

GROWTH PATTERN, HETEROSIS AND CORRELATION IN SUNFLOWER

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Six tall growing genotypes possessing 30–40 leaves were crossed with two short statured early maturing genotypes with 19–20 leaves per plant. Eight hybrids and eight parents were studied. For plant height and number of leaves per plant dominance towards high expression in few hybrids and intermediary position between the parents in other hybrids were observed. Four hybrid combinations viz. 'Morden' x 'Co. 1' 'EC. 75270' X 'Co. 1' 'EC. 44281' x 'Morden' and 'SUF. 3, X 'Morden' were found to be heterotic for seed yield. The correlation analysis revealed significant positive association of plant height number of leaves, diameter of capitulum and number of seeds/capitulum with seed yield.

In sunflower (*Helianthus annuus* (L.)) twenty to forty leaves are produced per plant their rate of development and number being a varietal characteristics. Leaf production and stem elongation continue until the inflorescence opens and flowering begins, when the number of active leaves decline (Weiss.1983)

The emergence of capitulum simultaneously arresting the leaf development is a natural phenomenon in sunflower. As informations on the pattern of elongation of stem and development of leaves and the extent of heterosis for these traits are meagre, the present investigation was undertaken in eight intervarietal hybrids of sunflower.

MATERIALS AND METHODS

Six tall growing genotypes possessing 30-40 leaves per plant were crossed with two short statured early maturing varieties ('Co.1' and 'Morden') having 19-20 leaves per plant during *kharif* 1983 at TNAU, Coimbatore. The following eight hybrid combinations viz. 'Morden' x 'Co.1', 'EC.75270 x 'Co.1'

'EC.100108' x 'Co.1', 'EC.75269' x 'Morden', 'EC.100108' x 'Morden', 'EC. 44281' x 'Morden', 'No:11-15-2' x 'Morden and 'SUF.3' x 'Morden'; thus obtained were raised along with eight parents in a randomised block design with two replications during summer 1984 under irrigated conditions. Each genotype was raised in 4.5x1.2m plots providing a spacing of 60x30cm². Plant height and number of leaves per plant were measured in randomly marked 10 plants in each replication on 30th, 45th and 60th day after sowing and also at harvest. Days to maturity, diameter of capitulum at the time of harvest, number of seeds/capitulum and seed yield/capitulum were also recorded in the selected plants. The heterosis for the above characters in the hybrids was estimated. The phenotypic and genotypic correlations among different traits were computed as suggested by Johnson *et al* 1965.

RESULT AND DISCUSSION

The parents and hybrids tested differed significantly among themselves

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Table 1. Mean expression of characters in the parents and hybrids of sunflower

Parents/ Hybrids	Days to maturity	Plant height (cm)						Number of leaves			Diameter of capi- tulum (cm)	Number of seeds per capi- tulum	Seed yield pe- capitular (gm)
		on 30th day	on 45th day	on 60th day	at har- vest	on 30th day	on 45th day	on 60th day	at har- vest				
'Co 1'	65.00	31.07	49.87	84.91	86.44	14.45	16.25	19.70	19.70	9.75*	279.40	12.21	
'Morden'	76.00	25.61	105.17	119.30	120.17	13.90	18.50	20.25	21.25	13.65	375.50	13.96	
'No. 11-15-2'	83.50	43.23	162.68	179.60	181.53	16.50	23.30	25.00	31.20	14.42	605.25	26.75	
'SUF. 3'	83.00	36.56	149.95	162.86	169.90	16.30	20.75	23.30	29.60	14.29	718.75	30.89	
'EC. 75269'	85.00	39.71	151.87	192.75	204.36	14.75	23.00	27.10	33.00	12.65	712.95	28.19	
'EC. 75270'	88.50	33.35	141.66	215.17	227.97	14.80	26.75	33.15	41.45	14.56	616.60	28.71	
'EC. 100108'	88.50	27.36	126.16	148.62	186.60	12.55	25.55	29.00	34.25	12.43	538.85	30.47	
'EC. 44281'	86.50	35.98	150.84	178.42	194.88	16.05	25.75	27.50	31.40	11.95	668.00	32.38	
'Morden' x 'Co. 1'	79.00	41.47	99.22	125.47	127.39	16.20	20.40	22.55	26.40	14.15	527.90	33.31	
'EC. 75270 x 'Co 1'	79.50	40.55	152.52	168.88	174.09	15.25	23.45	27.80	31.00	14.41	503.80	32.71	
'EC. 100108' x 'Co. 1'	82.00	38.42	148.90	164.43	176.23	15.30	28.60	29.75	31.35	14.05	485.35	29.66	
'EC. 75269' x 'Morden'	80.00	29.79	130.48	143.77	160.61	13.75	24.35	26.15	30.05	14.25	601.50	32.19	
'EC. 100108' x 'Morden'	82.00	27.64	122.86	140.16	147.20	14.35	22.00	24.65	27.10	13.14	499.55	21.57	
'EC. 44281' x 'Morden'	82.00	37.41	154.53	164.45	177.23	16.65	24.75	27.15	31.15	13.44	827.05	39.10	
No. 11-15-2' x 'Morden'	80.00	31.70	144.74	152.52	164.39	13.55	22.15	25.30	29.00	11.96	538.55	25.93	
'SUF. 3' x 'Morden'	82.00	31.69	144.76	156.48	172.53	15.33	24.60	27.85	30.85	12.98	601.00	36.85	
S. E.	1.56	4.37**	6.75**	5.77**	12.08**	0.98*	1.25**	1.74**	1.92**	1.08*	118.47**	3.28**	
C. D.	3.32	9.31	14.38	12.29	25.74	2.09	2.67	3.70	4.10	2.30	252.47	6.98	

*—Significant at 5% level.

**—Significant at 1% level.

Table 2: Percentage of heterosis in sunflower crosses over midparent (di), betterparent (dii), betterparent (dii) and best of all the parents (diii) for different traits.

Character	Hetero- sis	'Morden x 'Co. 1'	EC. 75270' x 'Co. 1'	'EC. 100108' x 'Co. 1'	'EC. 75269' x 'Morden'	'EC. 100108' x 'Morden'	'EC. 44281' x 'Morden'	11-15-2' x 'Morden'	'SUF. 3' x 'Morden'
Plant height	di	23.31	10.74	29.09	-1.18	-4.04	12.51	8.98	18.99
	dii	6.01	-23.63	-5.56	-21.60	-21.11	-9.06	-9.44	1.58
	diii	-44.12	-23.63	-22.70	-29.55	-35.43	-22.26	-27.89	-24.29
Number of leaves/plant	di	28.91	1.37	16.20	10.76	-2.34	18.31	10.56	21.31
	dii	24.24	-25.21	-8.47	-8.94	-20.88	-0.80	-7.05	4.22
	diii	-36.31	-25.21	-24.37	-27.50	-34.62	-24.85	-30.04	-25.57
Diameter of capitulum	di	20.94	18.50	26.69	8.37	0.77	5.00	-14.81	-7.09
	dii	3.66	-1.03	13.03	4.40	-3.74	-6.80	-17.06	-9.17
	diii	-2.82	-1.03	-3.50	-2.13	-9.75	-7.69	-17.86	-10.85
Number of seeds/capitulum	di	61.22	12.46	6.16	10.62	9.27	58.51	9.82	9.85
	dii	40.59	-18.29	-9.93	-15.63	-7.29	23.81	-11.02	-16.38
	diii	-26.55	-29.91	-32.47	-16.31	-30.50	15.07	-25.07	-16.38
seed yield/ capitulum	di	154.47	59.87	38.99	52.70	-2.93	68.75	27.36	64.29
	dii	138.61	13.93	-2.66	14.19	-29.21	20.75	-3.07	19.29
	diii	2.87	1.02	-8.40	-0.59	-33.36	20.75	-19.92	13.80

for all the characters studied (Table 1). The days taken to maturity ranged from 65 (Co.1) to 88.5 (EC.75270 and EC.100108). The hybrids between late and early maturing parents were intermediate in duration. The plant height recorded on 30th, 45th, 60th day after sowing and at harvest revealed mostly intermediary position in hybrids as compared to the stature of the parents. However dominance of plant height towards tallness was evident in four combinations viz. 'Morden' x 'Co.1', 'EC.100108' x 'Co.1' 'EC.44281' x 'Morden' and 'SUF.3' x 'Morden'. In the quick maturing parent Co.1, the plant height showed almost uniform increase throughout its duration. In contrast, a conspicuous increase in plant height was observed in medium and late maturing parents and hybrids between 30th and 45th day after sowing. A similar steep increase in plant height between 60th and 80th day after sowing has been reported by Weiss (1983) in sunflower genotype of 140 days duration. The hybrids between 'EC.75269' x 'Morden', 'EC.44231' x 'Morden' and '11-15-2' x 'Morden' closely resembled their better parents for number of leaves indicating the dominance nature of the trait in these crosses. A distinctly superior performance for number of leaves was realized in 'Morden' x 'Co.1' and 'SUF.3' x 'Morden' than their parents. However, in other combinations intermediary position for this character was noticed. An examination of the mean expression and the heterotic response of the hybrids

(Table 2) for various characters revealed that the magnitude of heterosis was relatively higher in 'Morden' x 'Co.1', a combination of two short statured parents with low number of leaves per plant, than in the other crosses. The maximum seed yield per plant (39.10 gm) was obtained in 'EC.44281' x 'Morden'. Shankara (1983) observed heterosis for plant height, capitulum diameter and plant yield. He also reported that the performance of crosses had not corresponded with *per se* performance of the parents but well related with the g. c. a. effects of their parents. In the present study, the highest yielding parent 'EC.44281' produced the best combination with 'Morden' for yield. With reference to seed yield per plant, the combinations 'Morden' x 'Co.1', 'EC.75270' x 'Co.1', 'EC.44281' x 'Morden', and 'SUF.3' x 'Morden' were found to be highly heterotic with positive expression over the best available parent. The heterotic combination between 'Morden' and 'Co.1' indicates that the two parents might be genetically different though they are selections from the same source viz. 'Cernianka-66'.

The estimation of correlation coefficients revealed that seed yield has significantly positive association with all the characters studied at genotypic level (Table 3). Therefore, these traits are also to be given due considerations for yield improvement in sunflower. Diameter of capitulum did not establish any relationship with plant height, number of leaves

Table-3. Phenotypic and genotypic correlations between different economic traits in sunflower.

Charactor	Number of leaves	Diameter of capitulum	Number of seeds/ capitulum	Seed yield/ capitulum
Plant height	0.9525** (0.9759**)	0.4055 (0.4107)	0.6973** (0.7418**)	0.6021* (0.6352*)
Number of leaves	—	0.4376 (0.4722)	0.6112* (0.6727**)	0.6208* (0.5653*)
Diameter of Capitulum	—	—	0.3621 (0.4783)	0.4425 (0.5572*)
Number of seeds/	—	—	—	0.7590** (0.766**)

Figures in parentheses denote the genotypic correlations

* - Significant at 5% level and ** - at 1% level

and number of seeds/capitulum. The correlations among other characters showed significant positive associations both at phenotypic and genotypic levels.

The investigation has brought out that the parents possessing high leaf number did not produce heterotic hybrids though the capitulum formation coincided with the suppression of leaf production in sunflower.

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