

Studies on Character association for yield and yield attributing components in Sunflower (*Helianthus annuus* L.) germplasms in coastal saline belts of West Bengal

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ABSTRACT

A study on genetic variability was made with different quantitative and yield attributing characters in sunflower (*Helianthus annuus* L.). One hundred and twenty five inbred lines of sunflower were selected for studying the character association both direct and indirect to assess the relationship among seed yield and its components. The trial was conducted in the Instructional Farm of Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith on rabi-summer season of 2011-12. The analysis of variance revealed significant differences among the genotypes for all the characters under study. Observations were recorded on twelve different quantitative and yield attributing traits viz., days to 50% flowering, days to maturity, no. of leaves per plant, plant height (cm), head diameter (cm), 100-seed weight (g), no. of seeds per head, seed filling %, hull content (%), volume weight per 100 ml (g), oil content (%) and seed yield per plant (g) and (g). Hence simultaneous selection of these characters would contribute for the improvement of seed yield and oil yield per plant. The maximum positive association in relation to seed yield per plant were found with no. of seed per head, 100seed weight, head diameter and percentage of seed filling. The genetic influence of all the said four characters were more than 80% which signifies the importance of all these four characters in improving the seed yield in case of open pollinated population development as well as hybrid variety development programme.

Keywords: Sunflower, Yield, Character association, Selection indices.

I. INTRODUCTION

India is facing a shortage of edible oil in recent years. During 2009-10 India imported almost 8 million tonnes of vegetable oil which is almost 45 per cent of country's needs spending almost 25000 crores. Sunflower has maximum potential for bridging the gap in the demand and production of edible oil in the country. Its seeds contain high oil content ranging from 35 to 40% with some types yielding upto 50% (Skoric and Marinkovic, 1986). Oil yield is influenced by many plant traits like days to 50 %flowering, plant height, 100-seed weight, volume weight per 100 ml and oil content. Earlier Fick et al. (1974), Green (1980) and Joksimovic et al.

(1999) used simple correlation analysis to study the relationships between oil yield on one side and the other sunflower plant traits on the other side. In the present investigation, simple correlation between oil yield and its component characters was studied to identify the selection indices.

In the present investigation, 78 hybrids derived from crossing between 78 inbred lines and one CMS line 234 A by top cross fashion in sunflower (*Helianthus annuus* L.) were studied. They were raised in a randomized block design with two replication in the Oil seeds Farm, Centre for Plant Breeding and Nimpith during Summer 2010-11. In each replication, each entry was raised in 12.6 m² plot

adopting a spacing of 60 cm between the rows and 30 cm between plant to plant. Established agronomic practices were followed under irrigated condition. The data were recorded on ten randomly selected plants for the yield and yield contributing traits viz, days to 50% flowering, plant height, head diameter, 100-seed weight, volume weight per 100ml, oil content, seed yield per plant, oil yield per plant. The data collected were statistically analyzed for simple correlation.

Simple correlation coefficients among the oil yield and its component characters in sunflower are presented in Table 1. Oil yield was highly significant and positively correlated with seed yield per plant(0.97), plant height (0.49), head diameter (0.61), volume weight (0.29), 100-seed weight (0.49) and oil content (0.39). Similar results were reported by Chikkadeviah et al. (2002), and Ramasubrahmanyam et al. (2002). The character days to 50% flowering had non-significant and positive association with oil yield. Association among yield components days to 50 per cent flowering had positive and significant correlation with plant height. Similar results were reported by Teklewold et al. (2000) and Vidhyavathi et al. (2005). Plant height had positive and significant correlated with head diameter, seed yield per plant. Similar reports were also made by Lakshminarayana et al., (2004) and Vidhyavathi et al. (2005). Head diameter had positive and significant per plant. Similar reports were also made by Moorthy (2004) and Manivannan et al. (2005). Volume weight had positive significant correlation with oil content and seed yield per plant. Similar results were reported by Vidhyavathi et al. (2005) and Manivannan et al. (2005). The character 100-seed weight had shown positively significant correlation with oil content and seed yield per plant.

The non significant association between days to 50% flowering and oil yield indicates that a breeder can

develop high oil yielding hybrids/varieties in early or late maturity group.

Hence considering the correlation analysis, characters namely plant height, head diameter, volume weight/100 ml, 100-seed weight, oil content and seed yield per plant are considered as important selection indices for oil yield improvement.

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Table 1

Characters	Plant height (cm)	Hd. Dia. (cm)	Vol. Wt 100 ml (g)	100-seed weight (g)	Oil content(%)	Seed yield/plant(g)	Oil Yield /pl (g)
Days to 50% flowering	0.51**	0.12	0.19	0.21	-0.04	0.11	0.09
Plant height (cm)		0.54**	0.39	0.12	0.15	0.49**	0.49**
Head diameter (cm)			0.21	0.50**	0.26*	0.59**	0.61**
Volume weight/100 ml(g)				0.20	0.35**	0.25*	0.29**
100-seed weight (g)					0.29**	0.46**	0.49**
Oil content (%)						0.21	0.39**
Seed yield/plant (g)							0.97**

*, ** are significant at 5 and 1 per cent respectively

Genotypic Correlation Co-efficient of different Yield attributing traits on seed Yield of sunflower

Table 2

Character	Days to 50% Flowering	Days to Maturity	No of leaves/pl	Hd.Dia(cm)	Pl.Ht. (cm)	100 seed wt (g)	No of seeds/hd	Seed filling %	oil%	Hull%	Vol.Wt (g/100cc)
Days to Maturity	0.874**										
No of leaves/pl	-0.253	-0.061									
Hd.Dia(cm)	0.326	0.575**	0.198								
Pl.Ht.(cm)	0.093	0.243	0.899**	0.247							
100 seed wt (g)	0.121	0.516**	0.432*	1.057**	0.334						
No of seeds /hd	0.255	0.453**	0.419*	0.975**	0.388*	0.959**					
Seed filling %	0.235	0.404*	0.587**	0.849**	0.651**	0.886**	0.911**				
oil%	0.418*	0.408*	-0.241	-0.253	0.107	-0.293	-0.206	-0.259			
Hull%	-0.304	-0.288	-0.199	0.123	-0.459**	0.101	0.043	-0.025	-0.753**		
Vol. Wt (g/100cc)	-0.045	-0.117	0.443**	-0.473**	0.447**	-0.351	-0.186	-0.057	0.212	-0.271	
Seed yield/pl(g)	0.272	0.448**	0.288	0.932**	0.314	0.957**	0.998**	0.851**	0.244	0.014	-0.204

*, ** are significant at 5 and 1 per cent respectively

Phenotypic Corelation Co-efficient of different Yield attributing traits on seed Yield of sunflower germplasm

Table 3

Characte RS	Days to 50% Flowering	Days to Maturity	No of leaves/pl	Hd.Dia(cm)	Pl.Ht. (cm)	100 seed wt (g)	No of seeds/hd	Seed filling %	oil%	Hull%	Vol.Wt (g/100cc)
Days to Maturity	0.820**										
No of leaves/pl	-0.225	0.089									
Hd.Dia(cm)	0.307	0.496**	0.180								
Pl.Ht.(cm)	0.099	0.281	0.738**	0.205							
100 seed wt (g)	0.092	0.390*	0.296	0.752**	0.326						
No of seeds /hd	0.235	0.431*	0.314	0.767**	0.380*	0.943**					
Seed filling %	0.189	0.261	0.543**	0.615**	0.562**	0.670**	0.708**				
oil%	0.401	0.370*	-0.238	-0.206	0.100	-0.274	-0.201	-0.217			
Hull%	-0.284	-0.264	-0.131	-0.110	-0.421*	0.102	-0.029	0.209	-0.720**		
Vol. Wt (g/100cc)	-0.049	-0.093	0.281	-0.452**	0.419*	-0.210	-0.119	0.013	0.206	-0.247	
Seed yield/ pl(g)	0.261	0.419*	0.249	0.826**	0.295	0.867**	0.965**	0.674**	-0.237	0.019	0.204

*, ** are significant at 5 and 1 per cent respectively

Direct and indirect effects of different Yield attributing traits on seed Yield of sunflower

Table 4

Characte RS	Days to 50% Flowering	Days to Maturity	No of leaves/pl	Hd. Dia.(cm)	Pl.Ht. (cm)	100 seed wt (g)	No of seeds/h d	Seed filling %	oil%	Hull%	Vol. Wt (g/100cc)	Seed Yield/PL (r)
Days to 50% Flowering	-0.574	-0.502	0.146	-0.187	-0.054	-0.070	-0.147	-0.135	-0.240	0.175	-0.026	0.2728
Days to Maturity	0.394	0.451	-0.028	0.260	0.110	0.188	0.205	0.182	0.284	-0.130	-0.053	0.4489**
No of leaves/pl	0.085	0.021	-0.338	-0.06	-0.302	-0.145	-0.138	-0.197	0.081	-0.067	-0.149	0.2887
Hd. Dia(cm)	0.025	0.045	0.015	0.078	-0.019	0.082	0.076	0.066	0.020	0.010	-0.037	0.9321**
Pl. Ht.(cm)	0.013	0.035	0.128	0.035	0.142	0.047	0.055	0.093	0.015	-0.065	0.064	0.3148
100 seed wt (g)	-0.137	-0.473	-0.491	-1.200	0.378	-1.136	-1.081	-1.006	0.333	-0.116	0.399	0.9574**
No of seeds /head	0.457	0.811	0.737	1.742	0.694	1.714	1.787	1.028	-0.368	-0.078	-0.333	0.9989**
Seed filling %	0.071	0.121	0.176	0.255	0.195	0.266	0.273	0.800	-0.078	-0.075	-0.017	0.8517**
Oil%	0.019	0.018	-0.011	-0.011	0.005	-0.013	-0.009	-0.012	1.045	0.034	0.010	-0.2444
Hull%	-0.080	-0.076	-0.053	0.033	-0.121	-0.027	-0.012	-0.066	-0.198	0.863	-0.071	0.0141
Vol. Wt (g/100cc)	0.000	-0.001	0.004	-0.004	0.004	0.003	-0.002	-0.001	0.002	-0.002	0.009	-0.2045

Data on Yield attributes of sunflower germplasm-2011-12&2012-13

Table 5

Name of the Germplasm	Plant Ht.(cm) at Harvest	Head dia.(cm)	Seed yield(g /pl)	100 seed wt.(g)	Seed Filing (%)	Kernel wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% Flowering	Days to maturity
GMU-454	76.1	7.1	12	7.07	86	4.69	2.38	33.66	40.3	62	93
GMU-321	84.8	12.8	12	8.89	70	6.32	2.57	28.91	35.3	68	100
GMU-321	88.6	14.5	14	7.72	90	5.45	2.27	29.40	51.5	69	101
GMU-488	102.6	9.35	15	6.28	75	4.70	1.58	25.16	38.2	63	94
GMU-442	112.2	16.65	26	6.07	70	3.47	2.60	42.83	50.3	71	102
GMU-488	103.7	8.95	14	6.60	75	4.83	1.77	26.82	40.4	70	102
GMU-389	137.2	19.5	40	7.32	90	3.87	3.45	47.13	44.0	73	107
GMU-442	80.1	16.0	20	5.34	80	3.72	1.62	30.33	48.6	68	102

GMU-2-2	77.8	15.1	20	9.34	78	5.85	3.49	37.37	38.2	63	95
GMU-351	147.0	18.55	24	3.66	15	2.51	1.15	31.42	23.4	72	106
GMU-2-2	100.0	15.3	14	9.87	60	6.58	3.29	33.33	40.1	64	96
GMU-1119	128.9	14.5	10	5.31	80	2.47	2.84	53.49	41.2	66	99
GMU-389	151.8	21.5	30	10.4	25	6.99	4.43	38.79	38.2	71	104
GMU-488	103.3	10.4	14	6.72	92	4.32	2.35	35.23	46.9	64	96
GMU-1147-4-2	140.1	15.3	30	6.35	79	3.84	2.52	39.62	39.4	72	105
GMU-1034	82.8	16.4	20	4.67	78	3.12	1.48	32.18	42.0	70	103
GMU-312	135.6	15.5	15	4.55	71	3.02	1.53	33.63	39.0	68	100
GMU-423	106.4	9.1	17	5.38	94	2.98	2.49	45.52	35.8	71	104
GMU-301	163.8	13.5	12.5	3.22	81	1.28	1.94	60.25	44.1	66	98
GMU-592	87.9	9.5	11	4.24	93	2.50	1.74	41.03	42.3	63	95
GMU-566	134.6	13.6	13	5.49	92	3.80	1.69	30.78	38.5	67	99
GMU-1023	129.6	12.9	6.2	2.49	70	1.60	0.89	35.74	31.4	67	100
GMU-1099	135.6	14.7	7.0	3.61	96	2.50	1.10	30.55	42.4	68	101
GMU-539	110	14.45	14	7.99	70	5.19	2.80	35.04	45.2	64	98
GMU-559	125.6	13.5	12	7.85	70	5.41	2.44	31.08	41.1	65	98
GMU-420	121.0	12.6	8	5.44	95	4.21	1.23	22.61	42.2	62	95
GMU-400	93.0	10.5	22	8.46	95	4.70	3.76	44.44	42.0	67	101
GMU-539	115.2	17.6	8	5.33	85	3.87	1.46	27.39	41.5	65	96
GMU-454	87.6	9.75	10	5.63	55	4.03	1.60	28.42	39.8	61	95
GMU-420	121.0	12.6	8	5.86	91	4.323	1.54	26.26	42.0	64	96
GMU-431	105.0	13.6	10	7.97	79	5.24	2.73	34.25	46.1	63	97
GMU-376	87.0	6.80	10	4.77	91	3.36	1.41	29.56	44.6	65	98
GMU1147	125.1	11.9	15	7.05	33	4.73	2.32	32.90	40.2	66	99
GMU-376	109.6	8.6	30	5.6	91	3.51	2.09	37.33	44.2	75	107
GMU-349	112.6	10.5	12	5.03	75	3.59	1.44	28.62	41.6	72	102
GMU-359	121.2	12.6	13	8.69	90	6.49	2.20	25.31	43.2	64	96
GMU-349	115.6	13.2	18	7.08	89	4.21	2.87	40.54	39.2	68	100
GMU-347	112.9	12.9	20	3.97	75	2.88	1.09	27.45	46.3	70	102
GMU-389	163.4	19.7	32	8.76	50	5.12	3.64	41.55	45.1	74	106
GMU-1034	118.1	17.8	30	10.16	46	5.90	4.26	41.92	36.0	71	103
Mean	113.82	13.45	16.70	6.42	75.0	4.16	2.25	35.07	41.37	67.90	98.92
Range	76.1-163.8	7.1-21.5	6.2-40	3.61-10.16	15-96	1.28-6.58	0.89-4.43	25.10-60.25	23.4-51.5	61-75	93-107

Table 6

Name of the Germplasm	Pl. Ht.(cm)	Head dia.(cm)	Seed yield(g/pl)	100 seed wt.(g)	Seed Filing(%)	Kerne l wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% flowering	Days to maturity
AKSFI-197	102.1	15.3	25	4.79	94	2.94	1.85	38.62	38.1	66	98
AKSFI-71	170.6	18.6	50	5.57	91	3.37	2.21	39.60	40.6	73	105
AKSFI-58-3	125.0	14.6	10	6.46	67	4.75	1.71	26.47	48.6	64	96
AKSFI-190	141.6	15.2	24	5.78	65	3.94	1.84	31.84	41.0	66	98
AKSFI-52-1	110.6	13.6	10	6.75	92	4.52	2.23	33.04	39.2	65	97
AKSFI-186	106.8	16.6	21.0	9.15	66	6.42	2.73	29.84	38.1	69	102
AKSFI-7	124.6	15.2	25	7.26	68	3.42	3.84	52.90	41.1	62	94
AKSFI-52-4	129.8	14.3	17	6.66	73	4.05	2.61	39.19	44.5	67	100
Mean	126.38	15.42	22.75	6.55	77.0	4.18	2.37	36.44	41.4	66.5	98.75
Range	102-129.8	14.6-18.6	10-50	4.8-9.1	66-94	2.92-6.42	1.71-3.84	26.47-52.90	38.1-48.6	62-73	94-105

Table 7

Name of the Germplasm	Pl. Ht.(cm)	Head dia.(cm)	Seed yield(g/pl)	100 seed wt.(g)	Seed. Fil(%)	Kerne l wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% flowering	Days to maturity
ID-5022	78.0	13.5	20.0	5.47	95	4.05	1.43	26.09	32.0	68	98
ID-5022	88.0	15.39	22.0	7.62	85	5.07	2.55	33.47	48.4	71	102
ID-60	102.0	16.2	14.0	6.33	60	3.04	3.29	51.97	33.6	65	96
ID-5204	88.2	17.6	16.0	7.73	70	5.01	2.72	35.19	32.1	66	97
ID-63	110	16.6	20.0	3.75	90	2.50	1.25	33.34	43.1	70	102
ID-4036	130.5	16.35	22.0	8.53	50	5.51	3.02	35.41	44.1	71	103
ID-60	102.0	16.2	20.0	4.89	73	3.51	1.38	28.23	35.8	70	103
ID-4036	122.0	20.33	50.0	7.47	71	4.36	3.11	41.64	44.1	74	106
Mean	102.6	16.52	23.0	6.48	74.2	4.13	2.34	35.66	39.15	69.37	100.87
Range	78-130	13.5-20.3	14.0-50.0	3.75-7.73	60-95	2.50-5.51	1.43-3.29	26.09-51.97	32.0-48.4	65-74	97-106

Table 8

Name of the Germplasm	Pl. Ht.(cm)	Head dia.(cm)	Seed yield(g/pl)	100 seed wt.(g)	Seed. Fil.(%)	Kerne l wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% Flw	Days to maturity
GP R-1-1	97.4	9.3	16	4.5	95	2.95	1.55	34.45	40.1	66	98
GP-5082	132.7	16.5	21.0	4.75	90	3.45	1.30	27.37	43.0	69	101
GP-5082	138.4	15.7	19.0	4.77	94	3.11	1.66	34.81	45.2	68	101
GP-1019	126	12.6	10	4.52	73	2.92	1.60	35.40	36.4	72	103
GP-475	64.0	7.2	10	4.37	76	3.37	1.00	22.88	40.0	64	94
GP-150	93.4	11.3	12	4.35	85	2.70	1.65	37.93	41.6	69	100
GP-113	73.9	11.2	10	5.45	61	3.94	1.51	27.70	33.6	70	100
GP-450	85.1	9.35	10	9.99	96	6.72	3.27	32.73	47.3	66	96
GP-39	92.7	12.65	14	5.38	79	3.61	1.77	32.90	38.2	74	105
GP-450	91.5	11.3	11.0	6.90	80	4.50	2.40	34.78	42.8	60	92
GP-175	116.5	10.9	12.0	4.98	47	3.26	1.75	34.93	44.9	70	102
GP-475	122.8	11.5	22.0	7.84	89	5.55	2.29	29.21	39.8	74	105
GNPL-109	99.6	14.6	26	5.26	93	3.64	1.62	30.79	44.1	68	101
GNPL-109	92.8	16.4	30.	9.63	90	6.39	3.24	33.65	46.5	72	103
DRSF-113	158.6	16.45	70	8.09	95	5.38	2.39	30.76	46.1	63	94
DRSF-108	168.4	13.1	30.0	5.62	81	5.23	2.27	30.27	45.0	65	95
LSF-11	84.0	10.5	24.0	8.36	80	5.82	2.54	30.39	36.8	67	99
LSF-8	78.2	9.2	34.0	6.83	91	4.73	2.10	30.75	46.8	72	102
LSF-8	124.8	14.7	12.0	9.314	87	6.49	2.64	28.92	48.0	69	101
LSFH-35	144.0	19.2	34.0	4.62	91	2.59	2.03	43.94	45.1	72	106
LSF-11	76.0	9.5	15.0	6.4	85	4.42	4.98	52.98	40.1	61	91
PLVSF-9	138.6	16.0	16.0	5.71	75	3.49	2.22	38.88	32.0	67	98
PKVSF-22	122.6	14.2	16.8	6.33	92	4.16	2.17	34.28	47.8	68	99
Mean	111.39	12.75	20.64	6.26	83.7	4.28	2.17	33.50	42.22	68.34	99.65
Range	64-168.4	7.2-19.2	10-34	4.5-9.99	47-96	2.6-6.7	1.0-4.98	27.37-52.98	36.4-48	61-74	91-105