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Comparative Evaluation of Population Improvement Schemes in The Second Generation Seasons for Yield and Yield Attributes in Sunflower (*Helianthus Annus* L.)

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ABSTRACT

The present investigation has taken up to study the effect of various selection schemes in the second generation of sunflower and the following observations were observed from Base population to second generation in all the schemes. Increase in head diameter, oil per cent and seed yield / plant were found in MS_2 *kharif* and *rabi* seasons over that of MS_0 population. Whereas in BS_2 population, in different seasons, the mean values of all the yield attributes were lower than BS_0 and BS_1 populations except 100-seed weight and oil percent in summer season.

The HS_2 and FS_2 population showed increased mean values in oil yield and seed yield / plant over the base population. However, HS_2 population further showed an improvement in the mean values in the attributes like head diameter, 100-seed weight and oil percent. However, in S_2 bulk population, oil yield and seed yield / plant were mostly affected characters when compared to S_0 and S_1 populations.

The variance and co-efficient of variation were reduced as the generations advanced in all the populations of mass selection, bulk sib selection, half sib, full sib selection and selfed progeny selection schemes.

Key words : Comparative Evaluation, Generation Seasons, Yield.

The present investigations, Morden variety was chosen for imposing various population improvement selection schemes as this variety is the most stable, early, short stature and dependable variety grown with varying managerial skills and input capacities of the farmers in different environments.

Thus the present investigation aimed at in open pollinated Morden Variety with the following objective.

To compare the efficiency of mass selection (MS), Bulk Sib (BS), half sib (HS), Full Sib (FS) and selfed progeny (S) Selection Schemes in the second generation cycle in the yield and yield attributes.

MATERIAL AND METHODS

The present investigation was carried out from *kharif* 1997 to *Rabi* 1999 at the Regional Agricultural Research Station, Nandyal, Andhra Pradesh.

Field Plot Technique During Kharif, 1997:

During *Kharif* 1997, the open pollinated base population of Morden was sown in isolation at Regional Agricultural Research Station, Nandyal, Andhra Pradesh in an area of 1800 square meters. Nearly 10,000 plants were raised by adopting a spacing of 60 cm between rows and 30 cm between plants with in a row.

The Population of MS_2, BS_2, HS_2, FS_2, S_2 bulk and open pollinated variety morden as check were raised during 1998 – 99 *summer*, 1999 *kharif* and 1999 *rabi* in a randomized block design with four replications with a spacing of 60 cm between rows and 30 cm plant to plant within a row. Each population in a replication was sown in ten rows each with a 3 meters row length. The data recorded on individual plants was used to work out mean, range, variance and co-efficient of variation in all seasons.

Field Plot Technique during *rabi* 1997:

The selected bulks of mass and bulk sib selections made during *kharif* 1997 were advanced to raise as MS_1 and BS_1 populations during rabi 1997. The procedure as described in the previous season was followed in mass and bulk sib material in MS_1 and BS_1 generation. The seed of these generations harvested separately and designated as MS_2 and BS_2 for sowing in the next season.

Table 1. Mean values of various populations for yield and yield attributes during Summer, 1998-99.

S.No	Character	MS2	Percent increase over check	BS2	Percent increase over check	HS2	Percent increase over check	FS2	Percent increase over check	S2	Percent increase over check	Modern check	S.Em
1	Plant height (cm)	58.60	90.15	65.70	101.07	60.30	92.76	66.40	102.15	64.20	98.76	65.00	1.66
2	Head diameter (cm)	7.65	101.59	8.46	112.35	8.93	118.59	8.90	118.19	8.04	106.77	7.53	0.42
3	Stem thickness (cm)	0.76	89.41	0.83	97.64	0.93	109.41	0.86	101.17	0.77	90.58	0.85	0.04
4	Days to maturity	81.23	96.01	81.51	96.34	83.04	98.00	84.00	99.29	84.32	99.66	84.60	1.10
5	100 seed weight (g)	5.23	138.35	5.80	153.43	5.40	142.85	6.40	169.31	4.58	121.16	3.78	0.09
6	Oil percent	27.41	84.33	36.71	112.95	34.43	105.93	33.80	104.00	32.77	100.83	32.50	1.57
7	Oil yield / plant (g)	1.69	65.00	3.97	152.69	4.53	174.23	2.84	109.23	2.47	95.00	2.60	0.09
8	Seed yield / plant (g)	6.23	83.62	10.89	146.17	13.16	176.64	8.47	113.69	7.55	101.34	7.45	0.48

Table 2. Mean values of various populations for yield and yield attributes during *Kharif*, 1999.

S.No	Character	MS2	Percent increase over check	BS2	Percent increase over check	HS2	Percent increase over check	FS2	Percent increase over check	S2	Percent increase over check	Modern check	S.Em
1	Plant height (cm)	79.60	87.76	80.60	88.86	88.70	99.79	95.80	105.62	68.10	75.08	90.7	1.12
2	Head diameter (cm)	17.09	105.49	15.60	96.29	19.03	117.46	22.03	135.98	10.50	64.81	16.2	0.55
3	Stem thickness (cm)	1.81	61.56	1.79	60.88	2.99	101.70	4.39	149.31	1.40	47.61	2.9	0.07
4	Days to maturity	87.41	98.79	81.20	98.54	81.43	98.82	81.34	98.71	79.92	96.99	82.4	0.49
5	100 seed weight (g)	3.92	108.88	3.72	103.33	5.13	142.50	6.57	182.50	2.48	68.88	3.6	0.29
6	Oil percent 39.7	108.46	33.44	91.30	42.76	116.83	47.66	130.22	40.12	109.62	36.60	0.6	
7	Oil yield / plant (g)	7.70	108.75	5.06	71.46	12.79	180.64	18.96	267.79	2.90	470.96	7.0	0.32
8	Seed yield / plant (g)	20.06	89.55	16.31	72.82	30.57	136.47	39.85	177.90	7.49	33.43	22.4	0.59

Sixty six S_1 progenies were grown in a randomized block design with two replications. At maturity the data was recorded on each of the left over plants in each of the progeny line. Based on yield data, Superior progenies were identified and seeds of corresponding selfed plants were bulked to raise it as S_2 bulk progeny in the next season.

After retaining 50 percent of the seed as remnant, selected 115 HS_1 and 123 FS_1 progenies were planted in separate trials in randomized block design with two replications. Each progeny was represented by a row of 15 plants. Based on seed yield and oil yield, top five percent of progeny lines were identified. Based on this data, the corresponding remnant seeds of the lines were taken and mixed to raise as HS_1 and FS_1 generations.

Field Plot Technique during Rabi 1998:

The Hs_1 generation was raised in isolation. The entire population was left for random pollination and at maturity the entire population was harvested in bulk and preserved to raise it as HS_2 in the next season.

Similarly FS_1 were raised in isolation and plants were bagged and crossed interse. At maturity equal quantity of seed from each cross was taken and mixed to raise as FS_2 in the next season.

Statistical Analysis:

The data obtained from MS_0, BS_0, HS_0, FS_0, S_0, MS_1, BS_1, HS_1, FS_1, S_1 and MS_2, BS_2, FS_2, and S_2 in different seasons were used to estimate range, mean, variance and co-efficient of variation.

RESULTS AND DISCUSSION

The second generation populations were laid out in an experiment in different seasons along with the Morden as check variety to compare the efficiency of various selection schemes and seasons in improving mean yield and yield attributes.

In *summer* season, for plant height, the two populations MS_2 and HS_2 recorded significantly low mean values 58.6 and 60.3 cm when compared to the rest of the populations and also with Morden. Whereas for head diameter, all the populations recorded superior mean values than the Morden variety. Not much improvement was found by the imposition of various population schemes in improving stem thickness over the Morden variety except HS_2 population showed superior mean of 0.93 cm. Though significant differences were found for days to maturity but none of the populations recorded numerical superiority over the Morden variety. All the selection schemes were effective in reducing the number of days to reach maturity. FS_2 population recorded the highest mean for 100 seed weight (6.40 (g)) and is significantly superior to the rest of the populations. Almost all the populations showed improvement in oil per cent over Morden except MS_2 population (27.41%). However, BS_2 population recorded the highest oil per cent 36.71% among all the populations studied. Similar type of results were found in oil yield / plant and seed yield / plant where in MS_2 populations recorded lowest mean oil yield and seed yield / plant followed by S_2 population. However, HS_2 population recorded highest oil yield and seed yield plant 4.53 (g) and 13.16 (g) followed by BS_2 population 3.97 (g) and 10.89 (g), respectively. From the foregone discussion based on percentage increase over Morden variety, it is concluded during *summer*, half sib selection scheme is more effective in improving the attributes like seed yield, oil yield, stem thickness and head diameter and full sib selection scheme for 100 seed weight and plant height and bulk sib selection for oil per cent. When the fore most important characters like oil per cent, oil yield and seed yield / plant were taken into account, half sib selection followed by bulk sib selection were effective in improving these attributes and the least influence was found by mass selection (Table 1).

During *kharif* season, though significant differences were found among populations for plant height and head diameter, FS_2 population recorded highest mean values for both plant height 95.8 cm and head diameter 22.02 cm followed by HS_2 population. The other populations of MS_2, BS_2 and S_2 recorded lower mean values than Morden variety for these characters except BS_2 and S_2 populations for head diameter. Only two populations of FS_2 and HS_2 showed higher mean values for stem thickness 4.39 cm and 2.99 cm respectively and the other populations showed lower mean values when compared to Morden variety (Table 2). Significant differences for days to maturity were found among the populations

Table 3. Mean values of various populations for yield and yield attributes during *Rabi*, 1999.

S.No	Character	MS2	Percent increase over check	BS2	Percent increase over check	HS2	Percent increase over check	FS2	Percent increase over check	S2	Percent increase over check	Modern check	S.Em
1	Plant height (cm)	74.06	92.50	81.30	101.62	86.00	107.50	92.80	116.00	71.30	89.12	80.00	1.33
2	Head diameter (cm)	17.62	111.66	16.78	106.34	20.66	130.92	21.60	136.88	10.98	69.58	15.78	1.06
3	Stem thickness (cm)	3.48	122.53	2.60	91.54	4.36	153.52	4.64	163.38	1.60	56.33	2.84	0.14
4	Days to maturity	81.20	97.59	80.91	97.24	81.44	97.88	80.93	97.27	80.84	97.16	83.20	0.53
5	100 seed weight (g)	3.41	86.11	3.13	79.04	47.53	114.39	6.89	173.98	3.30	83.33	3.96	0.06
6	Oil percent	33.68	92.02	31.00	84.69	41.08	112.24	48.36	132.13	40.72	111.25	36.60	1.03
7	Oil yield / plant (g)	7.07	102.46	5.48	79.42	13.10	189.85	18.62	269.85	2.79	40.13	6.90	0.26
8	Seed yield / plant (g)	22.64	103.85	18.20	83.48	32.44	148.80	41.98	192.56	6.76	31.00	21.80	0.43

studied. However, none of the populations recorded more number of days to maturity than Morden variety. All the populations showed significantly superior mean values for 100 seed weight than S_2 population. Only two populations FS_2 (6.57 g) and HS_2 (5.13 g) showed significantly superior 100 seed weight than Morden variety. For oil per cent and oil yield / plant, FS2, HS2 and MS2 populations showed superior mean performance than Morden variety. The S2 and BS2 populations showed lower mean values than the Morden variety. Similar trend was found for seed yield / plant except MS2 population which recorded lower mean seed value than Morden variety. From the fore gone discussion, percentage increase over Morden variety is taken into consideration, it is concluded that full sib selection will be more effective in improving the mean values of all the attributes except days to maturity followed by half sib selection. Selfed progeny selection has not made any improvement in influencing the characters over Morden variety. Between mass selection and bulk sib selection, MS2 population showed superiority over BS2 population.

During *rabi* season, though significant differences were observed among populations for plant height and days to maturity, none of the populations recorded higher mean values than Morden variety except BS_2 for plant height. FS_2 and HS_2 populations recorded significantly superior mean values for head diameter, stem thickness, 100 seed height, oil per cent, oil yield and seed yield / plant with few exceptions where in MS_2 population also showed superiority over Morden for certain traits. When the percentage increase over the Morden variety is taken into account, it is concluded that full sib selection followed by half sib selection were more effective in improving the yield attributes in second generation. Mass selection will be better than bulk sib selection and both of them were superior to selfed progeny selection (Table 3).

In general full sib and half sib selection schemes were effective in improving the yield and yield attributes over all the seasons tested than mass selection, bulk sib selection and selfed progeny selection and even over Morden variety. The superior performance of full sib and half sib selection schemes is expected because progeny testing is involved in these schemes where as no progeny test for selection is mass and bulk sib selection schemes. Between full sib and half sibs, full sib selection scheme is more effective because of controlled pollination than half sib selection

schemes. Shivakumar (1995) also reported similar results. Funduianu (1977) revealed that half sib family selection was superior to mass and S_1 selections. On the contrary Mukherjee *et al.* (1980) noticed among the progenies of S_1, half sib, and full sib selections, S_1 progenies yielded 94 per cent higher seed yield compared to the source population, where as half sib progenies yielded no gain but, two of the four full sib progenies yielded 5 per cent improvement. Between MS_2 and BS_2, response for BS_2 was good in *summer* season than MS_2, where as in *kharif* and *rabi*, MS_2 showed better performance. Normally it is expected that BS_2 should perform better than MS_2 because of controlled pollination. But the present results showed in *kharif* and *rabi*, MS_2 performance is better than BS_2 and BS_2 performance better in *summer* season. So it is inferred that the populations of MS_2 and BS_2 were affected by the seasonal conditions. Shivakumar (1995) reported better performance of BS_2 over MS_2 might be due to controlled pollination.

Sprague and Eberhart (1977) concluded from the results obtained from different intrapopulation improvement methods that although differences in base population (parental material), environments and selection intensities made direct comparison of the relative efficiency difficult but there appeared to be no striking or consistent difference among these different methods.

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