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EVALUATION OF DIVERSE INBRED LINES FOR SEED SET UNDER AUTOGAMY, GEITONOGAMY, AND OPEN POLLINATION IN SUNFLOWER (*Helianthus annuus* L.)

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Seventy seven diverse sunflower inbred lines, four hybrids and one open pollinated variety (Morden) were evaluated for autogamy, geitonogamy and open pollination based on six characters viz., head diameter, no. of filled seeds per head, no. of unfilled seeds per head, test weight, oil per cent and yield per plant under three treatments namely complete bagging (SP), bagging with hand pollination (HP) and open pollination (OP). The mean per cent of seed set was observed to be higher under open pollination (80.8%) followed by bagging with hand pollination (58.35%) and complete bagging (50.37%). Under HP, SP, hybrids recorded higher per cent of seed set (62.50%, 59.06%) followed by inbred lines (58.58%, 50.47%) and Morden variety (40.25%, 28.11%). Among the inbred lines GPI 1949, GPI 1499, ARM-239 and ARM-240 recorded higher rate of seed set under complete bagging and were on par with yields of HP and OP. These promising inbred lines having high self compatibility should be used in sunflower breeding programme.

Key words : Sunflower, seed set, autogamy, geitonogamy

Poor seed set is one of the important factor limiting productivity in sunflower. The problem of seed setting arises due to pollination problems of insects and the insect activity is seriously impeded by adverse weather conditions. Under such conditions seed setting is lower. This problem is more severe particularly in self incompatible sunflower varieties (Birch *et al.*, 1984). Although this crop is cross-pollinated due to the presence of sporophytic incompatibility, increased seed set per cent in bagged capitulums of sunflower has been reported in hybrids, open pollinated varieties and inbred lines to varying extent (Fick, 1978; Shivaraj *et al.*, 1987; Swamy Gowda and Giriraj, 1989). Thus breeding hybrids and open pollinated varieties for higher autogamy is one of the solution to alleviate the problem of poor seed set. Keeping in view with the earlier research reports, 82 sunflower genotypes (including diverse inbreds, four hybrids and one open pollinated variety) were evaluated to estimate the extent of seed set per cent under 3 different conditions viz., complete bagging, hand pollination with bagging and open pollination and also the estimation of autogamy and geitonogamy per cent.

MATERIALS AND METHODS

The material comprising 82 genotypes (77 diverse inbreds, four hybrids and one open pollinated variety-Morden) were sown in two rows of 5 m length with 60 × 30 cm spacing in randomised block design (R.B.D) with 2 replications at College Farm, College of Agriculture, Rajendranagar, Hyderabad during

rabi, 1997. All the recommended package of practices were taken to raise a good crop. Out of 16 plants in each genotype, 10 plants were bagged after the appearance of first ray floret in the capitulum. In these bagged plants, 5 plants were left undisturbed till harvest to estimate the autogamy per cent and remaining 5 bagged plants were hand sibbed daily till the fertilization is completed to estimate the geitonogamy per cent. The rest of 5 random plants were allowed for open pollination.

Per cent seed setting

The seed set was calculated in the three treatments by the following formulae

$$\text{Seed set \%} = \frac{\text{Number of filled seeds under OP}}{\text{Total no. of seeds under OP}} \times 100$$

Seed set under autogamous condition =

$$\frac{\text{No. of filled seeds under SP}}{\text{Total no. of seeds under SP}} \times 100$$

$$\text{Autogamy \%} = \frac{\text{\% seed set under SP}}{\text{\% seed set under OP}} \times 100$$

Seed set under geitonogamous condition =

$$\frac{\text{No. of filled seeds under HP}}{\text{Total no. of seeds under HP}} \times 100$$

$$\text{Geitonogamy \%} = \frac{\text{\% seed set under HP}}{\text{\% seed set under OP}} \times 100$$

RESULTS AND DISCUSSION

The mean per cent seed set (Table 1) recorded was maximum under OP (80.8%) followed by HP (58.35%) and SP (50.37%). Hybrids gave higher per cent of seed set under HP (62.5%) and complete bagging (54.06%) followed by inbreds (58.58%, 50.47%, respectively) and open pollinated variety (40.25% and 28.1%, respectively). Similar results were observed by Fick (1983), Petrov and Siskov (1985); Burlov and Krotko (1986), Swamy Gowda and Giriraj (1989) and Doddamani *et al.* (1997).

In open pollination, the per cent seed set ranged from 68.11 per cent (GPI 1937) to 90.75 per cen t (KBSH-1). Among the inbred lines

Table 1. Percent seed set, Autogamy, Geitonogamy in sunflower under different conditions

S. No.	Genotype	Seed set percent OP	HP	SP	Auto-gamy percent	Geito-nogamy percent
I. Inbreds						
1	DRM 82	82.60	52.50	48.90	59.20	63.50
2	DRM 69	82.30	52.40	48.96	59.48	63.66
3	DRM 7	83.20	50.94	48.35	59.11	61.22
4	DRM 77	78.25	46.60	40.66	51.96	59.55
5	DRM 6	83.03	63.13	49.17	59.21	76.03
6	DRM 91	74.05	48.8	45.17	60.99	65.90
7	DRM 3	82.48	52.18	46.20	56.01	63.26
8	DRM 85	84.21	52.46	45.29	53.78	62.29
9	DRM 11	78.16	46.93	41.96	63.69	60.04
10	DRM 84	86.26	41.58	50.44	58.48	48.20
11	DRM 1	80.66	52.73	32.72	40.56	65.37
12	DRM 83	81.80	55.76	53.67	65.61	68.16
13	DRM 89	88.55	52.32	47.48	53.61	59.08
14	DRM 81	77.37	54.89	39.60	47.00	70.94
15	DRM 88	82.97	44.17	38.96	46.95	53.23
16	DRM 78	84.47	58.17	34.77	41.16	68.86
17	DRM 86	81.50	47.50	36.07	44.25	58.28
18	DRM 93	74.74	49.95	39.77	52.76	66.83
19	DRM 59	78.40	47.98	52.52	66.98	61.19
20	DRM 63	77.18	39.26	38.28	49.59	50.86
21	DRM 68	86.38	64.21	34.18	39.56	74.33
22	DRM 12	80.72	61.75	42.75	52.96	76.49
23	DRM 60	81.30	54.01	46.28	56.92	66.43
24	DRM 15	79.05	49.14	49.24	62.28	62.16
25	DRM 4	80.60	48.81	49.15	60.98	60.55
26	DRM 5	79.01	45.86	40.36	51.08	58.04
27	DRM 11	81.09	60.97	49.84	61.46	75.18
28	DRM 2	81.89	47.86	42.11	51.42	58.44
29	GPI 545	84.29	56.09	45.38	53.83	66.54
30	GPI 529	81.57	73.62	68.90	84.46	90.25
31	GPI 1949	80.57	78.26	76.80	95.32	97.13
32	GPI 1288	82.45	57.88	55.42	67.21	69.83
33	GPI 1519	82.50	66.32	53.18	62.19	77.56
34	GPI 1499	79.00	77.66	77.06	97.54	98.30
35	GPI 255	87.84	45.87	35.28	40.16	52.21
36	GPI 594	73.53	44.44	32.91	44.75	60.43
37	GPI 2324	84.27	49.35	47.31	56.14	58.56
38	GPI 19.37	68.11	58.78	52.53	77.12	86.30
39	GPI 3001	76.53	63.06	49.53	64.71	82.39
40	GPI 1669	69.48	66.95	64.81	93.27	96.35
41	ARM 245	89.33	51.90	50.77	56.83	64.81

42	ARM 238	86.24	59.84	46.22	53.59	69.38
43	ARM 247	86.07	59.22	50.53	58.70	68.80
44	ARM 248	76.50	59.50	47.13	61.60	78.30
45	ARM 242	80.40	71.90	69.34	86.24	89.42
46	ARM 241	80.59	70.08	54.37	67.46	86.95
47	ARM 244	80.84	62.70	57.72	71.40	77.56
48	ARM 249	69.65	49.75	47.42	68.08	71.42
49	ARM 239	87.19	78.94	79.00	90.60	90.53
50	ARM 246	69.54	50.46	49.27	70.85	72.56
51	ARM 250	80.87	64.33	47.86	59.18	79.54
52	ARM 240	85.86	83.33	79.45	92.53	97.05
53	X15NB-5	69.24	47.45	38.03	52.97	73.86
54	X15NB-2	73.54	48.27	40.55	53.82	64.06
55	R-17	84.17	75.56	44.43	52.78	89.97
56	R-856	87.78	71.95	44.81	51.04	81.96
57	R-272-I	79.27	63.05	58.67	74.01	79.53
58	R-272-II	77.15	53.18	48.46	62.81	68.93
59	R-298	75.48	59.41	48.73	64.56	78.70
60	R-265	85.31	59.82	47.06	55.16	70.12
61	6D-1	84.09	69.44	51.44	61.17	82.57
62	RHA-859	70.42	56.30	43.13	61.24	79.94
63	RHA-271	85.09	46.60	32.85	38.60	54.76
64	234-B	79.99	59.27	48.62	60.78	74.09
65	P-356-R	72.96	62.27	56.45	77.37	85.34
66	IV55NB-13	84.99	51.23	48.58	57.15	60.27
67	LIB02M-14	77.01	57.36	48.12	62.48	74.48
68	LIB02M-1	79.01	68.47	57.11	72.28	86.65
69	LIB02M-6	74.88	65.03	60.29	80.51	86.84
70	LIB02M-3	79.86	55.83	50.29	66.71	71.14
71	VNDNB-7	85.43	64.22	48.76	60.37	73.46
72	VNDNB-2	87.81	70.16	65.57	74.72	79.06
73	VNDNB-10	82.67	63.57	59.04	71.73	78.05
74	88-2	82.31	77.71	70.55	85.71	94.41
75	88-4	83.86	73.60	62.92	78.25	85.38
76	88-9	80.76	68.82	59.32	73.45	85.21
77	88-8	80.12	73.22	69.89	87.23	91.38
	Mean	**80.46**	**58.58**	**50.47**	**60.68**	**70.86**
II. Hybrids						
78	APSH-11	84.27	57.77	46.66	60.36	70.55
79	KBSH-1	90.75	65.28	59.67	65.75	71.93
80	MSFH-17	89.84	63.48	55.16	61.39	70.65
81	Jwalamukhi	86.24	63.49	54.75	64.38	73.62
	Mean	**87.77**	**62.50**	**54.06**	**61.99**	**72.18**
III. Open pollinated variety						
82	Morden	79.52	40.25	28.11	35.95	50.73
	Overall mean	**80.80**	**58.35**	**50.37**	**62.29**	**72.50**
	C.D.S.E.	4.73	4.56	8.92	4.92	5.36

OP: Open Pollination; HP : Hand Pollination + Bagging; SP : Complete Bagging

ARM-245 recorded maximum seed set per cent (89.33). The mean per cent seed set was higher in hybrids (87.77%) than inbreds (80.46%).

Under bagging with hand pollination, the seed set per cent ranged from 39.26 (DRM 63) to 83.33 per cent (ARM-240), among the hybrids KBSH-1 recorded the highest seed set per cent (65.28) and Morden recorded 40.25 per cent. Under complete bagging, ARM-240 recorded maximum seed set (79.48%), however, minimum was in Morden (28.1%). Among the hybrids, KBSH-1 recorded the highest seed set per cent (59.67%), while in inbred lines GPI-594 minimum seed set per cent (32.91%) was recorded. Among the inbred lines, GPI-1949, GPI-1499, ARM-239 and ARM-240 recorded good seed set under SP and were on par with the yields of HP and OP These inbred lines with high self compatibility may be used in sunflower breeding programme.

The mean values of autogamy ranged from 39.95 (Morden) to 97.54 per cent (GPI-1499), while in inbred lines, the minimum autogamy per cent was recorded in DRM-68 (39.56). In hybrids, KBSH-1 recorded the highest autogamy per cent (65.75%). The mean value of geitonogamy ranged from 48.20 per cent (DRM-84) to 98.30 per cent (GPI-1499). In hybrids, Jwalamukhi recorded the maximum geitonogamy per cent (73.62%), while in Morden, it was 50.73 per cent. In general, hybrids recorded maximum autogamy and geitonogamy per cent than inbred lines and open pollinated variety Morden. These findings are in confirmity with the earlier results of Leclercq (1980) and Swamy Gowda and Giriraj (1989). Among the inbred lines, GPI-1499 exhibited maximum autogamy and geitonogamy per cent followed by GPI 1669 and ARM-240.

For the development of population, highly self compatible lines with uniform plant height, head diameter, high seed yield and high oil content should be utilized. This may further enable us for accumulate self compatible genes in the

population and for the development of superior parental lines. Further this helps to derive high autogamous hybrids for stabilising sunflower productivity in farmers fields.

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