RESEARCH ON THE BEHAVIOR OF SOME SUNFLOWER GENOTYPES IN THE CONDITIONS OF SANDY SOILS IN THE SOUTH-WEST OF OLTENIA

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Abstract

The sunflower is a plant well adapted to the pedo-climatic conditions from Romania, having a high productive potential. There are several varieties and hybrids of sunflowers, each of which has its own requirements for cultivation and also, maximum production potential utterance. Till now, the climatic conditions recorded in the area of sandy soils in the South of Oltenia were favorable for the growth and development of sunflower plants. In 2022 year, the studies on the behaviour of 24 sunflower genotypes in the conditions of sandy soils in Southern Oltenia was carried out at the Research Station Development for Plant Culture on Sands Dăbuleni. Here, the yield recorded for the 24 genotypes of sunflower evaluated, showed productions between 2743-3188 kg/ha, with an average of 2989 kg/ha, compared to which they were highlighted by production differences of 156-199 kg/ha, statistically assured as significant and distinctly significant, genotypes: T 19 - 9A1, T 19 - SU- 6A and ANT -IMI- CL+/2066A.

Key words*: **sandy soils, sunflower, genotypes, productivity, quality***

INTRODUCTION

The sunflower is native to Central and North America and spread around the globe especially for oil.

According to FAO statistics (2017), Romania ranks 4th in the top of the largest sunflower producers (2.91 million tons) after Ukraine, Russia and Argentina (https://nuseed.com/ro/floarea-soarelui- the history/).

It is a plant that is grown on large areas in our country, especially in Dobrogea, the Romanian and Western Plains. The sunflower is one of the most widespread oleiferous plants in our country.

The importance of sunflower cultivation is given by its widespread use in human food, but also in animal feed, including industrial and energy uses (https://www.agro.basf.ro; https://nuseed.com/ro).

An oil is obtained from its seeds that is widely distributed both in Romania and abroad. The high demand for sunflower oil, as well as the multiple uses of this plant, lead more farmers to turn to its cultivation.

The sunflower is a plant well adapted to the pedo-climatic conditions in Romania, having a high productive potential. There are several varieties and hybrids of sunflower, each with its own requirements in terms of suitable areas for cultivation and production potential.

In choosing the variety, farmers must take into account the characteristics of the soil, the area of cultivation and the objectives they plan with the establishment of the crop.

In the context of climate change and the fact that Romania's agriculture has more than 3 million hectares affected by drought, the research carried out on sunflowers had as its national objective the creation of lines and finally hybrids, with resistance to drought and high air temperatures , but also with increased resistance to low temperatures during the period of germination and emergence of plants (Maria Păcureanu et al., 2007, Tabără Olesea et al., 2018).

In general, sunflower breeding for abiotic stress resistance has seen the most progress in selection for drought resistance. This was done with the help of a large number of parameters, most of which are physiological parameters (Țerbea M. et al., 1995, Škorić, 2009). Due to the structure of its major organs (root, stem and leaves), sunflower is more resistant to abiotic stress than other field crops.

Due to the very well developed root system and the ability to accumulate water reserves in the core of the stem and to resist the temporary dehydration of the tissues (Vronschih, M. et al. 2002, Drăghici Iulian et al., 2016), the sunflower does not show changes essentials of yield under the action of drought, being considered a tolerant plant to this phenomenon. However, long-term drought can significantly affect crop growth and development. The negative effect of water and heat stress on productivity varies according to the developmental stage of the crop, the severity of drought and the tolerance of the genotype. During vegetative growth and development under stress conditions, stem height, calathidium diameter, number of nodes or leaves, and plant leaf area are reduced. Young seedlings are considered to be the most sensitive to lack of water (Fulda S. et al. 2011). The research carried out by Marinică Gh. and Dascălu D., 1984, on sunflower grown on sandy soils showed that prolonged drought, as well as its repeated return during the vegetation period, has negative repercussions on production, therefore it is necessary to ensure a water consumption of approx. 1200-2400 m^3/ha.

MATERIALS AND METHODS

The research was carried out at the Research - Development Station for Plant Culture on the Dăbuleni Sands in 2022 and aimed to study the behavior of 24 genotypes of sunflower in the conditions of sandy soils in the south of Oltenia.

The experiment was located according to the randomized block method in 3 replications, under irrigation conditions (Table 1).

Table 1. The experimental variants studied at SCDCPN Dăbuleni in 2022

No. crt.	*HYBRID*	*No. crt.*	*HYBRID*
1	*Performer*	13	*HS - 8445*
2	*FD 15 CL 44*	14	*HS - 8564*
3	*FD 15 E 27*	15	*HS - 8840*
4	*FD 18 E 41*	16	*HS - 5440*
5	*FD 19 E 42*	17	*T 20- IMI- 7 A2*
6	*FD 16 CL 50*	18	*T 19- SU -6A*
7	*FD 18 CL 58*	19	*T 19 – 9 A1*
8	*FD 20 CL 70*	20	*T 19- SU -9A2*
9	*HS - 7083*	21	*T 19- 10A1*
10	*HS - 8566*	22	*ANT- IMI-CL+/2066*
11	*HS - 6877*	23	*H94 -2022*
12	*HS - 8232*	24	*T-20-9A*

The study was carried out on a psammosol with low natural fertility, characterized by a low supply of organic carbon (0.28-0.45%) and nitrogen (0.06-0.08%), an average supply of phosphorus (21.8-30.5 ppm) and in potassium (75-91.5 ppm). The pH of the soil on which the experiment was located showed values of 4.18 - 6.25, which shows a strongly acidic to moderately acidic reaction (Table 2).

Table 2. Soil chemical composition in the experimental field

Depth (cm)	*Total nitrogen (%)*	*Extractable phosphorus (ppm)*	*Exchangeable potassium (ppm)*	*Organic carbon (%)*	*pH*
0-20	0.08	21.8	75	0.28	4.18
20-40	0.06	30.5	91.5	0.45	6.25

The mineral elements necessary for the nutrition of the sunflower plant were provided, according to the cultivation technology in sandy soil conditions, by applying the dose of N150P80K80, as follows: the dose of N80P80K80, in the form of complex fertilizers of the type 16:16:16 (500 kg/ha), was applied to the preparation of the sown bed, and the dose of N70 was applied to the vegetation, in the form of ammonium nitrate (approx. 210 kg/ha), together with mechanical weeding. The sunflower hybrids were sown on 04.05.2022, 18 days being needed from sowing until the plants sprout. The water consumption of the plant was ensured from precipitation and irrigation, by applying 4 waterings with watering norms of 250 m^3 water/ha. In order to determine the degree of readiness of the studied sunflower hybrids to the pedoclimatic conditions specific to the southern area of Oltenia, determinations of plant resistance to natural infection with various pathogens, determinations of biometry, productivity and quality of seed production were carried out obtained. The results of the research were calculated and analyzed by the method of analysis of variance (ANOVA) and with the help of mathematical functions.

RESULTS AND DISCUSSIONS

The sunflower is a mesothermal, relatively heat-demanding plant that, to pass through the vegetation stages, needs at least 2350 ^{0}C (T> 0 ^{0}C) or 1600 ^{0}C (T > 5 ^{0}C), (Bîlteanu et al., 1988). In 2022, the sum of the temperature degrees recorded at the weather station RDSPCS Dabuleni was 3010.52^{0}C (sowing-maturity) and 2618.74 ^{0}C (sunrise-maturity), sufficient for the biological requirements of the studied genotypes. From a thermal point of view, the year 2022 was very hot throughout the vegetation period of the sunflower crop, with the average monthly temperature recorded being higher by 1.35 ^{0}C, compared to the multiannual average temperature (Table 3). In April, however, the low temperatures during the nights, associated with the phenomenon of frost recorded on the 11th, 14th and 21st of April, extended the interval until the emergence of sunflower plants (18 days). The summer months were extremely hot, with maximum temperatures between 35.7 - 41.6 ^{0}C. As for the rainfall regime, it was deficient during the vegetation period, with only 225 mm of rainfall recorded, 44.96 mm below the multiannual average, insufficient rainfall for the normal development of plant metabolism. The negative effect of water and thermal stress on productivity varies depending on the stage of crop development, the severity of the drought and the tolerance of the genotype (Drăghici I. et al., 2020). During vegetative growth and development under stress conditions, stem height, calathidium diameter, number of nodes or leaves, and leaf area of plants are reduced. Except for April, when the amount of precipitation was sufficient for the needs of sunflower plants under the germination-emergence phenophase, during the period May-August, the amount of precipitation recorded was not sufficient for normal growth and development of sunflower plants, requiring sprinkler irrigation (4 waterings at a rate of 250 m^3 water/ha. The emergence of sunflower plants was uniform, the number of plants/m2 being between 5.2-5.5.

Table 3. Climatic conditions during the sunflower growing season – 2022

Climatic element	***April***	***May***	***June***	***July***	***August***	*Average /The amount*
Average temperature (°C)	11.7	18.2	22.9	25.2	25.1	20.62
Montly maximum (°C)	26.3	31.8	35.7	41.6	40.8	35.24
Montly minimum (°C)	-3.1	3.5	11.8	12.5	14.1	9
Rainfall (mm)	73.6	38.4	48.6	15	49.4	225
Days with rain	13	8	11	8	11	51
Relative humidity (%)	62.6	56.8	61.6	50.6	57.3	57.78
Temperature multianual average (1956-2022), (°C)	11.88	16.95	21.55	23.29	22.66	19.27
Rainfall (mm) Multianual average (1956-2022)	46.97	62.39	69.83	54.00	36.76	269.96

Biometrical determinations, regarding plant height and calathide diameter, revealed the following aspects (Table 4): plant height differed according to genotype, being between 133 cm for the *T 19 - 9 A1* hybrid and 154 -164 cm for the *T19-10 - A1* hybrid and *Performer*, with an average of 145 cm, and the diameter of the calathes oscillated between 13.6 cm, for the *HS 5440* hybrid and 20.8 cm, for the *T 19-10-A1* hybrid, with an average of 17.6 cm.

From the point of view of drought resistance, all studied hybrids receivedgrade 2, in the culture conditions from RDSPCS Dabuleni, showing a high tolerance to temperatures above 40 ^{0}C and low relative air humidity.

Table 4. Experimental determinations in sunflower hybrids studied on sandy soil 2022

No. crt.	*Hybrid*	*No. plants/m^{2}at emergence*	*Plant height at flowering (cm)*	*Diameter of calathides (cm)*	*Drought resistance (grades 1- 9)*
1	*Performer*	5,5	164	18,4	2
2	*FD 15 CL 44*	5,5	152	17,3	2
3	*FD 15 E 27*	5,4	147	17,8	2
4	*FD 18 E 41*	5,5	149	18,8	2
5	*FD 19 E 42*	5,5	140	19,2	2
6	*FD 16 CL 50*	5,4	142	18,4	2
7	*FD 18 CL 58*	5,5	138	14,6	2
8	*FD 20 CL 70*	5,5	144	13,6	2
9	*HS - 7083*	5,5	151	16,2	2
10	*HS - 8566*	5,5	145	15,6	2
11	*HS - 6877*	5,4	146	16,7	2
12	*HS - 8232*	5,5	150	14,4	2
13	*HS - 8445*	5,5	147	16,8	2
14	*HS - 8564*	5,5	144	17,9	2
15	*HS - 8840*	5,4	142	19,6	2
16	*HS - 5440*	5,5	149	18,1	2
17	*T20 - 1M1-7A2*	5,4	138	18,5	2
18	*T 19 - SU-6A*	5,2	135	18,4	2
19	*T 19 - 9A1*	5,4	133	18	2
20	*T 19 - SU- 9A2*	5,4	139	18,6	2
21	*T 19 - 10A1*	5,5	154	20,8	2
22	*ANT-IMI-CL+/2066A*	5,2	149	19,4	2
23	*H94-2022*	5,2	153	18,2	2
24	*T – 20 - 9A*	5,5	146	18,8	2
AVERAGE		5,4	145	17,6	2

Native to southern areas, the sunflower is a short-day plant that loves light and heat. In intense light the plants develop well, form a relatively short stem with large calathides,

which give high yields. Under such conditions, the seeds have a high oil content. The course of the main vegetation phenophases was differentiated, depending on the genotype (Table 5) and its adaptability to the conditions of the cultivation area. The button phenophase was recorded between June 6 and 10, the flowering phase between June 10 and 15, and seed formation was recorded between June 20 and 25, 2022. In terms of heat, sunflower requirements vary depending on the phenophase it is in. To reach full maturity, the sunflower needs a heat amount of 2500 ^{0} C. Excess heat, high heat during flowering, have negative effects both on the physiological processes carried out at the level of the leaves, as well as on pollination and fruiting, with negative repercussions on the productions obtained. In the summer of 2022, the temperatures recorded in the flowering phenophase were very high, frequently exceeding 35-37 ^{0}C. Against the backdrop of low and unevenly distributed rainfall, sunflowers grown on sandy soils faced thermohydric stress, even more so if we refer to the flowering phenophase, corresponding to the driest calendar period of the year.

Table 5. Phenological observatios on sunflower hybrids studied on sandy soil, under the conditions of 2022

No. crt.	*Hybrid*	*Budding*	*Flowering*	*Seed format*	*Harvest date*
1	*Performer*	6.06.2022	10.06.2022	20.06.2022	29.08.2022
2	*FD 15 CL 44*	6.06.2022	10.06.2022	20.06.2022	29.08.2022
3	*FD 15 E 27*	6.06.2022	10.06.2022	20.06.2022	29.08.2022
4	*FD 18 E 41*	7.06.2022	10.06.2022	20.06.2022	29.08.2022
5	*FD 19 E 42*	7.06.2022	10.06.2022	20.06.2022	29.08.2022
6	*FD 16 CL 50*	7.06.2022	10.06.2022	20.06.2022	29.08.2022
7	*FD 18 CL 58*	8.06.2022	12.06.2022	22.06.2022	29.08.2022
8	*FD 20 CL 70*	8.06.2022	12.06.2022	22.06.2022	29.08.2022
9	*HS - 7083*	8.06.2022	12.06.2022	22.06.2022	29.08.2022
10	*HS - 8566*	9.06.2022	13.06.2022	23.06.2022	29.08.2022
11	*HS - 6877*	9.06.2022	13.06.2022	23.06.2022	29.08.2022
12	*HS - 8232*	9.06.2022	13.06.2022	23.06.2022	29.08.2022
13	*HS - 8445*	9.06.2022	13.06.2022	23.06.2022	29.08.2022
14	*HS - 8564*	9.06.2022	14.06.2022	24.06.2022	29.08.2022
15	*HS - 8840*	9.06.2022	13.06.2022	23.06.2022	29.08.2022
16	*HS - 5440*	9.06.2022	14.06.2022	24.06.2022	29.08.2022
17	*T20 - 1M1-7A2*	9.06.2022	14.06.2022	24.06.2022	29.08.2022
18	*T 19 - SU-6A*	10.06.2022	15.06.2022	25.06.2022	29.08.2022
19	*T 19 - 9A1*	10.06.2022	15.06.2022	25.06.2022	29.08.2022
20	*T 19 - SU- 9A2*	10.06.2022	14.06.2022	24.06.2022	29.08.2022
21	*T 19 - 10A1*	10.06.2022	15.06.2022	25.06.2022	29.08.2022
22	*ANT-IMI-CL+/2066A*	10.06.2022	15.06.2022	25.06.2022	29.08.2022
23	*H94-2022*	10.06.2022	15.06.2022	25.06.2022	29.08.2022
24	*T- 20-9A*	10.06.2022	15.06.2022	25.06.2022	29.08.2022

The course of the main vegetation phenophases was differentiated, depending on the genotype. The button phenophase was recorded between June 6 and 10, the flowering phase between June 10 and 15, the seed formation phase between June 20 and 25, 2022.

Regarding the resistance of sunflower plants to natural infection with pathogens (Table 6), the analyzed genotypes behaved differently, the degree of attack being between 2-20% for infection with *Plasmopara helianthi*, between 3-25% for infection with *Botrythis cinerea* and between 2-12% in *Phoma oleraceae* infection (Table 6). The most sensitive hybrid was *HS 8566*, where pest sensitivity was noted as 20% to *Plasmopara helianthi*, 25% to *Botrythis cinerea* and 12% to *Phoma oleraceae*.

Table 6. The behavior of sunflower hybrids against the attack of pathogens, 2022

No. crt.	Hybrid	*Plasmopara helianthi*		*Botrythis cinerea*		*Phoma oleraceae*	
		Ga (%)	*Behavior*	*Ga (%)*	*Behavior*	*Ga (%)*	*Behavior*
1	*Performer*	4	R	4	R	3	R
2	*FD 15 CL 44*	3	R	3	R	2	R
3	*FD 15 E 27*	3	R	4	R	3	R
4	*FD 18 E 41*	3	R	5	R	3	R
5	*FD 19 E 42*	3	R	3	R	3	R
6	*FD 16 CL 50*	5	R	4	R	3	R
7	*FD 18 CL 58*	3	R	3	R	3	R
8	*FD 20 CL 70*	3,5	R	4	R	3	R
9	*HS - 7083*	2	R	3	R	3	R
10	*HS - 8566*	*20*	*MR*	25	*MR*	12	*MR*
11	*HS - 6877*	2	R	3	R	3	R
12	*HS - 8232*	3,5	R	3	R	3	R
13	*HS - 8445*	2	R	3	R	3	R
14	*HS - 8564*	2	R	3	R	3	R
15	*HS - 8840*	2	R	3	R	3	R
16	*HS - 5440*	2	R	3	R	3	R
17	*T20 - 1M1-7A2*	2	R	3	R	3	R
18	*T 19 - SU-6A*	2	R	3	R	3	R
19	*T 19 - 9A1*	2	R	3	R	3	R
20	*T 19 - SU- 9A2*	2	R	3	R	3	R
21	*T 19 - 10A1*	2	R	3	R	3	R
22	*ANT-IMI-CL+/2066A*	2	R	3	R	3	R
23	*H94-2022*	2	R	3	R	3	R
24	*T- 20-9A*	3	R	3	R	3	R

The rating scale was used for the degree of attack (Ionescu C. et al., 1989):
0 = FR (very resistant)
1-10 = R (Resistive)
11-25 = MR (Medium Resistance)
26-50 = S (sensitive)
51-100 = FS (highly sensitive)

The production results obtained for the 24 genotypes of sunflower under sandy soil conditions showed an average production of 2989 kg/ha, with variation limits in the range of 2743-3188 kg/ha (Table 7). Compared to the average of the hybrids, the hybrid *ANT -IMI- CL+/2066A* stood out with a distinctly significant increase in production compared to the control, of 199 kg/ha, and with an increase of 174 kg/ha the hybrid *T19 - SU-6A*. A significant increase in production compared to the control, of 156 kg/ha, was recorded by the hybrid *T 19 - 9A1*.

Sunflower is one of the most important oil crops globally, being cultivated on more than 22 million hectares worldwide (Škorić et al., 2008). Sunflower is the main oilseed crop in Romania, due to the oil content of the seeds. The specialized literature shows an oil content in sunflower seeds between 44-53%. Productivity and quality are strongly influenced by genotype, environment and their interaction (Sidlauskas and Bernotas, 2003; Denčić et al., 2011). Unfavorable environmental conditions lead to variation in seed size and quality, mechanical seed injury and damage during seed storage, and disease attack (Chloupek et al., 2003; Rahman et al., 2009). Škorić et al. (1990, 1996) and Dušanić (1998) mention variations in the oil content of sunflower seeds in different years and localities. Studying sunflower production in many localities, determined that environmental factors significantly affect seed oil content.

Table 7. Synthesis of production results obtained in sunflower hybrids, 2022

Nr. crt	*Hybrid*	*Production*		*Difference – kg/ha -*	*Significance*
		Kg/ha	*%*		
1	Performer	2743	91.8	-246	000
2	FD 15 CL 44	2983	99.8	-6	-
3	FD 15 E 27	3088	103.3	99	-
4	FD 18 E 41	2849	95.3	-140	0
5	FD 19 E 42	2946	98.6	-43	-
6	FD 16 CL 50	2923	97.8	-66	-
7	FD 18 CL 58	2930	98.0	-59	-
8	FD 20 CL 70	3063	102.5	74	-
9	HS - 7083	3083	103.1	94	-
10	HS - 8566	3056	102.2	67	-
11	HS - 6877	3054	102.2	65	-
12	HS - 8232	2885	96.5	-104	-
13	HS - 8445	2943	98.5	-46	-
14	HS - 8564	3052	102.1	63	-
15	HS - 8840	2850	95.3	-139	0
16	HS - 5440	2966	99.2	-23	-
17	T 20 – IMI- 7A2	3000	100.4	11	-
18	T 19 - SU- 6A	3163	105.8	174	**
19	T 19 - 9A1	3145	105.2	156	*
20	T 19 - SU- 9A2	2928	98.0	-61	-
21	T 19 - 10 A1	3048	102.0	59	-
22	ANT -IMI- CL+/2066A	3188	106.7	199	**
23	H 94- 2022	2875	96.2	-114	-
24	T 20- 9A	2970	99.4	-19	-
Average		2989	100	0	Mt

LSD 5% = 120 kg/ha LSD 1% = 160 kg/ha LSD 0.1% = 210 kg/ha

In 2022, the quality determinations of the 24 sunflower hybrids considered: oil content, mass of hectoliters and weight of 1000 seeds (table 8). In the studied

hybrids, the oil content was between 55.6% in the *Performer* hybrid and 61.0% in the *T20-IMI-7A2* hybrid with an average of 57.9%. The hectoliter mass is the mass of one hectoliter of seed expressed in kilograms. The higher the number of well-formed, healthy, whole-shelled, insect-free kernels in the seed mass, the higher the hectoliter mass value. In the sunflower hybrids studied, MH was between 27.2 kg/hl in the hybrid *HS 7083* and 38.1 kg/hl in the hybrid *T19-SU-9A2*, with an average of the hybrids of 30.6 kg.

1000-grain mass is the weight of a thousand grains (WTG) at the current moisture content. Dušanić (1998) claims that WTG depends on the genotype, the conditions of the year of study. Mrdja, J., et al., 2012 determined in the climatic conditions of Serbia the weight of a thousand grains of 51.99-70.10 g, and in the conditions of Ukraine, 48.02-57.03 g. In the 24 sunflower hybrids studied in 2022, WTG was between 35.0 g for *FD 15 E 27* and 74.8 g for *HS 8840*, with a hybrid average of 50.2 g.

Table 8. Chemical composition of sunflower seeds

Hybrid	*Oil (%)*	*MH (kg/hl)*	*MMB (g)*
Performer	55.6	34.0	54.0
FD 15 CL 44	59.0	28.4	55.4
FD 15 E 27	58.7	34.4	35.0
FD 18 E 41	57.3	32.8	43.4
FD 19 E 42	59.3	34.6	53.7
FD 16 CL 50	56.4	28.6	45.1
FD 18 CL 58	60.0	30.8	47.7
FD 20 CL 70	56.0	29.6	50.0
HS - 7083	58.0	27.2	52.4
HS - 8566	56.9	27.8	47.0
HS - 6877	57.0	32.6	35.8
HS - 8232	58.3	31.6	39.5
HS - 8445	59.0	30.4	41.8
HS - 8564	56.0	33.2	45.6
HS - 8840	60.8	31.8	74.8
HS- 5440	56.6	31.0	45.4
T20- IMI-7A2	61.0	31.4	54.6
T19- SU- 6A	57.6	34.4	58.0
T19- 9A1	58.8	34.8	45.4
T19- SU- 9A2	57.9	38.1	38.2
T19- 10A1	56.7	31.6	70.0
ANT - IMI- CL +/2066A	57.6	32.0	60.0
H94- 2022	57.0	33.4	52.1
T- 20 - 9A	59.0	30.8	60.2
AVERAGE	57.9	30.6	50.2

A distinctly significant positive correlation was established between the diameter of the calathids and the weight of a thousand grains, given by a polynomial equation of the second degree (r = 0.69 **), which demonstrates that the larger the calathids, the higher the weight of the weight of a thousand grains will be higher (Figure 1).

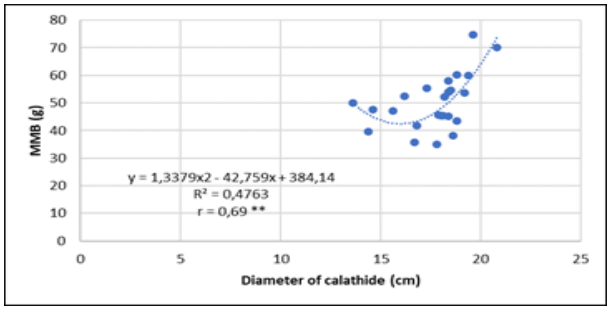

Figure 1. Correlation between calathide diameter and the weight of a thousand grains in sunflower

CONCLUSIONS

The climatic conditions recorded in the area of sandy soils in the south of Oltenia were favorable for the growth and development of sunflower plants.

Plant height determined in the flowering phenophase of the 24 sunflower hybrids differed depending on the genotype, being between 133 cm for the *T 19 - 9A1* hybrid and 164 cm for the *Performer* hybrid.

The diameter of the calathids oscillated between 13.6 – 20.8 cm, the hybrids *T 19 - 10A1*, *HS – 8840, ANT-IMI-CL+/2066A* and *FD 19 E 42* with values over 19 cm are noteworthy.

The production results recorded for the 24 genotypes of sunflower tested in the conditions of sandy soils, showed productions between 2743-3188 kg/ha, with an average of 2989 kg/ha, compared

to which they were highlighted by differences of production of 156-199 kg/ha, statistically assured as significant and distinctly significant, hybrids: *T 19 - 9A1, T 19 - SU- 6A* and *ANT -IMI- CL+/2066A.*

The oil content was differentiated according to the hybrid, the best quality being the hybrid *T-20-IMI-7A2* (61.0%).

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