

## THE BEHAVIOUR OF SOME SUNFLOWER (*Helianthus annuus*) HYBRIDS FROM ABROAD UNDER WATER AND HEAT STRESS AT ARDS SIMNIC

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### Abstract

*The heat and water stress always bring about a diminishing of yields, the magnitude of it being influenced by the duration and the intensity of the stress phenomenon. Sunflower is a drought tolerant species yet long term water shortage can inflict damages in the growing and development of the sunflower plant. The present paper deals with 5 sunflower hybrids of German origin in the soil and climate conditions of ARDS (Agricultural Research and Development Station) Simnic (Dolj) in the „extremelly” dry year 2007 and during 2008 year which was considered dry. There were recorded reductions of the vegetation phases, of productivity elements as well as of seed yield. The best yield was given by Enduro hybrid and this hybrid is recommended for extension and further studies in this area and simillar areas.*

**Key words:** head diameter, plant height, seed yield, sunflower, water and heat stress.

### INTRODUCTION

Sunflower is an important crop for Romania, ranking third in area after corn and wheat [3]. The main factor of progress of this culture is the introduction and expansion of production of sunflower hybrids with high production potential and high resistance to biotic and abiotic stress factors. Of abiotic stress factors, drought is an important goal of improving the species, especially in Oltenia area.

Although, in general, sunflower is a species well adapted to drought, due to efficient root system, the effects of climatic stress disturbance is manifested by morpho-anatomical, physiological and biochemical changes that ultimately lead to lower agricultural production [6].

In recent years the supply of sunflower hybrids became diverse, reaching 148 hybrids [1].

Therefore, sunflower growers must know these hybrids, both in terms of morphological and physiological traits and characteristics in terms of production, to choose hybrid or hybrids that best fit the actual conditions culture [4, 5].

This paper aims to analyze the behavior of five sunflower hybrids in central Oltenia area based testing for multi-cultures, compared with the recommendation of the best-adapted crop hybrids.

### MATERIAL AND METHOD

Biological material was represented by five experimented sunflower hybrids of German origin (Mateol RO, Heliasol RO, Enduro, Salut RM, Heliador). Experimentation was done on a red preluvosoil, the ARDS Şimnic in crop years 2006 -2007 and 2007-2008. Studies were made on both seed yield and main elements of productivity of hybrids. Experimental variants were located by the method plots randomized blocks with four repetitions pattern. Each experimental plot had an area of 29.4 m<sup>2</sup>.

The experimental results were statistically processed by analysis of variance - Anova, F test and differences limit [7].

Analysis of connections between the characters was done by simple correlation method [2].

To better characterize the climatic conditions of experimental years 2007-2008, there are

presented, in comparison (Table 1) the monthly rainfalls and average temperatures and multiannual average, hence the extreme drought and the dry period relevant to the sunflower crop in the experimental years.

Table 1. The climatic conditions of experimental years 2007-2008 at ARDS Simnic

Year agricol	The months of the year					
	The cold period IX - 31III	IV	V	VI	VII	VIII
Rainfalls (mm)						
Multi-annual average	203.4	54.0	63.7	74.4	88.3	66.3
2006/2007	-63.9	-54.0	+55.3	-27.4	-81.3	+49.7
2007/2008	+179.7	-2.0	-35.7	-30.4	+22.9	-66.3
Temperatures 0 C						
Multi-annual average		11.8	17.8	21.2	23.8	23.2
2006/2007		+0.9	+0.9	-0.4	+5.4	-0.1
2007/2008		+0.6	-0.7	+5.9	-0.3	+1.1

## RESULTS AND DISCUSSIONS

The analysis of variance for seed yield and productivity elements of sunflower hybrids in 2007-2008 (Table 2) revealed distinct significant interaction effects of the years with the hybrids in respect of seed yield, plant height and the 1000 seed weight (TSW), and significant effects for the head diameter.

They show that hybrids react differently from one year to another.

Analyzing the experimental results for each year separately shows that the values obtained were similar for both seed yield and the elements of productivity.

In 2008 seed yield ranged from 1.29 t/ha to 1.79 t/ha (Fig. 1). The highest yield was obtained by hybrid Enduro (1.79 t/ha - a very significant positive difference from the control), followed by hybrid Mateol RO (1.63 t/ha - with a distinctly significant positive difference from the control).

Table 2. Anova and F test for seed yield and elements of productivity

Source of variance	Degrees of freedom	Sum of squares	Mean square	F- value
Seed yield				
Years	1	0.01		
Hybrids	4	1.20	0.3	
H x Y	4	14.81	3.70	16.04** (3.01-4.77)
Error	16	0.30	0.0187	
Plant height				
Years	1	563.36		
Hybrids	4	729.03	182.25	
H x Y	4	118.91	29.72	5.25** (3.01-4.77)
Error	16	555.26	34.70	
Head diameter				
Years	1	456.3		
Hybrids	4	807.2	201.8	
H x Y	4	387.2	96.8	23.9** (3.01-4.77)
Error	16	134.8	8.42	
TSW				
Years	1	22.56		
Hybrids	4	52.56	13.14	
H x Y	4	78.08	19.52	4.56* (3.01-4.77)
Error	16	46.16	2.88	

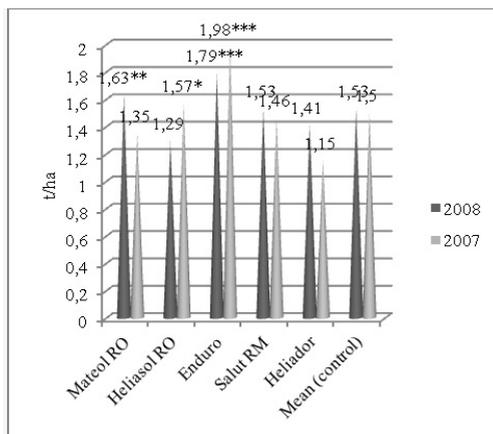


Fig. 1. Seed yield at hybrids studied - ARDS Simnic, 2007-2008

In 2007 seed yield ranged from 1.15 t/ha and 1.98 t/ha, the largest seed yield recorded by hybrid Enduro (1.98 t/ha).

Helisol RO hybrid had a good production (1.57 t/ha), significantly superior to control (mean).

The plant height in 2008 (Fig. 2) ranged between 106 cm and 126 cm.

Salut RM hybrid significantly exceeded only control (126 cm), the remaining hybrids

recorded close to control and they were insignificant.

In 2007 the plant height varied between 100 cm and 110 cm emphasizing Salut RM hybrid (118 cm) which significantly exceeded the control.

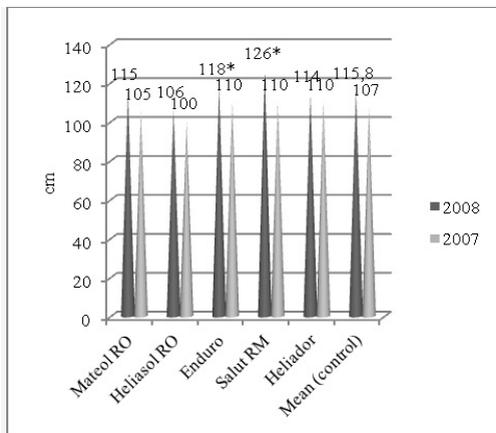


Fig. 2. Plant height at hybrids studied - ARDS Simnic, 2007-2008

The head diameter (Fig. 3) hybrids studied in 2008 ranged from 13 cm to 19 cm.

Enduro hybrid recorded the largest head diameter (19 cm - significantly positive compared to the control).

In 2007, hybrid Mateol RO recorded the largest head diameter (20 cm - significantly positive compared to the control).

1000 seed weight (TSW) in 2008 (Fig. 4) ranged between 34 g and 60 g, the highest value obtained TSW Mateol RO a hybrid (60 g), the only hybrid significantly exceeded distinct control.

In 2007, Enduro was the only hybrid which recorded a significantly higher TSW compared to the control (44 g).

As a mean, those two years of experimentation (Table 3) obtained a seed yield of 1.52 t/ha. We noted that Enduro hybrid with a production of 1.89 t/ha, was very significantly superior to control.

The lowest seed yield was obtained by Heliador (1.28 t/ha) and the remaining hybrids have achieved insignificant production.

The highest plant height (Table 3) was recorded at hybrid Salut RM (122 cm), the largest head diameter was obtained by hybrid Enduro

(18.5 cm), and the largest TSW was obtained by hybrid Mateol RO (51 g).

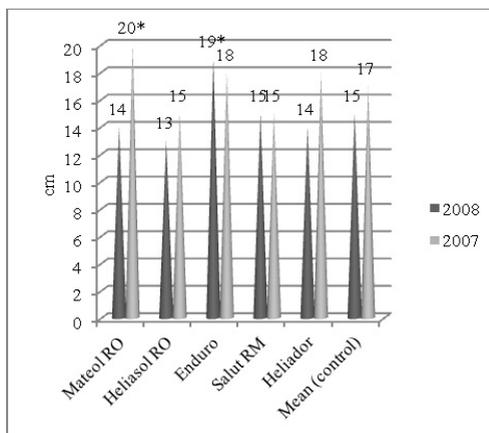


Fig. 3. Head diameter at hybrids studied - ARDS Simnic, 2007-2008

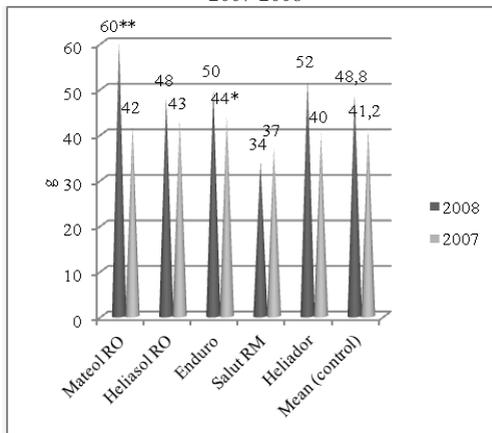


Fig. 4. 1000 seed weight at hybrids studied - ARDS Simnic, 2007-2008

In the study there were observed correlations between characters (Table 4) yet they were insignificant.

Table 3. Mean values for seed yield and productivity elements - ARDS Simnic (2007-2008)

Hybrid	Seed yield (t/ha)	Plant height (cm)	Head diameter (cm)	TSW (g)
Mateol RO	1.49	108	17	51**
Heliasol RO	1.43	103 <sup>0</sup>	14 <sup>0</sup>	45.5
Enduro	1.89***	114	18.5*	47
Salut Rm	1.50	122**	15	35.5 <sup>000</sup>
Heliador	1.28 <sup>00</sup>	110	16	46
Mean (control)	1.52	111.4	16.1	45
LSD 5%	0.165 t/ha	7.21 cm	1.97 cm	3.54 g
LSD 1%	0.227 t/ha	9.93 cm	2.72 cm	4.88 g
LSD 0.1%	0.317 t/ha	13.84 cm	3.79 cm	6.80 g

Correlations between seed yield and elements of productivity were positive but very small, contrary to data obtained by other authors showing that adverse climatic conditions of culture can change these correlations. The only negative correlation, there was close to significant between plant height and TSW.

Table 4. Correlations between seed yield and productivity elements in hybrids studied - ARDS Șimnic (2007-2008)

	Seed yield (t/ha)	Plant height (cm)	Head diameter (cm)	TSW (g)
Seed yield (t/ha)	-	0.302	0.694	0.089
Plant height (cm)		-	0.186	-0.743
Head diameter (cm)			-	0.486
TSW (g)				-

## CONCLUSIONS

- The climate of the years 2007-2008 were unfavorable for sunflower crop.
- Enduro hybrid obtained the highest seed yields in both years of experimentation, recommending extension of the culture for the study area and other areas with similar climatic conditions.

- The least adapted to the experimental conditions was the hybrid Heliador which gave negative differences in comparison with control, both in 2007 and in 2008.
- In these conditions, plant height, head diameter and TSW were positively correlated with seed yield, but the values were insignificant.

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