

Researches regarding the behavior of a sunflower hybrids assortment under the climatic conditions of the years 2006 and 2007, on the reddish preluvosoil from South of the country

Cercetări privind comportarea unui sortiment de hibrizi străini de floarea-soarelui în condițiile climatice ale anilor 2006 și 2007, pe preluvosoilul roșcat din sudul țării

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Abstract

The present paper presents the results of researches carried out on an assortment of 20 foreign sunflower hybrids, in the trial field of the Field Crop Production Department of the Faculty of Agriculture, Bucharest, from SDE Moara Domnească (15 km away from Bucharest on the North East Direction), under climatic conditions registered over the years 2006 and 2007 on a reddish preluvosoil. The paper also comprises results of an experiment carried out on 4 foreign sunflower hybrids under climate condition of 2007.

Rezumat

În prezenta lucrare sunt prezentate rezultatele cercetărilor efectuate la un sortiment de 20 hibrizi străini de floarea-soarelui, în câmpul experimental al Catedrei de Fitotehnie aparținând Facultății de Agricultură din București, de la SDE Moara Domnească (15 km de București pe direcția nord-est), în condițiile climatice ale anilor 2006 și 2007 și pe un preluvosoil roșcat. De asemenea, sunt prezentate rezultatele obținute într-o experiență cu 4 hibrizi străini de floarea-soarelui semănați la diferite epoci în condițiile climatice din 2007.

Key words: Sunflower; Hybrids; Characteristics

Cuvinte cheie: Floarea-soarelui; Hibrizi; Caracteristici

INTRODUCTION

The biological material (cultivar) used has a great importance within the group of factors that influence the crop yield. Thus, knowing the biological particularities of each cultivar, in one area or another, contributes to a large extent to the quantitative and qualitative achievement of the yield. The most adequate technological measurements can be established based on knowing these particularities.

The sunflower represents one of the most important crop plants in Romania, given the cultivated area. Thus, it comes third after maize and wheat. Currently, the offer of sunflower hybrids has diversified a lot, Romanian hybrids as well as a large number of foreign hybrids being accepted for cultivation in our country.

It is absolutely necessary to know the biological particularities of foreign sunflower hybrids that can be cultivated in Romania, as well as their behavior under soil and climate conditions specific to our country, as grower to have the possibility to choose the right cultivar according to the specific growing conditions.

MATERIALS AND METHOD

During the two years of experiment (2006 and 2007), in the experimental field of the Field Crop Production Department, from the Faculty of Agriculture Bucharest, an experimental crop with 20 foreign sunflower hybrids was set up, at SDE Moara Domnească,

including the following: Huracan (only in 2006), Kasol, Lindor, Masai, Mateol, Podium, Saxo, Sunko, Fly, Rigasol, Rigasol OR, Fleuret OR, Arena, Melody, NK Armoni, Alexandra, NK Ferti, NK Dolbi, Opera PR, Sanay, Rocky (only in 2007).

The experiments set up in the two years are part of the research project entitled: „Estimating the honey production, self-fertility and productive features in foreign sunflower hybrids, accepted for cultivation in Romania”, Contract CEEEX no.106/2005.

In the spring of 2007, another experimental plot was set up, with different times of sowing (27.03; 6.04; 18.04; 12.05; 2.06; 19.06), on four foreign sunflower hybrids (Fleuret OR, Melody, Sunko, Arena), in order to study their reaction to various conditions during the vegetation period of plants.

The experiences were located on a reddish preluvosoil. The experimental designs were distributed according to the method of randomized plots, in multiple stage blocks, with 4 replications, for studying the assortment of hybrids, and in subdivided plots with 2 factors (the sowing period and the hybrid) for studying the sowing calendar.

During the vegetation period of sunflower plants, several determinations were executed, as follows: total number of leaves per plant, number of green and senescent leaves per plant during flowering, the leaf area index (LAI) during flowering, height of plants and diameter of flower heads at the end of flowering. When the plants reached maturity, the crop components were determined respectively the number of flower heads per surface unit, average number of seeds per flower head, weight of 1000 grains (MMB), and seed production (kg/ha).

Five plants from each experimental plot were analyzed, in order to determine the number of plant leaves, the leaf area index, the height of plants and diameter of flower heads, while for determining the productivity elements, 10 plants from each experimental plot were analyzed.

RESULTS AND DISCUSSION

The two years of cultivation (2006 and 2007) were less favorable for the sunflower, from the climatic point of view, for the area where researches were conducted. If in 2006, the average temperatures were not much deviated from the multi-annual average, the soil water deficit before flowering affected the growth of the leaves and thus the photosynthetic leaf area. The interception of a more reduced quantity of solar radiations had a negative influence on the number of full seeds per flower head and on the average mass of a seed, which no longer reached the normal values that characterize each hybrid. The year 2007 was even less favorable for agricultural crops, including for sunflower, from the climate point of view, following the spring and summer drought, as well as the high temperatures during the vegetation period, conditions that had a negative influence on the growth and development of the plants.

The total number of leaves in the 20 sunflower hybrids studied was of 29.4 (table 1), in 2006. An average of 22.4 leaves, in the 20 hybrids studied, were photo-synthetically active, during flowering, with a LAI of 1.49. Under the conditions of 2007, the total number of leaves was greater, the average value of the 20 hybrids studied being of 31.4; however, the number of green leaves, on flowering, was smaller, i.e. 19.7 leaves, and more senescent leaves (11,7), the average value of the ISF being 1.43.

Large differences on yield were registered from one year to another were in the height of plants and in the diameter of flower heads. If in 2006, the plants reached an average of 137

cm in height, with a flower head diameter of 15.7 cm, in 2007 the plants were much shorter, i.e. 98 cm, with a flower head diameter of 11 cm (table 2).

Table 1

Number of leaves per plant and leaf area index (LAI) at the flowering stage at different sunflower hybrids

Nr. crt.	Sunflower hybrid	2006						2007					
		Total number of leaves			No of dry leaves	No of green leaves	LAI	Total number of leaves			No of dry leaves	No of green leaves	LAI
		No	Difference	t test				No	Difference	t test			
1	Huracan	29.8	0.4	0.50	9.1	20.7	1.68	-	-	-	-	-	-
2	Kasol	28.8	-0.6	0.76	9.1	19.7	1.57	30.7	10.3	20.4	-0.7	0.75	1.20
3	Lindor	28.6	-0.8	1.00	5.7	22.9	1.37	29.3	10.5	18.8	-2.1°	2.26	1.41
4	Masai	29.1	-0.3	0.38	8.7	20.4	1.75	31.4	11.1	20.3	-	-	1.36
5	Mateol	30.5	1.1	1.4	7.6	22.9	1.61	31.0	11.9	19.1	-0.4	0.43	1.47
6	Podium	27.6	-1.8°	2.30	4.9	22.7	1.49	29.1	11.7	17.4	-2.3°	2.48	1.26
7	Saxo	25.9	-35°	4.48	1.0	24.9	1.45	29.2	10.8	18.4	-2.2°	2.37	1.31
8	Sunko	29.4	-	-	7.4	22.0	1.52	31.0	12.0	19.0	-0.4	0.43	1.33
9	Fly	29.8	0.4	0.50	11.3	18.5	1.48	32.2	12.3	19.9	0.8	0.86	1.49
10	Rigasol	28.7	-0.7	0.89	3.5	25.2	1.30	30.5	13.3	17.2	-0.9	0.97	1.32
11	Rigasol OR	27.8	-1.6	2.00	5.5	22.3	1.33	30.9	12.8	18.1	-0.5	0.54	1.32
12	Fleuret OR	26.6	-28°	3.59	1.7	24.9	1.33	31.2	11.7	19.5	-0.2	0.21	1.14
13	Arena	32.7	33°	4.2	11.3	21.4	1.64	33.2	13.2	20.1	1.8	1.94	1.41
14	Melody	29.2	-0.2	0.25	8.1	21.1	1.65	30.7	12.2	18.5	-0.7	0.75	1.39
15	NK Armoni	32.0	2.6**	3.3	10.3	21.7	1.52	33.5	12.7	21.3	2.1*	2.26	1.60
16	Alexandra	31.2	1.8*	2.3	8.0	23.2	1.52	32.7	12.9	19.8	1.3	1.40	1.33
17	NK Dolbi	28.6	-0.8	1.00	2.8	25.8	1.28	30.6	11.3	19.4	-0.8	0.86	1.51
18	NK Ferti	28.6	-0.8	1.00	3.7	24.9	1.48	31.1	10.7	20.4	-0.3	0.32	1.66
19	Opera PR	29.6	0.2	0.25	8.4	21.2	1.49	33.2	10.5	22.7	1.8	1.94	1.81*
20	Sanay	32.0	2.6**	3.3	10.8	21.2	1.38	34.1	11.3	22.8	2.7*	2.91	1.84*
21	Rokcy	-	-	-	-	-	-	32.6	11.0	21.5	1.2	1.29	1.55
Average		29.4	-	-	7.0	22.4	1.49	1.49	11.7	19.7	-	-	1.43

Table 2

Plant high and head diameter at the end of the flowering stage at different sunflower hybrids

Nr. crt.	Sunflower hybrid	Plant high				Head diameter			
		2006		2007		2006		2007	
		cm	Difference	cm	Difference	cm	Difference	cm	Difference
1	Huracan	147	10	-	-	15.6	-0.1	-	-
2	Kasol	143	6	99	1	15.2	-0.5	11.4	0.4
3	Lindor	136	-1	100	2	15.3	-0.4	11.8	0.8
4	Masai	128	-9	95	-3	15.6	-0.1	10.7	-0.3
5	Mateol	135	-2	91	-7	16.5	0.8	11.2	0.2
6	Podium	133	-4	95	-3	17.3	1.6	10.6	-0.4
7	Saxo	135	-2	93	-5	15.2	-0.5	10.4	-0.6
8	Sunko	141	4	95	-3	16.7	1.0	10.8	-0.2
9	Fly	128	-9	102	4	16.0	0.3	10.4	-0.6
10	Rigasol	130	-7	101	3	14.7	-1.0	10.4	-0.6
11	Rigasol OR	141	4	101	3	15.0	-0.7	10.3	-0.7
12	Fleuret OR	117	-20	87	-11°	15.0	-0.7	11.8	0.8
13	Arena	136	-1	99	1	16.8	1.1	11.2	0.2
14	Melody	151	14	105	7	15.6	-0.1	10.2	-0.8
15	NK Armoni	137	-	96	-2	16.4	0.7	11.4	0.4
16	Alexandra	137	-	101	3	14.5	-1.2	10.7	-0.3
17	NK Dolbi	131	-6	94	-4	14.4	-1.3	11.9	0.9
18	NK Ferti	139	2	103	5	15.4	-0.3	11.5	0.5

19	Opera PR	135	-2	98	-	16.1	0.4	11.1	0.1
20	Sanay	158	21	118	20*	17.3	1.6	11.7	0.7
21	Rokcy	-	-	95	-3	-	-	11.7	0.7
Average		137	-	98	-	15.7	-	11.0	-

Both in 2006 and in 2007, the height of plants and the diameter of flower heads for the 20 foreign sunflower hybrids did not register values high enough to ensure statistic differences from the average values of hybrids. However, the Fleuret OR hybrid is remarked for being the smallest in height, in 2006 (117 cm) and in 2007 (87 cm), as well as the Sanay hybrid, for being the highest in 2006 (158 cm) and in 2007 (118 cm). Large differences from one year to another were also registered by the two components of productivity, i.e. the average number of seeds and the weight of 1000 grains (table 3).

Table 3

Number of seeds on the sunflower head and weight of 1000 seeds (MMB) at different sunflower hybrids

Nr. crt.	Sunflower hybrid	Number of seeds on the sunflower head				Weight of 1000 seeds (MMB)			
		2006		2007		2006		2007	
		No	Difference	No	Difference	g	Difference	g	Difference
1	Huracan	895	-73	-	-	35.8	-4.5	-	-
2	Kasol	1296	328**	665	-85	37.4	-2.9	24.8	-2.3
3	Lindor	811	-157	598	-152	47.7	7.4*	34.2	7.1*
4	Masai	1098	130	870	120	39.4	-0.9	19.9	-7.2°
5	Mateol	967	-1	746	-4	48.0	8.6*	35.1	8.0*
6	Podium	843	-125	770	20	41.4	1.1	22.8	-4.3
7	Saxo	881	-87	773	23	41.0	0.7	30.3	3.2
8	Sunko	1200	232*	694	-56	35.1	-5.2	28.2	1.1
9	Fly	926	-42	803	53	34.7	-5.6	26.2	-0.9
10	Rigasol	700	-268	665	-85	48.6	8.3*	36.1	9.0**
11	Rigasol OR	722	-246	599	-151	46.0	5.7	33.1	6.0*
12	Fleuret OR	869	-99	588	-162	37.8	-2.5	43.0	15.9***
13	Arena	1347	379**	722	-28	30.8	-9.5°	22.1	-5.0
14	Melody	933	-35	748	-2	40.1	-0.2	23.9	-3.2
15	NK Armoni	914	-54	781	31	40.1	-0.2	19.7	-7.4°
16	Alexandra	973	5	681	-69	37.6	-2.7	26.2	-0.9
17	NK Dolbi	1171	203	1078	328**	37.3	-3.0	21.1	-6.0°
18	NK Ferti	1105	137	984	234	40.7	0.4	23.0	-4.1
19	Opera PR	845	-123	601	-149	44.4	4.1	21.8	-5.3
20	Sanay	873	-95	694	-56	40.6	0.3	27.7	0.6
21	Rokcy	-	-	943	193	-	-	22.2	-4.9
Average		968	-	750	-	40.3	-	27.1	-

The average number of seeds per flower head in the 20 studied hybrids was of 968 in 2006, and 750 in 2007, 23% less, as compared to the first year of research. The hybrids notable for the conditions recorded in 2006 are Arena (1347 seeds/flower head), Kasol (1296 seeds/flower head) and Sunko (1200 seeds/flower head), which registered positive differences, statistically ensured, as compared to the average of all hybrids, while the differences were no longer statistically ensured, for the other hybrids. For the year 2007, under even less favorable conditions for the sunflower, only the NK Dolbi hybrid (1078 seeds/flower head) records a positive difference, statistically ensured, as compared to the average of the 20 hybrids studied.

The weight of 1000 grains in 2006 recorded an average of 40.3 g, for all 20 hybrids studied, while in 2007 it recorded only an average of 27.1 g. It can be noticed that in 2006, as well as in 2007, the positive differences, compared to the average of each year, recorded for the Lindor, Mateol and Rigasol hybrids, are statistically ensured.

Generally, the density of plants before harvest, in the studied hybrids did not record differences statistically ensured, as compared to the average value of one year or the other (table 4), due to the fact that the same number of germinating seeds per surface unit was ensured, on sowing.

The seed production, as average value recorded for the 20 foreign sunflower hybrids was of 17.8 q/ha in 2006, while in 2007 it was of only 10.4 q/ha. Under the conditions recorded in 2006, the Sunko hybrid is notable, with the largest yield, of 22.4 q/ha, while the Rigasol OR hybrid obtained the smallest yield, i.e. 14.0 q/ha. No differences statistically ensured were recorded in 2007, between the studied hybrids and their average. In this year, the largest yield was recorded for the Mateol hybrid (13.8 q/ha), while the smallest yield was recorded for the Kasol hybrid (7.6 q/ha).

In the experiment with sowing periods, only the first three out of the six calendar dates, i.e. March 27, April 6 and April 18, yielded seeds, while the yield was compromised for the other sowing dates, because of the delayed sowing and of the unfavorable vegetation conditions, recorded in 2007. For the three calendar dates of seed yielding, the average production was of 18.2 q/ha (table 5).

As compared to the sowing session on April 18 (10.0 q/ha), the earlier sowing, on March 27 (21.1 q/ha) and on April 6 (23.5 q/ha), led to obtaining some statistically ensured yield differences. The Melody yield is notable, for recording the greatest yield, when sowed on March 27 (25.7 q/ha) and on April 6 (28.6 q/ha), as compared to the other hybrids studied in this experiment.

CONCLUSIONS

1. The climatic conditions in 2006 and 2007, years of research, were unfavorable for the sunflower, having a negative influence on the leaf area, respectively on the surface of the photosynthetic leaf area, the height of plants, the diameter of flower heads, as well as the production components.
2. In 2006, the sunflower plants obtained during flowering a leaf area index (LAI) of 1.49, with an average of 7 senescent leaves, from a total of 29.4 leaves; in 2007, the leaf area index (LAI) was of 1.43, with an average of 11.7 senescent leaves per plant, from a total of 31.4 leaves.
3. The height of plants was of 137 cm in 2006, as an average of the 20 studied sunflower hybrids, while in 2007, the height was of only 98 cm. The Sanay hybrid was notable, as being the highest, while the Fleuret OR hybrid was the shortest.
4. The average number of seeds per flower head was of 968 in 2006 and of only 750 in 2007. Large differences were recorded in the weight of 1000 grains, from one year to the other, i.e. 40.3 g in 2006 and 27.1 g in 2007.
5. The average production of sunflower seeds was of 17.8 q/ha in 2006, and of only 10.4 q/ha in 2007.
6. For the conditions of year 2007, the earlier sowing led to obtaining much higher yields, 21.0 q/ha (27.03) and 23.5 q/ha (6.04), as compared to the normal sowing period, recommended for the area where researches were conducted, i.e. 10.0 q/ha (18.04).

LITERATURE

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Table 4

Plant density before harvesting and yield at different sunflower hybrids

Nr. crt.	Sunflower hybrid	Plant density before harvesting				Yield			
		2006		2007		2006		2007	
		Thousand plants/ha	Difference	Thousand plants/ha	Difference	q/ha	Difference	q/ha	Difference
1	Huracan	53.6	2.3	-	-	19.4	1.6	-	-
2	Kasol	51.4	0.1	47.2	-5.5	18.2	0.4	7.6	-2.8
3	Lindor	49.5	-1.8	46.9	-5.8	19.0	1.2	9.6	-0.8
4	Masai	53.0	1.7	48.4	-4.3	19.3	1.5	8.4	-2.0
5	Mateol	42.7	-8.6 ⁰⁰⁰	52.7	-	14.9	-2.9	13.8	3.4
6	Podium	53.3	2.0	54.8	2.1	17.3	0.5	9.7	-0.7
7	Saxo	50.8	-0.5	43.8	-8.9	17.1	-0.7	10.3	-0.1
8	Sunko	49.4	-1.9	51.8	-0.9	22.4	4.6 ^{***}	9.8	-0.6
9	Fly	52.2	0.9	51.5	-1.5	18.2	0.4	10.8	0.4
10	Rigasol	51.8	0.5	54.1	1.4	14.5	-3.3 ⁰⁰⁰	12.9	2.5
11	Rigasol OR	52.4	1.1	54.6	1.9	14.0	-3.8 ⁰⁰	10.7	0.3
12	Fleuret OR	54.3	3.0	43.4	-9.3 ^o	18.0	0.2	10.6	0.2
13	Arena	51.7	0.4	55.0	2.3	18.9	1.1	8.9	-1.5
14	Melody	53.1	1.8	57.1	4.4	17.6	-0.2	10.6	0.2
15	NK Armoni	55.9	4.6 [*]	55.6	2.9	19.0	1.2	8.5	-1.9
16	Alexandra	53.4	2.1	53.9	1.2	16.5	-1.3	9.7	-0.7
17	NK Dolbi	53.8	2.5	55.8	3.1	20.2	2.4	12.7	2.3
18	NK Ferti	51.9	0.6	54.7	2.0	19.1	1.3	11.9	1.5
19	Opera PR	49.5	-1.8	58.2	5.5	16.7	-1.1	7.6	-2.8
20	Sanay	42.2	-9.1 ⁰⁰⁰	59.5	6.8	15.8	-2.0	11.8	1.4
21	Rokcy	-	-	55.3	2.6	-	-	11.6	1.2
	Average	51.3	-	52.7	-	17.8	-	10.4	-

Table 5

Yield components and yield at different sunflower hybrids function of planting date

Planting date	Sunflower hybrid	Plant density before harvesting (Thousand plants/ha)	Number of seeds on the sunflower head	Weight of thousand seeds (MMB)	Yield (q/ha)
27.03	Fleuret OR	44.4	1086	41.8	19.5
	Melody	51.7	1244	40.2	25.7
	Sunko	45.8	1156	32.0	16.8
	Arena	49.6	1172	38.2	22.3
	Average	47.8	1164	38.0	21.0
6.04	Fleuret OR	55.2	988	45.2	24.6
	Melody	56.1	1230	39.2	28.6
	Sunko	53.3	1218	31.2	20.4
	Arena	56.1	1407	25.6	20.6
	Average	55.1	1210	35.3	23.5
18.04	Fleuret OR	43.4	588	43.0	10.6
	Melody	57.0	748	23.9	10.6
	Sunko	51.8	694	28.2	10.2
	Arena	55.0	722	22.1	8.9
	Average	51.8	688	29.3	10.0
Average	51.6	1020	34.2	18.2	