RESEARCHES REGARDING THE MELLIFEROUS CHARACTERISTICS OF THE SUNFLOWER HYBRIDS, AS NECESSARY ELEMENTS FOR LEADING THE POLLINATION ACTIVITY BY THE HELP OF MELLIFEROUS BEES

CERCETĂRI PRIVIND CARACTERISTICILE MELIFERE ALE HIBRIZILOR DE FLOAREA-SOARELUI, CA ELEMENTE NECESARE PENTRU DIRIJAREA ACTIVITĂȚII POLENIZATOARE CU AJUTORUL ALBINELOR MELIFERE

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Abstract: *Within the present paper there are presented the results of researches carried out in the period 2002-2007 on an assortment of 40 sunflower hybrids with respect to their melliferous characteristics, which represent elements of interest for sunflower grower in view to assure the pollination by the help of melliferous bees, but also for the beekeeper who is leaving in pastoral with its beehives to the sunflower crops. The experiments were carried out within the experimental field belonging to the Field Crop Production Department of the Faculty of Agriculture from Bucharest, located at SDE Moara Domnească (15 km faraway from Bucharest on North-East direction), on a reddish preluvosoil.*

Rezumat: *În prezenta lucrare este prezentată o sinteză a rezultatele cercetărilor efectuate în perioada 2002-2007, la un sortiment de 40 hibrizi de floarea-soarelui, cu privire la caracteristicile melifere ale acestora, acestea constituind elemente de interes pentru cultivatorul de floarea-soarelui în vederea asigurării polenizării cu ajutorul albinelor melifere, dar şi pentru apicultorul care se deplasează în pastoral cu stupii de albine la culturile de floarea-soarelui. Experienţele au fost efectuate în câmpul experimental al Catedrei de Fitotehnie aparţinând Facultăţii de Agricultură din Bucureşti, de la SDE Moara Domnească (15 km faţă de Bucureşti pe direcţia nord-est), pe un preluvosol roşcat.*

Key words: *Sunflower; Hybrids; Melliferous characteristics; Pollination*
Cuvinte cheie: *Floarea-soarelui; Hibrizi; Caracteristici melifere; Polenizare*

INTRODUCTION

Sunflower seed yield is depending very much of the pollination of the flowers by melliferous bees and other spontaneous insects. In view to assure the pollination, the grower has to know which the percentage of self-pollination is and which is the gain in seed yield because of the insect's pollination for its sunflower hybrid. Thus, he will become aware of the importance of pollination and will become concerned to assure the necessary beehives. In addition, the beekeeper has to know which are the melliferous characteristics of the sunflower hybrids, respectively the period and duration of the flowering process, as well as the honey yield potential, thus he will get a high honey yield. In view to ensure the pollination for the sunflower crops, the sunflower growers and the beekeepers have to establish some mutual relationships.

MATERIALS AND METHOD

In the period 2002-2007, there were carried out researches in field experiments for studying 40 sunflower hybrids, among which 20 were Romanian hybrids (Favorit, Festiv, Florina, Jupiter, Alcazar, Top 75, Venus, Alex, Saturn, Minunea, HS 2442, HS 2606, Milenium, Romina, Performer, Select, Justin, Splendor, Hercule, Felix) and 20 were foreign hybrids (Huracan, Kasol, Lindor, Masai, Mateol, Podium, Saxo, Sunko, Fly, Rigasol, Rigasol OR, Fleuret OR, Arena, Melody, NK Armoni, Alexandra, NK Dolbi, NK Ferti, Opera PR, Sanay). The experiments were located on a reddish preluvosoil located 15 km faraway Northeastern from Bucharest, within the experimental farm Moara Domnească belonging to the Faculty of Agriculture from Bucharest.

To the studied sunflower hybrids, determinations were performed in view to establish the flowering period and duration of this phenological stage, the nectar secretion and sugar nectar concentration in view to calculate the potential honey yield, as well as the number of seeds per sunflower head isolated from insects and number of seeds per sunflower head free-pollinated in view to calculate the degree of self-pollination and to establish the necessity of pollination. In addition, there were performed yield determinations in view to calculate the seed yield obtained under pollination conditions and the gain in seed yield through pollination (compared to the yield obtained under self-pollination conditions).

For establishing the period and duration of flowering process, the flowered heads were counted every two days. Thus, it was established the moment when the first sunflower heads flowered, the starting moment of the flowering process within the crop, i.e. the moment when 10% of the heads were flowered. In addition, it was established the moment when 10% of the heads were still in flower within the crop (10% of the heads still had flowers), and the moment when all the heads within the crop finished the flowering process, respectively.

In view to determine the self-pollination degree, five plants from each experimental plot (29.4 m^2 resulted from six plant rows at 0.7 m between rows and 7 m along the rows) were mull isolated ant their heads were analyzed at the maturity, parallel with another five heads free-pollinated, while for determining the seed yield of sunflower hybrids under free-pollination, 10 plants from each experimental plot were analyzed.

The percentage of self-pollination was estimated according to the following formula:

$$\text{Self - pollination} = \frac{\text{average no of fertile achenes per isolated sunflower head}}{\text{average no of fertile achenes per freely pollinated sunflower head}} x100 \quad (\%)$$

In view to calculate the honey yield, the nectar secretion was determined using the capillaries method, and by means of a refractometer, the nectar concentration in sugar was determined.

RESULTS AND DISCUSSION

The occurrence date for the first heads flowering in the studied sunflower hybrids varied between 18th of June and 1st of July (Table 1), while the beginning of the flowering process, i.e. the moment when 10% of the heads have flowered in the whole crop, was recorded between 20th of June and 2nd of July. Thus, one can conclude that for South Romania the beginning of the flowering process is recorded in the second part of June. Depending on the hybrid, a period of 1-6 days was necessary between the occurrence of the first flowered heads and the beginning of the flowering process (10% of the sunflower heads have flowered).

The time when only 10% of the sunflower heads were still in flower was recorded between 5th and 18th of July, whiles the end of flowering process, i.e. when no sunflower heads are in flower in the whole crop, and was recorded between 6th and 20th of July.

From a melliferous point of view, the most important period is that between the beginning of flowering process (10% of the sunflower heads have flowered) and the time when only 10% sunflower heads are still in flower, as this period marks the actual intense nectar gathering by the melliferous bees. This period varied between 10 and 20 days, this been the period that the melliferous bees and respectively the beekeepers have for the sunflower nectar gathering and sunflower honey making respectively.

The flowering duration of the whole crop (since the occurrence of the first flowered heads to the end of the flowering process) ranged between 12 and 30 days.

The beginning of flowering process was earlier by 5-6 days in the drought year 2007 compared with other years, but the flowering duration was longer because of the irregular development of plants, process that were strongly influenced by limited water supply of plants.

All these aspects related to the flowering period and duration have to be taken into account by the beekeepers when they leave with their beehives in pastoral, but also have to be taking into account by the sunflower grower in view to assure the necessary bees for pollinating the sunflower plants.

The potential honey yield that could be obtained from the different sunflower hybrids is an essential element the beekeepers want to know. For the studied sunflower hybrids, the potential honey yield varied between 6 and 24 kg per hectare, according to the hybrid (Table 2). The hybrids with the highest honey yield were the following: Favorit, Venus, Hercule, and Florina, Minunea among the Romanian hybrids, and NK Dolbi, Sunko, Kasol, Nk Armoni, Melody, Huracan among the foreign hybrids. The hybrids with the smallest honey yield were the following: Romina, Saturn, Top 75, Alex, Alcazar, HS2606, among the Romanian hybrids, and Rigasol OR, Fleuret OR, Rigasol, Saxo, Alexandra, Sunay among the foreign hybrids.

There are sunflower hybrids with a high and constant honey potential under time, as Favorit, Sunko, NK Dolbi, NK Ferti, NK Armoni, and Melody hybrids. However, there are also hybrids with a small and constant honey potential under time, as Saturn, Romina, Rigasol OR and Fleuret OR hybrids. In addition, there are sunflower hybrids with a big variation of the honey potential in time, as Lindor, Arena and Fly hybrids, these hybrids been the most affected by the influence of the climatic conditions. The majority of the hybrids have some variation of the honey potential during the time, under different climatic conditions.

The percentage of self-pollination ranged from 18% (Romina and Select hybrids) to 98% (Performer hybrid). The hybrids with the highest self-pollination percent under time were NK Armoni, Huracan, Melodi, Sunay, Opera, Performer, while the hybrids with the smallest percent under time were Romina and Festive. The obtained results lead to the conclusion that the presence of honeybees is not strictly necessarily in the pollination of some sunflower hybrids (e.g. Huracan, NK Armoni, Sunay), while for other hybrids honeybees must be present in order to perform pollination and to insure increased seed production (e.g. Florina and Festive). With a few exceptions (Huracan, NK Armoni, Sunay hybrids), the percentage of self-pollination varied quite a lot under time, this been affected by the climatic conditions.

Honey yield does not depend on the self-pollination percentage, there have been hybrids with high self-pollination percent and high honey yield (Huracan, NK Armoni, Sunay

hybrids), as well as hybrids with small self-pollination percent and small honey yield (Romina and Festive hybrids). This aspect comes to support the idea according to which the pressure of selection over a high self-pollination does not lead to a decrease in nectar secretion, which would become useless in attracting the insects in *Helianthus annuus* crops.

The gain in seed yield by pollination, compared to the yield obtained under self-pollination conditions varied from 70 to 910 kg per hectare, according to the hybrid. Thus, sunflower growers must take into account the necessity of bringing the necessary beehives for pollination the sunflower crop, especially for the hybrids with the highest gain in seed yield (Romina, Festiv, Rigasol, Justin and Select hybrids), but also to the other sunflower hybrids in view to be sure that the pollination is assured and do not depending of the climatic conditions.

Table 1

Data regarding the flowering process at some of the sunflower hybrids grown in Romania

Nr. crt.	Sunflower hybrid	First heads flowering	10% of heads flowered (beginning of flowering process)	10% of heads still in flower	End of flowering process (no any flowered heads)	No of days from the stage 10% of heads flowered to the stage 10% of heads still in flower	No of days from the first calitides flowering to the end of flowering process
1.	Favorit	30 June	01 July	13 July	15 July	13	16
2.	Performer	01 July	02 July	14 July	17 July	13	17
3.	Florina	30 June	01 July	13 July	15 July	13	16
4.	Jupiter	26 June	27 June	06 July	07 July	10	12
5.	Alcazar	29 June	30 June	10 July	11 July	11	13
6.	Top 75	28 June	29 June	10 July	11 July	12	14
7.	Venus	25 June	26 June	05 July	06 July	10	12
8.	Splendor	28 June	29 June	11 July	13 July	13	16
9.	Felix	30 June	01 July	10 July	11 July	10	12
10.	Justin	01 July	02 July	13 July	15 July	12	15
11.	Select	27 June	28 June	11 July	14 July	14	18
12.	Alex	30 June	01 July	11 July	12 July	11	13
13.	Saturn	25 June	26 June	06 July	07 July	11	13
14.	Hercule	27 June	28 June	10 July	11 July	13	15
15.	Minunea	26 June	27 June	10 July	12 July	14	17
16.	HS2442	28 June	29 June	10 July	12 July	12	15
17.	HS2606	25 June	26 June	08 July	11 July	13	17
18.	Festiv	01 July	02 July	13 July	13 July	12	13
19.	Milenium	27 June	28 June	10 July	13 July	13	17
20.	Romina	26 June	27 June	10 July	12 July	14	17
21.	Huracan	28 June	29 June	13 July	18 July	15	21
22.	Kasol	22-28 June	25-29 June	08-16 July	18-19 July	13-18	22-26
23.	Lindor	20-28 June	23-29 June	07-16 July	14-19 July	14-18	22-24
24.	Masai	22-28 June	26 June-01 July	09-17 July	18-19 July	13-17	22-26
25.	Mateol	19-26 June	24-28 June	07-14 July	18 July	13-17	23-29
26.	Podium	22-28 June	25-29 June	09-16 July	18-19 July	14-18	22-26
27.	Saxo	19-27 June	25-29 June	09-14 July	15-18 July	14-16	22-26
28.	Sunko	21-27 June	23-29 June	10-16 July	18-19 July	17-18	23-27
29.	Fly	21-28 June	24 June-01 July	07-16 July	18 July	13-16	21-27
30.	Rigasol	18-28 June	21-29 June	06-16 July	15-18 July	15-18	21-27
31.	Rigasol OR	18-24 June	20-28 June	05-13 July	18 July	15-16	25-30
32.	Fleuret OR	18-24 June	20-27 June	07-12 July	18 July	16-17	25-30
33.	Arena	22-28 June	23-29 June	11-12 July	16-18 July	14-18	21-24
34.	Melody	22-28 June	24-30 June	07-15 July	18 July	13-16	21-26
35.	NK Armoni	23-28 June	25 June-01 July	11-18 July	19-20 July	16-18	23-26
36.	Alexandra	21-27 June	23-29 June	08-14 July	18 July	15-16	22-27
37.	NK Dolbi	22-28 June	24-29 June	08-14 July	18 July	14-16	21-26

Nr. crt.	Sunflower hybrid	First heads flowering	10% of heads flowered (beginning of flowering process)	10% of heads still in flower	End of flowering process (no any flowered heads)	No of days from the stage 10% of heads flowered to the stage 10% of heads still in flower	No of days from the first calitides flowering to the end of flowering process
38.	NK Ferti	22-27 June	23-29 June	10-14 July	18 July	16-17	22-26
39.	Opera PR	23-28 June	25-29 June	11-14 July	18 July	16	21-25
40.	Sanay	21-24 June	24-28 June	14-15 July	18-20 July	18-20	25-29
Limits of variation		*18 June – 01 July*	*20 June – 02 July*	*05 July – 18 July*	*06 July – 20 July*	*10-20 days*	*12-30 days*

Table 2

Data regarding the melliferous characteristics at some of the sunflower hybrids grown in Romania

Nr. crt.	Sunflower hybrid	Honey yield (kg/ha)	Self-pollination (%)	Gain in seed yield through pollination (compared to the yield obtained under self-pollination conditions) (q/ha)	Seed yield obtained under pollination and currently technological conditions (q/ha)
1.	Favorit	13.5 – 24.0	20 – 60	1.8	17.9
2.	Performer	9.3 – 16.8	61 – 98	1.1	21.7
3.	Florina	10.8 – 19.2	-	-	15.9
4.	Jupiter	8.4 – 14.9	-	-	17.1
5.	Alcazar	7.1 – 12.6	-	-	15.3
6.	Top 75	6.2 – 11.1	-	-	18.7
7.	Venus	11.8 – 19.2	-	-	17.6
8.	Splendor	13.0 – 15.3	47 – 69	1.7	18.7
9.	Felix	10.3 – 15.5	48 – 81	1.0	20.8
10.	Justin	12.1 – 13.0	46 – 97	6.3	18.1
11.	Select	11.5 – 16.0	18 – 93	6.0	24.0
12.	Alex	9.3 – 11.1	36 – 91	2.2	16.8
13.	Saturn	6.0 – 8.4	-	-	17.1
14.	Hercule	13.0 – 17.0	29 – 75	1.0	17.7
15.	Minunea	10.8 – 19.3	-	-	18.6
16.	HS2442	8.8 – 15.6	-	-	22.1
17.	HS2606	7.5 – 13.3	-	-	18.8
18.	Festiv	11.3 – 13.0	33 – 54	8.8	20.5
19.	Milenium	10.1 – 18.2	-	-	20.1
20.	Romina	7.3 – 8.5	18 – 47	9.1	20.3
21.	Huracan	11.8 – 17.2	94	5.3	19.4
22.	Kasol	13.8 – 18.0	50 – 64	1.5 – 4.5	18.2
23.	Lindor	9.2 – 23.2	52 – 73	4.0 – 6.0	19.0
24.	Masai	6.8 – 15.4	78 – 84	1.5	19.3
25.	Mateol	10.3 – 17.3	57 – 79	0.7 – 8.3	14.9
26.	Podium	11.7 – 12.1	66 – 86	4.4	17.3
27.	Saxo	6.1 – 11.3	70 – 83	2.9 – 3.8	20.0
28.	Sunko	14.5 – 16.0	56 – 85	1.1 – 6.0	22.4
29.	Fly	8.9 – 17.6	58 – 84	3.3 – 4.8	18.2
30.	Rigasol	12.0 – 12.6	61 – 80	7.2	15.1
31.	Rigasol OR	8.9 - 10.9	78 – 83	3.6	14.4
32.	Fleuret OR	10.3 – 10.6	51 – 62	3.7 – 4.2	18.0
33.	Arena	9.0 – 23.0	59 – 73	3.0 – 5.2	18.9
34.	Melody	13.6 – 15.8	87 – 90	1.9 – 2.4	17.6
35.	NK Armoni	13.5 – 17.2	93 – 95	1.2	19.6
36.	Alexandra	8.1 – 12.3	61 – 93	4.7	16.5

Nr. crt.	Sunflower hybrid	Honey yield (kg/ha)	Self-pollination (%)	Gain in seed yield through pollination (compared to the yield obtained under self-pollination conditions) (q/ha)	Seed yield obtained under pollination and currently technological conditions (q/ha)
37.	NK Dolbi	14.2 – 17.5	55 – 86	7.6	20.2
38.	NK Ferti	12.9 – 14.1	70 – 81	2.7 – 4.1	19.1
39.	Opera PR	10.3 – 17.4	74 – 86	1.1 – 3.1	17.8
40.	Sanay	9.5 – 13.0	84 – 89	1.8 – 2.7	17.6
Limits of variation		*6.0 – 24.0*	*18 - 98*	*0.7 – 9.1*	*15.1 – 24.0*

Seed yield obtained under pollination and currently technological conditions in South Romania for the studied sunflower hybrids varied from 1510 to 2400 kg per hectare.

CONCLUSIONS

Sunflower growers have to take into consideration in view to assure the melliferous bees for pollinating the sunflower crops and the beekeepers have to take into account when they leave with their beehives in pastoral the following aspects:

1. In South Romania, the beginning of the flowering process in sunflower is recorded in the second part of June, respectively from 18th of June to 1st of July, with differences according to hybrid and climatic conditions.
2. Depending on the hybrid, a period of 1-6 days is necessary between the occurrence of the first flowered heads and the beginning of the flowering process (10% of the sunflower heads in flower).
3. The end of flowering process, i.e. when no sunflower heads are in flower in the whole crop, is recorded in South Romania between 6th and 20th of July.
4. The period from 10% of the sunflower heads have flowered and the moment when only 10% of sunflower heads are still in flower, which is the period of actual intense nectar gathering by the melliferous bees, varied between 10 and 20 days.
5. The flowering period of the whole crop (since the occurrence of the first flowered heads to the end of the flowering process) ranges between 12 and 30 days.
6. The flowering period is earlier with 5-6 days in the drought years, while the flowering duration is longer because of the irregular development of sunflower plants.
7. At the forty studied sunflower hybrids the potential honey yield varied between 6 and 24 kg per hectare, this been according to the hybrid and climatic conditions.
8. Honey yield does not depend on self-pollination percentage, these two characteristics been not correlated.
9. The gain in seed yield by pollination, compared to the yield obtained under self-pollination conditions, varied from 70 to 910 kg per hectare, according to the hybrid.
10. Sunflower growers have to pay attention for bringing the beehives for pollinating the sunflower crop, especially for the hybrids with the highest gain in seed yield (Romina, Festiv, Rigasol, Justin and Select hybrids), but also for the other sunflower hybrids in view to be sure the pollination is assured and do not depend on the climatic conditions.

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