

INCREASE OF SUNFLOWER SEED AND OIL YIELD BY THE USE OF BEES (*Apis mellifica*) AS POLLINATING AGENT

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Abstract

Research Institute for Cereals and Industrial Crops Fundulea is the coordinator of the subnetwork on the experimentation of sunflower international trials (one of the subnetworks of the F.A.O. Research Network on Sunflower). The mentioned subnetwork completed the ninth biennial cycle in 1992-1993. In the trial performed at Fundulea, observations concerning melliferous value of sunflower hybrids and their degree of attractivity to bees were carried out. Also the possibility to increase the seed and oil yield utilizing the bees as pollinators was studied. Twenty-one sunflower hybrids originated from Bulgaria, France, Hungary, Romania, Yugoslavia, Turkey, U.S.A., representing the recent achievements of breeders from these countries, were studied.

The best yielding for seed and oil were: Hu-GKI-43 (Szeged-Hungary) X-9210 (NK-Hilleshog-France), Albena (Pr. Genetique-France), Domino and Decor (I.C.C.P.T.-Romania) with 40.9-44.8 q/ha and 46.1 - 52.4% respectively.

Concerning the melliferous capacity, the highest values were registered by the same mentioned hybrids, the glucidic index having values between 0.188 and 0.390 mg sugar/flower.

A positive significant correlation between yielding ability and melliferous value has been found. The increase of yield utilizing bees as pollinator was different (111.8-117.2%) to the studied hybrids. The highest values were registered by Hu-GKI-43 (Szeged-Hungary), P-6541 (Pioneer France), Domino, Decor (I.C.C.P.T.-Romania), Hoggar (Rustica-France) and H.B.-9201 (I.W.S.-Bulgaria).

Key words: sunflower, honey bees, pollinating agent, degree of attractivity, melliferous capacity.

Introduction

Because of its constant and high yield the sunflower is well-known in the apiculture. When the bees are visiting the flowers for nectar and pollen, they are

making the transfer of the pollen and nectar from one flower to another, being so the main pollinating agent of the sunflower.

The interest of the beekeepers and farmers for the sunflower determined the initiation of several trials, mainly for the nectar secretion and the use of the bee (*Apis mellifica*) as pollinating agent.

Materials and methods

Research Institute for Cereals and Industrial Crops Fundulea is the coordinator of the subnetwork on the experimentation of sunflower international trials (one of the subnetworks of the F.A.O. Research Network on Sunflower). The mentioned subnetwork completed the ninth biennial cycle in 1992-1993. In the trial performed at Fundulea, observations concerning melliferous value of sunflower hybrids and their degree of attractivity to bees were carried out. Also the possibility to increase the seed and oil yield utilizing the bees as pollinators was studied. Twenty-one sunflower hybrids originated from Bulgaria, France, Hungary, Romania, Yugoslavia, Turkey, U.S.A., representing the recent achievements of breeders from these countries, were studied (Table 1).

To determine the melliferous value the capillary-refractometric method has been used. The flowers visiting frequency and the attractivity degree of the hybrids was established based on the observations and the registration of the bees number per sunflower head and minute (Table 2).

To determine the increase of seed yield utilizing the bees as pollinating agent, 2 bee-families/ha have been used (Table 3).

The statistical interpretation of the obtained data was made by utilizing the variance analysis and correlation coefficients, the report was made to the trial average.

Results, discussion and conclusion

Concerning seed and oil yield, the hybrids demonstrated high values as Hu-GKI-43 (Szeged-Hungary), P-6451 Pioneer (France), Domino and Decor (Romania), Hoggar and Albena (France), H.B.-9201 (Bulgaria), X-9210 and Euroflor (France). The seed yield had values between 41.1 - 44.8 q/ha, and the oil content between 47.1 - 52.3% (Table 1).

The hybrids Iseo, Azur and Isostar (France), Hu-GKI-55 (Hungary) and X-9210 (France) were situated below the average value.

As melliferous value, Decor and Domino (Romania), P-6451 Pioneer and Hoggar (France) have been evidenced with significant positive differences related to the group average, respectively with nectar secretions between 1.13-1.23 mg/flower.

Below the group average were situated N.S.H.-240 (Yugoslavia), X-9201 and X-10326 (France), (Tables 2 and 2.1).

Between the seed and oil yield capacity and the melliferous value has been determined a positive very significant correlation, the correlation coefficient registered was $r = 0.70$.

The increase yield registered, as a result of the pollination by bees, were between 111.4-117.7 percent related to non-pollinated, the highest values being obtained by P-6451 Pioneer (France), Decor and Domino (Romania) hybrids. Values below the group average registered Azur, Iseo and Malabar (France) (Tables 3 and 3.1).

Concluding we could say:

- Concerning seed and oil yield, the sunflower hybrids experimented in F.A.O. trial in Fundulea in 1992-1993, demonstrated high values as Hu-GKI-43 (Szeged-Hungary), P-6451 Pioneer (France), Domino and Decor (Romania), Hoggar and Albena (France), H.B.-9201 (Bulgaria), X-9210 and Euroflor (France). The seed yield had values between 41.1 - 44.8 q/ha, and the oil content between 47.1 - 52.3%

- Also, the hybrid group presents high values as melliferous value point of view, being placed between 0.76 and 1.23 mg/nectar flower, the highest values being obtained by P-6451 (France), Decor and Domino (Romania), Hoggar (France), H.B.-9201 (Bulgaria) and Hu-GKI-43 (Hungary) hybrids.

A positive correlation between the melliferous value and seed and oil yield ($r = 0.70$) has been found.

- The increase of seeds yield reached by the experimental hybrids group of the F.A.O. trial, as a result of the use of bees as pollinating agent, were between 111.8-117.2 percent, the highest values reaching the Hu-GKI-43 (Hungary), P-6451 Pioneer (France), Domino and Decor (Romania), Hoggar (France) and H.B.-9201 (Bulgaria) hybrids.

Table 1
Results concerning seed and oil yield of sunflower F.A.O. trial, 1992-1993
Fundulea

No.	Hybrids	Country	Seed yield q/ha	Oil conc. %	Oil yield q/ha
1.	HB-9201	I.W.S - Bulgaria	40.1	51	20.7
2	X-9210	NK - Hilleshog-France	42.8	47	20.2
3	X-10326	NK - Hilleshog-France	39.5	46	18.5
4	P-6451	PIONEER -France	40.1	53	21.6
5	EUROFLOR	Rustica-France	41.1	48	20.1
6	MALABAR	Rustica-France	39.2	47	18.6
7	HOGGAR	Rustica-France	40.8	52	21.4
8	BAMBO	Verneuil-GKI-France-Hungary	37.4	47	17.7
9	ALBENA	Pr. Genetique-France	42.4	49	21.0
10	AZUR	Pr. Genetique-France	32.7	48	15.8
11	N.H.S.-170	Novi Sad-Yugoslavia	40.3	44	17.9
12	N.H.S.-240	Novi Sad-Yugoslavia	40.9	46	18.8
13	HUGKI-43	Szeged-Hungary	44.8	50	22.4
14	HUGKI-55	Szeged-Hungary	36.5	48	17.6
15	TR-129	Edirne-Turkey	40.2	47	19.2
16	VOLTASOL	Cargill-France	38.7	48	18.6
17	ISOSTAR	Coop de Pau-France	33.5	50	17.0
18	ISEO	Coop de Pau-France	33.3	46	15.5
19	DOMINO	I.C.C.P.T.-Romania	41.4	51	21.5
20	DECOR	I.C.C.P.T.-Romania	40.8	52	21.4
	<i>Mean</i>		39.3	48	19.3

Table 1.1
Analysis of variance for oil yield, F.A.O. trial, (1992-1993) - Fundulea

No.	Hybrids	Oil yield (q/ha)	Relative yield (%)	Difference		Differences signification
				Absolute	Relative (%)	
1	HUGKI-43	22.4	116	31.3	16	***
2	P-6451	21.6	112	23.2	12	***
3	DOMINO	21.5	111	22.1	11	***
4	HOGGAR	21.4	110	20.9	10	***
5	DECOR	21.4	110	20.9	10	***
6	ALBENA	21.0	108	17.0	8	***
7	H.B.-9201	20.7	107	14.7	7	**
8	X-9210	20.2	104	9.0	4	*
9	EUROFLOR	20.1	104	8.0	4	
10	<i>Mean</i>	19.3	100	0.0	-	
11	TR-129	19.3	99	0.1	-	
12	N.S.H.-240	18.9	97	-4.2	-2	
13	VOLTASOL	18.6	96	-6.4	-3	
14	MALABAR	18.6	96	-7.1	-3	
15	X-10326 N.K.	18.6	96	-7.2	-3	
16	N.S.H.-170	17.9	92	-14.0	-7	--
17	BAMBO	17.8	92	-15.3	-7	--
18	HUGKI-55	17.6	91	-17.1	-8	---
19	ISOSTAR	17.0	88	-22.7	-11	---
20	AZUR	15.8	82	-34.8	-18	---
21	ISEO	15.5	80	-38.2	-20	---

Table 2

Melliferous value of the sunflower hybrids of the F.A.O. trial, 1992-1993, Fundulea

No.	Hybrids	Nectar yield mg/flower	Sugar conc. %	Glucidic index
1	HB - 9201	1.08	57	0.6210
2	X - 9210	0.79	50	0.3989
3	X - 10326	0.80	50	0.4040
4	P - 6451	1.17	61	0.7195
5	EUROFLOR	0.95	55	0.5225
6	MALABAR	0.85	54	0.4590
7	HOGGAR	1.13	61	0.6893
8	BAMBO	0.85	51	0.4377
9	ALBENA	0.93	55	0.5161
10	AZUR	0.90	55	0.4950
11	N.H.S. - 170	0.80	51	0.4080
12	N.H.S. - 240	0.77	51	0.3927
13	HUGKI - 43	1.05	56	0.5932
14	HUGKI - 55	0.86	51	0.4429
15	TR - 129	0.83	54	0.4523
16	VOLTASOL	0.85	51	0.4377
17	ISOSTAR	0.95	59	0.5605
18	ISEO	0.81	54	0.4414
19	DOMINO	1.22	61	0.7442
20	DECOR	1.23	60	0.7441
	<i>Mean</i>	0.94	55	0.5179

Table 2.1

Analysis of variance concerning melliferous value of
sunflower F.A.O. trial (1992-1993) - Fundulea

No.	Hybrids	Nectar yield mg/flower	Relative nectar yield (%)	Difference		Differences signification
				Absolute	Rel.	
1	DECOR	0.747	142	0.222	42	***
2	DOMINO	0.741	141	0.216	41	***
3	P-6451	0.723	137	0.198	37	***
4	HOGGAR	0.690	131	0.165	31	***
5	H.B.-9201	0.621	118	0.096	18	**
6	HUGKI-43	0.593	112	0.068	12	*
7	ISOSTAR	0.563	107	0.038	7	
8	<i>Mean</i>	0.525	100	0.000	-	
9	EUROFLOR	0.522	99	-0.002	-1	
10	ALBENA	0.516	98	-0.009	-2	
11	AZUR	0.495	94	-0.030	-6	
12	MALABAR	0.462	88	-0.063	-12	-
13	TR-129	0.455	86	-0.070	-14	-
14	HUGKI-55	0.442	84	-0.083	-16	--
15	ISEO	0.442	84	-0.083	-16	--
16	VOLTASOL	0.440	83	-0.085	-17	--
17	BAMBO	0.440	83	-0.085	-17	--
18	N.S.H.-170	0.408	77	-0.117	-23	---
19	X-10326	0.407	77	-0.118	-23	---
20	X-9210	0.399	75	-0.126	-25	---
21	N.S.H.-240	0.393	74	-0.132	-26	---

Table 3
The seed yield increase by using bees as pollinating agent
F.A.O. trial, 1992-1993 - Fundulea

No.	Hybrid Country	Free pollinated seed yield q/ha	Seed, yield, isolation conditions q/ha	Yield differences q/ha	Yield increase %
1	HB - 9201	40.5	33.5	5.01	114
2	X - 9210	43.0	37.0	5.93	116
3	X - 10326	39.2	34.3	4.91	114
4	P - 6451	40.3	34.2	6.06	117
5	EUROFLOR	41.2	36.1	5.10	114
6	MALABAR	38.8	34.3	4.54	113
7	HOGGAR	41.0	35.4	5.53	115
8	BAMBO	37.1	32.8	4.29	113
9	ALBENA	41.8	36.0	5.79	116
10	AZUR	23.3	29.0	3.31	111
11	N.H.S. - 170	40.5	35.5	5.04	114
12	N.H.S. - 240	40.7	35.4	5.28	114
13	HUGKI - 43	44.2	38.1	6.14	116
14	HUGKI - 55	36.8	32.2	4.47	113
15	TR - 129	39.8	24.4	5.39	115
16	VOLTASOL	38.3	33.1	5.12	115
17	ISOSTAR	33.3	29.2	4.03	113
18	ISEO	33.1	29.6	3.46	111
19	DOMINO	41.4	35.7	5.78	116
20	DECOR	40.8	34.8	6.02	117
	<i>Mean</i>	39.2	34.1	5.06	114

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