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NEW EDITION ON SUNFLOWER CROP - ROMANIAN TECHNOLOGY UNDER CLIMATE CHANGE CONDITIONS IN DOBROGEA

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Abstract

In Dobrogea, about 200,000 ha of sunflower (Helianthus anuus L.) are cultivated, accounting for 20% of the total area from Romania. SC FIRST GRAIN SRL-Amzacea organized in 2018 two polyfactorial experiences in the Amzacea and Fantanele fields in order to improve the technology for the sunflower culture in Dobrogea under climate change. In this paper, the behavior of 5 sunflower hybrids was observed at the attack of the main pests (pathogens: Phomopsis helianthi Munt.-Cvet. et al., Sclerotinia sclerotiorum (Lib.) de Bary, Alternaria helianthi (Hansf.) Tubaki & Nishihara, and the parasite Orobanche cumana Wallr.) and 5 experimental models for weeds and parasite control. The phytosanitary status and the yields obtained in both localities are presented. The two phytosanitary treatments during the vegetation period controlled the pathogens attack. The four ways of herbicide tested have differentiated the attack of weeds and especially the broomrape attack. The highest yield was obtained for Katana hybrid when Listego Plus was applied at 4-6 leaves 4555 kg/ha and 4480 kg/ha in Amzacea and Fantanele, respectively.

Key words*: sunflower hybrids, major pest control, yield.*

INTRODUCTION

In Romania, sunflower crop is the 3rd agricultural crop after maize and wheat. In 2018, around 1.000.000 ha were cultivated with sunflower of which 20% in Dobrogea area. One of the most dangerous plant parasites in Dobrogea area is broomrape (Păcureanu et al., 1998) due to an improper implementation of crop rotation plan. Sunflower crop has shown a significant extension, especially in the south and south-eastern area of Romania (Parker, 1994; Vrânceanu & Păcureanu, 1995). On sunflower crops, the losses can reach 30-70% due to diseases and broomrape (Iliescu et al., 1995).

Farmers can choose the sunflower hybrids from a vastly offer of new foreign hybrids. Therefore, it is required to know their behavior in the presence of main pathogens and their yields under particular abiotic (Ion et al., 2010) and biotic conditions.

Experiments were carried out to improve the technology of sunflower cultivation under climate changes by modifying the seed period about 30 days earlier to avoid the droughts periods of June-August, to develop more vigorous plants and to prevent the attack of broomrape (Manole et al., 2018). Experiments were carried out in order to control weeds that are closely related to the crop itself and some main parasitic weeds using imidazolinone herbicides (Jinga et al., 2016).

The aim of this paper is to present the five experimental plots with different weed control methods and the behaviour of five sunflower hybrids in the presence of main pathogens: white mold (*S. sclerotiorum*), stem canker (*P. helianthi*), alternaria blight (*A. helianthi*) and root parasite plant (*O. cumana*) attack. The yields are presented.

MATERIALS AND METHODS

The hybrids taken into account were imazamox-resistant: Diamantis CL, Bacardi CLP, Neostar CLP, Katana, Odessa.

The experience has been organised at SC FIRST GRAIN SRL-Amzacea, and Fantanele fields - Constanta county on demonstrative plots (Figure 8).

The soil was represented by cambic chernoziom with a profile deeper than other chernozioms, a blackish-brown soil of 40-50 cm thickness with 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. Quantity of precipitations during the vegetation period was presented in Table 1.

The surface of each plot was 1612 m^2. The planting density was 65000 plants per hectare.

In 2017 autumn the field was ploughed at 23-25 cm deep and after that, when the weeds emerged, there was applied glyphosate. Sowing was performed on April 12. The preceding crop was wheat. The seed treatment with fludioxonil 2g/l + metalaxil M 9,7 g/l (MAXIM XL 5l/t) was performed. Concurrent with sowing was applied 190 kg/ha of complex fertilizer 20.10.10+10S. Sunflower had come back on this field after four years. During the crop vegetation a mechanic hoeing was realised. At the same time 200 kg/ha of complex fertilizer (40 N + 13 SO_3) was applied. The pathogens were controlled with two fungicides applications with procloraz (Mirage 1 l/ha) and boscalid + dimoxystrobin (Pictor 0,5 l/ha), respectively.

The attack rate (AR) was calculated with the formula AR = F x I/100 (F% -frequency of the attacked organs, I % -intensity of organs attack). Observations on phytosanitary status of sunflower hybrids were made on July 16 and August 7, 2018 the last being displayed. The yields realised by the five hybrids in the five experimental plots are presented.

The five variants for weed and broomrape control were: V1 - S-metalaclor + terbutilazin applied pre-emergent (Gardoprim Plus 4 l/ha), and imazamox 25 g/l (Listego Plus 1.6 l/ha) applied post-emergent at 6-8 leaves. V2 - Control, V3 - imazamox 25 g/l (Listego Plus 1.6 l/ha) applied post-emergent at 4-6 leaves (Figure 1), V4 - S-metalaclor + terbutilazin applied pre-emergent (Gardoprim Plus 4 l/ha) and IMI 1 l/ha applied post-emergent at 8 leaves, V5-IMI 0.5 l/ha at 2-4 leaves and IMI 0.5 l/ha at 6-8 leaves.

Figure 1. Application of imazamox 25 g/l at 4-6 leaves

Table 1. Precipitation during 2018 growing season of sunflower (Valu lui Traian Station, Constanta, Romania)

	Month								
	Jan.	Feb.	March	Apr	May	June	July	Aug.	
Days	The growing season 2018: Precipitation (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	Average 1961-1990 : monthly values of precipitation (mm)								Sum
1-31	27.7	24.0	29.1	31.8	37.7	47.1	38.9	37.4	464.0

RESULTS AND DISCUSSIONS

Precipitation was atypical in June and July representing 223 mm, making possible a high attack of the main pathogens of sunflower as it is shown in the results.

Observations on phytosanitary status of sunflower plots were made on July 16 and August 7, 2018 the last being presented in the tables.

In August, due to the abundant rainfall in July (147 mm), the occurrence of *S. sclerotiorum*, *P. helianthi* and *A. helianthi* pathogenic attack on the studied hybrids was observed.

In the first location, Amzacea, in V1 *S. sclerotiorum* showed AR between 2-8%, *P. helianthi* between 3-8.75%, *A. helianthi* between 17.5-51% and *O. cumana* between 1-8.5% (Table 2).

In V2 *S. sclerotiorum* had shown an AR between 5-8%, *P. helianthi* between 3.75-7.5%, *A. helianthi* between 8.25-38% and *O. cumana* under 1.5-9.5% (Table 3).

Table 2. Phytosanitary status in V1 - Amzacea

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	7	100	7	20	15	3	60	60	36	25	10	2.5
KATANA	5	100	5	20	15	3	50	35	17.5	15	10	1.5
NEOSTAR CLP	2	100	2	25	20	5	80	25	20	100	10	10
BACARDI CLP	8	100	8	30	25	7.5	85	60	51	95	9	8.55
DIAMANTIS CL	7	100	7	35	25	8.75	90	25	22.5	80	6	4.8

Table 3. Phytosanitary status in V2 - Amzacea

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	3	100	3	95	35	33.25	50	25	12.5	25	10	2.5
KATANA	3	100	3	55	15	8.25	65	35	22.75	15	10	1.5
NEOSTAR CLP	5	100	5	60	25	15	70	35	24.5	100	10	10
BACARDI CLP	3	100	3	95	40	38	65	25	16.25	95	10	9.5
DIAMANTIS CL	7	100	7	85	15	12.75	75	30	22.5	80	10	8.0

In V3 *S. sclerotiorum* had shown an AR between 5-8%, *P. helianthi* between 5-16.25%, *A. helianthi* between 15-25.5% and *O. cumana* under 1% (Table 4).

In V4 *S. sclerotiorum* had shown an AR between 1-6%, *P. helianthi* between 3-9%, *A. helianthi* between 11.25-24% and *O. Cumana* under 4.5% (Table 5).

Table 4. Phytosanitary status in V3 - Amzacea

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	8	100	8	45	25	11.25	75	20	15	0	0	0
KATANA	5	100	5	65	25	16.25	85	30	25.5	0	0	0
NEOSTAR CLP	7	100	7	25	20	5	80	25	20	10	3	0.3
BACARDI CLP	5	100	5	30	25	7.5	85	20	17	20	5	1
DIAMANTIS CL	5	100	5	25	20	5	70	25	17.5	10	5	0.5

Table 5. Phytosanitary status in V4 - Amzacea

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	2	100	2	20	15	3	80	30	24	0	0	0
KATANA	1	100	1	25	20	5	75	15	11.25	0	0	0
NEOSTAR CLP	6	100	6	30	20	6	65	35	22.75	20	5	1
BACARDI CLP	5	100	5	45	20	9	65	30	19.5	70	5	3.5
DIAMANTIS CL	5	100	5	25	20	5	68	25	17	75	6	4.5

In V5, *S. sclerotiorum* showed an AR between 2-4%, *P. helianthi* between 3-10.5%, *A. helianthi* between 7.5-25.5% and *O. cumana* under 0.3% (Table 6).

In Fantanele field in V1, *S. sclerotiorum* hadn't shown any AR, *P. helianthi* had shown an AR between 7-13.5%, *A. helianthi* between 24-38% and *O. cumana* under 2% (Table 7).

In V2, *S. sclerotiorum* hadn't shown any AR, *P. helianthi* between 14.4-20%, *A. helianthi* between 27-33.25% and *O. cumana* between 0.1-6% (Table 8).

In V3, *S. sclerotiorum* hadn't shown any AR, *P. helianthi* between 12.4-25.5%, *A. helianthi* between 21.25-40% and *O. cumana* did not show any AR (Table 9).

In V4, *S. sclerotiorum* hadn't shown any AR, *P. helianthi* between 10-19.5%, *A. helianthi* between 27-38% and *O. cumana* hadn't shown any AR (Table 10).

In V5, *S. sclerotiorum* and *O. cumana* did not show AR, *P. helianthi* showed values between 2.5-9% and *A. helianthi* between 25.5-38% (Table11).

Table 6. Phytosanitary status in V5 - Amzacea

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	2	100	2	15	20	3	30	25	7.5	0	0	0
KATANA	4	100	4	25	15	3.75	75	20	15	0	0	0
NEOSTAR CLP	2	100	2	28	30	8.4	45	50	22.5	0	0	0
BACARDI CLP	2	100	2	35	30	10.5	75	20	15	0	0	0
DIAMANTIS CL	4	100	4	25	20	5	85	30	25.5	10	3	0.3

Table 7. Phytosanitary status in V1 - Fantanele

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	0	0	0	35	20	7	80	30	24	0	0	0
KATANA	0	0	0	25	15	3.75	85	30	25.5	0	0	0
NEOSTAR CLP	0	0	0	45	30	13.5	85	35	29.75	20	3	0.6
BACARDI CLP	0	0	0	45	25	11.25	90	30	27	25	5	1.25
DIAMANTIS CL	0	0	0	45	30	13.5	95	40	38	40	5	2

Table 8. Phytosanitary status in V2 - Fantanele

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	0	0	0	75	20	15	92	30	27.6	20	10	2.0
KATANA	0	0	0	80	18	14.4	95	35	33.25	1	10	0.1
NEOSTAR CLP	0	0	0	95	18	17.1	98	30	29.4	5	10	0.5
BACARDI CLP	0	0	0	80	25	20	95	35	33.25	30	20	6
DIAMANTIS CL	0	0	0	95	20	19	90	30	27	40	10	4

Table 9. Phytosanitary status in V3 - Fantanele

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	0	0	0	80	15	12	85	25	21,25	0	0	0
KATANA	0	0	0	85	30	25,5	98	35	34,3	0	0	0
NEOSTAR CLP	0	0	0	85	25	21,25	100	40	40	0	0	0
BACARDI CLP	0	0	0	75	25	18,75	100	30	30	0	0	0
DIAMANTIS CL	0	0	0	80	25	20	95	30	28,5	0	0	0

Table 10. Phytosanitary status in V4 - Fantanele

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	0	0	0	55	30	16,5	80	40	32	0	0	0
KATANA	0	0	0	65	30	19,5	90	30	27	0	0	0
NEOSTAR CLP	0	0	0	65	20	13	95	40	38	0	0	0
BACARDI CLP	0	0	0	55	20	11	95	35	33,25	0	0	0
DIAMANTIS CL	0	0	0	50	20	10	95	40	38	20	3	0,6

Table 11. Phytosanitary status in V5 - Fantanele

HYBRID	Pathogens and parasite											
	Sclerotinia sclerotiorum			*Phomopsis helianthi*			*Alternaria helianthi*			*Orobanche cumana*		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
ODESSA	0	0	0	25	15	3,75	85	30	25,5	0	0	0
KATANA	0	0	0	35	10	3,5	95	35	33,25	0	0	0
NEOSTAR CLP	0	0	0	45	20	9	95	40	38	0	0	0
BACARDI CLP	0	0	0	25	10	2,5	95	40	38	0	0	0
DIAMANTIS CL	0	0	0	30	15	4,5	85	30	25,5	0	0	0

The yields obtained in the first location had values between 2805-3030 kg/ha at V2, 3710-4222 V5, 3780-4555 kg/ha at V3, 3810-4480 at V4 and 3900-4410 kg/ha at V1 (Figure 2).

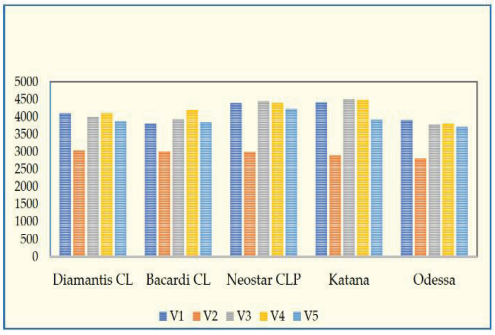

Figure 2. Yields (kg/ha) obtained in Amzacea plots

The yields obtained in the second location had values between 2810-3100 kg/ha at V2, 3810-4250 at V1, 3850-4480 kg/ha at V3, 3780-4300 at V4 and 3880-4300 kg/ha at V5 (Figure 3).

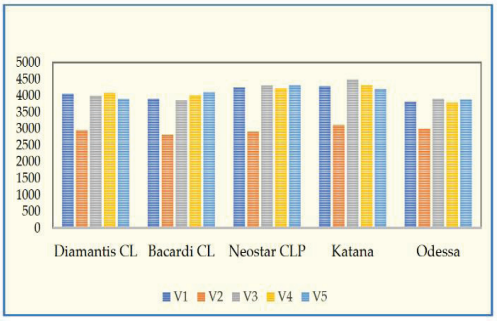

Figure 3. Yields (kg/ha) obtained in Fantanele plots

As a result of these experiments is recommended the following technological elements: a pre-emergent herbicide with glyphosate in autumn and one with S-metalaclor + terbutilazin in spring, during the vegetation an IMI herbicide applied at 4-6 leaves, using a competitive hybrids of new generation which be able to ensure considerable yields.

Weeds problem in sunflower crops in Amzacea and Fantanele fields were: *Chenopodium album*, *Amaranthus blitoides*, *Convolvulus arvensis*, and *Echinochloa crus-galli*.

Weed species, which had a density of 3-5 plots, became a problem for diseases and plants per square meters in sunflower cultivated yields in untreated plots (Figures 4, 6, 7).

Figure 4. *P. helianthi* attack

Figure 5. *A. helianthi* attack

Figure 6. *S. sclerotiorum* attack

Figure 7. *O. cumana* attack

Figure 8. Overview of the experimental field

CONCLUSIONS

The 2018 was an atypical year for Dobrogea, with precipitations over limits in June and July, which favoured the attack of the pathogens.

The two phytosanitary treatments during the vegetation period controlled the pathogens attack.

The four ways of herbicide tested have differentiated the attack of weeds and especially the broomrape attack. The production obtained in the 5 herbicide blocks and 5 experienced hybrids were clearly differentiated. V4 determined constant high yields throughout all hybrids. The highest yields were obtained for V3 at the Neostar and Katana hybrids 4444 and 4555 kg/ha, respectively in Amzacea and 4300-4480 kg/ha, respectively in Fantanele.

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