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Sunflower in Romania in the Climate Change Context

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Abstract: *Agriculture is the second leading branch of the world economy. Agriculture plays a key role in the development of the economy, agricultural production being the main source of food, the basis of human existence and the basis of raw materials for many industries. The need for development and modernization stems from its vital role in meeting the food needs of the world's population. This human activity has the greatest contribution to human well-being. Currently, 60% of the Earth's population makes a living directly from farming. Agriculture has a decisive role in solving the food problem, agriculture is a branch that provides the raw material for the food industry - 90%, light industry - 70%, chemical industry - 20%.*

At the national level, agriculture is one of the important branches of the Romanian economy. The contribution of agriculture, forestry, fish farming in the formation of the Gross Domestic Product is around 6%, and in the EU member states, it is around 1.7%

1. INTRODUCTION

Sunflower is a resistant crop to weather changes, able to produce viable yields even in hot and dry seasons. Climate change continues to affect weather patterns and influence sunflower production.

It is estimated that climate change will affect agricultural regions in Europe, the drought will occur more often. Drought periods will start earlier and last longer.

In Southern Europe, high temperatures and poor rainfall will reduce yields crop, while in Northern Europe growing conditions could improve the ability to grow a greater crops variety. Despite the fact that more extreme weather events are likely to increase crop yield volatility.

This could be replicated around the globe, as farmers want to adapt farming methods to combat drought conditions by choosing drought- and heat-tolerant crops, such as sunflowers increasing the yield of this millennial culture.

However, the problem of drought is not only Romania's problem. Europe has been affected by climate change in recent years, with droughts becoming more frequent in the region from the centre to the south of the continent. Scientific analysis shows that the globe is warming strongly, and extreme weather events will be more and more present. Thus, drought is a factor that will influence agriculture in the years to come.

Due to climate change, the agro-climatic requirements of crops are affected by the positive/negative deviations of the natural conditions, the sustainable administration of crops and the

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rational use of land become major issues for insurance sustainability of production in each agricultural year, (https://www.icpa.ro/documente/CodBPA_SchClimatice_ADER111.pdf).

Global warming has caused and will cause a growing number of extreme weather (floods, droughts, extreme rainfall, heat waves), fires forests, water scarcity, disappearance of glaciers and rising sea levels, change distribution or even extinction of part of the fauna and flora, plant diseases and pests, food and freshwater shortages, as well as the migration of the population trying to be get rid of these dangers. There is scientific evidence that shows the risks of change irreversible and catastrophic would increase significantly if global warming would exceed 2 ° C - or even 1.5 ° C – above pre-industrial levels.

On 11 December 2019, the Commission presented the European Green Pact, a package of ambitious measures for the European Union to achieve carbon neutrality until 2050. The measures, which are accompanied by a roadmap of the main actions, include ambitious emission reductions, investment in research and innovation avant-garde and conservation of Europe's natural environment. Supported by investments in environmentally friendly technologies, sustainable solutions and new businesses, the Green Pact intends to be and a new growth strategy for the EU, transforming the EU into an economically sustainable and competitive (https://www.europarl.europa.eu/ftu/pdf/ro/FTU_2.5.2.pdf).

2. SHORT HISTORY

Sunflower is a plant native to North America where it was first cultivated and harvested by indigenous tribes over 4,500 years ago. It was observed that sunflower was cultivated in many tribes in North America, reaching the border with Mexico. Archaeological research has shown that the stem was used to colour fabrics, leaves for medical purposes and pollen for religious ceremonies.

Sunflower continued to be a staple crop in North America until it was discovered by European explorers in 1510. Spanish navigators were the first to collect large quantities of sunflower seeds and transport them to Europe. Once the sunflower has been brought to Europe, it will begin to spread to Egypt, Afghanistan, China and Russia.

Estimates suggest that the value of globally sunflower cultivation is $ 20 billion a year. The top ten of the sunflower cultivators in the world (mil. tone)[3]:

1. Ukraine - 12.24,
2. Russian Federation -10.48,
3. Argentina - 3.55,
4. Romania - 2.91,
5. China - 2.58,
6. Bulgaria - 2.06,
7. Turkey - 1.96,
8. Hungary - 1.89,
9. France - 1.62,
10. US 1.00

[3] Source: (https://www.researchgate.net/publication/269874280_Sunflower_-_cultivation_and_seed_production).

From a historical point of view, Russia was the largest producer with over 3 million ha at the beginning of the 20th century. At first, it was used only as an ornamental plant in botanical and private gardens. Then, around the middle of the 18th century, sunflower seeds came to be considered a delight. At the same time, people made tea from the leaves and flowers of the sunflower plant to fight fever (https://www.researchgate.net/publication/269874280_Sunflower_-_cultivation_and_seed_production).

In the last 25 years, the sunflower market has continued to grow and is currently ranked fourth among the most important oil crops in the world, after palm, soybean and rapeseed. The market changes have led to the return of the main area of crop production in Eastern Europe. Global production is dominated by Russia and Ukraine. In 2017, these two countries production accounted for over 22 million tons of global sunflower seed production which is 47.9 million tons.

Romania is the largest producer of sunflowers in the EU with the largest cultivated area in 2020/21. The area of sunflower is expected to decrease by 13% this year due to profit margins and lower yields rotation, after an expansion of 26% last season. In 2021, Romania was no longer exempt from the EU moratorium on neonicotinoid PPPs, another factor for many farmers in there to plant sunflower. Sowing taking place in drought conditions and the rains in May alleviated fears for a poor start to the growing season. Drought conditions remain in the South-Eastern regions. Based on the projected yield of 2,300 t/ha, the total production will reach 2.6 million tons, approximately 16 per cent less year on year. As a result, exports are expected to fall by 20%.

The largest share of sunflower exports is destined for EU markets and about 15% for non-EU markets. The high oleic acid content of sunflower causes an increase in the area estimated at 150,000 Ha, by about 20 percent compared to the previous season.

Table 1. Production of sunflowers

Romania	2016/17	2017/18	2018/19	2019/20	2020/21
Marketing year begin	October 2016	October 2017	October 2018	October 2019	October 2020
MY Imports MT	261	337	293	315	270
MY Exports MT	1.248	1.827	1.841	2.070	1.650

Source: 2016 - 2019 - Romanian Statistical Yearbook

3. MATERIAL AND METHODE

Characterization of sunflower cultivation areas:

- Zone I, which includes the Romanian Plain and Dobrogea on the chernozem soils and the Western Plain. In this area, the sunflower requirements for the temperature factor are optimally ensured (the sum of temperatures >7°C between April-August is 1600-1950), but the humidity requirements in the Romanian Plain and Dobrogea are covered only by irrigation. In the Western Plain, the precipitation regime is more favourable and in large areas, the plants benefit from groundwater contribution.
- Zone II, includes the Danube Meadow, in which the sunflower vegetation conditions are favourable due to the fertility of alluvial soils, the groundwater contribution and the specific microclimate. However, the droughts of some years bring significant production decreases.
- Zone III, includes the Romanian Plain and Dobrogea, on non-irrigated surfaces with reddish preluvosoils and chernozems, and in Dobrogea also white soils. Droughts are common in this area. The temperatures of more than 7°C sum during the April-August period is over 1700°C.

- Zone IV, which includes Gavanu-Burdea Plain (with vertisol associations), Leu-Rotunda Plain and Plenita Plain (with leached chernozems and reddish preluvosoils). This area is very favourable from a thermal point of view (the sum of temperatures >7°C during April-August is over 1700°C), and the annual rainfall is over 550 mm.
- Zone V, which includes the Jijia Plain, the Barlad Plateau and the Transylvanian Plain. In this area, it accumulates around 1500°C (sum of temperatures >7°C), with 450-550 mm multiannual average amount of precipitation in Moldova and 550-600 mm in Transylvania. The rating note is between 41 and 50 points, the area being at the lower limit of favourability for sunflower. Favourability is reduced primarily by the degree of soil erosion (from moderate to excessive), especially in Moldova, to which is added the water deficit in the vegetation period, and in the Transylvanian Plain by the temporary excess of water and lower temperatures.
- Zone VI, which includes the Moldavian Plateau, Western Piedmont and the southern Getic Piedmont. This area has low temperatures. Negative phenomena related to the soil are high acidity, excess water, compaction, reduced supply of humus and nutrients.

In 1990, 394,741 ha of sunflower were cultivated in Romania. In 2019 the cultivated area is 1,282,693 ha. For the first time, the surface of 1 million ha is exceeded in 2012. The evolution of the surface in the following years fluctuated, having a decrease of under 1 million ha in 2017 (998,415 ha). In 2019 it is the largest area of sunflower cultivated in Romania.

By development regions, the largest cultivated areas were in the South-East (335,524 ha), followed by South-Muntenia (267,923 ha), South-West Oltenia (208,307 ha), North-East (200,460 ha) and West (169,061 ha).

The counties with the largest cultivated area with sunflower also have the highest production: Dolj - 332,272 tons, Arad - 299,706 tons, Timiș - 276,105 tons, Teleorman - 233,509 tons, Constanța –230,976 ha, Olt - 230,908 ha, Brăila - 226,564 tons and Botosani - 158,361 tons.

We notice in the case of the regions, but also of the analysed counties a slight change in the ranking, which means that the average production per unit of cultivated area has decisively influenced. In 2019, the highest sunflower harvest per hectare was recorded in the West region - 3,459 kg / ha, followed by South-West Oltenia - 3,024 kg / ha, North-West - 2,944 kg / ha and Center - 2,705 kg / ha.

Table 1. Area (in Ha) cultivated with sunflower, by macroregions, development regions and counties

Macroregions, development regions and counties	Year									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CENTER region	4578	4432	5455	8227	8243	8026	8704	11367	13711	17895
NORD-EST region	91959	104215	133656	109393	111220	121624	132491	130298	128933	200460
VEST region	58353	52658	73988	89984	82054	89281	97839	119554	128303	169061
CENTRU region	4566	4406	5449	8227	8134	8026	8698	11271	13688	17868
NORD-EST region	91532	103978	133192	108957	110616	121120	131914	129613	128217	199925
VEST region	58028	52473	68740	89306	81275	88689	97054	118518	127673	168590
CENTRU region	2417	2111	1875	2073	2622	2708	3234	5681	5931	11540
NORD-EST region	60713	68941	80004	54931	59441	60016	79626	74230	78413	147689
VEST region	21763	17445	25272	25923	26367	25848	32067	27233	27153	47663

Source: Romania's Statistical Yearbook, 2010 - 2019

Out of the total number of counties, the highest sunflower yields obtained per hectare were registered in rainy areas and in those with a high soil fertility: Maramureș - 3,787 kg / ha, Timiș - 3,529 kg / ha, Arad - 3,495 kg / ha, Mehedinți - 3,399 kg / ha, Vâlcea - 3,299 kg / ha, Bistrița Năsăud - 3,114 kg / ha, Gorj - 3,070 kg / ha, Olt - 3,064, Cluj - 3,050 kg / ha, Iași - 3,022 kg / ha. From the series of counties that had the largest cultivated area, only three of them have an average per hectare of more than 3,000 kg (Timiș, Arad and Olt). All the others had productions around the national average: Dolj - 2,946 kg / ha, Teleorman - 2,650 kg / ha, Constanța - 2,660 kg / ha, Brăila - 2,821 kg / ha. The exception is Botoșani, which achieved a below-average harvest of 2,071 kg / ha. It should be mentioned that 19 counties exceeded the average production at national level (2,783 kg / ha),

4. CONCLUSION

- Today the sunflower (Heliantus annuus) is cultivated in over 72 countries in geographic areas with temperate climates. From the family of oilseeds (soybeans, rapeseed, cotton seeds and peanuts), sunflower is in the 5th place in terms of annual production worldwide by 32-44 million tons.
- Data from the National Institute of Statistics show that in the top of the countries with the largest sunflower production in the EU is the neighbouring country, Hungary, with a total of 1.749 million tons and a cultivated area of 617,000 hectares, followed by Bulgaria - 1.66 million tons (810,000 hectares) and France - 1,655 million tons (775,000 hectares).
- Romania has consistently occupied first place in the European Union since 2015 for sunflower production, but also cultivated area, and the seed export potential is significant, taking into account that the domestic consumption needs a total of only 750,000 tons, according to Agerpres (https://www.wall-street.ro/articol/Agricultura/270267/romania-ramane-si-in-2020-cel-mai-mare-producator-de-floarea-soarelui-din-ue.html#gref).
- In the marketing year 2020/2021 Romania will lose the leading position among European producers of sunflower seeds, after last year it won the competition with a production of 3.48 million tons. According to estimates, (2020/2021) the sunflower seeds production will decrease by 16% (2.6 million tons), and exports will decrease by 20%.

Romania will likely lose the leading position among EU producers, in the context in which for Bulgaria, number two last year, the estimates are much more favourable.

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