

THE IMPROVEMENT OF SUNFLOWER CROP TECHNOLOGY IN DOBROGEA UNDER CLIMATE CHANGES

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Abstract. The experimental field was placed in Amzacea, Constanta County within the climate conditions of years 2018 and 2019. Constanta County (Dobrogea area), had the largest weight regarding the surface cultivated in Romania with sunflower crop (19.6%) in 2018 and (23.8%) 2019 from Constanta County arable land. The area cultivated with sunflower crop in Dobrogea area in 2018 (19.5%) and 2019 (23%). The most drought area in Romania is Dobrogea (average 1961-1990: 464 mm rainfall). Climate change in recent years has accentuated this tendency. The number of hybrids taken into account was fifteen in 2018 and twenty in 2019. Of all tested hybrids, seven of them have been monitored in both years (Genesis, Janis, Loris, Diamantis, Neostar, P64LE99 and P64LE25). When the sowing was delayed the yield was decreased with over 1,000 kg/ha. The aim of this study was: (i) to see the yield and the behavior of sunflower hybrids to the attack of the main pathogens - *Phomopsis helianthi*, *Sclerotinia sclerotiorum*, *Alternaria helianthi*, and the parasite, *Orobanche cumana*, (ii) how the sowing date influence the yield and (iii) the importance of the pesticides used.

Keywords: sunflower, technological improvement, pest behavior, yield

1. Introduction

Constanta County (Dobrogea area) had the largest weight regarding the surface cultivated in Romania with sunflower crop (19.6%) from arable land in 2018 (NIS, 2019) [8].

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

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companies eliminating any suspicions. In Dobrogea such experiments were made over the years (Jinga et al., 2016; Manole et al., 2018, 2018b, 2019) which provided results for yield, behavior to the attack of the main pathogens and quality indices [3, 5, 6, 7].

The aim of this study was i) to see the yield and the behavior of sunflower hybrids to the attack of the main pathogens - *Phomopsis helianthi*, *Sclerotinia sclerotiorum*, *Alternaria helianthi*, and the parasite, *Orobanche cumana*, ii) how the sowing date influence the yield and iii) the importance of the pesticides used.

2. Materials and Methods

The experimental plots were organised in 2018 and 2019 in the field of SC SPORT AGRA SRL Amzacea, Constanta County (South-East of Romania) (Figure 1). The number of hybrids taken into account was fifteen in 2018 and twenty in 2019. The soil is a cambic chernoziom with a deeper profile than other chernozioms, a blackish-brown soil of 40-50 cm thickness, medium texture (Demeter, 2009). The content of nutrients was: mobile P index -72; N index -4; K index -200; humus -3.11%; neutral pH -7.2. The area of each plot was 560 m². The preceding crop was winter wheat. Sowing date was April 11th in 2018 and March 20th in 2019 at a 7 cm depth.



Fig. 1. Experimental field of SC SPORT AGRA SRL Amzacea, Constanta County, Romania
Source: 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) *Agriotes* spp., *Tanymecus dilaticollis* Gyll. using Cruiser 350 FS (350 g/l tiametoxam) at 10 l/t, the most infested area.

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

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 emergency and Pulsar Plus (25g/l imazamox) in a dose of 2 l/ha (used only for the imazamox resistant hybrids), at 6-8 leaves.

The soil was fertilized using two complex fertilizers: 10.20.0 + 20 SO₃ (of which 2N organic) - 300 kg/ha and 40.0.0+13 SO₃ -150 kg/ha. Foliar fertilizers were performed using two complex fertilizers: 12.60.0 - 2 kg/ha and 145 SO₃, 5 MgO, 100 B, 2 Cu, 25 Fe, 50 Mn, 0.5 Mo, 20 Zn - 2 kg/ha.

Phytosanitary assessments of plants were performed on August 7th in 2018 and on July 11th in 2019 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 $F \times I/100$ (F - frequency of the attacked organs, I - intensity of organs attack).

Table 1. Rainfalls during 2018 and 2019 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 2019: Rainfall (mm) for 10-day periods								Sum
1-10	10	0	10	19	0	10	12	7	68
11-20	26	8	0	1	6	4	22	0	67
21-31	0	0	6	15,5	12	0	10	0	43,5
Sum	36	8	16	35,5	18	14	44	7	178,5
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	464.0

Source: Valu lui Traian Station, Constanta County, Romania

Technological sheet includes data about number of plants/m² after emergency, flowering and harvesting date and the yield at 9% moisture.

Rainfalls during 2018 and 2019 in Amzacea, reveal that, the last year was really dry with 178.5 mm rainfalls during the growing season compared with 2018 when the rainfall sum was 569 mm (Table 1).

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, seven of them have been monitorized in both years (Genesis, Janis, Loris, Diamantis, Neostar, 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
	<i>Sclerotinia sclerotiorum</i>	<i>Phomopsis helianthi</i>	<i>Alternaria helianthi</i>	<i>Orobanche cumana</i>
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

Source: Original results.

In 2019, the attack of *Sclerotinia sclerotiorum* was lower than in 2018 three of the twenty hybrids being affected. *Phomopsis helianthi* and *Orobanche cumana* had a great DA average than in 2018. Tivolli had the highest average of DA for pathogens and parasite combined (16.75%) (Table 3).

All the hybrids tested had over 6 plants/ m² after emergence which means a good an uniform emergence. The average yield of the tested hybrids was 4,009 kg/ha exceeding the national average yield of 2,805 kg/ha reported for 2018 by the NIS, 2019 (Table 4).

Table 3. Phytosanitary status (DA%) – July 11 2019

Hybrid	Pathogen			Parasite
	<i>Sclerotinia sclerotiorum</i>	<i>Phomopsis helianthi</i>	<i>Alternaria helianthi</i>	<i>Orobanche cumana</i>
Diamantis	0	15	14	4
Odessa	0.2	14	24	0
Katana	0	24	5	0
Onestar	0.2	27	14	2.8
Neostar	0	22.5	20.0	4.5
Eiffel	0	14	24	0
Tivolli	0	30	33.25	3.75
Bellona	0	24.5	36.0	0.2
Clayton	0	6.0	20.0	0.2
Aurimi	0	14.0	28.0	12
Terramis	0	14.0	31.5	3.5
Loris	0	10.0	10.5	2.5
Janis	0	5.0	21.0	0.9
Genesis 2	0	21.0	21.0	3.5
Genesis	0	5.0	20.0	1.5
Aromatic	0	1.0	3.0	7
P64LE99	0	5.3	17.5	0
P64LE25	0	10.5	10.0	0
Centros	0	12.5	7.0	15
Rubisol	12	7.5	12.0	15

Source: Original results.

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
5555	6	June 16	August 16	4,827
56635	6	June 18	August 16	3,674
59580	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
P64LL125	6	June 22	August 16	4,508

Source: Original results.

In 2019 except Genesis 2 all the hybrids had over 6 plants/ m² after emergence. Flowering date was different due their genetic hybrids. Considering the hybrids cultivated in both years, all of them had a yield greater in 2018 due to climatic conditions.

In 2019, when Genesis was sown with a delay of 21 days the yield has decreased by almost 1,000 kg/ha (Tabel 5). The same results recorded in literature showed a higher duration for seed maturity increases yield in sunflower crop (Jonhson and Jellum, 1972; Ahmed et al., 2015; Demir, 2019) [4, 1, 2].

Table 5. Technological sheet for sunflower - 2019

Hybrid	No. of plants/m ² after emergence	Flowering date	Harvesting date	Yield at 9% moisture (kg/ha)
Diamantis	7	June 24	August 21	4,525
Odessa	6	June 22	August 21	4,379
Katana	7	June 22	August 21	4,165
Onestar	6.5	June 20	August 21	4,248
Neostar	6	June 20	August 21	4,128
Eiffel	6	July 1	August 21	3,660
Tivolli	6	June 23	August 21	3,245
Bellona	6	June 23	August 21	3,814
Clayton	6.5	June 25	August 21	3,518
Aurimi	6	July 1	August 21	3,799
Terramis	7	June 20	August 21	3,869
Loris	6.5	June 23	August 21	3,339
Janis	6	June 20	August 21	3,655
Genesis 2	5.5	June 28	August 21	3,474
Genesis	6	June 18	August 21	4,512
Aromatic	6	June 23	August 21	2,534
P64LE99	6	June 25	August 21	3,254
P64LE25	6.5	June 25	August 21	3,543
Centros	6	June 20	August 21	2,763
Rubisol	6	June 20	August 21	2,944

Source: Original results.

Conclusions

(1) In 2018, Suria was the most susceptible hybrid to *Phomopsis helianthi*, *Alternaria helianthi*, *Orobanche cumana* while in 2019 Tivolli had the highest average of DA. *Sclerotinia sclerotiorum* and *Alternaria helianthi* had a lower attack in 2019 than in 2018 while *Phomopsis helianthi* and *Orobanche cumana* had a higher attack in 2019 than in 2018.

(2) Considering the hybrids cultivated in both years, all of them had a yield greater in 2018 due to climatic conditions. When the sowing was delayed the yield was decreased with over 1,000 kg/ha.

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