

## SOME CONSIDERATIONS ON THE DYNAMICS OF FRUIT AND APPLE PRODUCTION AND CONSUMPTION IN ROMANIA IN THE PERIOD 2007-2014

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### **Abstract**

*The purpose of the paper was to analyze apple contribution to fruit production and consumption in Romania. The main trends regarding the area with apple plantations, apple production, yield, consumption and price were studied, as well as Romania's position as producer and consumer of apples among the EU-28. Romania has 145.4 thousand ha covered by orchards of which 39.5% are apple tree orchards. Apple is on the top position with a share of 48 % in fruit output, which accounted for 1,115.2 thousand tons in 2014. Average apple consumption is 23.5 kg/capita, with a good self-sufficiency rate, compared to fruit consumption which is not satisfactory yet compared to other EU countries. Romania is an important fruit and mainly apple producer, coming on the 3rd position for the apple tree orchards area, on the 8th position for apple production and for the 9th position for apple consumption in the EU. An average consumption of 73.7 kg fruit/capita, meaning about 202 g of fruit/day, reflects that the Romanian population must eat more fruit according to the WHO recommendations. Due to the classic technologies applied on 64 % of the orchards plantations and only 36 % intensive plantations, apple price at the farm gate accounts for Euro 62/ton, being very high compared to other EU countries. Due to its high potential for fruit production, and especially for apple production, Romania's fruit sector must continue to growth and become more competitive under the condition as the small producers to join their efforts in associative forms allowing them to set up modern plantations, to obtain farm inputs at a lower price, to assure a modern infrastructure, to apply intensive and super-intensive growing technologies, to conclude commercial contracts with the beneficiaries and sell better their fruits, increasing the economic efficiency across the whole fruit chain. In this way, domestic production is encouraged and fruit imports can be diminished, better satisfying consumers' preference for Romanian fruits.*

**Key words:** apple, cultivated area, production, consumption, price, Romania

### **INTRODUCTION**

Fruit are very important for human diet because of their content in vitamins, minerals, antioxidants, carbohydrates, and acids, which help the organism to have a normal metabolism, to be healthy and protected against cancer, diabetes, heart diseases and cholesterol growth. [4].

Fruit and vegetables are recommended to be consumed daily in the amount of more than 400 g, divided into 5 portions of 80 g every day, of which 3 portions vegetables (240 g) and 2 portions fruit (160 g). [17, 19, 22, 26, 27]

Other authors recommend even more fruit and vegetables a day, 500-800 g. [7].

In Europe, fruit and vegetables consumption varies from a country to another. For instance,

in Denmark, it is recommended more than 600 g a day [36].

In Europe, average fruit and vegetable consumption accounts for 386 g per day, of which main fruit intake is 166 g/day. However, fruit intake varies from a region to another, being higher in the Central and Eastern European countries, followed by the Southern countries [13].

Only Poland, Germany, Italy and Austria respect the WHO (World Health Organization) recommendation to consume more than 400 g fruit and vegetables a day. In more than 50 % European countries, fruit and vegetable consumption is lower than 400 g/day and in 33 % countries the intake is smaller than 300 g/day [35].

The dietary habits are determined by a large range of factors such as: income, educational

background [11], fruit and vegetable market price, awareness of healthy eating habits, gender (women eat more fruit and vegetables than men), age (the adults and old people consume more fruit and vegetables than the young people) [5, 16, 31], family factors, social factors [20], preferences, beliefs [29].

Apples are among the most common fruit consumed in the world besides bananas and oranges. The apple tree has its origins in the Caspian and the Black Sea region, proving that man consumed apples for more than 750,000 years [18].

From a botanical point of view, *Malus Domestica Borkh*, the cultivated apple tree, belongs to Rosaceae family, Pomoideae subfamily. Apple tree is suitable to be grown in various regions, in the hilly and also in the plain areas, on various soils and climate conditions, and in various range of technologies. It is very important for producing high nutritive and therapeutic value fruit [28].

The rich content in vitamins, minerals, and acids of the raw apple make it indispensable for a healthy body. The English saying "An apple a day keeps the doctor away" underlines its perennial importance since 1860s and later in 1922 when this proverb was launched [12, 34].

An apple 182 g weight (skin included) supplies 95 kcal, 19 g carbohydrates, 4 g dietary fiber and 195 mg Potassium [32].

The apple it is also rich in phenolics and flavonoids having an antioxidant effect on human body, protecting it against cancer [23, 33].

Apple trees are largely spread in the world, the North hemisphere supplying about 90 % of the world apple production. By continent, Asia comes on the 1st position (45%), being followed by Europe (23%) and North America (10%). China is the largest apple producer in the world.

Romania is among the top producers of apples in the EU both concerning the cultivated surface with apple orchards and apple production. The most important apple producers in the EU are France, Italy, Germany, Spain, Poland, Hungary and Romania.

About 3,500 domestic and also foreign cultivars are used in Romania to assure apple production in the market. Golden Delicious, Jonathan, Starkrimson, Jonagold, Idared, Prima, Florina, Romus 1, 2, 3, Generos, Pionier, Voinea, Frumos de Voinești, Rădășeni, Fălticeni, Roșu de Cluj etc are among the most important apple varieties cultivated in Romania.

About 77 % of apples are used as fresh fruit and 23 % are processed in natural juice, nectar, syrup, gem, marmalade, canned fruit, candies, ice cream, frozen fruit, dried fruit etc. [9, 25].

Apple quality depends on cultivars and it is perceived in a different way by consumers. Apple quality is given by a large variety of characteristics such as: size, shape, colour, skin, flavour, taste, juiciness, firmness etc, features which can be easily identified by consumers, and also quality depends on the growing applied technologies [1, 6, 30].

A recent study regarding consumer perception and preferences related to apple quality in close relationship to variety revealed that some Romanian consumers prefer to eat Braeburn, Golden Delicious and Jonagold apples, while other consumers does not like Granny Smith variety of apple. This is an alarm sign for the Romanian market which is invaded by imported apples. As long as the local apples are more tasty, flavoured and juicy, the demand/offer ration must be balanced in favour of the Romanian varieties well adapted to the local conditions. Also, it was not found any statistical correlation between apple quality and apple price, as a consequence of the average low income per household, a reason to buy apples or any other food to assure the lowest cost per the "daily food basket" [10].

Another research analyzed apple consumption habits in seven European countries on a sample of 4,271 respondents and found that there are important differences regarding apple intake in close relationship to consumer nationality. Poland was found with the highest apple consumption, as 55 % interviewed persons affirmed that they consume more than five apples a week. In the Italy, 39.3 % respondents consumed 3-5 apples a week,

while the respondents from Netherlands and Spain recorded the lowest apple consumption. Concerning age, it was confirmed that the respondents older than 61 years prefer to eat more apples than the young ones [21]. In this context, the paper purpose was to analyze apple contribution to fruit production and consumption in Romania. In this purpose, there were identified the main trends of the cultivated surface with apple orchards, apple production and consumption, apple price. Also, it was studied Romania's position as producer and consumer of apples among the EU-28.

## MATERIALS AND METHODS

The research was based on a large range of information sources, mainly the database provided on line by National Institute of Statistics, text books, scientific articles published in Romanian and international journals, press articles etc.

The analysis of the following indicators characterizing the fruit production, and especially apple production in Romania: orchards area, apple tree plantations area, fruit production, apple production, fruit and apple consumption, apple producer and consumer price.

These indicators were studied in their dynamics for the period 2007-2014, the data being collected from National Institute of Statistics Tempo-on-line data base.

The main methods used in this study were the following ones: index method, and also comparison method for reflecting the differences between the indicators level in Romania and other countries.

The results were tabled and graphically illustrated and interpreted.

## RESULTS AND DISCUSSIONS

**The dynamics of orchards area.** The fruit tree plantations cover an important area of Romania representing about 1.4 % of the total agricultural land surface. The orchards area declined by about 30 % from 206 thousand ha in 2007 to 145.4 thousand ha in the year 2014. Therefore, in 7 years, many orchards

have been destroyed, either because they were too old (over 30 years) and inefficient from an economic point of view due to the old technologies, determining a low fruit production and quality, or they could not be replaced by new modern plantations which have high costs. (Fig.1).

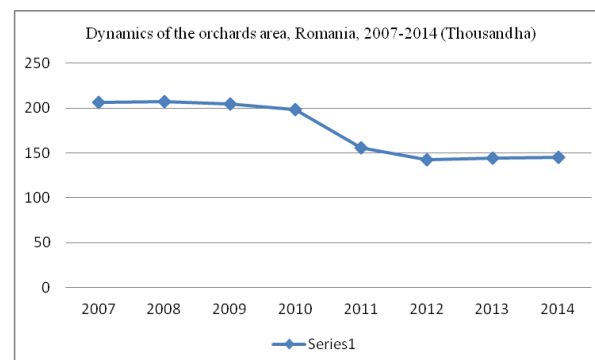


Fig.1. Romania's orchards area in the period 2007-2014 (Thousand ha)

Source: Own design based on NIS Tempo-online database 2015

Romania has the following age structure of the fruit trees plantations: 55% plantations older than 25 years, 25 % plantations between 15-24 years old, 13 % plantations between 5-14 years and just 7 % plantations are younger than 5 years.

Also, the density of plantations is not satisfactory. This is because about 64 % of the total number of fruit tree plantations are traditional plantations, 36 % are intensive plantations and zero % are super-intensive plantations. This situation does not make Romania a competitive country compared to other EU countries. This general situation also characterizes apple orchards [2, 3].

**The apple orchards** registered a similar descending trend. However, the decline was only 6.2 % from 61.3 thousand ha in 2007 to 57.5 thousand ha in the year 2014.(Fig.2.).

The share of apple orchards in the total area covered by fruit tree plantations increased from 29.7 % in the year 2007 to 39.5 % in the year 2014. This was the consequence of the fact that other fruit tree species were more affected by the reduction of surface and the second reason is that apples give the most important contribution to fruit production.(Fig.3.).

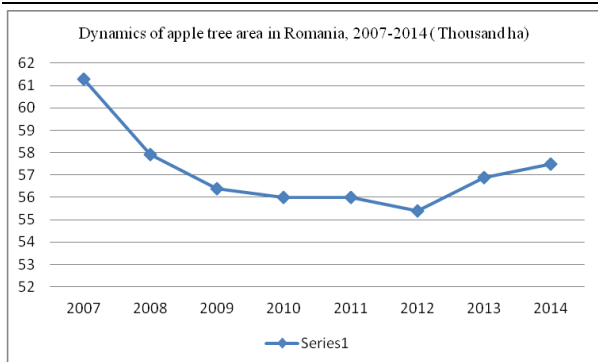


Fig.2. The evolution of Romania's apple tree orchards area in the period 2007-2014 ( thousand ha)

Source: Own design based on NIS Tempo-online database 2015



Photo 1. Apples in apple trees plantation.

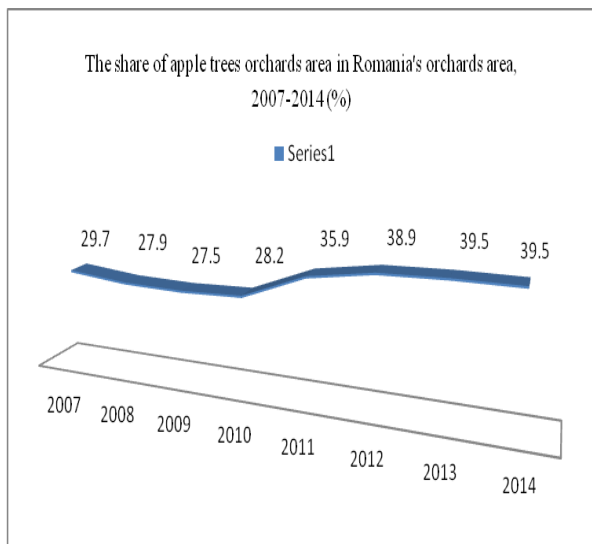


Fig. 3. The share of apple trees orchards area in Romania's orchards area, 2007-2014 (%)

Source: Own design based on NIS Tempo-online database 2015

The most orchards belong to individual householders and in general have a small size. About 49 % of apple orchards have less than 5 ha utilized agricultural area (UAA).

Regarding the surface with apple plantations, Romania comes on the 3rd position in the EU-

28, according to [14]. Romania has 51,226 ha apple orchards, representing 3.97 % of the EU-28 apple orchards area, accounting for 449,629 ha.

Apple tree is the most important fruit tree in the EU-28 as its share in the orchards area accounted for 35 % in the EU-28 orchards surface in 2013.

The major countries with large surfaces of apple orchards are: Poland (143,113 ha), Italy (52,251 ha), Romania (51,226 ha), France (36,741 ha), Germany (31,739 ha), Spain (26,753 ha) and Hungary (25,265 ha). Due to the EU enlargement, in the period 2002-2012, the apple orchards area has become more than double.

The apple tree plantations in the EU have 449,629 ha, representing 34.86 % of the total area of all the plantations of fruit trees in the EU in 2013, when it accounted for 1,289,693 ha.

Among the most important apple varieties cultivated in the EU, there are: "Golden Delicious", with a share of 17.6% in the apple orchards area, "Idared" with 10.3 % and "Jonagold/Jonagored" with 9.3 % [16].

**The fruit production.** In Romania, the production of fruit increased by 2.7 % in the analyzed period, from 1,085.8 thousand tons in 2007 to 1,115.2 thousand tons in 2014(Fig.4.)

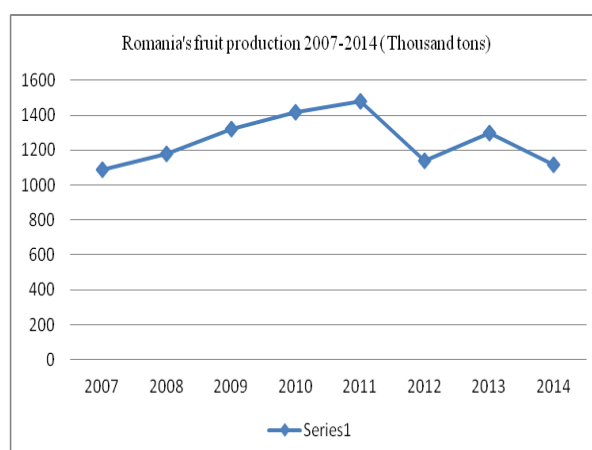


Fig. 4. The evolution of Romania's fruit production in the period 2007-2014 ( thousand tons)

Source: Own design based on NIS Tempo-online database 2015



Photo 2. Fruit production

The apple production increased faster by 12.6 %, from 475.4 thousand tons in 2007 to 535.1 thousand tons in 2014. In this way, apple keeps the 1st position among the fruits produced in Romania. (Fig.5.)

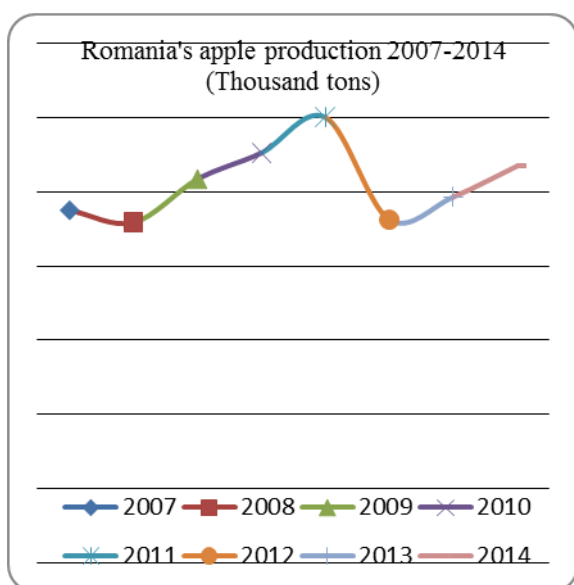


Fig. 5. The evolution of Romania's apple production in the period 2007-2014 ( thousand tons)  
 Source: Own design based on NIS Tempo-online database 2015

In Romania, 92 % of fruit production and 85 % of apple production is supplied by the individual households. About 80 % of fruit production is represented by apples and plums [2, 3].

In 2014, the EU-28 produced 14,304 thousand tones apples. The main producing countries are Poland, Italy and France. With 503 thousand tons apples in 2014, Romania comes on the 8th position as an apple producer in the EU, after Poland (3,195 thousand tons, 22.3 %), Italy (2,454 thousand tons, 17.1 %), France ( 1,892 thousand tons, 13.2 %), Greece (1,533 thousand tons, 10.7 %), Germany

(1,116 thousand tons, 7.8 %), Hungary ( 779 thousand tons, 5.4%), and Spain (621 thousand tons, 4.3 %) [8, 15].

Apple yield registered an important growth of 20 % in the analyzed period. In 2014, apple yield accounted for 9,306 kg/ha compared to 7,755 kg/ha in 2007. In the year 2012, the severe drought affected apple yield, which decreased to 8,355 kg/ha, being by 22.14% lower compared to the amount of 10,730 kg/ha, the maximum yield achieved in 2011. Of course, apple yield had a strong influence on apple production, which in the year 2012 accounted for 462.9 tons.



Photo 3. Apple production.

The evolution of apple yield reflects a continuous increasing trend from 2007 to 2010 and then, after the decline in 2012, a recover, so that in 2014, apple yield became 9,306 kg/ha, being by 7.3 5 higher than in 2012.(Fig.6.).

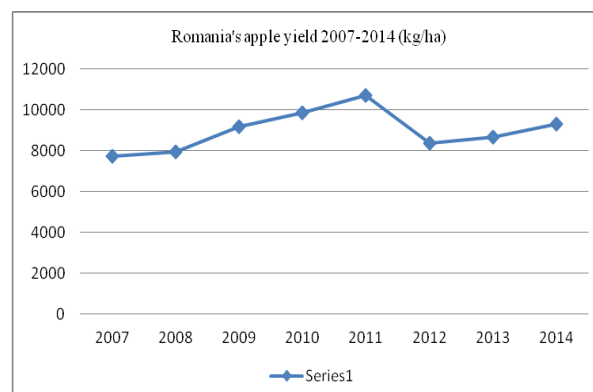


Fig. 6. The evolution of Romania's apple yield in the period 2007-2014 ( kg/ha)  
 Source: Own design based on NIS Tempo-online database 2015



According to Eurostat, apple yield is smaller in Romania, only 9.8 tons/ha, coming on the 8th position in the EU-28, among other EU countries such as: Greece 176.1 tons/ha, France 51.5 tons/ha, Italy 46.9 tons/ha, Germany 35.2 tons/ha, Hungary 30.8 tons/ha, Spain 23.2 tons/ha, Poland 22.3 tons/ha [15].

**The fruit consumption/inhabitant.** In Romania, fruit consumption increased due to the more intense recommendations as population to consume more fruit and vegetables. In 2013, fruit consumption was 73.7 kg/capita by 5.4 % higher than in 2007, when it recorded 69.9 kg.

**Apple consumption/inhabitant** registered a slight decline, in 2013, being 23.6 kg/capita compared to 23.6 kg in 2007. The share of apples in fruit consumption decreased by 5.3 % from 33.8 % in 2007 to 31.9 % in 2013(Fig.7.).

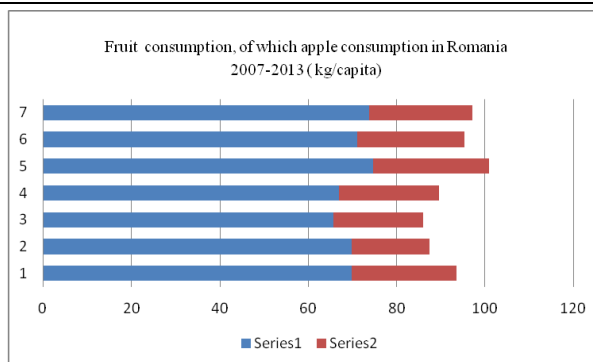


Fig. 7. Fruit consumption, of which apple consumption in Romania, 2007-2013 ( kg/capita)

Source: Own design based on NIS Tempo-online database 2015

Regarding apple consumption/inhabitant, Romania comes on the 16th position in the world, with 23.5 kg/capita and on the 9th position in the EU, after Austria (53 kg), Slovenia (36 kg), Netherlands (34), Hungary (31 kg), United Kingdom (27 kg), Luxembourg (26 kg), Croatia (25 kg), and Portugal (24 kg).(Table 1).

Table 1. Apple consumption per inhabitant in the top 16 countries in the world in 2015 ( kg/capita)

	Country	Apple consumption		Country	Apple consumption		Country	Apple consumption
1	Austria	53	7	Iceland	33	13	Luxembourg	26
2	Montenegro	43	8	Hungary	31	14	Croatia	25
3	Switzerland	38	9	Kazakhstan	31	15	Portugal	24
4	Slovenia	36	10	Turkey	29	16	Romania	23
5	Netherlands	34	11	Australia	28			
6	Norway	34	12	United Kingdom	27			

Source: <http://www.statsmonkey.com/bar/20935-list-of-countries-by-apple-consumption-per-capita.php> [37]

**Fruit production/inhabitant** increased by 8.7 % from 51.4 kg/capita in 2007 to 55.9 kg/capita in 2014. It was the result of the production growth and also of the decline in Romania's population. (Table 2)

**Apple production/inhabitant** registered an increase by 19.6 % from 22.4 kg/capita in 2007 to 26.8 kg/capita in 2014.

As a consequence, the share of apple production/inhabitant in the fruit production/capita increased by 10.1 % from 43.5 % in 2007 to 47.9 % in 2014. (Table 2).

Table 2. Fruit production/inhabitant and apple production/inhabitant, Romania, 2007-2014 (kg/capita)

	2007	2008	2009	2010	2011	2012	2013	2014	2014/2007 %
Fruit prod./Capita	51.4	57.1	64.7	69.9	73.2	56.6	64.9	55.9	108.7
Apple prod./Capita	22.4	22.2	25.3	27.2	29.7	23.0	24.6	26.8	119.6
Share (%)	43.5	38.9	39.1	38.9	40.6	40.6	37.9	47.9	110.1

Source: Own calculation based on National Institute of Statistics, Tempo On-line Database, 2014, [24]

**The differences between fruit and apple consumption and fruit and apple**

**production/capita** are explained as follows: (i) when the difference between consumption

and production is a positive one, this means that consumption is covered both by domestic production and also by imports: (ii) when the difference between consumption and

production is a negative one this means overproduction and the surplus could be exported (Table 3).

Table 3. Differences between fruit and apple consumption and fruit and apple production per inhabitant (kg/capita)

	2007	2008	2009	2010	2011	2012	2013	2013/2007 %
Fruit differences	+18.5	+12.7	+1.0	-2.9	+1.5	+14.5	+8.8	47.5
Apple differences	+1.2	-4.5	-5.0	-4.7	-3.5	+1.3	-1.1	90.9

Source: Own calculations.

Fruit consumption is difficult to be established. However, usually researches involves questionnaire based surveys on consumer panels to indentify consumer preferences and eating habits regarding fruit and apples.

In 2013, such a study concluded that about 95 % of the Romanian consumers prefer to consume fresh fruit at least one time a week, 43.4 % respondents prefer to consume fruit every day, 40.9 % individuals prefer to consume 2-3 times a week and 11 % prefer to consume fruit one time a week.

In Romania, the most consumed fruit are apples (88.9%), followed by bananas (85.1%), oranges (73.5 %), lemons (63.6 %), kiwi (43.1 %), grapefruit (37.4 %).

Regarding the place where the fruit are purchased, the interviewees responded as follows: 94.9 % respondents used to buy fruit and 22 % used to receive fruit from their relatives and friends from the countryside. Of the consumers who used to purchase fruit, 81.3 % prefer to buy them from a supermarket, 64.8 % prefer to buy them directly from the market where producers sell their fresh products, and 40.1 % prefer to buy fruits from specialized fruit shops.

**Self-sufficiency rate in fruit sector** values below 100 %, reflecting that internal production is not able to meet consumers' demand. In case of apple, self-sufficiency has higher rates reflecting a better situation.(Table 4).

Table 4. Self-sufficiency rate (SSR) in fruit sector in Romania, 2007-2013 (%)

	2007	2008	2009	2010	2011	2012	2013	2013/2007 %
Fruit SSR	77	77	83	81	81	75	79	102.5
Apple SSR	103	108	105	103	100	84	95	92.2

Source: [2]

**Average consumer's apple price.** The average consumer's apple price increased by 23.3 % from Lei 2.23 per kilogram in the year 2007 to Lei 2.75 in the year 2014. The price level was influenced by demand/offer ratio in the market.

In the years 2012 and 2014, the average

consumer's apple price in Romania was lower than in other EU countries such as: Germany, Italy, Spain and Czech Republic.

Also, it was equal to the average apple consumer's price in Bulgaria and higher compared to the average apple price in Poland (Table 5).

Table 5. Average consumer's price for apples in Romania compared to other EU countries, in 2012 and 2014 (Euro/kg)

Year	Romania	Bulgaria	Poland	Germany	Italy	Spain	Czech Rep.
2012	0.9	0.9	0.8	1.8	1.7	1.7	1.3
2014	0.8	0.8	0.6	2.0	1.9	1.8	1.2

Source: [2]

**Average producer's apple price** is higher in comparison with producer's price in other EU member states. In 2014, average producer's

price for apples accounted for Euro 62/100 kg, being 4.7 times higher than in Poland, 2.5 times higher than in Hungary, 1.67 times

higher than in Italy, 1.44 times higher than in Spain, 1.36 times higher than in Germany. The producer price is higher in Romania because of the high price for farm inputs, the old technologies, the low fruit quality and the lack of organization on the fruit chain (Table 6).

Table 6. Average producer's price for apples in Romania compared to other EU countries, in 2005, 2010 and 2014 (Euro/kg)

Country	2005	2010	2014	2014 %
Romania	48	51	62	100.0
Poland	12	18	13	476.9
Hungary	16	28	24	258.3
Italy	32	40	37	167.5
Spain	28	35	43	144.1
Germany	32	40	45	137.8

Source: [2]

### Descriptive statistics for the main studied

Table 7. Descriptive statistics for the main indicators characterizing fruit and apple sector in Romania in the period 2007-2014

Descriptive Statistics	Orchards area (Thou ha)	Apple tree area (Thou ha)	Fruit production (Thou tons)	Apple production (Thou tons)	Fruit consumption (kg/capita)	Apple consumption (kg/capita)
Mean	175.47	51.17	1,255.15	512.13	70.27	22.58
Standard deviation	31.00	1.86	147.26	49.39	3.26	2.79
Median	177.10	56.65	1,239.6	505.45	69.9	23.5
Kurtosis	-2.64	3.79	-1.45	-0.22	-0.99	0.52
Skewness	-0.03	1.81	0.39	0.71	-0.01	-0.079
Minimum	142.2	55.4	1,085.8	459	65.7	17.7
Maximum	207	61.3	1,479.9	600.9	74.7	26.2
Variation Coeff. (%)	17.66	3.63	11.73	9.64	4.63	12.3

Source: Own calculation.

**Fruit chain organization.** In Romania, the degree of organization in fruit sector either in fruit producers groups or producers organizations is very small, about 1 %, compared to other EU countries like Netherlands and Italy where the fruit chain is very well organized. This is because of an inadequate percentage ratio between the value of commercialized production and the value of gross production in the fruit sector. The main features of the fruit chain are the following ones: the large number of fruit producers, the small size of plantations, the old age of plantations, the lack of modern super-intensive technologies, the lack of modern endowment regarding: irrigation

indicators is presented in Table 11.

The variation coefficients for orchards area, apple tree area, fruit production, apple production, fruit consumption and apple consumption are small, ranging between 4.63 % in case of fruit consumption and 17.66 % in case of orchards area.

This reflect that the data series for each indicators were homogenous and the average was a representative one.

However, in case of orchards area, the coefficient of variation of 17.66 % is closer to the threshold 20 % between a homogenous indicator and a relatively homogenous one.

systems, logistics, climate-controlled warehouses, utilities etc, a reduced number of partnerships and commercial contracts with the beneficiaries and the reduced number of associative forms [2, 3].

### CONCLUSIONS

In the analyzed period, the orchards area registered a decline because of the plantations aging, the application in the most of cases of the classic technologies lacked of productivity, a low economic efficiency. Just a small surface is represented by new modern orchards.

However, fruit production has grown due to



the increased performance in fruit yield, conditioned by the large range of fruit trees varieties.

Apple plantations represent 39.5 % of the orchards area and contribute by 48 % to the fruit output. Romania comes on the 3rd position regarding the apple tree orchards and on the 8th position in the EU-28 for apple production.

Fruit consumption increased in Romania due to the orientation of the population to a healthier diet based much more on fruit and vegetables. With 23.5 kg/capita apple consumption, Romania is situated on the 9th position in the EU-28 and on the 16th position in the world.

However, the domestic production is not enough to cover consumers' needs, as reflected by the self-sufficiency rate and for this reason fruit imports were required. But apple self-sufficiency rate is satisfactory excepting the years when internal production is affected by climate conditions.

In Romania, both apple producer price (Euro 62/ton) and apple consumer price (Euro 80/ton) are very high compared to other EU countries in 2014.

The study identified that the main directions to develop fruit sector in Romania, a country with a high fruit production potential, are the following ones: the organization of small producers into associative forms allowing them to set up modern plantations, to get cheaper farm inputs, to assure a modern infrastructure, to apply intensive and super-intensive growing technologies, to conclude firm contracts with retailers and whole sellers, and sell better their fruit, increasing the economic efficiency across the whole fruit chain.

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