RESEARCH CLIMATE CHANGES – SUNFLOWER HYBRIDS 2018-2020 IN CONSTANTA COUNTY, SOUTH EAST OF DOBROGEA, ROMANIA

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Abstract. *The experimental field was placed in Amzacea, Constanta County at S.C. SPORT AGRA S.R.L., Center of Development, on the highway 38, 20 km. far from Bulgarian border. Constanta County had the largest weight regarding the surface cultivated in Romania with sunflower crop between 10-12%. The most drought area in Romania is Dobrogea (average 1961-1990: 464 mm rainfall). Climatic change in recent years has accentuated this tendency. The number of hybrids taken into account in our experiment were fifteen in 2018 and twenty in 2020. Genesis has been planted in two periods of the time in 2020. When the planting was delayed the yield was decreased by 303 kg/ha. The aim of this study was: (i) the behaviour of the hybrids in the unbeliveble dry conditions, (ii) to see the yield and the behaviour of sunflower hybrids to the attack of main pathogens - Sclerotinia sclerotiorum, Phomposis helianthi, Orobanche cumana, (iii) how the planting date influenced the yield, (iv) the importance of the pesticides used and (v)economical data.*

Keywords: sunflower, technological improvement, pest behaviour, yield, drought

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1. Introduction

Constanta County (Dobrogea area) had the largest weight regarding the surface cultivated in Romania with sunflower crop 19.6% in 2018 [10] and, 11.10% from arable land in 2020 - 20.63% from arable land Constanta area [4].

Nowadays there is a wide offer for sunflower hybrids which means without a screening of them is hard to decide which are the most suitable for every region. It should exist experimental fields not only for sunflower but for other important crops related to a specific region. The hybrids must be from different seed companies eliminating any suspicions. In Dobrogea such experiments were made over the years by [5, 7, 8, 9] who provided results for yield, behavior to the attack of the main pathogens and quality indices, including period of the planting.

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2. Materials and Methods

The experimental plots were organised in 2018 and 2020 in the field belongs to SC SPORT AGRA SRL Amzacea, Constanta County (South-East of Romania) (Figure 1),(Figure 2). The number of hybrids taken into account were fifteen in 2018 and twenty in 2020. The soil it's a cambic chernoziom with a deeper profile than other chernozioms, a blackish-brown soil of 40-50 cm thickness, medium texture [2]. The content of nutrients are: mobile P index -72; N index -4; K index -200; humus -3.11%; neutral pH -7.2. The area of each plot in 2018 was 560 m^2, and 670 m^2 in 2020. The proceeding crop was winter wheat. Planting date was April 11th in 2018 and March 12th in 2020. The depth of planting was 5-6 cm. in 2018, and 8 cm. in 2020 considering the moisture of the soil.

Fig. 1. Experimental field of SC SPORT AGRA SRL Amzacea, Constanta County, 2018 (Original)

Fig. 2. Experimental field of SC SPORT AGRA SRL Amzacea, Constanta County, 2020 (Original)

The seeds have been treated against (i) *Botrytis* and *Sclerotinia* phytopathogens using Maxim 025 FS (fludioxonil 25g/l) at 0.6 l/100 kg, (ii) *Plasmopara helianthi* using Apron XL (metalaxil 339 g/l) at 3 l/t.(iii), and to protect the seeds against Agriotes spp., Tanymecus dilaticolis Gyll. using Cruiser 350 FS (350 g/l tiametoxam) at 10 lt/t in 2018. In 2020 we didn't treat the seeds before planting with neonicotinoids (iii) Tanymecus dilaticollis Gyll., in this case we have used after emergence of the crop insecticides two times.

To control weeds, the herbicides used were: glyphosate, autumn application, in a dose of 2 l/ha, Frontier Forte (dimetenamid-P) in a dose of 1.4 l/ha, Racer 25EC (fluorocloridon) in a dose of 2 l/ha, mixed up before emergence and Pulsar Plus (25g/l imazamox) in a dose of 2 l/ha (used only for the imazamox rezistant hybrids), at 6-8 leaves. Sulfonylurea has been applied for the hybrids resistant to the herbicides tribenurom methyl 30g/ha.

Two fungicides were used in vegetative season, to control the pathogens: Mirage 45EC (procloraz 45%) - 1 l/ha 8-10 leaves, and Pictor (200g/l dimoxistrobin + 200g/l boscalid) - 0.5 l/ha before flowering.

In 2018 the soil was fertilized using two complex fertilizers: 10.20.0 + 20 SO_3 (of which 2N organic) - 300 kg/ha and 40.0.0+13 SO_3 -150 kg/ha. Foliar fertilizers were performed using two complex fertilizers: 12.60.0 - 2 kg/ha and 145 SO_3, 5 MgO, 100 B, 2 Cu, 25 Fe, 50 Mn, 0.5 Mo, 20 Zn - 2 kg/ha, and in 2020 the soil was fertilized using complex fertilizers (18.46.0 + 20 SO3) 200 kg/ha and nitrogen in vegetation two trips using 150 kg/ha, and second fertilizer 100 kg/ha.

Fig. 3. Planting 2020 (Original)

Fig. 4. Temperature of the soil in the moment of planting 2020
(Original)

Fig. 5. Experimental field in 2020
(Original)

Phytosanitary assessments of plants were performed on August 7th in 2018 and on July 17th in 2020 over the main pathogens: *Phomopsis helianthi* Munt.-Cvet. et al., *Sclerotinia sclerotiorum* (Lib.) de Bary, *Alternaria helianthi* (Hansf.) Tubaki & Nishihara and the parasite *Orobanche cumana* Wallr.. The degree of attack (DA%) was calculated using formula F x I/100 (F - frequency of the attacked organs, I - intensity of organs attack).

Fig. 6. *Orobanche cumana*, Onestar 2020.
(Original)

Technological sheet includes data about number of plants/m^2 after emergence, flowering and harvesting date and the yield at 9% moisture kg/ha.

Rainfall during 2018 and 2020 in Amzacea, reveal that, the last year was real dry, 2020 was the driest year at the time has been with 133 mm. rainfall during the growing season compared with 2018 when the rainfall sum was 569 mm (Table 1).

Table 1. Rainfall during 2018 and 2020 growing season of sunflower (Amzacea, Constanta)

	Month								
	Jan.	Feb.	March	Apr	May	June	July	Aug.	
Days	The growing season 2018: Rainfall (mm) for 10-day periods								Sum
1-10	0	9	6	2	64	35	98	0	214
11-20	44	31	37	0	28	0	2	0	142
21-31	19	80	26	0	0	41	47	0	213
Sum	63	120	69	2	92	76	147	0	569
Days	The growing season 2020: Rainfall (mm) for 10-day periods								Sum
1-10	0	20	0	0	18	4	29	2	73
11-20	0	0	0	4	0	10	0	0	14
21-31	2	8	16	6	14	0	0	0	46
Sum	2	28	16	10	32	14	29	2	133
Days	Average 1961-1990: monthly values of rainfall (mm)								Sum
1-31	27.7	24.0	29.1	31.8	37.7	47.1	38.9	37.4	273.7

Fig. 7. The height of the hybrids 2020 (Original)

Fig. 8. The height of the hybrids 2020 (Original)

3. Results and Discussions

The diseases can affect the yield and hybrids presented a DA greater or less due to their resistance linked with the climatic conditions. Of all tested hybrids, six of them were monitorized in both years (Genesis, Janis, Loris, Diamantis, P64LE99 and P64LE25).

In 2018, the greatest DA was attributed to *Alternaria helianthi*, with an average of 21.7%. The lowest attack was to *Orobanche cumana*, where DA was under 1% for all hybrids.

Among hybrids Suria was the most susceptible hybrid to *Phomopsis helianthi*, *Alternaria helianthi*, *Orobanche cumana* with a DA of 35,75%, 45% and 0,2% respectively (Table 2).

Table 2. Phytosanitary status (DA%) – August 7, 2018

Hybrid	Pathogen			Parasite
	Sclerotinia sclerotiorum	*Phomopsis helianthi*	*Alternaria helianthi*	*Orobanche cumana*
Suria	1	35.75	45	0.2
Genesis	0	3	26	0
Janis	8	13.5	40	0
Loris	5	16.5	26	0
Electric	2	8	15	0
Diamantis	1	6	13.75	0,1
Neostar	0	3.75	15.75	0.18
Bacardi	0	9	28	0.2
Gracia	0	8	12	0
5555	5	11	25.5	0
56635	0	13.5	25.5	0
59580	3	8	18	0
P64LE25	2	7	14	0
P64LE99	0	7	9	0
P64LL125	0	5.25	12	0

The very dry conditions of the year 2020 has affected the height of the hibryds between 70 cm (FD15E27, Genesis) to 105 cm.(P64LE25, P64LE99).
The diseases can affect the yield and hybrids presented a DA greater or less due to their resistance linked with the climatic conditions.

In 2020 the attack of *Sclerotinia sclerotiorum* all of twenty hybrids were'nt been affected. *Phomopsis helianthi* and *Orobanche Cumana* had a lower DA average.

ES Genesis CL 2 and SY NX82214 (Onestar) CLP had a great DA average for pathogens and parasite combined (8.12% - 7%) (Table 3).

Table 3. Phytosanitary status (DA%) – July 17, 2020

Hybrid	Pathogen			Parasite
	Sclerotinia sclerotiorum	*Phomopsis helianthi*	*Alternaria helianthi*	*Orobanche cumana*
ES Genesis CL	0	8	10	1
ES Genesis CL 2	0	10	20	2.5
ES Janis CL	0	5	12	0
ES Anthemis CLP	0	10	8	0
ES Terramis CL	0	12	15	0
Loris CLP	0	8	10	0
Coloris CL	0	10	6	0
SY Odessa CLP	0	8	0	0
SY Diamantis CL	0	11	0	0

SY NX82212 (Nexus) CLP	0	12	8	0
SY NX82214 (Onestar) CLP	0	20	8	2
RGT Absollute CL	0	12	14	0
RGT Eiffell CL	0	16	10	0
FD15CL44	0	10	8	2.5
ES Aromatic SU	0	0	2	3
SY NX81220 SU	0	15.5	12	0
P65LE99	0	6	10	0
P64LE25	0	2	8	0
P64LE137	0	8	10.5	0
FD15E27	0	10	7	0
FD18E41	0	8	12	0.2

Table 4. Technological sheet for sunflower - 2018

Hybrid	No. of plants/m^2 after emergence	Flowering date	Harvesting date	Yield at 9% moisture (kg/ha)
Suria	6	June 22	August 16	2,709
Genesis	6	June 17	August 16	**5,038**
Janis	6	June 17	August 16	4,562
Loris	6	June 21	August 16	4,054
Electric	6.5	June 19	August 16	4,638
Diamantis	6	June 19	August 16	**4,805**
Neostar	6.5	June 17	August 16	4,364
Bacardi	6	June 18	August 16	4,475
Gracia	7	June 19	August 16	4,003
LG5555	6	June 16	August 16	**4,827**
LG56635	6	June 18	August 16	3,674
LG59580	6.5	June 16	August 16	3,834
P64LE25	6.5	June 20	August 16	4,322
P64LE99	7	June 21	August 16	4,425
P64LE125	6	June 22	August 16	4,508

All the hybrids tested had over 6 plants/m^2 after emergence which means a good an uniform emergence. The average yield in 2018 of the tested hybrids was 4,282 kg/ha(Tabel 4) exceeding the National average yield of 2018, 2,805 kg/ha reported by the NIS 2019.

Majority of the area cultivated with sunflower in 2020 have been destroyed of the unbelievable dry conditions with an average yield around 778 kg/ha [4].
The best hybrid from thouse twenty hybrids wich have been tested in the experimental field was FD15E27 with 1,914 kg/ha, belongs to National Agricultural Research and Development Fundulea, Romania, followed by P64LE25 with 1,779 kg/ha.

Except Genesis 2 all the hybrids had over 6 plants/m^2 after emergence. Flowering date was different due their genetic hybrids. Considering the hybrids, all of them had a yield lower than the other years because this year was unforgettable looking to the very dry conditions.

Table 5. Technological sheet for sunflower - 2020

Hybrid	No. of plants/m^2 after emergence	Flowering date	Harvesting date	Yield at 9% moisture (kg/ha)
ES Genesis CL	6.5	June 21	August 11	**1,593**
ES Genesis CL 2	5.5	July 8	August 18	1,290
ES Janis CL	6.5	June 25	August 11	1,428
ES Anthemis CLP	6.5	June 25	August 11	1,774
ES Terramis CL	6.5	June 28	August 11	1,555
Loris CLP	6.5	June 29	August 18	1,420
Coloris CL	6.5	July 2	August 18	1,514
SY Odessa CLP	6	June 25	August 18	1,357
SY Diamantis CL	6.5	June 27	August 18	1,415
SY NX82212 (Nexus) CLP	6.5	June 25	August 11	1,345
SY NX82214 (Onestar) CLP	6	June 25	August 11	1,227
RGT Absollute CL	6.5	July 2	August 11	1,565
RGT Eiffell CL	6.5	July 2	August 18	1,341
FD15CL44	6.5	June 29	August 18	1,343
ES Aromatic SU	6.5	June 26	August 11	1,617
SY NX81220 SU	6.5	June 20	August 11	1,432
P65LE99	6.5	June 29	August 18	1,537
P64LE25	6.5	June 29	August 18	**1,779**
P64LE137	6.5	June 29	August 11	**1,745**
FD15E27	6.5	July 2	August 18	**1,914**
FD18E41	6.5	July 2	August 18	1,375

In 2020, when Genesis was planted with a delay of 22 days the yield has decreased with almost 303 kg/ha (Table 5). Same results were recorded in literature showed a higher duration for seed maturity increases yield in sunflower crop [6, 1, 2].

Fig. 9. Harvesting day 2020
(Original)

Fig. 10. Harvesting day 2020
(Original)

Conclusions

(1) In 2018, Suria was the most susceptible hybrid to *Phomopsis helianthi*, *Alternaria helianthi*, *Orobanche cumana,* while in 2020 Aromatic had a higher attack of Orobanche cumana, Genesis 2 the highest average of DA for *Alternaria helianthi*, *Onestar to Phomopsis helianthi.*

(2) Considering the hybrids cultivated in both years, all of them had a yield greater in 2018 due to climatic conditions. When the planting was delayed in 2020 the yield has been decreased with over 303 kg/ha.

(3) In 2020 the area cultivated with sunflower crop in Constanta County was 100.915 ha, but harvested area was 85.720 ha with an average yield per ha 660 kg/ha(General Direction of Agriculture). In 2018 the area cultivated with sunflower crop was 95,110 ha with an average yield/ha 3,512 kg.ha.

(4)The revenue per ha in 2018 was 981.7 Euro (4.65 RON/1 Euro) (FCR), while in 2020 the revenue per ha was 209 Euro (4.83 RON/1 Euro)(FCR) at August 25th. Price per tone in August 25th – 279.56 Euro (Argus Constanta).

(5)On the other hand Constanta County needs irigations, considering the normal climatic conditions of the year 2018.

R E F E R E N C E S

[1] Ahmed, B., Sultana, M., Zaman, J., Paul, S.K., Rahman, Md. M., Islam, Md. R., Majumdar, F., Effect of sowing dates on the yield of sunflower. In: Bangladesh Agronomy Journal, Vol. 18, no. 1, p. 1-5. (2015).

[2] Demeter, T., General Soil Science (Pedologie generala), Credis Publishing House, Bucharest, 174 (2009).

[3] Demir, I., The effects of sowing date on growth, seed yield and oil content of sunflower (*Helianthus annuus* L.) cultivars under rainfed conditions. In: Fresenius Environmental Bulletin, Vol. 28, no. 9, pp. 6849-6857. (2019).

[4] General Division of Agriculture and Development, Constanta, 2020.

[5] Jinga, V., Dudoiu, R., Lupu, C., Research regarding the improvement of sunflower crop technology in South - Eastern Dobrogea in the context of current climate changes. In: Romanian Journal for Plant Protection, Vol. 9, pp. 15-21 (2016).

[6] Jonhson, B. J., Jellum, M.D., Effect of planting date on sunflower yield, oil and plant characteristics. In: Agronomy Journal Abstract, Vol. 64, no 6, p. 747-748 (1972).

[7] Manole, D., Giumba, A.M., Jinga, V., Radu, I., The behavior of new barley and wheat varieties at S.C. Sport Agra-Amzacea, under 2018 conditions. Romanian Journal for Plant Protection, Vol. 11, pp. 39-43 (2018a).

[8] Manole, D., Jinga, V., Giumba, A.M., Dudoiu, R., Cristea, S., Researches regarding new and improved technologies for sunflower and sorghum crops in the context of climate changes in Dobrogea region. In: Sciendo, Vol. 1, no. 1., pp. 79-85 (2018b).

[9] Manole, D., Jinga, V., Grădila, M., Radu, I., New edition on sunflower crop - Romanian technology under climate change conditions in Dobrogea. In: Scientific Papers. Series A. Agronomy, Vol. 62, no. 1, pp. 348-354 (2019).

[10] National Institute of Statistics (2019).