DISCREPANCIES IN DAIRY FARMS STRUCTURE BETWEEN ROMANIA AND THE EU-28 TOP COUNTRIES RAISING COWS IN THE PERIOD 2010-2017

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Abstract. *The paper analyzed dairy farms structure in Romania comparatively with the top EU-28 countries growing dairy cows. The period of reference was 2010-2017 and the main studied indicators have been: number of dairy cows, number of dairy farms, dairy farms structure by farm size (ha) and by herd size (cows/farm), and yield (kg/cow/year). The number of dairy cows declined in Romania by 17.27% from 1,441.4 thousand heads in 2010 to 1,192.5 thousand heads in 2017, while milk yield increased by 16.16% from 2,750.7 kg/cow/year in 2010 to 3,198 kg in 2017. Romania has 531,851 dairy farms of which 81.58% were raising 1-2 cows, 10.97% between 3 and 5 cows, and just 0.09% are farms with over 100 cows. The average herd size is 2.4 cows/farm compared to United Kingdom (143), Netherlands (97.4), Ireland (76.2), Germany (61.7), France (57.1), Italy (37.6), and Poland (9). Herd size is a key factor for getting yield performance. Romania comes the penultimate position in the EU for its cow yield, which reflects the inappropriate dairy cows farm structure. Farmers have to join in associative forms for better managing farm inputs, increasing yield and production, reducing production cost and selling raw milk efficiently.*

Keywords: farm structure, dairy of cows, milk yield, Romania, discrepancies, EU countries

1. Introduction

Dairy sector is a strategic field of activity assuring milk, a basic food for the population and raw milk for processing industry, as well as giving an important contribution to agricultural output and sustaining producers' income.

Cow milk has the highest share in raw milk delivered to dairies. Its production depends on the number of dairy cows and their performance in terms of yield. In its turn, milk yield is the result of a large range of factors such as: farm size, herd size, breed, feeding, reproduction, animal health and welfare etc. [16, 23].

The economic efficiency in dairy farming is quantified by gross margin resulting as difference between gross product and variables costs, which in this area have a high percentage about 70% [9, 10, 11, 13].

The practice proved that the higher milk yield, the higher gross product and as a result gross margin as well [12, 16, 17, 18, 19, 20, 21].

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In this respect, research results showed various models which included the factors which could increase economic efficiency in dairy farming [22, 24, 25, 26, 27].

Production is stimulated by the increased demand on the internal and international market of milk and dairy products [28, 29, 32]. The demand/offer ratio is also closely linked of milk price [30, 31, 33, 34, 35].

The EU-28 is able produced about 170 million tons milk per year, of which over 97 % comes from dairy cows. About 70% of the EU milk output is achieved by Germany, France, the United Kingdom, Poland, the Netherlands and Italy. The EU average milk yield accounts for 7,280 kg/cow, but it is exceeded by more than 15 member states, the top position being kept by Denmark (9,504 kg/cow) [1, 2].

About 23 million dairy cows are grown in 1,237 thousand farms, the average herd size being 32 cows, ranging between 219 heads in Czechia and 2.4 heads in Romania.

The majority of EU countries recorded an annual decline in cow numbers, but milk yield and production increased at the community level as a result of the structural dynamics changes in dairy herds oriented to the growth of the most productive ones [4].

Romania has an important number of cows, for which it comes on the 8th position in the EU, but the smallest yield, accounting for just 3,198 kg/cow/year, being by almost 50% lower than the EU average [15, 23].

In this context, the goal of the research was the comparatively analysis between Romania and the other EU top countries raising dairy cows regarding the number of cows, farm structure, herd size, and milk yield in order to assess the differences and point out that farms structure is a key influencing factor on production performance in dairy farming.

2. Materials and Methods

2.1. Data collection

The data have been collected from various sources such as National Institute of Statistic, Eurostat, Faostat, Ministry of Agriculture and Rural Development and refer mainly at the years 2010 and 2016 for which the data were provided [2, 3, 7, 8, 36].

The main studied indicators have been: number of farms, number of dairy cows, farm structure by herd size (number of cows/farm), farm structure by farm size (ha), and milk yield.

2.2. Methodological aspects

The main methods and procedures to process tha data have been:

-*Fixed basis Index,* $I_{FB\%}$, whose formula is: $I_{FB\%} = (X_n/X_0)*100$ was used to evalute the growth rate of the number of cows and milk yield in Romania in the studied interval.

-*Comparison method* allowed to emphasize in what measure Romania's performance differed from the achievements registered by the other EU top seven member states which are dealing with dairy farming.

-*Trend line model* was used to reflect the general tendency in the number if dairy cows and yield.

The results shown in tabels and graphics were accompanied by their interpretation, and in conclusions there were were synthetized the main ideas resulting from this research.

3. Results and discussions

In Romania, in the analyzed interval 2010-2017, the number of dairy cows decreased by 17.27% from 1,441.4 thousand heads in 2010 to 1,192.5 thousand heads in 2017. Since 2014 it was noticed a slight growth (Fig. 1).
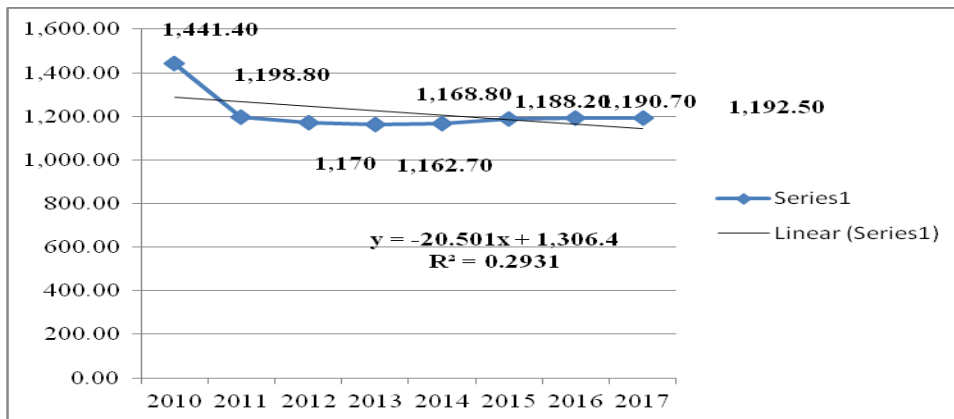

Fig. 1. Dynamics of the number of dairy cows in Romania, 2010-2017 (thousand heads)
Source: Own design based on the data from [3].

This was due to the fact that input prices increased and in consequence production cost also went up, milk collection was facing with difficulties, milk price at farm gate was enough small as milk quality does not fit the standards in all the cases, and the breeders thought that herd size has to be adapted optimizing production in relationship with resources [27, 30, 32, 33].

In 2017, for the number of dairy cows, Romania came on the 8th position in the EU after Germany, France, Poland, Italy, United Kingdom, Netherlands and Ireland.

In the same year, Romania had 604,473 dairy farms, representing 48.86% of the 1,237.12 thousand EU dairy holdings [6].

Within the farm structure, the farms with the smallest number of cows, 1-2 heads have the highest share, accounting for 83.7% in 2016 compared to 87.29% in 2010. Also, the farms raising between 3 and 5 cows are situated on the 2nd position with a share of 12.27 % in 2016 compared to 10.14% in 2010 (Table 1).

The figures confirm that it is a weak tendency to improve farm structure in dairy farming but it is a slow process, as long as the smallest farms are dominant, and the farms with over 100 cows represent just 0.07% of the number of dairy farms.

Table 1. Dairy farms structure in Romania in 2016 versus 2010 by herd size (%)

Herd size (heads)	2010	2016	2016-2010 (± Δ)
Number of dairy farms	761,528	604,473	-157,055
1-2	87.29	83.70	-3.59
3-5	10.14	12.27	+2.13
6-10	1.52	2.07	+055
11-15	0.45	0.83	+0.38
16-20	0.23	0.39	+0.16
21-30	0.17	0.27	+0.10
31-50	0.11	0.19	+0.08
51-100	0.07	0.19	+0.12
over 100	0.04	0.07	+0.03

Source: Own calculation based on the data from [7].

A Field Survey run in 2016 by NIS identified the number of dairy cows holdings, the number of cows raised by them, which allowed to calculate the average herd size by each size class of dairy cows [8] (Table 2).

Table 2. Number of agricultural exploitations with dairy cows by size classes of dairy cows in Romania in 2016

Size class (cows)	Number of agricultural units with dairy cows	Number of dairy cows	Average herd size (cows/farm)
1-2	**365,080**	**498,196**	**1.36**
3-9	**96,158**	**382,301**	**3.97**
10-19	8,448	107,570	12.73
20-19	1,607	37,024	23.03
30-49	854	31,098	36.41
50-99	409	27,417	67.03
100-499	207	40,939	197.77
500 and over	**15**	**13,341**	**889.4**
Total	**472,778**	**1,237,885**	**2.41**

Source: Own calculation based on [8].

The results showed that the average herd size by size class varied between 1.36 cows in the smallest farms and 889.4 dairy cows in the largest farms raising 500 and over cows.

Taking into account that in dairy farming it is important as the farm to have its own surface to produce forages and purchase at least as possible, the survey presented the situation of the number of agricultural holdings raising cows by class size of the utilized agricultural area (UAA) (Table 3).

At the country level, in 2016, there were 472,778 agricultural holdings with dairy cows raising 1,137,885 cows, the average herd size being 3.4 cows.

Table 3. Number of agricultural holdings with dairy cows by size classes of dairy cows and by size classes of utilized agricultural area in Romania in 2016

Size class (UAA-ha)	Number of agricultural units with dairy cows	of which: with 1-2 cows	with 3-9 cows
Below 0.1	18,505	14,858	3,102
0.1-0.3	23,639	19,669	3,641
0.3-0.5	15,658	13,610	1,960
0.5-1	44,445	40,632	3,533
1-2	92,445	81,597	10,505
2-5	**170,732**	**138,014**	**31,350**
5-10	75,137	45,569	27,221
10-20	22,858	8,977	11,277
20-30	4,231	1,075	1,983
30-50	2,504	631	906
50-100	1,693	338	487
100 and over	**1,031**	**110**	**193**
Total	**472,778**	**365,080**	**96,158**

Source: [8].

The most numerous farms, more exactly, 170,732 dairy farms have between 205 ha, and raise 327,581 cows, meaning 1.9 cows in average per farm.

Also, of the total number of agricultural holdings with dairy cows, 365,080 farms, meaning 77.22% are growing 1-2 cows, summing 498,195 heads, representing 43.78% of the number of dairy cows in Romania, the average herd size being 1.36 cows.

A number of 96,158 agricultural holdings representing 20.32% of the number of dairy farms in Romania are growing 3-9 cows, summing 382,301 cows, meaning an average herd size of 3.97 cows.

Also, 157 farms, whose share is 0.03% in the number of farms with cows are raising between 50-99 cows, totalizing 27,416 cows, meaning 174.6 cows in average per farm.

A number of 161 farms are growing between 100 and 499 cows, summing 40,939 heads, reflecting an average herd size of 254.2 cows/farm.

Only 15 farms have 500 and over cows, summing 13,341 heads, meaning 889.4 heads per farm, the highest herd size in Romania (Table 3).

The number of farms utilizing 100 ha and over accounted for 1,031 holdings, of which 110 farms have 168 cows, meaning 1.5 cows/farm. A number of 193 farms grow 1,019 cows, and their herd size is 5.3 cows in average. A number of 157 farms have 10,942 cows, meaning 69.7 cows average herd size. A number of 161 farms keep 33,221 heads, accounting for 206.3 cows in average per farm. Finally, only 15 farms have 13,341 heads, which means the highest herd size in dairy farming in Romania, that is 889.4 heads.

As mentioned above, the countries with the largest number of dairy cows in the EU-28, in the decreasing order, are Germany, France, Poland, Italy, Netherlands and Ireland, followed by Romania [36].

Studying the situation of the dairy farms structure in these member states, we noticed a huge difference regarding the distribution of the number of cows by farm size in terms of UAA (ha) and the average herd size which is far away from the figures registered in Romania (Table 4).

In Germany, about 30.3% of the dairy cows are raised in farms with 50-100 UAA (ha), having an average herd size of 62.58 dairy cows, and 50% of the number of cows are raised in the largest farms with over 100 ha, and the average herd size in this case is 151.92 heads. Therefore, in Germany the largest farms grow the highest number of dairy cows.

In France, also the largest farms with over 100 ha grow 57.34% of the dairy cows, the average herd size being 77.93 heads. On the second position, there are the farms with 50-99.9 ha, which raise 34.77% of the number of dairy cows, and the average herd size is 49.59.

In Poland, 27.725 of the cows are raised in small farms whose size varies between 10 and 19.9 ha, and the average herd size is 8.49 cows, about 18.87% of the dairy cows are grown in farms with 20-29.9 ha, and the herd size is 15.41% and 17.99 dairy cows are kept in farms with 30-39.9 ha, and the herd size is 22.63. All these farms totalize 65% of the number of dairy farms in the country.

In Italy, 16.16 % of dairy cows is grown in small farms of 10-20 ha, with a herd size of 25.54 cows, and 24.74% dairy cows are raised in the largest farms with over 100 ha, and the average herd size is 34.55 cows.

In Netherlands, 43.19% of dairy cows are grown in the farms with 50-99.9 ha, the average herd size is 124.18 cows, and 29.20% dairy cows are raised in farms with 30-49.9 ha, with an average herd size of 80.47.

Table 4. The dominant dairy farms structure in the main EU countries raising dairy cows in 2016

	Number of farms	Farm size (ha)	Number of dairy cows	Average herd size (cows/farm)	Number of cows in the country	Share of the number of cows in the farm (%)
Germany	20,420	50-100	1,278,060	62.58	4,217,700	30.30
	13,890	> 100	2,110,190	151.92		50.03
France	26,760	> 100	2,085,480	77.93	3,637,000	57.34
	25,500	50-100	1,264,780	49.59		34.77
Poland	70,050	10-19.9	595,000	8.49	2,145,800	27.72
	26,280	20-29.9	405,070	15.41		18.87
	17,060	30-49.9	386,110	22.63		17.99
Italy	11,530	10-20	294,490	25.54	1,821,700	16.16
	11,400	> 100	450,830	34.55		24.74
Netherlands	6,420	50-99.9	774,890	124.18	1,794,000	43.19
	6,510	30-49.9	523,880	80.47		29.20
Ireland	7,740	50-99.9	673,550	87.02	1,397,900	48.18
	1,930	> 100	321,720	166.69		23.01

Source: Own calculation based on the data from [36].

In Ireland, 48.18 dairy cows are raised in farms whose size varies between 50 and 99.9 ha and the herd size is 87.02 cows in average, and 23.01 cows are raised in the largest farms with over 100 ha, the average herd size is 166.69 heads (Table 4).

Milk yield in Romania increased by 16.26% in the analyzed interval, from 2,750.7 kg/cow/year in 2010 to 3,198 kg/cow in 2017. This is a positive aspect, but the growth rate is very small compared to other EU countries (Fig. 2).

Milk yield is influenced by a large range of factors, among which the most important ones are: breed production potential, forage amount and quality, reproduction activity, animal health.

Milk yield is closely connected with production cost, a higher milk performance imposes higher expenses, but cost level per kg of milk is smaller. Variable costs have to be kept under control, as their share in production cost is about 75%, the main weight being kept by feeding. Only in this way, the difference between gross product and variable costs, may assure a higher gross margin and obviously a higher income and profit per cow and at the farm level [5, 6, 14, 17, 18, 19].
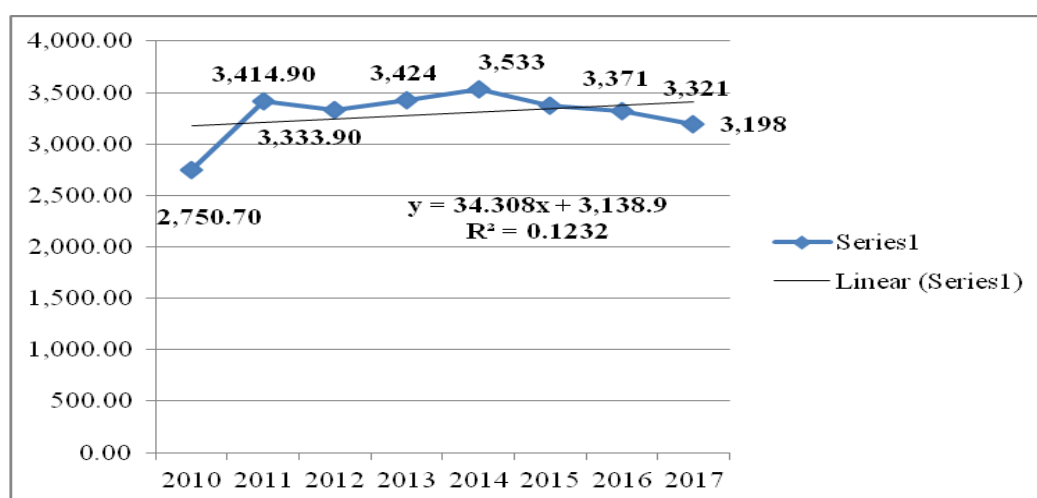
Fig. 2. Dynamics of cow mik yield in Romania, 2010-2017 (kg/cow/year)
Source: Own design based on the data from [3].

Milk yield in Romania is very small and the comparison with the records in the other countries emphasizes the gap in this respect as well. The figures show huge discrepancies regarding average herd size and milk yield between Romania and the EU average and the performances of Romania compared to the other EU countries considered in this research (Table 5).

Table 5. Number of dairy cows, number of cows per farm and milk yield in Romania compared to other EU countries in 2016

	Number of dairy cows	Average number of cows per farm	Milk yield (kg/cow/year)	Differences in milk yield Romania and the other country	
				±Δ	±Δ %
Germany	4,274,490	61.77	7,746.5	-4,425.6	-57.14
France	3,678,410	57.09	7,046.2	-3,725.3	-52.87
Poland	2,183,490	8.96	6,172.1	-2,851.2	-46.20
Italy	2,010,110	37.65	5,913.6	-2,592.7	-43.85
United Kingdom	1,897,000	143.00	7,729.0	-4,408.1	-57.04
Netherlands	1,744,830	97.47	7,984.6	-4,663.7	-58.41
Ireland	1,398,070	76.27	4,901.2	-1,580.3	-32.25
EU-28	-	32	7,280	-3,959.1	-55.39
Romania	1,137,885	2.41	3,320.9	-	-

Source: Own calculation based on the data from [3, 36].

Conclusions

(1). The analysis showed a decline in the number of dairy cows and just a slight recover since the year 2014 in Romania.

(2). Milk yield increased in Romania by 16.26% in the analyzed interval, but its level of 3,320.9 is the lowest one in the EU-28.

(3). Romania has an inappropriate farm structure, as the smallest farms of 1-2 cows are dominant, representing 83.7%, while the farms with 30-50 heads represent 0.46%, the ones with 50 dairy cows represent 0.22 %.

(4). Romania has 2.4 cows average herd size, the smallest in the EU-28. Its level varies between 1.36 cows in the farms with 1-2 cows, 67.03 cows in the farms with 50-99 dairy cows, 197.77 heads in the farms raising 100-499 cows, and 889.4 heads in the largest farms, with 500 and over dairy cows.

(5). A number of 170,732 dairy cows, that is 36.11% of the total number of dairy cows in Romania are raised by the farms having 2-5 ha utilized agricultural area.

(6). About 77.22 % of the number of cows are raised in the smallest farms with 1-2 heads and 20.33% of cows are grown in farms with 3-8 heads. This reflects that dairy farming is practiced in subsistence and semi-subsistence households, where the raising system is an extensive one, production potential of the breeds is low, feeding is not appropriate to sustain production, milk quality does not meet the standards, the obtained milk covers the family needs, and just a small amount could be sold mainly as direct delivery and not as raw milk for processing industry.

(7). The structure of dairy farms does not sustain yield performance, and this is why associative forms have to be created as breeders to strengthen their capital, assure farm inputs at lower prices, reproductive and production animals from breeds and crossbreds of high potential, a corresponding feeding, to keep under control animal health and wellness, reduce production cost, assure a high milk quality and deliver more milk to industry.

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