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BEHAVIOR OF SOME EXPERIMENTAL SUNFLOWER HYBRIDS IN DIFFERENT LOCATION

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Abstract

In year 2020, we tested experimental sunflower hybrids at herbicide Pulsar Plus and Express 50SG in three locations, Fundulea1, Fundulea2 and Braila for resistance at biotic factors. Oil content was between 41.24% at H4CL+, treated with herbicide Pulsar Plus and 53.54% at H3CL+, treated with herbicide Pulsar Plus. Seed yield of sunflower hybrids, was between 2258 kg/ha at H4CL+, treated with herbicide Pulsar Plus and 3975 kg/ha at H7E, treated with herbicide Express 50SG. Hectolitre weight (kg/100 l) was between 62.8 kg/hl at H6E, treated with herbicide Express 50SG and 69.1 kg/hl at H5CL+, treated with Pulsar Plus. In location Fundulea 1, sunflower plants infected with pathogen Plasmopara hastedii, was between 0% at sunflower hybrid H3CL+, and 17.5% at sunflower hybrid H4CL+. In location Fundulea 2, sunflower plants infected with pathogen Plasmopara hastedii, was between 4.81% at sunflower hybrid H3CL+, and 73.7% at H5CL+. In Braila location, in year 2020, sunflower plants infested with broomrape, was between 0%, at sunflower hybrid H3CL+ treated with herbicide Pulsar Plus and 100% untreated with herbicide.

Key words*: sunflower, herbicide, downy mildew, broomrape, resistance.*

INTRODUCTION

To register a sunflower hybrid, it must be tested before in different condition of medium to see his behavior, agronomic traits, resistance at abiotic and biotic factors**.** The time to obtain a sunflower hybrids is 7-8 years and after that is tested for another three years at The State Institute for Testing and Registration of Varieties (I.S.T.I.S.) and after that is register in National Official Catalog.

Sunflower hybrids must have uniformity, stability, distinctiveness and value added per unit, to be tolerant at new downy mildew races, tolerant at broomrape races G, H, tolerant at verticillium wilt, rust, resistant to lodging, must have a high seed yield, a high oil content, resistant a herbicide imidazolinone in ClearField plus technology or at herbicide sulfonilureea in ExpessSun technology (Delchev, 2019; Stanciu et al., 2019; Risnoveanu et al., 2019).

MATERIALS AND METHODS

In year 2020, we tested three experimental sunflower hybrids H3CL+, H4CL+ and H5CL+ in ClearField plus technology and two experimental sunflower hybrids H6E and H7E, in ExpessSun technology.

These sunflower hybrids, were sowing in micro parcels of four rows, with seven meters long, in three replications in three location, Fundulea 1, Fundulea 2, in South Romania and Braila, in South East Romania. Sowing date at Fundulea 1 and Fundulea 2, was April 29, 2020 and at Braila, was May 12, 2020 (Table 1).

Table 1. Sunflower hybrids tested in three locations, in year 2020, for resistance at biotic factors

Sunflower hybrid	Location		
	Fundulea 1	Fundulea 2	Brăila
H3CL+	Date of herbicide treatment 11.05.2020	Date of herbicide treatment 11.05.2020	Date of herbicide treatment 15.06.2020
H4CL+			
H5CL+			
H6E			
H7E			

All seeds of sunflower hybrids was treated with fungicide Apron XL (2 ml/kg) with active substance metalaxil-M against downy mildew from all three locations.

Sunflower hybrids H3CL+, H4CL+ and H5CL+, was sprayed in phenophase of six true leaves, with herbicide Pulsar Plus, who have active substance imazamox 25 g/l (Arda and Alyürük, 2020), in concentration of 1.6 l/ha.

Sunflower hybrids H6SU and H7SU, was sprayed in phenophase of six true leaves, with herbicide Express 50SG, who have active substance 50% tribenuron methyl (Christov and Hristova-Cherbadzhi, 2020), in concentration of 30 g/ha.
At sunflower hybrids tested in all three locations, in year 2020, was made notation about sunflower downy mildew, broomrape, the oil content was analyzed with Oxford Instruments Magnetic Resonance.

RESULTS AND DISCUSSIONS

The 58 mm precipitation, recorded in May, in 2020, in the Fundulea location, was ideal for the development of the pathogen *Plasmopara hastedii* who causes sunflower downy mildew. The precipitations registered in 2020, in Fundulea, during the period of sunflower development, from April to August, were lower than the average of 60 years (Figure 1).
In 2020, in the Fundulea location, the amount of precipitation was 423.2 mm and the average amount of precipitation over 60 years was 584.3 mm.

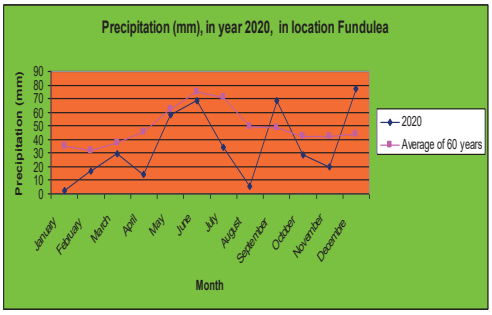

Figure 1. Precipitations (mm) registered in year 2020, in location Fundulea

The temperature of 17ºC, recorded in May, in 2020, in the Fundulea 1 location, was ideal for the development of the pathogen *Plasmopara hastedii.* The temperature recorded in year 2020, in Fundulea 1, was higher than the average of 60 years (Figure 2).
In 2020, in the Fundulea location, the average annual temperature was 13.5ºC and the average multiannual temperature for 60 years was 10.9ºC

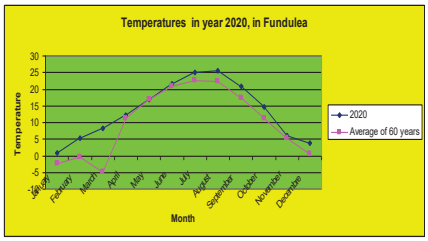

Figure 2. Temperature (ºC) registered in year 2020, in location Fundulea

In Fundulea 1 location, was used six differential lines (Table 2), for identifying races of downy mildew present in this area.

Table 2. Behaviour of differential lines in Fundulea 1 location, in year 2020

Number	Differential lines for downy mildew	*Pl* genes	Sunflower plants with downy mildew/Total sunflower plants
D3	RHA274	Pl_2/Pl_{21}	0/13
D4	PMI3	Pl_{PMI3}	20/72
D4	DM2	Pl_5	5/30
D7	HAR-4	Pl_{15}	0/2
D8	QHP1	Pl_1/Pl_{15}	10/18
D9	HA335	Pl_6	3/9
D17	RHA340	Pl_8	4/18

(Differential lines after Gascuel et al, 2015; Gilley, 2017)

Differential line PMI3, is sensible at downy mildew races 314, 330, 334, 710, 714, 717, 730, 774. Differential line DM2, is sensible at downy mildew races 314, 710, 714, 730, 774. Differential line QHP1, is sensible at downy mildew races 307, 703, 707, 717. Differential line HA335, is sensible at downy mildew races 304, 307, 314, 334, 704, 707, 714 717, 774. Differential line RHA340 is sensible at downy mildew races 700 and 710 (Gascuel et al, 2016; Türkmen and Çalışkan, 2016).
In Fundulea location is identifying downy mildew races 304, 314, 330, 334, 710, 714.
In location Fundulea 1, sunflower plants infected with pathogen *Plasmopara hastedii*, was between 0% at sunflower hybrid H3CL+, and 17.5% at sunflower hybrid H4CL+ (Table 3).
In location Fundulea 2, sunflower plants infected with pathogen *Plasmopara hastedii*, was between 4.81% at sunflower hybrid H3CL+, and 73.7% at H5CL+ (Figure 3).

Table 3. Sunflower plants infected with pathogen *Plasmopara hastedii*, in three location, in year 2020

Sunflower hybrid	Fundulea 1	Fundulea2	Brăila
H3CL+	0%	4 ,81%	0 %
H4CL+	17.5%	72 %	0 %
H5CL+	14.47%	73.7%	0 %
H6SU	4.28%	55 %	0 %
H7SU	6.66%	73.4%	0 %

Figure 3. Aspects from location Fundulea 2, with the highest infection with pathogen *Plasmopara halstedii*

In locations Brăila, sunflower plants infected with pathogen *Plasmopara hastedii* was 0%, at all five sunflower hybrids.
In Braila area (Figure 4), is the most virulent races of broomrape (races G and H), who causes low seed yield (Risnoveanu et al, 2016 a, b).

Figure 4. Aspects from location Braila, with the highest infestation with parasite *Orobanche cumana*

In Brăila location, in year 2020, sunflower plants infested with broomrape caused by parasite *Orobanche cumana*, was between 0%, at sunflower hybrid H3CL+ treated with herbicide Pulsar Plus (1.6l/ha) and 100% at sunflower hybrids H3CL+, untreated with herbicide (Table 4).

Table 4. Sunflower plants infested with parasite *Orobanche cumana*, in Brăila location, in year 2020

Sunflower hybrid	Treated with herbicide Pulsar Plus		Untreated with herbicide	
	Infested plants with broomrape (%)	The average number of broomrape stalks per sunflower plant	Infested plants with broomrape (%)	The average number of broomrape stalks per sunflower plant
H3CL+	0	0	100	1.2
H4CL+	6	1.4	43	1.1
H5CL+	3	1	63	1
Sunflower hybrid	Treated with herbicide Express SG50		Untreated with herbicide	
	Infested plants with broomrape (%)	The average number of broomrape stalks per sunflower plant	Infested plants with broomrape (%)	The average number of broomrape stalks per sunflower plant
H6SU	100	1.8	100	1.3
H7SU	31	1.2	30	1.2

In the Fundulea 1 and Fundulea 2 locations, no broomrape was observed.
Oil content, was between 41.24% at H4CL+, treated with herbicide Pulsar Plus and 53.54% at H3CL+, treated with Pulsar Plus, in location Fundulea 1 (Table 5).

Table 5. Oil content of sunflower hybrids, in Fundulea 1 location, in year 2020

Sunflower hybrid	Oil content %	
	Treated with herbicide Pulsar Plus	Untreated with herbicide
H3CL+	53.54	45.61
H4CL+	41.24	45.44
H5CL+	41.77	44.70
Sunflower hybrid	Oil content %	
	Treated with herbicide Express SG50	Untreated with herbicide
H6SU	42.90	45.30
H7SU	42.80	44.90

The year 2020, with low rainfall, especially in the vegetation phase of seed filling, affected the seed yield of tested sunflower hybrid. Seed yield, was between 2258 kg/ha at H4CL+, treated with Pulsar Plus and 3975 kg/ha at H7SU, treated with herbicide Express, in location Fundulea 1 and was calculate at density of 48000 plants/ha and humidity of 5.8.

Regarding seed yield of sunflower hybrids treated with herbicide and untreated, there were no major differences (Table 6).

Table 6. Seed yield, of sunflower hybrids, in Fundulea 1 location, in year 2020

Sunflower hybrid	Seed yield (kg/ha)			
	Treated with herbicide Pulsar Plus		Untreated with herbicide	
H3CL+	73 plants / 3720g	2446 kg/ha	36 plants / 2190g	2920 kg/ha
H4CL+	71plants / 3340g	2258 kg/ha	73 plants / 3440g	2261 kg/ha
H5CL+	57plants / 3170g	2669 kg/ha	85 plants / 4740g	2676 kg/ha
Sunflower hybrid	Seed yield (kg/ha)			
	Treated with herbicide Express SG50		Untreated with herbicide	
H6SU	51plants / 3230g	3040 kg/ha	50plants / 3240g	3110 kg/ha
H7SU	32plants / 2650g	3975 kg/ha	36plants / 2980g	3973 kg/ha

Sunflower hybrids, in the Fundulea 1 location, in a field without irrigation and with low rainfall, recorded a lower seed yield than in a year with higher rainfall.

Hectolitre weight (kg/100L) was between 62.8 kg/hl at H6SU, treated with herbicide Express and 69.1 kg/hl at H5CL+, treated with herbicide Pulsar Plus, in location Fundulea 1 (Table 7).

Table 7. Hectolitre weight, of sunflower hybrids, in Fundulea 1 location, in year 2020

Sunflower hybrid	Hectolitre weight (kg/ 100L)	
	Treated with herbicide Pulsar Plus	Untreated with herbicide
H3CL+	68.6	61.6
H4CL+	62.8	69.6
H5CL+	69.1	73.3
Sunflower hybrid	Hectolitre weight (kg/ 100L)	
	Treated with herbicide Express SG50	Untreated with herbicide
H6SU	62.8	68.5
H7SU	63.8	67.7

CONCLUSIONS

All five sunflower hybrids behave differently in all three locations we tested. Regarding sunflower downy mildew, sunflower hybrid H3CL+ has a good genetic resistance in all three locations. In location Fundulea 2, was the biggest attack of pathogen *Plasmopara hastedii*. Regarding sunflower broomrape *(Orobanche cumana)*, sunflower hybrid H3CL+ who has incorporated in mother line gene *Or5 (*resistance at race F of broomrape), if is treated with herbicide Pulsar Plus can be cultivated in area infested with this parasite with race G, G+. In location Braila, was the biggest attack of parasite *Orobanche cumana* with race G and G+ of broomrape. Sunflower hybrid H3CL +, has the biggest oil content (53.54%) than other sunflower hybrids tested and can be send to The State Institute for Testing and Registration of Varieties (I.S.T.I.S.) to be tested for another three years.

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