020 [12].

Despite its high sheep population for which Romania came on the 2nd position in the EU, production performance was very small just 23.3 thousand tons per year in the analyzed period. This is due to low production potential of the local breeds, the small herd size per farm and farm structure, low forage resources mainly in the recent years with long period of drought, the extensive growing system largely used and the existence of disadvantaged areas [30].

The coefficients of variation registered low values below 10 % in case of France, Italy and Greece reflecting a homogenous production in the analyzed interval and that the means are representatives. In case of Spain, the variation coefficient was 18.28 reflecting a relatively homogenous production, and in case of Romania the variation coefficient had a high value, CV =30.55 %, meaning that the ewes' production varied very much, and the mean is not representative (Table 6).

Table 6. Statistical parameters: mean, standard deviation, variation coefficient and average annual growth rate for ewes' milk delivered to dairies in the top five EU countries based on sheep livestock

	Spain	Romania	Greece	Italy	France
Mean (Thousand tons)	452.42	23.30	566.97	414.15	277.09
St. Dev.	82.74	7.12	61.99	27.52	14.08
Coefficient of variation (%)	18.28	30.55	10.93	6.64	5.08
Cumulated raw milk, 2010-2018 (Thousand tons)	4,071.79	209.73	5,102.8	3,727.39	2,493.85
Average annual growth rate (%)	+4.90	-1.54	+2.48	+0.80	+1.37

Source: Own calculation.

Goats' milk production. The highest amount of goat milk is produced by three EU countries: France, Spain, Netherlands and Greece, which all together achieved 1,451.39 thousand tons in the year 2018.

Table 7. Dynamics of goats' milk production in the main EU producing countries, 2010-2018 (Thousand tons)

	France	Spain	Netherlands	Greece	Belgium	Italy	Cyprus	Portugal	Romania	Germany	Austria	Bulgaria	Croatia
2010	531.2	337.8	178.9	151.6	8.5	24.9	17.9	12.2	3.9	ND	8.8	4.6	4.2
2011	547.0	315.5	190.2	132.6	9.0	23.7	21.8	13.5	3.4	ND	11.8	4.9	4.3
2012	506.8	302.4	212.7	114.5	9.5	27.9	20.1	12.7	4.7	12.6	12.6	7.1	4.3
2013	468.5	295.0	227.3	123.0	9.3	27.5	18.3	13.1	7.1	13.2	11.8	7.2	3.6
2014	471.2	372.4	239.6	128.7	12.5	28.5	21.9	14.0	15	13.5	12.3	8.2	3.5
2015	474.9	467.82	257.0	129.7	45.6	33.2	23.1	16.1	16.8	13.3	12.1	8.3	3.7
2016	484.2	435.4	289.0	141.8	55.8	31.7	23.2	18.0	18.3	14.6	11.8	10.7	4.0
2017	484.4	491.4	315.0	149.5	69.6	37.1	30.4	21.9	17.9	15.3	12.6	12.1	4.2
2018	497.5	461.4	340.0	152.5	69.4	43.4	29.8	21.7	16.1	15.5	14.6	9.00	4.3
2018/ 2010 %	93.6	136.5	190.0	100.6	817.1	174.2	165.7	178.0	412.8	122.8	165.6	194.4	102.1

Source: Own calculation based on the data from Eurostat, Data Base, 2020 [12]. Note: ND-No data.

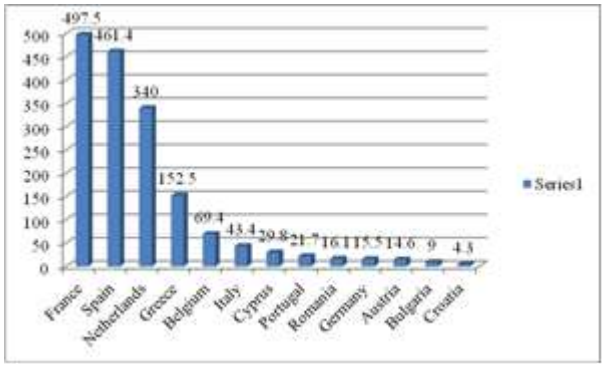

Fig.4. Goats' milk production in 2018 in the main producing EU countries (Thousand tons)
Source: Own design based on the data Eurostat, Data Base, 2020 [12].

In the analyzed interval, almost the producing goat milk registered an important increase of production, except France where milk output declined by 6.4%.

The growth rate varied between 0.6 % in case of Greece and 717.1 % in case of Belgium (Table 7).

The other group of producing countries includes, in the decreasing order of output level, the following countries: Greece, Belgium, Italy, Cyprus, Portugal, Romania, Germany, Austria, Bulgaria and Croatia, which all together carried out only 223.77 thousand tons, that is 6.48 times less than the top four countries (Fig.4.).

The statistical parameters for goats' milk in the top six EU countries raising goats reflect a high production performance in France, Spain, Greece, and Netherlands, varying between 496.25 thousand tons per year in France and 135.98 thousand tons per year in Greece. Despite the high goats livestock raised in Romania and its fast increase mainly in the last years with a benefic impact on production, the milk output level is still small, only 11.47 thousand tons per year, far away from the one recorded by the other EU countries mentioned above [30].

In France where goat sector is very well developed and consolidated along the milk chain the variation of production was small, as reflected by the variation coefficient, CV%= 5.52%. In Greece, CV%= 9.95%, also reflecting a representative mean and small production variation. In Spain and Italy the variation coefficients were about 20% showing a relative homogenous milk production, but in Romania the CV% = 56.75% meaning a completely heterogenuous milk performance in the analyzed period. Like in case of ewes' milk production, goats' milk performance depended on the sheep breeds and their potential, the extensive system of goats raising largely extended, and mainly on the forage resources which could not be assured at the required level due to the severe droughts. But, during the last five years, the livestock and production increased as a result of the aids coming from the EU funds (Table 8).

Table 8. Statistical parameters: mean, standard deviation, variation coefficient and average annual growth rate for goats' milk delivered to dairies in the top six EU countries based on goats livestock

	Greece	Spain	Romania	France	Italy	Netherlands
Mean (Thousand tons)	135.98	386.56	11.47	496.25	30.88	249.97
St. Dev.	13.54	77.98	6.51	27.44	6.26	55.37
Coefficient of variation (%)	9.95	20.17	56.75	5.52	20.27	22.15
Cumulated milk output, 2010-2019 (Thousand tons)	1,223.9	3,479.1	103.22	4,466.24	277.99	2,249.79
Average annual growth rate (%)	+0.06	+4.05	+34.75	-0.71	+8.24%	+10 %

Source: Own calculation.

The share of sheep and goat raw milk delivered to dairies in Total milk collection

In the EU-28 total milk collection, dairy cows are the main contributors, accounting for about 97%. In 2018, the EU raw milk production accounted for 172.2 million tons, of which about 12.2 million tons were used on farms by the farmer's family or directly sold to clients, and the remaining of 160 million tons were delivered to dairies, and of this amount 156 million tons were produced by dairy cows and the rest by other specie including ewes, goats and buffalos [28, 29].

The contribution of various species to the EU milk production in 2018 was the following one: 96.81% cow milk, 1.62 % ewe milk, 1.33 % goat milk and 0.24 % buffalo milk [12].
The EU contributes by about 17% to the world goat milk output grace to its high yields per goat [22].
The analysis presented above proves that there are several countries in the EU raising sheep and goats for producing milk and the hierarchy based on the performance in raw milk delivered to dairies has been already shown.
Based on these figures, it was determined the share of raw milk produced by ewes and goats in the total raw milk delivered to dairies.
Despite that ewes' and goats' contribution to total raw milk looks to be small, it is increasing year by year in almost all the countries raising these species.
The highest contribution to milk production is given in Greece where the share of ewes and goats is 44.91 % and respectively 10.18% in total raw milk output. On the 2nd position is Cyprus with 11.1 % for ewes' milk and 10.18 % for goats' milk. Ewes have also an important share in total raw milk delivered to dairies in: Italy 3.74%, Bulgaria 3.64%, Romania 1.82 %, France 1.16%.
Goats are also important in milk production contributing to total raw milk by: 2.29% in Netherlands, 1.94% in France, 1.36% in Belgium, 1.26 % in Bulgaria, 1.16% in Romania, 0.43 % in Austria and 0.35% in Italy (Table 9).

Table 9. The share of ewes' and goats' milk in the total raw milk produced in the EU-28 in the year 2018

	Total raw milk delivered to dairies (1,000 Tons)	of which:			Share in total raw milk		
		Ewes' milk	Goats milk	Ewes' and Goats' milk	Ewes' milk (%)	Goats' milk (%)	Ewes' and Goats' milk (%)
Belgium	5,088.13	-	69.37	69.37	-	1.36	1.36
Bulgaria	712.50	26.0	9.0	35.00	3.64	1.26	4.91
Germany	ND	-	15.52	15.52	-	-	-
Greece	1,498.30	672.9	152.5	825.40	44.91	10.18	55.09
Spain	ND	544.64	461.38	1,006.02	-	-	-
France	25,639.67	298.8	497.51	796.31	1.16	1.94	3.10
Croatia	ND	2.74	4.26	7.00	-	-	-
Italy	12,384.22	463.35	43.44	506.79	3.74	0.35	4.09
Cyprus	292.09	32.40	29.76	62.16	11.1	10.18	21.28
Netherlands	14,872	-	340	340	-	2.29	2.29
Austria	3,379.53	6.38	14.56	20.94	0.19	0.43	0.62
Portugal	ND	28.55	21.72	50.27	-	-	-
Romania	1,285.19	25.25	16.14	41.39	1.82	1.16	3.22
Slovakia	ND	8.60	-	8.60	-	-	-

Source: Own calculations based on the data from Eurostat Statistics Explained, [12].
ND- No available data.

In the EU sheep and goat farming is a complementary source of raw milk which could be processed either on farm using traditional manufacturing methods or in industrialized units for obtaining various sorts of cheese which are preferred by consumers in many of the member states, but also are required on the international markets.
However, there are difference among the producing countries regarding the milk and cheese chain which result in various level of performance in production, product quality and efficiency.
However, most of the products achieved from ewes and goats' milk are natural products, of high quality, are obtained under the safety and hygiene and animal welfare regulations which assure a good image in the consumer's eyes and contribute to the decision to purchase and consume them.
In France, Spain, Greece, Italy, Netherlands, the milk and cheese chain is very well

organized and efficient, there are well known brands such as "Feta cheese" carried out in Greece, "Pecorino cheese" in Italy, which are successfully consumed in the EU market and not only. In many countries, various sorts of cheese have a protected origin attested by PDO label which is a guarantee of the product quality and safety [14].

The relationships between milk production and sheep and goats' livestock in the EU main growing countries

In case of sheep milk sector

The values of the coefficients of correlation reflect that between the sheep population and milk production available for dairies exists a positive and strong relationship mainly in Romania, r = 0.890, and Greece, r = 0.771, a positive and medium connection in Spain r = 0.545 and France r = 0.492 and a positive but weak link in Italy, r = 0.281.

Therefore, in case of the countries with a high value of correlation coefficient like Romania and Greece, ewes' milk production depends in a higher proportion on the number of sheep, more exactly of ewes, while in the other countries France, Spain and Italy, milk output depends much more on other factors such as: yield level, growing system, feeding quality, flock size per farm.

The value of the coefficient of determination confirms the above affirmation and shows that in Romania 79.3 % and in Greece 59.5% of the variation in the ewes' milk output depends in a higher measure on the number of sheep. In the other three countries, the change in the ewes' milk production is determined in a lower proportion by sheep livestock, more exactly: 29.7 % in Spain, 24.2 5 in France and only 7.9 % in Italy.

The regression equations reflect that an increase by one thousand heads in sheep livestock will lead to:

- a decline in milk output by 0.0488 thousand tons in Spain, by 0.0975 thousand tons in Greece and by 0.0211 thousand tons in France;
- an increase in milk production by 0.0228 thousand tons in Italy and by 0.0096 thousand tons in Romania (Table 10).

Table 10. Relationships between raw milk production delivered to dairies and sheep and goats' population in the main EU growing countries

Country	Regression model	R^2	r	F	Sign. F
Relationship between ewes' milk production and livestock					
Spain	Y = -0.0488 X +1,251.57	0.297	0.545	2,961	0.1289
Romania	Y= 0.0096 X -67.1528	0.793	0.890	26.87	0.00127
Greece	Y= -0.0975 X + 1,454.09	0.595	0.771	10.302	0.0148
Italy	Y= 0.0228 X +246.629	0.079	0.281	0.601	0.4635
France	Y= -0.0211 X+ 431.179	0.242	0.492	2.235	0.1784
Relationship between goats' milk production and livestock					
Greece	Y = -0.0243X +236.15	0.283	0.532	2.765	0.1402
Spain	Y = 0.3003 X -456.421	0.455	0.675	5.8666	0.0459
Romania	Y =0.0526 X - 61.35	0.927	0.962	89.3318	3.1005
France	Y = 0.2709 X + 147.40	0.636	0.797	12.2363	0.0100
Italy	Y =0.0569 X -24.25	0.117	0.342	0.9328	0.3663
Netherlands	Y = 0.8750 X -144.57	0.928	0.963	90.5731	2.9605

Source: Own calculation.

In case of goats milk sector

The relationship between livestock and milk production is a positive and very strong one as attested by the values of the correlation coefficients in Netherlands r = 0.963, Romania r = 0.962, France r = 0.797, Spain r = 0.675, a positive and medium relationship in Greece, r = 0.532, and a positive and weak connection in Italy, r = 0.342.

The same aspect is confirmed by the determination coefficient whose values showed that the variation in goats' milk production is influenced by the variation in goats livestock as follows: 92.8% in Netherlands, 92.7% in Romania, 63.6% in France, 45.5 % in Spain, 28.3 % in Greece and 11.7% in Italy. Obviously, the difference up to 100% of variation is given by the

change of other factors peculiar to each country.

The regression equations reflected that an increase of the number of goats by one thousand will:

- decline milk production by 0.0243 thousand tons in Greece;
- increase milk output by 0.8750 thousand tons in Netherlands, by 0.2709 thousand tons in France, by 0.3003 thousand tons in Spain, by 0.0569 thousand tons in Italy and by 0.0526 thousand tons in Romania (Table 10).

CONCLUSIONS

The analysis proved that sheep and goats have an important economic role in the EU agriculture, more exactly in the dairy sector as confirmed by the increased contribution to milk production in order to diversify cheese offer and satisfy better consumers' needs and create availabilities for export.

While sheep livestock is diminishing in the main growing countries, the goats population has a fast growing.

The main countries dealing with sheep farming are Spain, Romania, Greece, Italy and France, while the main member states growing goats are: Greece, Spain, Romania, France, Italy and Netherlands.

Both ewes' and goats milk production increased in general in various proportions from a country to another, with a few exceptions.

The main producing countries of ewes' milk are: Greece, Spain, Italy and France, while the main countries producing goat milk are: France, Spain, Netherlands and Greece.

The regulations approved by the EU Parliament during the last decade have been real incentives to sustain sheep and goat farming and dairy sector, to maintain employment and incomes of the farmers, the beauty of the landscapes, biodiversity, animal health and welfare, environment quality and the offer of healthy organic dairy products to consumers.

However, the adopted policies regarding sheep and goats sector management and market have a large variability from a country to another. It is very important as farmers to have high skills to be able to assure a sustainable resources, livestock and production management and benefit of a direct access to markets. Producers associations play an important role in providing low price farm inputs, in accessing the technical services, and in sustaining the delivery of the final products in the market to benefit of the increasing demand.

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