Research Journal of Agricultural Science, 58 (1), 2026; ISSN: 2668-926X;

http://doi.org/10.59463/RJAS.2026.1.01

DECLINE IN SUNFLOWER SEED YIELD IN ROMANIA DURING THE 2020–2025 PERIOD

Florin Gabriel, ANTON [1] (ORCID: 0000-0003-3016-7998), Maria, JOIȚA-PĂCUREANU [1,2] (ORCID: 0009-0009-2797-6672), Sabina, PINTILIA [1] (ORCID: 0009-0000-9962-8321),Marius, BORDEI [1] (ORCID: 0009-0008-2174-7863), Mihaela, CERGAN [1] (ORCID: 0009-0009-9051-7946)

[1] National Agricultural Research and Development Institute Fundulea, Romania

[2]Romanian Academy, Centre of Study and Research for Agroforestry Biodiversity "Acad. David Davidescu", Bucharest, Romania

Corresponding author: gabi22mai@yahoo.com

Abstract. *Between 2020 and 2025, the sunflower cultivated area in Romania consistently exceeded 1 million hectares, representing a significant share of the total area at the European Union level. Despite maintaining its leading position in both cultivated area and overall production, output levels were notably constrained by recurrent drought conditions. In recent years, sunflower production in Romania has been characterised by substantial variability in seed yield, mainly driven by increasing climate instability, particularly the frequency and intensity of droughts and extreme heat during critical phenophase such as flowering and seed filling. In 2024, and 2025, seed yields consistently fell below the six-year average, highlighting the strong impact of repeated drought and heat stress. In contrast, more favourable climatic conditions in 2021 revealed the crop's high productive potential, underlining the key role of precipitation in shaping yield performance. Overall, yield variability is closely linked to rainfall distribution, with essential phenological stages, especially flowering and seed development, being highly sensitive to water deficit. In 2024, the sunflower hybrid FD15E27, developed by NARDI Fundulea, recorded its lowest yield of the 2020–2025 period (2295 kg/ha), followed by 2025 with 2637 kg/ha. Across all study years and counties, the lowest seed yield was recorded in 2025, in Romania, in Dolj County, where the sunflower hybrid FD 15E27 produced only 707 kg/ha, while the highest seed yield was achieved in 2021 in Galați County, reaching 4638 kg/ha.*

Keywords*: sunflower, drought, seed yield*

INTRODUCTION

Romania has an important role in sunflower breeding through obtaining the first commercial sunflower hybrids in the world, Romsun 52 and Romsun 53, based on nuclear androsterility in 1970 (BRAN and ION, 2018; CONSTANTINESCU et al, 2024; ONISAN et al, 2023; ȘTEFAN and CONSTANTINESCU, 2022; VRÂNCEANU, 2000). In the same period, in France, Leclercq discovery cytoplasmic androsterility, that significantly improved the efficiency and large-scale production of hybrid sunflower seeds worldwide (VEAR, 2016; VRANCEANU, 2000). Nowadays, all commercial sunflower hybrids are developed using cytoplasmic androsterility. Sunflower (*Helianthus annuus* L.) plays a key role in Romanian agriculture, being one of the most important oilseed crops cultivated in the country. Due to its high adaptability to different soil and climatic conditions, as well as its economic value, sunflower occupies a significant share of the arable land in Romania. Sunflower represents a major source of vegetable oil production and contributes substantially to both the domestic market and export sector (CONSTANTINESCU et al, 2024). In addition, sunflower is particularly important in crop rotation systems, helping to improve farm profitability and agricultural sustainability.

In year 2025, Union European occupied third place in the world, after Russia and Ukraine in top sunflower seed producer (Table 1).

Table 1

Total area harvested with sunflower (hectares), in 2025 in the world

Country	Total area harvested with sunflower, in 2025 (hectares)
Russia	10.5 Million
Ukraine	5.6 Million
European Union	4.6 Million
Argentina	3 Million
Kazakhstan	1.8 Million
Turkey	750000
China	730000
Burma	600000
South Africa	570000
United States	504000

Source: https://www.fas.usda.gov/data/production/2224000#:~:text=2.10168%20(MT/HA),+15.6%25

The average sunflower seed yield at the European Union level decreased during drought years, reaching 2003.4 kg/ha in 2020, 1889.7 kg/ha in 2022, 1809.3 kg/ha in 2024, and 1870.1 kg/ha in 2025 (Figure 1).

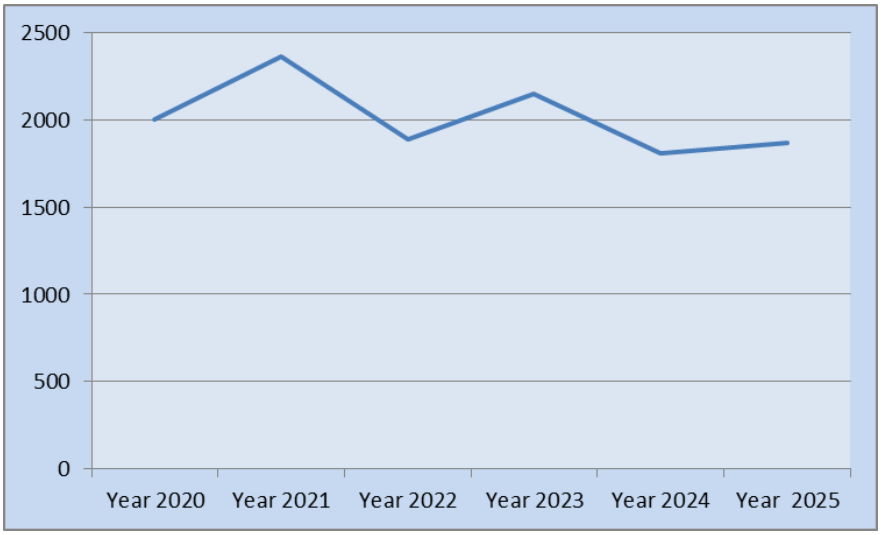

Figure 1. Average seed yield of sunflower (kg/ha), in period 2020-2025 at European Union level
Source: https://www.fas.usda.gov/data/production/2224000#:~:text=2.10168%20(MT/HA),+15.6%25

Romania is a major producer of sunflower seeds worldwide and in certain years has ranked first in the European Union in terms of the area cultivated with sunflowers, over one million hectares (PANZARU et al, 2023; JURJESCU and SALA, 2023; SOARE and CHIURCIU, 2023).

Romania plays a significant role in the European Union in terms of sunflower cultivation (Figure 2), accounting for approximately one quarter of the total cultivated sunflower area (EUROSTAT, 2026).

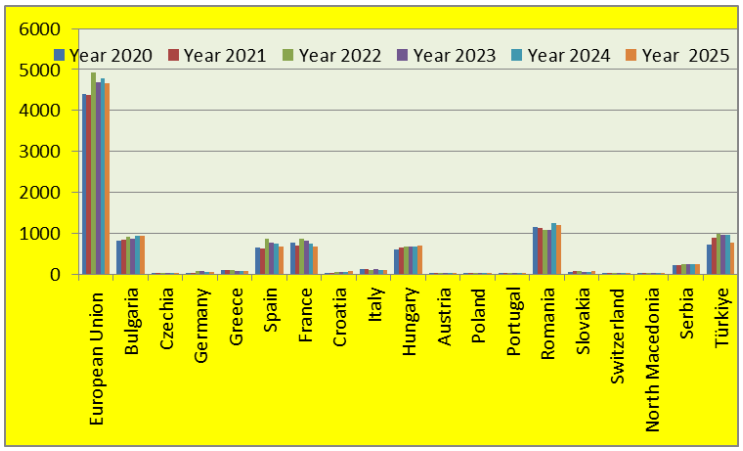

Figure 2. Area cultivated with sunflower (thousand hectares) in European Union in period 2020-2025
Source:
https://ec.europa.eu/eurostat/databrowser/view/tag00100/default/table?lang=en&category=t_agr.t_apro.t_apro_cp

In Romania, production of sunflower, decrease in last years due to severe drought, especially in year 2024 (Figure 3).

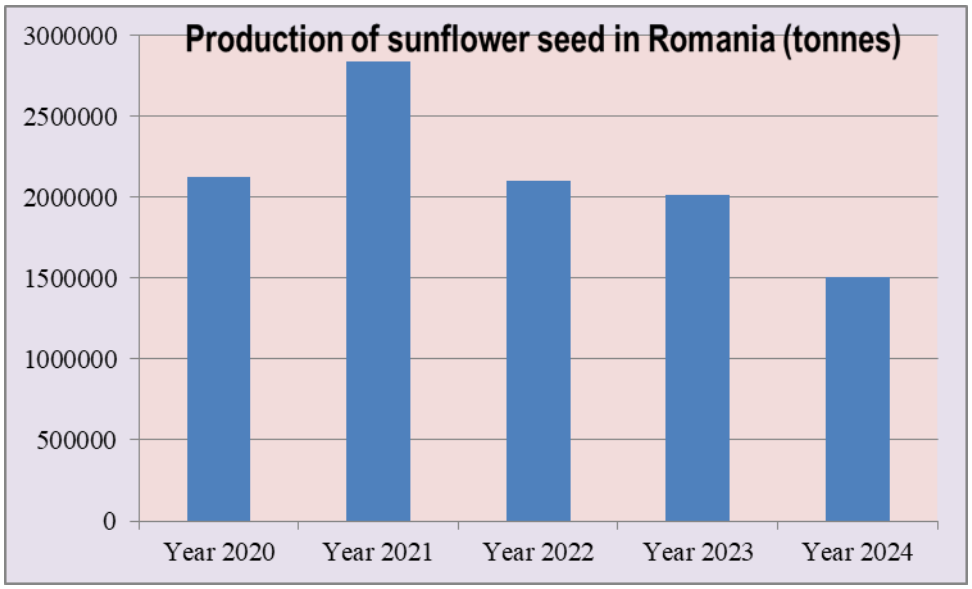

Figure 3. Total production of sunflower seed (tonnes), in Romania, in period 2020-2024
Source: https://www.fao.org/faostat/en/#data/QCL

î

The large area of sunflower was harvested in each year in Romania, especially in year 2024. (Figure 4).

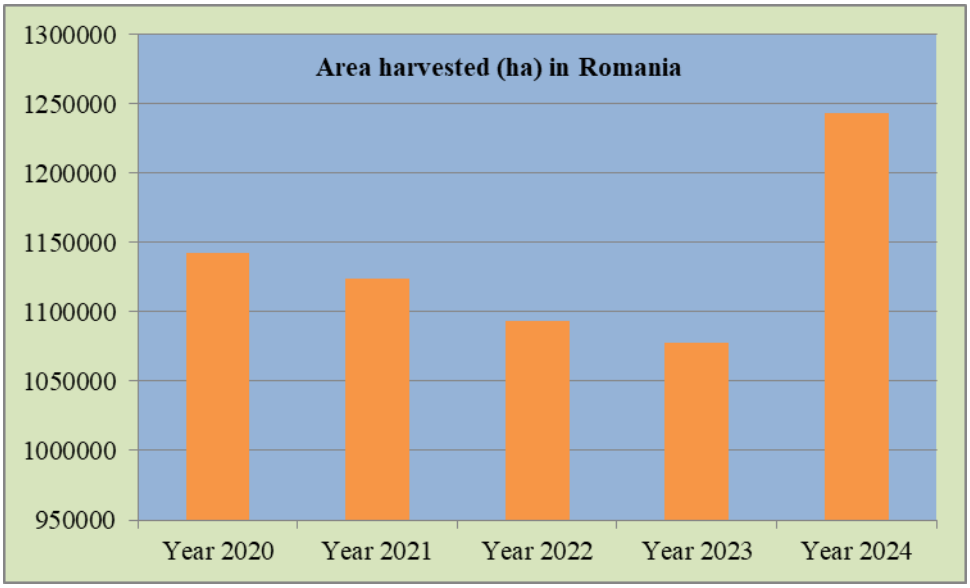

Figure 4. Area harvested (ha) with sunflower, in Romania, in period 2020-2024
Source: https://www.fao.org/faostat/en/#data/QCL

Average seed yield of sunflower (kg/ha), in Romania, was in year 2024 the lowest from last years (Figure 5). Climate changes affect sunflower culture through heat stress and water stress and lead to significantly yield loses (DOMENCO et al., 2024).

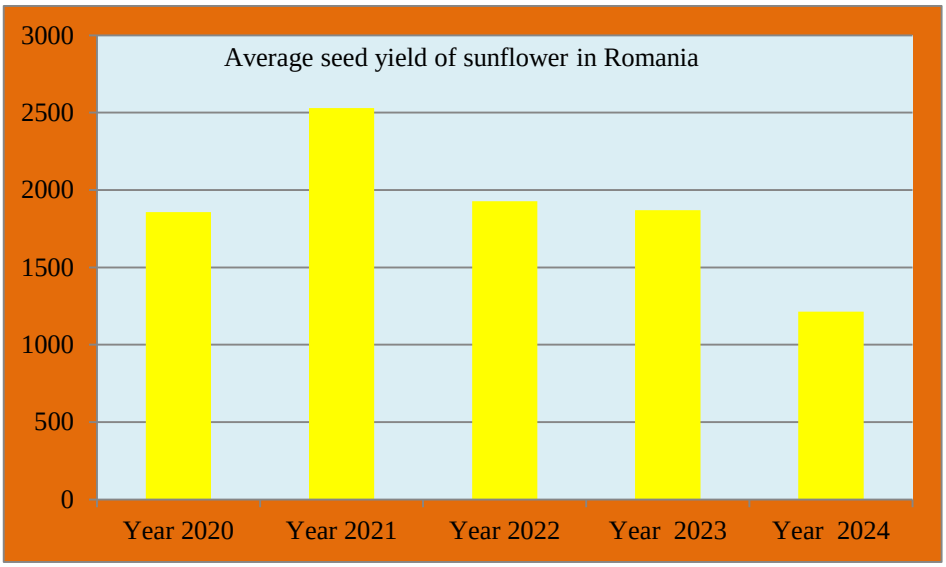

Figure 5. Average seed yield of sunflower (kg/ha), in Romania, in period 2020-2024
Source: https://www.fao.org/faostat/en/#data/QCL

http://doi.org/10.59463/RJAS.2026.1.01

MATERIAL AND METHODS

Sunflower hybrid FD15E27, developed by the National Agricultural Research and Development Institute Fundulea, was cultivated in 10 counties in Romania: Dolj, Bihor, Brăila, Vaslui, Timiș, Buzău, Teleorman, Galați, Călărași, and Constanța, in six years, during the period 2020-2025. The objective was to evaluate its performance under multi-annual and multi-location environmental variation, with particular emphasis on its behaviour during drought years. Half-late sunflower hybrid FD15E27 was registered in year 2019 in The official catalogue of crop plant varieties in Romania (ISTIS, 2025) and is suitable for ExpressSun technology due to resistance at sulfonylurea herbicides with active substance tribenuron-methyl. In the flowering phenophase, measurements were made on plant height (cm) and analysed after harvest, seed yield (kg/ha), 1000-seed weight (TSW, g) and hectolitre weight(HW, kg/hl) to observe differences between years and locations of the sunflower hybrid FD15E27.

RESULTS AND DISCUSSIONS

According to BORLEANU and BONEA (2020) and CONSTANTINESCU et al (2024), plant height is influenced by climatic conditions each year.

The average plant height (cm) by year has the lowest value in 2024 with 136 cm, and the highest value was in 2021 with 164 cm (Table 2).

Average of plant height (cm) by County has the lowest value in Bihor County with 125 cm and the higher value was in Dolj County with 166 cm.

The lowest value of plant height (cm) recorded across all years and counties occurred in 2022, in Bihor County with 95 cm, and the highest values of plant height (cm) were recorded in 2021, in Constanța County with 199 cm.

Table 2

Average plant height (cm) of sunflower hybrid FD 15E27, recorded in period 2020-2025, in 10 Counties from Romania

County	Average plant height (cm) of sunflower hybrid FD15E27						
	2020	2021	2022	2023	2024	2025	Average by County
Dolj	155	185	165	175	170	145	166
Bihor	176	113	95	153	104	110	125
Brăila	113	171	135	125	147	181	145
Vaslui	150	150	137	161	180	145	154
Timiș	146	107	147	173	141	124	140
Buzău	143	175	125	135	140	135	142
Teleorman	160	160	133	145	102	135	139
Galați	173	196	147	165	120	145	158
Călărași	125	185	137	130	135	155	145
Constanța	105	199	155	151	117	108	139
Average by year	145	164	138	151	136	138	145

http://doi.org/10.59463/RJAS.2026.1.01

Average of period of vegetation (days) by year of sunflower hybrid FD15E27, were between 107 days in 2023 and 124 days in 2020 (Table 3).

Average of period of vegetation (days) by County of sunflower hybrid FD15E27, were between 106 days in Teleorman County and 129 days in Brăila County (Table 3).

The lowest value of plant height (cm) recorded across all years and counties occurred in 2022, in Bihor County with 95 cm, and the highest values of plant height (cm) were recorded in 2021, in Constanța County with 199 cm.

Table 3

Period of vegetation (days) of sunflower hybrid FD 15E27, recorded in period 2020-2025, in 10 Counties from Romania

County	Average period of vegetation (days) of sunflower hybrid FD15E27						
	2020	2021	2022	2023	2024	2025	Average by County
Dolj	117	110	113	102	111	93	108
Bihor	130	120	116	111	124	117	120
Brăila	120	135	126	131	128	132	129
Vaslui	127	133	118	98	117	123	119
Timiș	121	114	108	104	114	82	107
Buzău	151	119	117	115	114	115	122
Teleorman	110	110	109	97	104	107	106
Galați	129	108	122	100	97	98	109
Călărași	123	104	115	103	122	101	111
Constanța	116	116	112	107	112	116	113
Average by year	124	117	116	107	114	108	114

During the period 2020–2025, the sunflower hybrid FD15E27 showed notable variation in seed yield depending on both year and location (Table 4). The lowest annual average yield was recorded in 2024, with 2295 kg/ha, followed by 2025 with 2637 kg/ha, indicating less favourable growing conditions in these years compared to the rest of the study period.

When analysed by county, the lowest average yield over the six-year interval was observed in Constanța County, with 2200 kg/ha, while the highest average yield was recorded in Galați County, reaching 3676 kg/ha. This highlights the strong influence of local environmental conditions on sunflower hybrid FD15E27 performance.

The lowest seed yield recorded across all years and counties occurred in 2025, in Dolj County, where sunflower hybrid FD 15E27 produced only 707 kg/ha and the highest seed yield were recorded in 2021, in Galați County with 4638 kg/ha (Figure 5). According to DUCA et al (2022), BONEA et al. (2013) drought throught water stress, decrease yield of sunflower genotypes.

1000-seed weight (TSW, g) of the sunflower hybrid FD15E27, showed considerable variation across locations and years (Table 5). Annual average 1000 seed weight (TSW, g) of FD15E27, was between 50 g, in 2024, and 58 g in 2021. Average 1000 seed weight (TSW, g) of FD15E27 by county, during period 2020-2025 was between 42 g in Constanța County and 63 g in in Brăila County

Research Journal of Agricultural Science, 58 (1), 2026; ISSN: 2668-926X;

http://doi.org/10.59463/RJAS.2026.1.01

Table 4

Average seed yield (kg/ha) of sunflower hybrid FD 15E27 recorded in period 2020-2025, in 10 Counties from Romania

County	Average seed yield (kg) of sunflower hybrid FD15E27						
	2020	2021	2022	2023	2024	2025	Average by County
Dolj	3818	3532	3545	3316	2158	707	2846
Bihor	2975	2113	1659	3457	2115	1692	2335
Brăila	3968	4171	1779	2520	2990	3320	3125
Vaslui	3882	3011	3785	2501	2654	3545	3230
Timiș	3723	2585	2322	3466	3220	2468	2964
Buzău	3243	4204	2941	2887	1629	3384	3048
Teleorman	3952	4563	3690	2492	1242	2713	3109
Galați	3166	4638	3991	3523	2883	3857	3676
Călărași	3422	3273	3380	3774	2865	3389	3351
Constanța	2154	2052	3348	3153	1196	1298	2200
Average by year	3430	3414	3044	3109	2295	2637	2988

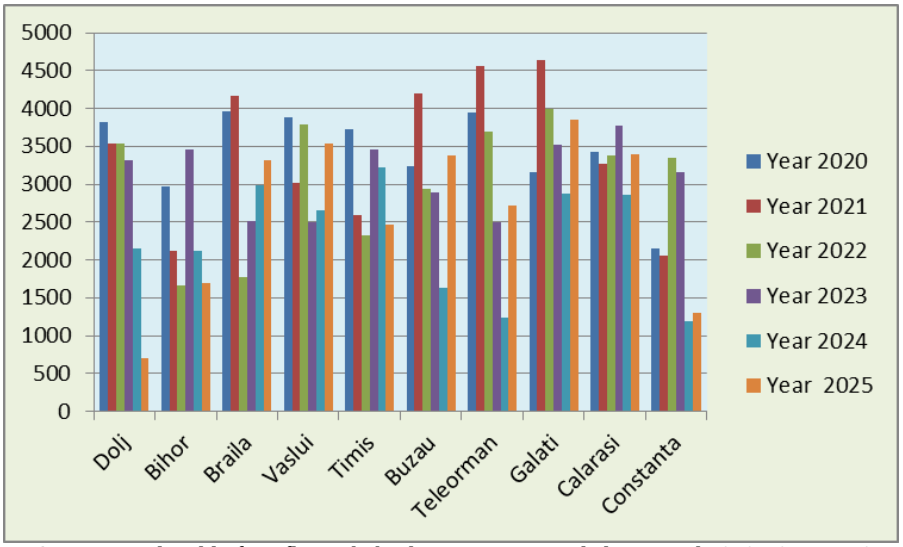

Figure 5. Average seed yield of sunflower hybrid FD15E27, recorded in period 2020-2025, in 10 counties from Romania

The lowest 1000 seed weight (TSW, g) recorded across all years and counties occurred in 2024, in Teleorman County, and in 2025, in Dolj County, where sunflower hybrid FD 15E27 has 33g TSW, and the highest TSW were recorded in 2021, in Brăila County with 79 g.

Table 5

Average 1000 seed weight (TSW, g) of sunflower hybrid FD 15E27, recorded in period 2020-2025, in 10 counties from Romania

County	Average 1000 seed weight (TSW, g) of sunflower hybrid FD15E27						
	2020	2021	2022	2023	2024	2025	Average by county
Dolj	42	46	50	45	54	33	45
Bihor	46	52	46	52	42	51	48
Brăila	60	79	54	57	56	73	63
Vaslui	54	60	47	74	46	70	59
Timiș	56	70	61	66	68	48	62
Buzău	59	58	57	55	37	61	55
Teleorman	50	64	50	41	33	43	47
Galați	46	64	56	57	56	54	56
Călărași	59	48	52	65	63	45	55
Constanța	41	36	49	57	36	35	42
Average by year	51	58	52	57	50	51	53

There were no significant differences regarding annual average hectolitre weight (HW, kg\hl) of sunflower hybrid FD15E27 (Table 6). Average hectolitre weight (HW, kg\hl) by county of FD15E27, during period 2020-2025 was between 37 g in Buzău County and 43 g in Dolj County and in Teleorman County. According to KULUNDŽIĆ-MARKULJ et al. (2022) and CONSTANTINESCU et al (2024), hectolitre weight is influenced by the agricultural year through climatic conditions.

Table 6

Hectolitre weight (HW, kg\hl) of sunflower hybrid FD 15E27, recorded in period 2020-2025, in 10 Counties from Romania

County	Average Hectolitre weight (HW, kg\hl) of sunflower hybrid FD15E27						
	2020	2021	2022	2023	2024	2025	Average by County
Dolj	48	44	40	41	41	46	43
Bihor	32	52	40	39	36	36	39
Brăila	37	45	36	38	41	39	39
Vaslui	39	37	39	37	39	44	39
Timiș	38	39	39	43	43	47	42
Buzău	38	39	38	36	36	37	37
Teleorman	48	45	43	43	39	42	43
Galați	41	45	38	37	40	38	40
Călărași	37	32	39	42	43	35	38
Constanța	43	45	38	40	39	39	41
Average by year	40	42	39	40	40	40	40

CONCLUSIONS

The average 1000-seed weight (TSW) of the sunflower hybrid FD15E27, recorded between 2020 and 2025 across 10 counties in Romania, showed relatively low values, likely due to unfavourable climatic conditions. Specifically, TSW was 50 g in 2024, 51 g in 2020 and 2025, and reached a slightly higher value of 52 g in 2022. The lowest average 1000-seed weight (TSW) was observed in Constanța (42 g), Dolj (45 g), Teleorman (47 g), and Bihor (48 g), reflecting the negative impact of climatic conditions on sunflower seed development.

Counties Constanța with an average seed yield of 2200 kg/ha, recorded in all six years, Bihor with 2335 kg/ha, Dolj with 2864 kg/ha, and Timis with 2964 kg/ha, were under average of all years and all counties of sunflower hybrid FD15E27 (2988 kg/ha).

Agricultural years 2024 (annual average recorded by FD15E27 in 10 counties-2295 kg/ha) and 2025 (annual average recorded by FD15E27 in 10 counties 2637 kg/ha) were below average of period 2020-2025 (2988 kg/ha).

The years 2024 and 2025 were characterised by very difficult conditions for sunflower cultivation in Romania due to excessive heat and prolonged drought during flowering and seed filling.

BIBLIOGRAPHY

BONEA, D., URECHEAN, V., MÎNDRILĂ, G., IANCU, D., 2013 - Results on the yield and correlations between characters in some sunflower (*Helianthus annuus* L.) hybrids grown in Oltenia. Annals of the University of Craiova, Agriculture, Montanology, Cadastre Series 43:73-77.

BORLEANU, I.C., BONEA, D., 2020 - Investigation of relationships between seed yield and agronomic traits in sunflower. Scientific Papers. Series A. Agronomy 63(1):192-197.

BRAN, A., ION, V, 2018 - Sunflower varieties and hybrids registered for cultivation in Romania in the last century. Agriculture for Life, Life for Agriculture Conference Proceedings 1(1), 22–31. https://doi.org/10.2478/alife-2018-0004.

CONSTANTINESCU, E., BONEA, D., DUNĂREANU, I.C, BOTU, M., SĂRĂCIN, I., OLARU, L.A, NITU-NĂSTASE, S., 2024 - Agronomic performance of sunflower hybrids grown in the semi-arid climate of Romania. Chilean journal of agricultural research, 84(1):43-55. https://dx.doi.org/10.4067/S0718-58392024000100043

DOMENCO, R., CLAPCO, S.,, DUCA, M., 2024 - Zoning of sunflower fields based on climatic variables: A case study in the Republic of Moldova. Not Bot Horti Agrobo 52(4):14000

DUCA, M., BURCOVSCHI, I., GISCĂ, I., 2022 - Drought effect on quantitative traits of sunflower genotypes. Analele Universitatii din Oradea, Fascicula Biologie 29(1):30-37.

JURJESCU, A.L., SALA, F., 2023 - Sunflower crop situation in Romania - comparative study over the last decade. Lucrări Științifice Management Agricol, XVII (2):131-138.

KULUNDŽIĆ-MARKULJ, A., SUDARIĆ, A, MATOŠA-KOČAR, M., MIJIĆ, A., LIOVIĆ, I., VULETIĆ, M.V., VARGA, I., CESAR, V., LEPEDUŠ, H., 2022 – Sunflower agronomic traits in field irrigation conditions. Genetika 54(1):473-489.

ONISAN, M., SARAC, I., PETRESCU, I., DORIN C., 2023 - New breeding methods in sunflower hybrid research and development. Scientific Papers. Series A. Agronomy, LXVI(1): 485-489.

PANZARU, R.L., MEDELETE, D.M., ȘTEFAN, G., BALAN, M., 2023 - The integration of Romania into the European Union market of sunflower seeds. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 23(4): 609-618.

SOARE, E., CHIURCIU, I.A., 2023 - Study on the sunflower seeds market in Romania. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development 23(1):739-744.

ŞTEFAN, I.O., CONSTANTINESCU, E., 2022 - Research on the behavior of some sunflower cultivations of the north area of Olt County. Annals of the University of Craiova, Agriculture, Montanology, Cadastre Series 52(2):170-173.

VEAR, F., 2016 - Changes in sunflower breeding over the last fifty years. OCL 23(2) D202. https://doi.org/10.1051/ocl/2016006

VRÂNCEANU, A.V., 2000 – Floarea-soarelui hibridă. Editura Ceres, Bucureşti: pp. 516.

https://istis.ro/wp-content/uploads/2025/07/Catalog-2025-Ordin.pdf

https://www.fao.org/faostat/en/#data/QCL

https://www.fas.usda.gov/data/production/2224000#:~:text=2.10168%20(MT/HA),+15.6%25

https://ec.europa.eu/eurostat/databrowser/view/tag00100/default/table?lang=en&category=t_agr.t_apro.t_apro_cp