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SOYBEAN PRODUCTION TRENDS IN THE WORLD, EUROPEAN UNION AND ROMANIA

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Abstract

The study aimed to investigate the trends in soybean crop cultivated area, yields and production at the global level and in the EU (2015-2023) and Romania (2007-2023) using the data from USDA, European Commission, National Institute of Statistics. The processing was based on growth rate, trend line regressions, R square, food balance, self sufficiency rate (SSR), comparisons etc. Soybean is an important protein-based and energy crop, called to produce healthier foods and animal meals, to sustain renewable energy production, to reduce pollution by capturing Nitrogen, diminishing the amounts of fertilizers, protecting environment and conserving biodiversity. In *2023, at the global level, 139.74 Million ha were cultivated with soya, production reached 419.5 Million tons seeds, (+32% vs. 2015), and yield attained 2.82 tons/ha (+0.06 vs. 2022).This was due to high consumption of 406.1 Million (+27.3% vs. 2015). Brazil, USA, Argentina and Paraguay produce 91.7% of the global soy seed output. In 2023, the EU-27 cultivated 11.94 Million ha with oilseeds crops, of which: rape 52.2%, sunflower 39.2% and soybean 0.98 Million ha (8.2%). For the next year, the forecast is +0.1 Million ha for soybean, +0.21 Million ha for sunflower and a decline by -0.46 Million ha for rape. In 2023, the EU produced 32.55 Million tons oil seeds of which soybean (9.2%), sunflower (30.1%) and 60.7% rape. Soybean SSR was 17.59% vs. SSR 63.91% for rape + sunflower + soybean, 84.98% for rape+ sunflower. Italy, France, Romania, Croatia and Austria contributes by 83% to the EU output. Romania accounts for 14% in the EU soya market. In 2023, 141.7 thousand ha were cultivated with soya (+ 6.38% vs. 2007). Production reached 303.2 thousand (2.2 times higher vs. 2007). The top output was 465.6 thousand tons in 2018, and yield raised to 2,140 kg/ha (2.09 times vs. 2007). As a conclusion, soybean is called to have a greater role in human food, animal meals, energy production, environment protection and biodiversity preservation. This means an extend in cultivated area, higher yield and production globally. However, the EU will continue not to cultivate GM soybean, but to import for covering the market requirement.*

Key words**:** *soybean, importance, cultivated area, production, yield, trends, world, EU, Romania*

INTRODUCTION

Soybean (*Glycine max* (L) Merrill) is a wonderful plant among the oil seeds crops cultivated in the world, grace to its large range of utilizations for assuring livestock feed, for producing various foods and other commodities, a reason to be nick-named "the plant useful to carry out more than 1,000 products" [21].

In the year 2021, at the global level, after maize, rice and wheat whose production was 1,200, 600, 595 million tons, soybean came on the 4th position with 372 million tons [12].

Compared to the global situation of soybean one decade before, nowadays, both the cultivated area and obtained production are higher [24].

In 2023/2024, it is cultivated on over 137.10 million ha worldwide, the largest surfaces being in Brazil, 45.8 million ha, from which 153 million tons seeds have been harvested, meaning an yield of 3.3 ton/ha [43].

On the 2nd position comes USA, where soybean is grown on 33.3 million ha, obtaining 113.27 million tons seeds and, respectively, 3.4 tons/ha [44].

In the EU, soybean is grown on 1.1 million ha and the harvest accounted for 2.98 million tons,

by about 30% more than in 2022/2023 as the climate was favorable in 2023-2024 [45]. In the year 2023, soybean was situated on the 6th position after wheat, maize, barley, rapeseeds and sunflowers seeds [30, 45].

The EU countries growing soya are France, Italy, Serbia, Romania and Austria. Netherlands, Germany, France, Poland, Belgium, Denmark, and Ireland do not produce too much soybean output.

In Europe, soybean production was 11.5 million tons, and taking into consideration the EU needs of 30-35 tons, this means that the offer from own output could cover about 30% of demand. This is a good sign to diminish imports from overseas countries [23].

Romania cultivates soybean on an important surface, but its yield is not so high mainly in the last decade when climate change had a negative impact. Soybean has a smaller share in the cultivated surface and production of oil seeds crop after sunflower and rape [25, 27, 28, 36]. However, the general trend in the last decades reflects and increased surface and production, showing a higher interest in the cultivation of this crop.

Grace to its high protein and fat content, it is expected that soybean to contribute to the diversification of plant-based foods and sources of renewable energy, but taking into consideration the large variety of climates, farmers must select and cultivate the varieties which are suitable to the growing season [9].

As long as the global population is continuously raising and food requirements are higher and higher, soybean is consider a potential source of protein which could diversify protein production destined to nourish both the livestock and the humans, and this means a new challenge and opportunity for farmers [19, 40].

Nutritional and energetic value

The chemical composition reflects that the dried soybean seeds have: 36% protein and 20% oil, 30% carbohydrates, 9 % water and 5% ash and 100 g has an energetic value of 446 kcal and 1,870 kJ. Soybean is also rich in micro-elements such as: Calcium 277 mg, Iron 15.7 mg, Magnesium 280 mg, Potassium 704 mg, Sodium 2 mg, Zinc 4.89 mg, Copper 1.66 mg, Manganese 2.52 mg and Selenium 17.8 μg [41, 16, 38].

A part of the soya foods are healthy because of the high quality protein and fat which contains important fatty acids [15].

Because of the soybean chemical composition, soybean has become the standard to which other vegetable food ingredients are compared [21].

The digestibility corrected amino acid score of soy protein is equivalent to that of meat, eggs and casein as mentioned by [33].

Agronomical and environmental advantages

Soybean growth is influenced by genetics, soil quality and climate conditions. Its roots depths could vary between 75 and 150 cm, an advantage which make the plant to be resistant to drought.

Due to the presence of symbiotic bacteria from the Rhizobia group, soybean can fix atmospheric nitrogen like other legumes [8].

In this way, its cultivation contributes to the fight against soil, water and air pollution, preserving environment quality. More than this, farmers are advantaged using less quantities of fertilizers and diminishing production costs per surface unit.

In addition, soybean could also contribute to lower gas emissions in the green houses as it releases 24.5 times lower gas than beef. Also, its Carbon footprint accounts for 6.44 kg CO_2e per kg [21, 7].

Soybeans have also a high impact on the preservation of biodiversity and conservation of agro-ecosystems [18].

Economical advantages

Soybean production is much higher than the output of all pulses.

Grace to the results in the scientific research, modern soybean varieties have a shorter growing period from sowing to harvesting, which advantage the farmers [49].

Soybean produces the highest protein production per surface unit, and that is why many researchers consider that it could become the most important crop in assuring protein production to nourish the mankind and animals [47, 48].

Soybean is useful in crop rotation because it fixes Nitrogen and sustains yield of other crops [1].

The extend of soybean cultivation and higher yields could reduce production costs compared to other crops and increase farmers' income and profit [39].

A higher production could stimulate exports, enhancing the trade and improving the payment balances in the producing and exporting countries [40, 17].

Social advantages

The implementation of modern technologies for cultivating soybean could help the farmers to get a good income and high profit and this will assure the well-being of their families.

Increasing soybean production could led to a higher protein and energy production which will be available for nourishing the globe population and fighting against hunger.

The large range of uses could contribute to the diversification of food production and improvement of the human diet [13].

Soybean uses

Approximately 85% of the world's soybean crop is processed into soybean meal destined to complete animal feed and soybean oil, the remainder processed in other ways or eaten whole.

Full-fat soybean is successfully used as an ingredient in poultry rations [29] and also it may be included in the diets for pigs to increase the energy density.

During the industrial processing, a large variety of byproducts could be introduced in the soybean meal to optimize diet for pigs and poultry [14].

For ruminant livestock, soybean meal is defatted containing hulls, which are readily digestible and could be used as an ingredient in ration [2].

Soybeans has multiple uses in food industry, where there are produced: soy flour, tofu, soymilk, soy-based yogurt, meat analogs, soy nuts, miso, tempeh, nato, souces, edamame, curls, chocolate, bread, biscuits and other bakery products, okara, soybean oil, soy concentrates, etc.

Soybean oil is used in various ways, but usually it is utilized for frying or sautéing a variety of

dishes or is used as such, being a support for heart, bones and skin health.

By industrial processing, soybean is a raw material for producing "biodiesel for any diesel engine and also for hydraulic oil, grease, solvent, ink, plastics and other products" [37].

Health advantages

Because of its high quality protein and fat compared to animal protein from meat, dairy products and eggs, soybean could have a larger application in producing healthier food of a great variety of diets both in traditional and modern cuisine. This will be in accordance with the modern consumers' preferences which more oriented to healthier diets including plant-based protein and hybrid diets with a lower share or missing animal protein.

Therefore, soybean could be utilized as an ingredient in diverse recipes of meals and cuisines, based on soy protein like: soybean meat and dairy food alternatives.

Soybean ingredients could satisfy both the ill people who needs healthy diets without animal protein and fats, and also modern consumers who belong to various categories of diet preferences like: vegetarians, who do not consume meat and fish, flexitarians, who consume less than 50g/day (less than 350g/week) meat and meat products, omnivorous who consume more meat and meat products ≥ 170 g/day (more than 1,190 g/week), and vegans who do not consume foods of animal origin [6].

In this way, the development of a new vision in human nutrition and gastronomy based on plant diets including soybean ingredient could contribute to a lower environmental footprint.

The consumption of soybean foods could prevent heart diseases and cancer, diminish depression and kidneys and skin problems.

Therefore, soybean is a plant which have future as a source of high protein and energy, with multiple uses, under the condition of implementing modern environmentally friendly technologies and meeting the SDGs (Sustainable Development Goals) as established by FAO [16].

Soybean disadvantages

The consumption of foods having GM soybean ingredients could led to allergies and cancer compared to non GM plants whose products are healthy.

The GM soybean is mainly used for producing tofu, soy flour, chocolate, biscuits, potato chips, dairy products, margarine, mayonnaise, sauces. The most sensitive people to soybean protein are babies and children [5].

However, the EU has recently authorized the use of GM soybean intended to be used for human and animal consumption, under the condition *"not to be cultivated in the EU and to be used only for food and feed, and to follow a complete and rigorous procedure, which guarantees a high level of protection of human and animal health, as well as for the environment"* [35].

The import constrains for GM soybean has led to a disturbance in soy feed market and also had a negative effect of price evolution [4].

The cultivated area is projected to raise as demand for GM-free soybean in the market is higher due to the human consumption requirements. In consequence, soybean out will grow to better cover the needs and diminish imports [34]. In this context, the goal of this study is to analyze the dynamics of cultivated area, production, yield at the global level, pointing out the updated performance in the main producing countries, also at the EU level and in Romania, and finally to identify the main trends.

MATERIALS AND METHODS

To perform this research work, a large range of published articles have been studied and also the statistical data were collected from various official information sources like USDA, FAOSTAT, European Commission, and National Institute of Statistics. For processing the data, there were used different procedures and methods including: dynamic analysis on various periods depending on the data availability, the growth rate in the analyzed interval for soybean cultivated area, yield and production, market share of various countries in total soybean seeds production, making comparisons, regression equations for reflecting the trend line, R square for showing the determinants of the changes across the time, food balance, self sufficiency rate where it was the case to show the capacity for meeting the market needs from internal production and from import.

Graphical representations were utilized for a better understanding of the evolution of the indicators and tables synthesized the data and results, being accompanied by corresponding comments.

RESULTS AND DISCUSSIONS

Soybean - World cultivated area, yield and production

In 2022/2023, soybean was cultivated on 137.10 million ha, from which there were produced 378.7 million metric tons seeds, reflecting an average yield of 2.76 Metric tons/ha. The estimates for 2023/2024 and 2024/2025 are presented in Table 1.

Table 1. Soybean cultivated area, yield and production in the world

	MU	2022/2023	Prel. 2023/2024	Proj. 2024/2025 In October
Cultivated area	Million ha	137.10	139.74	145.81
Yield	Metric tons/ha	2.76	2.82	2.94
Production	Million Metric tons	378.7	394.7	428.92

Source: [42].

The global soybean seeds output has recorded an ascending tendency from 317.8 Million tons in 2015 to 419.5 Million tons in 2024, an estimated level which reflects a growth by 32% in the last decade. The regression equation reflects that in the year 2025, soybean seeds output is expected to be 427.1 Million tons. The value of R square = 0.906 shows that soybean production has definitely grown almost year by year (Fig. 1).

This trend was sustained by the increased consumption which is estimated to reach 406.1 Million tons in 2024, by 27.3% higher than 319 Million tons in 2015. The requirements of soybean seeds have increased year by year taking into consideration its multiple uses both for animal feed and also for human foods. The

regression equation reflects that in the year 2025, it is expected as soybean seeds consumption to reach 414.3 Million tons. The R square = 0.764 tells us that only 76.4% of the variation in consumption depended on time, and that the difference of 23.6% was influenced by other factors (Fig. 1).

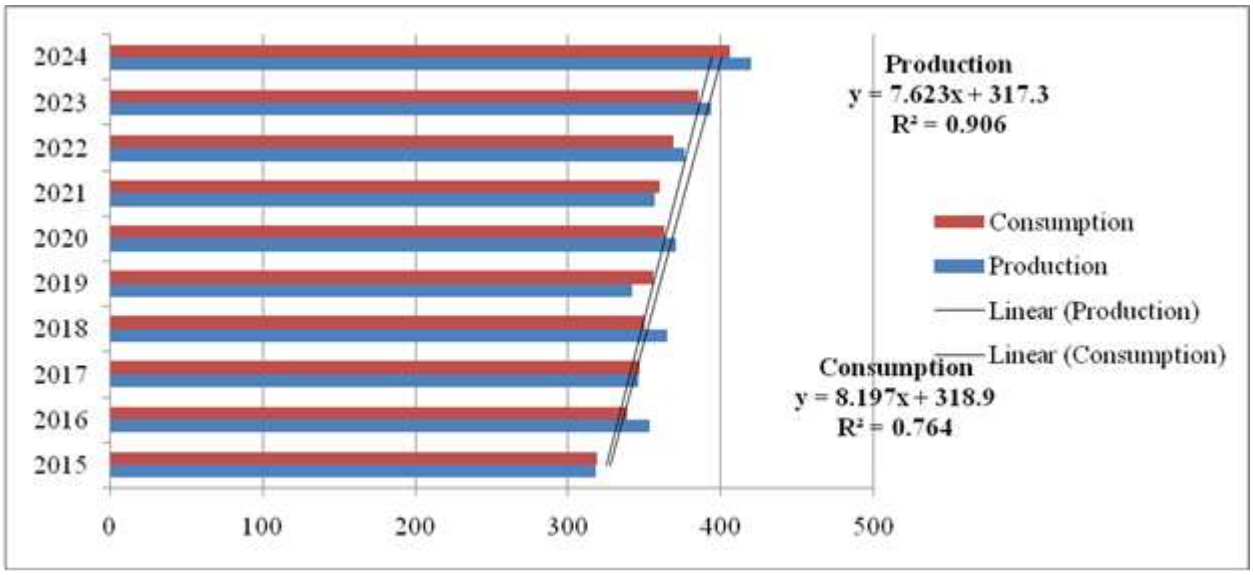

Fig. 1. Dynamics of soybean production and consumption worldwide, 2015-2024 (Million tons).
Source: Own design based on [10].

However, FAO estimated a little bit different figure than us, with about 2 Million tons more, so that in the 2024/2025 projection for the world oil seeds production is 687 Million MT, of which: 429 (62.4%) soybean seeds, 88 Million MT (12.8%) rapeseeds and 51 Million MT (7.42%) sunflower seeds and the remaining representing 119 Million MT (17.38%) belonging to other oil seeds crops. Using the FAO of United Nations (2023), concerning the changes in the cultivated area with soya, yield and production in the year 2022 versus 1961 level, as term of reference, the harvested surface was by +461.71% larger, seeds yield was by 131.02% higher and output increased by +1,197.94 [22].

Table 2. The top 10 main producing countries of soybean seeds and their share in world production in 2023/2024 (Estimates)

	Area (Million ha)	Yield (Metric tons/ha)	Production (Million Metric tons)	Market share (%)
1.Brazil	45.8	3.34	153	38.7
2.USA	33.29	3.4	113.27	28.6
3.Argentina	16.30	2.95	48.10	12.2
4.Paraguay	3.75	2.93	48.10	12.2
5.China	10.47	1.99	20.84	5.2
6.India	13.20	0.90	11.88	3.0
7.Canada	2.26	3.09	6.98	1.7
8.Russia	3.50	1.94	6.8	1.7
9.Ukraine	2.00	2.60	5.2	1.3
10.EU-27	1.03	2.90	2.99	0.75

Source: Own calculations based on the data from [42].

The top 10 main producing countries of soybean seeds and their share in the world production, in the decreasing order, are: Brazil, USA, Paraguay, Argentina, China, India, Canada, Russia, Ukraine and the EU (Table 2).

Four countries Brazil, USA, Argentina and Paraguay produce 91.7% of the global soybean seeds output (Table 2).

According to USDA, it is expected that in 2024/2025, soybean seed production to grow in the major producing countries to: 162 Million MT in Brazil, 124.9 Million MT in USA, 51.5 Million MT in Argentina, 7.2 Million MT in Canada, 7.2 Million MT in Russia, 5 Million MT in Ukraine.

However, in the EU-27, it is expected a relatively constant level of about 2.9 Million MT [46].

Soybean area, yield and seeds production in the EU-27

In the 2023/2024, in the EU-27, the cultivated area with the major oil seeds crops accounted for 11.94 Million ha, of which: rape 6.23 Million ha (52.2%), sunflower 4.69 Million ha (39.2%), and soybean 0.98 Million ha (8.2%).

Compared to the EU cultivated area with oil crops in the year 2018, we may notice a slight increase by +0.14 Million ha. In case of each oil crop, in the year 2023-2024 versus 2018, it was found a decline in cultivated surface by -0.7 Million ha for rape, -0.67 Million ha for sunflower and by - 0.03 Million ha for soybean. The comparison was made with the results found in 2018 by [30].

For September 2024/2025, it is projected a growth to 1.08 Million ha soybean (+0.1 Million ha), to 4.9 Million ha for sunflower (+0.21 Million ha) and to 5.77 Million ha (-0.46 Million ha) for rape (Fig. 2) [11].

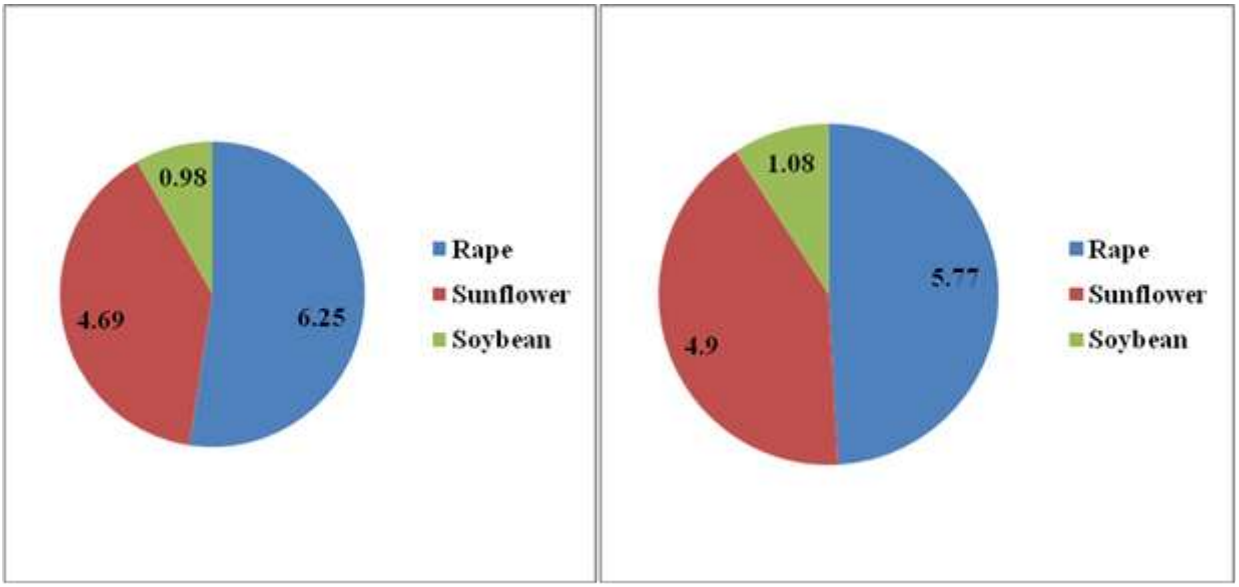

Fig. 2. Soybean cultivated area in the EU-27 in 20232024 and projected for September 2024-2025 compared to rape and sunflower surface (Million ha).
Source: Own design based on the data from [11].

If we compare with the results found in 2017 by [30], when the EU produced 35.09 Million tons oil seeds, of which rape seeds 21.91 Million tons, sunflower seeds 10.44 Million tons and soybean seeds 2.74 Million tons, with the data provided by [11] for 2023-2024, we may notice that in 2023-2024, the EU oilseeds output will be by 2.54 Million tons smaller than in 2018, the rape seeds production will decline by -2.19 Million tons, the sunflower seeds output will decrease by -0.62 Million tons, and, in case of soybean seeds production it is expected an increase by +0.27 Million tons (Fig. 3).

Regarding oil seeds production, for 2024-2025, it is projected that the EU-27 to carry out 29.51 Million tons oil seeds, of which: 17.21 Million tons rapeseeds (58.3%), 9.52 Million tons sunflower seeds (32.2%) and 2.78 Million tons soybean seeds (9.5%).

Therefore, it is expected that soybean output to grow (Fig. 3).

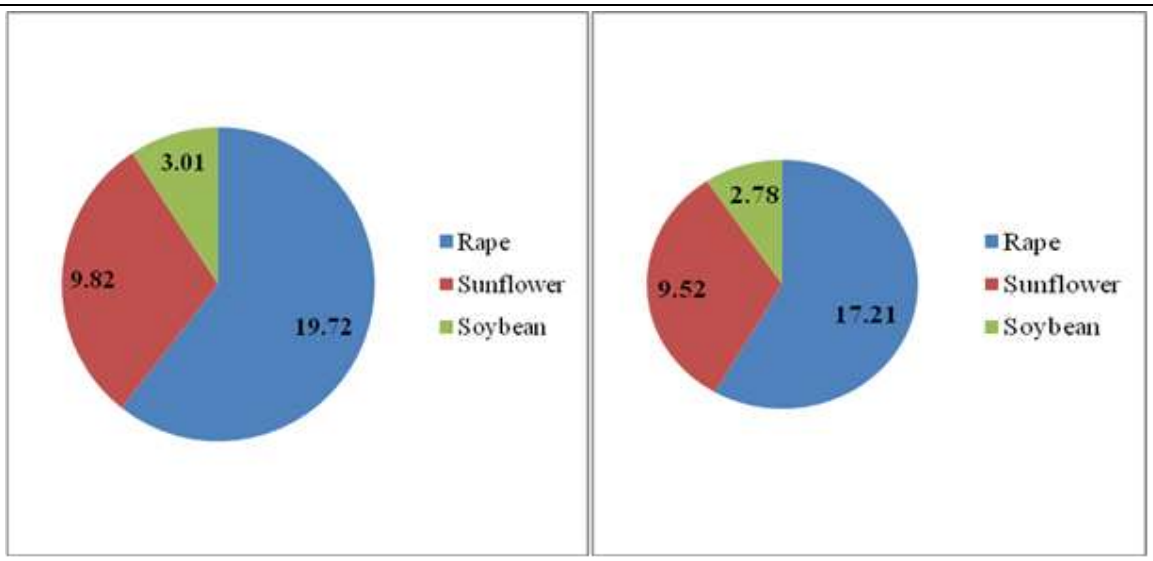

Fig. 3. Soybean seeds production in the EU-27 in 20232024 and projected for September 2024-2025 compared to rape and sunflower output (Million tons).
Source: Own design based on the data from [11].

The EU-27 yields for oil seed crops for the year 2023-2024 and 2024-2025 are presented in Table 3 comparatively in with the records mentioned by [30] in the year 2017. From this table, we may notice a decline of production performance per surface unit for each oil crop. In case of soybean, yield is expected to decrease from 2.85 tons per ha in 2017 to 2.10 tons in 2023-2024 (-0.01) and to 1.94 tons in 2024-2025 (-0.07).

Table 3. Oil seed yields by main oil seed crops in the EU in 2023-2024 and 2024-2025 versus 2014 (Tons/ha)

Crop	2017	2023-2024		2024-2025	
	(Tons/ha)	(Tons/ha)	Diff, versus 2017 (Tons/ha)	(Tons per ha)	Diff, versus 2017 (Tons/ha)
Soybean	2.85	2.84	-0.01	2.78	-0.07
Sunflower	2.45	2.10	-0.32	1.94	-048
Rape	3.25	3.14	-0.11	2.98	-0.27

Source: Own calculations based on the data from [11] and [30].

Table 4. Soybean balance in the EU-27 in 2023-2024 and forecast for 2024-2025 and its share in total oil crops balance (rape + sunflower and soybean) (Million tons)

	2023-2024			2024-2025		
	Soybean	Total oil seeds	Soybean share (%)	Soybean	Total oil seeds	Soybean share (%)
Beginning stocks	1,200	2,567	46.7	1,300	3,100	41.9
Usable production	2,782	32,324	8.6	3, 007	29,741	10.11
Imports from the 3rd countries	13,250	19,477	68.02	13,436	19,970	67.28
Total supply	17,232	54,368	31.69	17,743	52,722	33.65
Domestic use	15,709	50,127	31.33	16, 209	48,402	33.48
Of which crushing	13,861	46,483	29.81	14,339	44,876	31.95
Exports to the 3rd countries	223	1,230	18.13	234	1,309	17.87
Total use	15,932	51,357	31.02	16,443	49.711	33.07
Ending stocks	1,300	3,011	43.17	1,300	3,011	43.17

Source: Own calculations based on the data from [11].

The soybean balance Sheet in the EU-27

The figures presented in Table 4 regard the soybean balance in 2023-2024 and forecast for 2024-2025 and its share in total oil seeds balance (rape + sunflower and soybean).
They reflect an increase in usable production (+225), seed import (+186), total supply

(+511), domestic use (+500), of which crushing (+478), seed export (+11) and total use (+511).

These increases are also showed by the higher share of soybean in total oil seed balance sheet in 2024-2025 as presented in the last column. The figures indicate that imports of soybean will continue to increase to complete the supply in the common market.

Taking into consideration that imports of soybean meals for animal feed is very costing, the EU should have another orientation in its policy encouraging internal production. Imports increased costs with farm inputs for animal feed and not only will affect farmers' business efficiency.

Self Sufficiency Rate (SSR) for soybean seeds in comparison with the other oils seeds in the EU-27

Taking into account production, import and export, it was determined the Self Sufficiency Rate (SSR) separately for soybean, oils seeds (rape + sunflower + soybean) and rape + sunflower.

The results showed that soybean has the lowest SRR, accounting for 17.59% in 2023-2024 and in 2024-2025, this rate is expected to be by -3.72 percentage points lower.

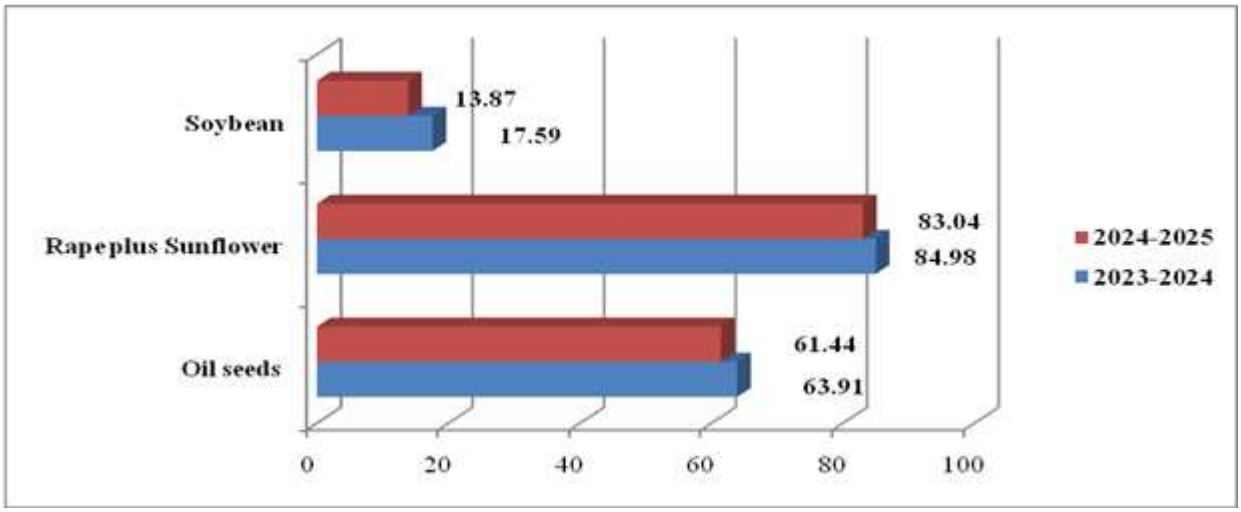

Fig. 4. The EU Self Sufficiency Rate for Soybean, Oil Seeds and Rape plus Sunflower in 2023-2024 and 2024-2025 (%)
Source: Own calculations.

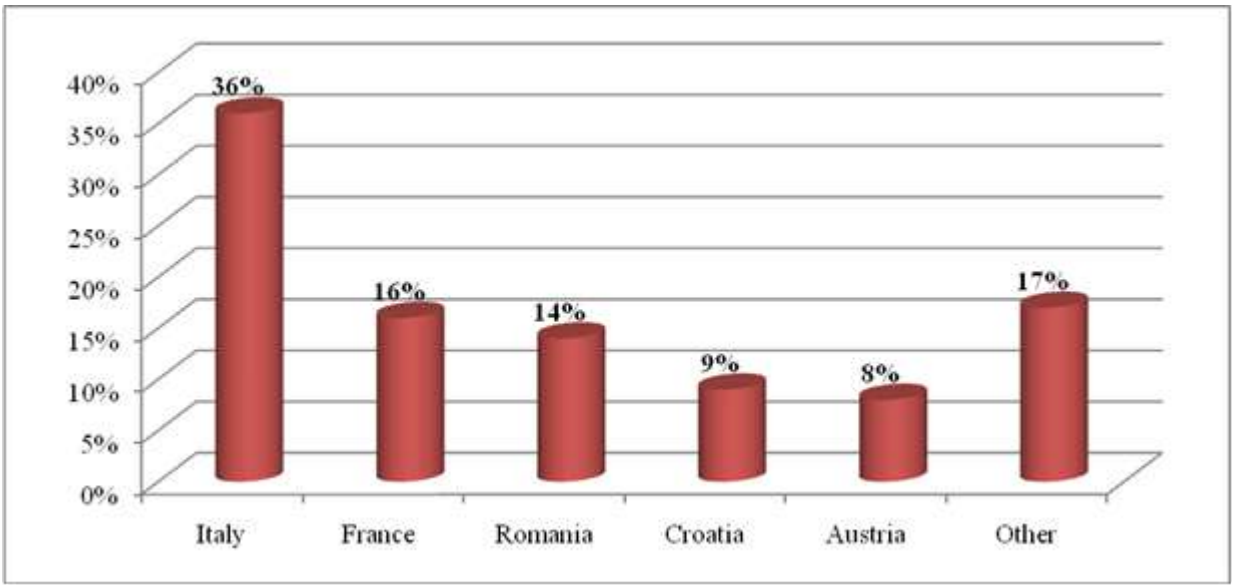

Fig. 5. The main EU member states producing soybean by October 2024 (% of total EU soybean production)
Source: Own calculation based on [46].

In case the all three oilseeds (rape + sunflower + soybean), SSR was 63.91% in 2023-2024, but in 2024-2025 is expected to be by -2.47 percentage points smaller. Taking into account only rape and sunflower, SSR has the highest level, accounting for 84.98% in 2023-2024. However, for the next 2024-2025, it is expected a SSR of 83.04%, meaning a decrease of -1.94 percentage points (Fig. 4). Till October 2024, the EU-27 produced 2.9 Million Metric tons soybeans, representing 1% of the global output. The main EU countries producing soybean are: Italy (36%), France (16%), Romania (14%), Croatia (9%) and Austria (8%), all these 5 countries together summing 83% of the EU soybean output. The remaining of 17% is carried out in other countries: Netherlands, Poland, Belgium, Denmark and Ireland (Fig. 5) [46].

Soybean area, yield and production in Romania

Romania comes on the 3rd position in the EU with 14% market share in the EU-27 output.

In Romania oleaginous seeds crops were studied regarding their cultivated and production performance by various researchers as shown by literature in the field. [1] studied the trends in trade with oleaginous seeds, [26] analyzed sunflower production, import and export , [31] approached the rape production concentration, [21], referred to the impact of climate change on sunflower yield and [39] emphasized soybean profitability.

The cultivated area with soybean increased starting from 2007 when the country joined the EU.

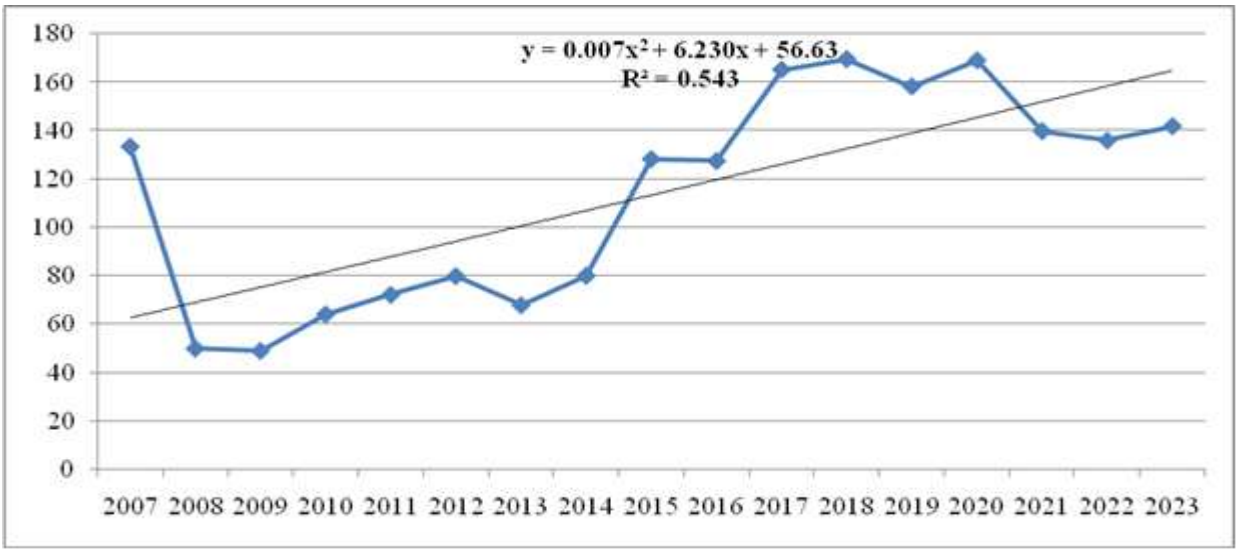

Fig. 6. Dynamics of soybean area in Romania, 2007-2024 (Thousand ha)
Source: Own design based on the data from [20].

In 2007, the cultivated area with soybean was 133.2 thousand ha, but in 2008 dropped to 49.8 thousand ha and then in 2009 went down again to 48.8 thousand ha, the minimum level registered in the interval 2007-2023. Year by year, the surface increased, the maximum level being 169.4 thousand ha in the year 2018, the best year for this crop in term of production as well. In 2023, the area with soybean accounted 141.7 thousand ha, meaning by 6.38% larger than in 2007 and by 16.4% smaller than in 2018 (Fig. 6). The regression equation reflects that for the year 2025 it is expected that the area cultivated with soya to be 147.9 thousand ha. The R square value = 0.543 reflects that the variation of cultivated area in Romania depended 45.7% of other factors (cultivars used, technology applied, climate change, farm inputs price: seeds, diesel etc, farm gate delivery price etc) than time. In 2007, the share of cultivated area with soybean represented 9.94% of the surface with oilseeds crops, including sunflower, rape and linen for oil. In 2023, the soybean area accounted for 7.59%, being by 2.35 percentage points smaller than in 2007. In 2018, when soybean was cultivated on the largest surface, its share in total oils seeds area was 9.33% (Fig. 7).

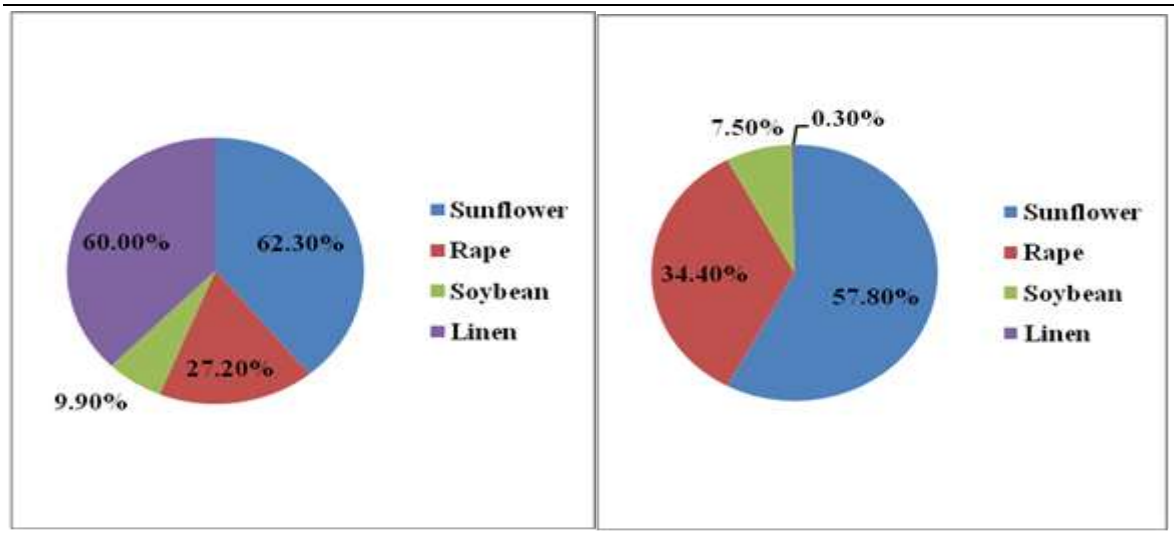

Fig. 7. The share of soybean cultivated area in total surface with oil crops, Romania, 2023 versus 2007 (%).
Source: Own design based on the data from NIS, 2024 [20].

The reduction in the cropped area with sunflower, soybean and linen was made in favor of rape which had to give a higher contribution as a raw material for producing renewable energy.

Taking into account the importance of soybean as a source of protein destined to cover the reduction in meat production, it is expected as in the future, soybean to have a greater role being cultivated on larger areas.

The soybean seeds production increased 2.2 times in 2023, attaining 303.2 thousand tons compared to 136.1 thousand tons in 2007. In the studied interval, the greatest output was achieved in 2018, 465.6 thousand tons, while the minimum production was registered in 2008 (90.6 thousand tons) (Fig. 8).

It followed a sinuous trend which depended on the evolution of cultivated area and also of the production performance per surface unit.

This was determined on the technologies applied by farmers and their adaptation to climate change which had a deep impact in agriculture of Romania during the last decade.

High temperatures and long and severe droughts affected many regions including the ones which are favourable for soybean crop.

This is proved by the fact that after 2018 when soybean attained the peak of production, in the next years the output was much smaller.

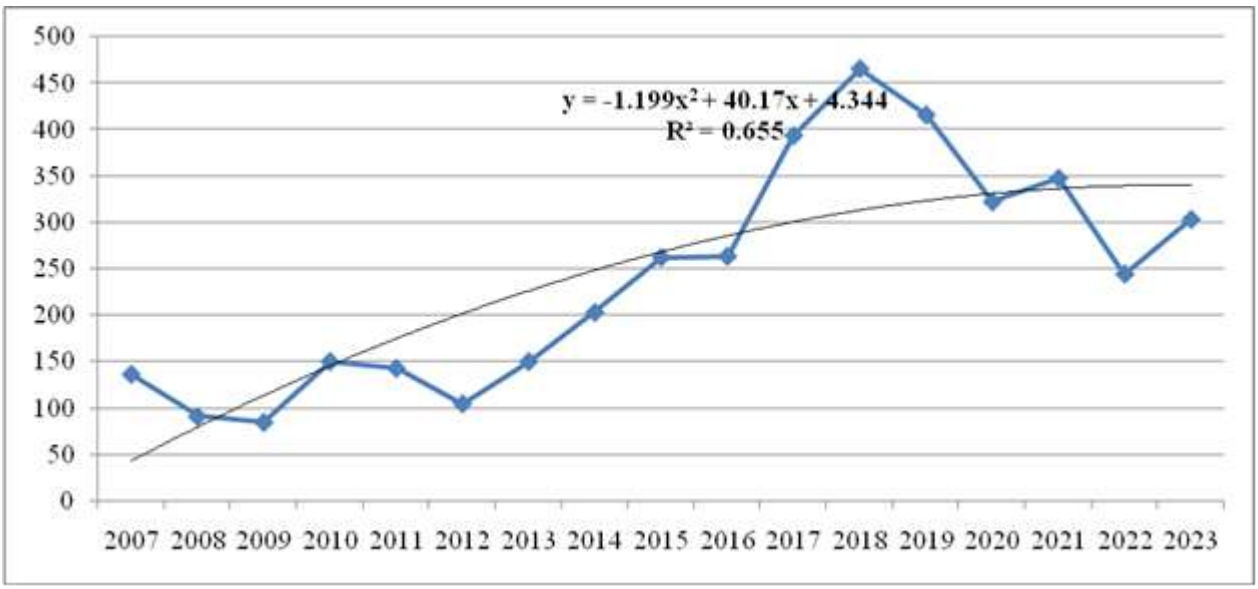

Fig. 8. Soybean production, Romania, 2007-2023 (Thousand tons)
Source: Own design based on the data from NIS, 2024 [20].

In 2007, soybean output had a share of 13% in total oil seeds production, and was ranked the 3rd after sunflower (52.25%) and rape (34.53%). In 2023, the share of soybean decreased to 7.36%, remaining on the 3rd position after sunflower (48.98%) and rape (43.49%) (Fig. 9).

Figure 9 shows a decline in sunflower contribution to oil seeds output by 3.27 percentage points, an increase of 8.95 pp in case of rape and a decline in soybean by -0.04 pp. This reflect farmers' orientation to rape crop for which they received subsidies to sustain biodiesel production.

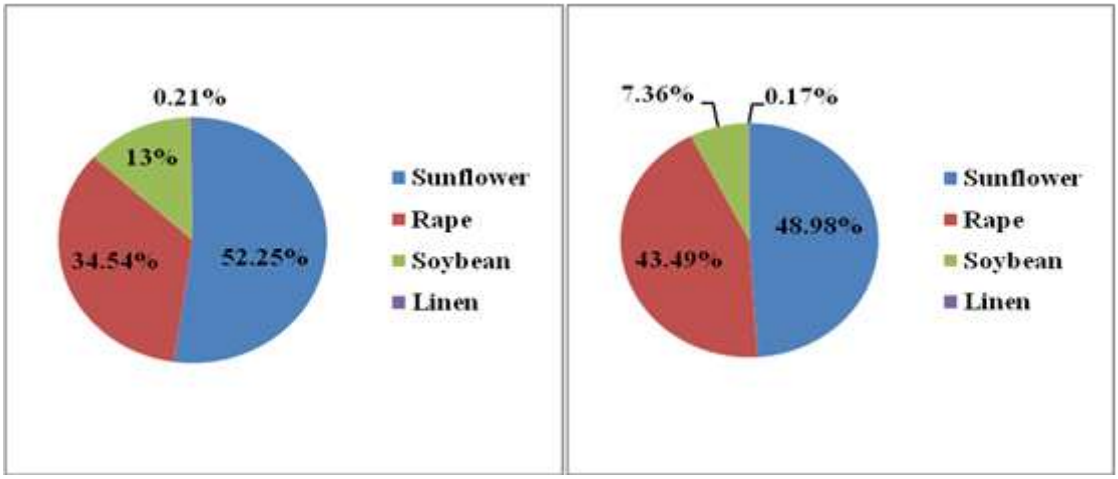

Fig. 9. The contribution of soybean and other oil seeds crops to production in 2023 versus 2007 (%)
Source: Own design based on the data from NIS, 2024 [20].

Soybean yield increased in Romania to 2,140 kg/ha in 2023 being 2.09 times higher than in 2007, when it was recorded the lowest level.
However, in the most favorable year, 2018, it was carried out the highest yield accounting for 2,748 kg per surface unit (Fig. 10).
Also, in the year 2018 versus the performance registered in the year 1961, soybean seeds production was +10,610.43% higher, cultivated area was +1,594.2 % larger and yield was by +532.17% greater [22].
In fact, since 2013, soybean seeds yield started to exceed 2,000 kg/ha, except the years 2020 and 2022 when the performance was below this figure because of the unfavorable climate conditions with high temperatures and long and severe droughts.

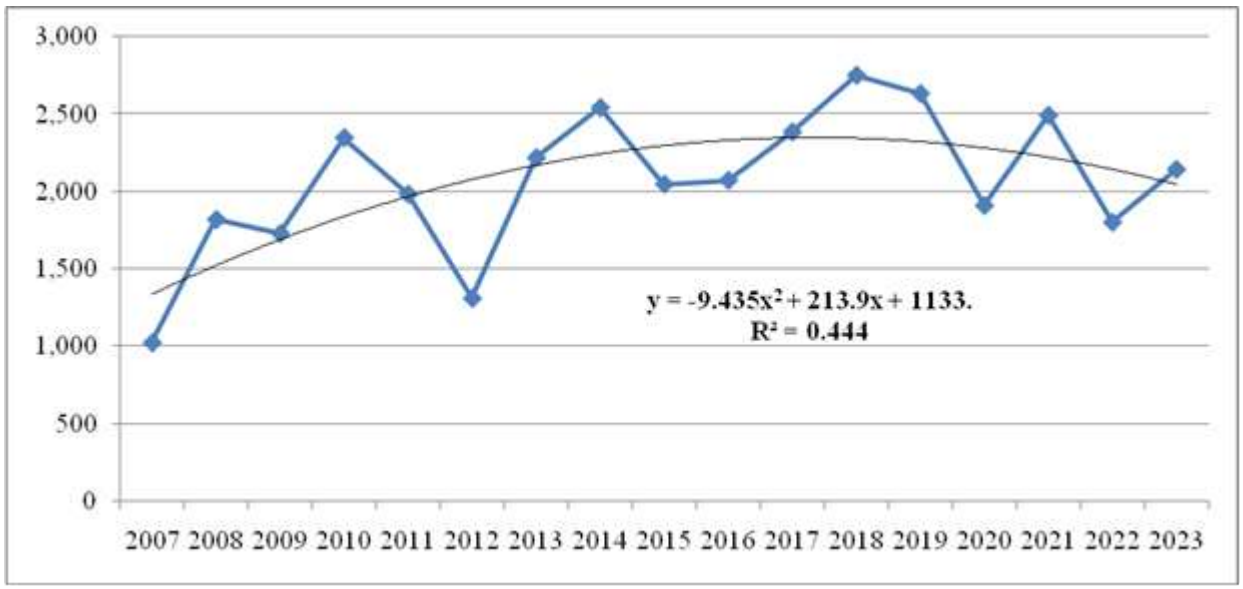

Fig. 10. Dynamics of soybean yield in Romania, 2007-2023 (tons/ha).
Source: Own design based on the data from NIS, 2024 [20].

Yields could be sustained by farmers if they will test various varieties in the their local soil and climate conditions and select the ones with the highest performance.
In addition, they have to look for the most appropriate moment for sowing in connection to temperature and soil moisture and to apply the agricultural works at the right moment and of high quality.

CONCLUSIONS

The study investigated the trends in soybean crop cultivated area, yields and production at the global level, in the EU and Romania.
Soybean is consider an important protein and energy source which could enhance the plant position among the protein-based crops called to compensate the decline in meat production and healthier food products and animal meals, to sustain renewable energy production, to reduce pollution by capturing Nitrogen, diminishing the amounts of fertilizers, protecting environment and conserving biodiversity.
In 2023, at the global level, the cultivated area was 139.74 Million ha, production reached 419.5 Million tons, being by 32% higher than in 2015, and average yield accounted for 2.82 tons/ha compared to 2.76 in 2022.
The increased production was stimulated by the higher consumption which in 2024 attained 406.1 Million, by 27.3% more than in 2015.
The main producing are Brazil, USA, Argentina and Paraguay which all together produce 91.7% of the global soy seed output.
In the EU-27, in the year 2023, 11.94 Million ha were covered by oilseeds crops, of which: rape 52.2%, sunflower 39.2% and soybean 0.98 Million ha (8.2%). For the next year, it is provided an increase by +0.1 Million ha for soybean, +0.21 Million ha for sunflower and a reduction by -0.46 Million ha for rape.
In 2023, the EU produced 32.55 Million tons oil seeds including rape, sunflower and soybean, of which 3.01 Million tons soybean seeds (9.2%), 9.82 Million tons sunflower seeds (30.1%) and 19.72 Million tons rape seeds (60.7%).
The soybean balance 2024-2025 versus 2023-2024 reflected an increase in usable production (+225), seed import (+186), total supply (+511), domestic use (+500), of which crushing (+478), seed export (+11) and total use (+511).
The Self Sufficiency Rate for soybean was 17.59% in 2023, very small, compared to SSR 63.91% for rape + sunflower + soybean together and 84.98% for rape+ sunflower. For the next year, forecast estimates a lower SSR for soybean, reflected that the EU do not cover the needs of soybean from internal production and imports are called to meet the higher demand.
The EU-27 soybean production of 2.9 Million Metric accounts for 1% of the global output. The main EU producing countries are: Italy (36%), France (16%), Romania (14%), Croatia (9%) and Austria (8%), all these 5 countries together summing 83% of the EU output.
Romania comes on the 3rd position in the EU (14% market share). In 2023, the country cultivated 141.7 thousand ha with soya, by 6.38% more than in 2007, but 16.4% less than in 2018.
Soybean seeds output increased 2.2 times in 2023, attaining 303.2 thousand tons compared to 2007. The top production of 465.6 thousand tons was achieved in 2018.
Soybean yield raised to 2,140 kg/ha in 2023 being 2.09 times higher than in 2007 (the lowest level).
As a conclusion, taking into account the importance of soybean as a source of protein destined to cover the reduction in meat production, it is expected as in the future, soybean to have a greater role being cultivated on larger areas and sustain yield.
In the EU imports of soybean will continue to grow to cover the market requirements, but the recent approval of two GM soybean will led to a disturbance in soy feed and food market and will have a negative effect on price evolution.

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