

5 x T 163 exhibited good specific combining ability for two traits viz., protein and ash content and tryptophan and ash content respectively. Similar observations have been recorded in respect to protein and other components (Chauhan *et al.*, 1988; Gupta *et al.*, 1982).

The specific combiners for protein content involved high x average, high x low, low x average and low x low general combining ability. The general combining ability variances were higher than specific combining ability variances for protein, methionine, ash and total sulphur and vice-versa in respect to tryptophan and lysine contents indicating predominance of additive and non-additive gene effects, respectively in the expression of these variables.

The results revealed that both additive and non-additive genetic variances were important in

the inheritance of quality traits in pea. Therefore, conventional methods of breeding which capitalise mainly on the additive genetic variance may not hold good in improving these characters. Some alternate methods like biparental mating in early generations may be more effective for selection of these characters.

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## TIME OF PLANTING STUDIES IN SUNFLOWER HYBRIDS

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#### ABSTRACT

Field experiment was conducted to study the response of sunflower hybrids viz., BSH-1 and MSFH 17 in different dates of sowing during summer and *Kharif* seasons of 1991-93 at the Agricultural Research Station, Bhavanisagar. The results revealed that with the hybrid MSFH 17, early June and Mid-December plantings gave higher seed yield, head diameter, seed filling, hundred seed weight and oil content.

**KEY WORDS:** Sunflower, planting Time

Sunflower (*Helianthus annuus* L.), being a photo insensitive crop, could be sown around the year and can find a place in existing cropping pattern. But cultivars differ in their response to varying seeding dates even in a given season. Seasonal factors play a major role in the growth and yield of sunflower (Yadav and Vikrem Singh, 1976). The knowledge on its crop husbandry particularly in hybrids has not attained such a level as that of other oil seed crops commonly grown. For any crop, the optimum time of sowing has to be worked out in order to obtain higher yields. A study was therefore carried out to find out the optimum time of sowing in different seasons for getting maximum yields in sunflower hybrids.

#### MATERIALS AND METHODS

Field experiments were conducted to study the response of sunflower hybrids in different dates of sowing during summer and *Kharif* seasons of 1991-93 at the Agricultural Research Station, Bhavanisagar. The experimental soil belongs to Alfisol, sandy loam in texture, neutral p<sup>H</sup>, free from soluble salt and low fertility status in available nitrogen (182 kg/ha), low in available phosphorous (9.6 kg/ha) and medium in available potassium (216 kg/ha).

Treatments consisted of two hybrids viz., BSH 1 and MSFH 17 and four times of sowing in summer starting from December 15 at fortnightly intervals upto February 1 and during *Kharif* from

Table 1. Influence of sowing date on the growth attributes of sunflower hybrids.

Hybrids	Days to 50% Flowering				Days to maturity				Plant height (cm)			
	S'91	K'91	K'92	S'93	S'91	K'91	K'92	S'93	S'91	K'91	K'92	S'93
BSH-1	57.0	56.9	56.4	55.0	96.3	96.6	97.2	93.5	153.0	155.1	157.4	153.9
MSFH-17	58.8	61.7	60.8	57.6	99.3	100.5	100.8	97.1	157.3	161.5	164.5	161.4
CD	0.45	0.49	0.53	0.34	0.50	1.13	0.52	0.45	4.76	3.59	2.46	1.66
Sowing date												
1 June / 15 Dec.	55.5	56.0	56.0	55.0	95.7	96.5	97.0	94.0	152.2	156.4	158.3	156.9
15 June / 1 Jan	57.3	57.5	57.3	55.7	96.5	96.8	98.0	94.8	155.5	160.7	161.6	156.5
1 July / 15 Jan	58.7	61.0	59.8	56.2	98.8	99.7	100.0	95.5	164.2	163.1	162.4	157.7
15 July / 1 Feb	60.2	62.7	61.3	58.3	100.0	101.2	100.8	96.8	158.5	161.0	161.4	159.6
CD	0.63	0.66	0.75	1.48	0.71	1.60	0.74	0.63	NS	NS	NS	NS
Inter CD	0.90	NS	NS	NS	1.00	NS	NS	NS	NS	NS	NS	NS

S : Summer; K : Kharif

June 1st onwards upto July 15th, replicated thrice in split-plot design. Half the recommended nitrogen and full potassium were applied basally and the remaining were top dressed at button initiation and flowering stages. Potassium applied uniformly to all the treatments at the rate of 60 kg/ha as constant. Standard agronomic practices were adopted to raise the crop. Observation on Days of 50 per cent flowering, days to maturity, plant height, head diameter, seed filling, hundred seed weight and seed yield were record. Seed collected treatmentwise were estimated for its oil content by NMR.

## RESULTS AND DISCUSSION

### Days of 50 per cent flowering

The data showed that hybrids and different times of sowing had influenced the flowering behaviour of sunflower. Being a genetic character, it differed significantly with the hybrids tried. Among the hybrids, BSH 1 completed its 50 per cent flowering by 55-57 days while MSFH 17 the days interval extended to 58-62 days both in summer and *kharif* seasons respectively. Regarding different times of sowing, the days to attain 50 per cent flowering increased gradually as the days passed on and it varies from 55-63 (Table 1)

### Days to maturity

Consequent to the flowering behaviour of sunflower, the days to maturity was also significantly altered by the hybrids and different times of sowing (Table 1) BSH 1 attained maturity between 94 and 97 days while MSFH took 97 to 100 days to come to harvest. The time of harvest

was also delayed due to delay in sowing both in summer and *Kharif* seasons.

### Plant height

The data (Table 1) showed that there was marked difference between hybrids with regard to plant height registered (15 to 157 cm in BSH 1 and 157 to 165 cm in MSFH 17) because of genetic differences. Similar findings were reported by Yadav and Vikram sing (1976). Different times of sowing have not influenced the plant height.

### Head diameter

Head diameter measured at harvest stage indicated that both hybrids and different times of sowing independently influenced the head diameter of sunflower (table 2) Highest values were recorded for the hybrid MSFH 17. There was significant difference due to different times of sowing both in summer and *Kharif* seasons respectively. Delay in planting resulted in consistent and significant decrease in diameter. The head diameter decreases drastically due to delay in sowing.

### Seed filling

The filling percentage was influenced greatly both hybrids and different time sowing (Table 2). Highest filling percentage was registered under hybrid MSFH 17.

The seed filling behaviour was affected due to different times of sowing and it was lowest at last sowing both in summer and *Kharif*. The results corroborates the findings of Bhattacharya *et al* (1975) and Ghosh and Chatterjee (1976).

Table 2. Influence of sowing date on the yield attributing characters of sunflower hybrids.

Hybrids	Head diameter (cm)				Seed filling (%)				Seed yield (kg/ha)			
	S'91	K'91	K'92	S'93	S'91	K'91	K'92	S'93	S'91	K'91	K'92	S'93
BSH-1	14.3	13.1	12.8	14.4	90.0	92.8	82.4	90.4	894	1063	948	1036
MSFH-17	14.4	14.6	14.3	14.9	93.7	95.3	85.5	92.3	1210	1468	1378	1453
CD	NS	0.45	0.34	0.22	1.35	0.77	0.34	1.42	85.01	58.82	79.77	77.75
Sowing date												
1 June / 15 Dec.	15.4	14.6	14.6	15.3	96.1	96.4	87.1	93.8	1679	1849	1502	1444
15 June / 1 Jan	14.8	14.2	13.9	15.0	96.3	94.6	85.0	92.2	1033	1358	1278	1371
1 July / 15 Jan	14.1	13.9	13.1	14.4	89.8	93.0	82.3	90.8	841	1052	1056	1218
15 July / 1 Feb	13.1	12.8	12.6	14.0	89.3	92.3	81.4	88.7	668	802	816	945
CD	0.83	0.64	0.48	0.31	1.91	1.09	0.48	2.01	120.22	83.19	112.82	109.53
100 Seed wt. (g)												
Hybrids	S'91	K'91	K'92	S'93	S'91	K'91	K'92	S'93	Oil content (g)			
BSH-1	2.97	3.2	3.28	3.36	35.3	33.8	35.1	36.4				
MSFH-17	4.32	4.5	4.52	4.11	34.8	33.7	33.7	38.7				
CD	0.67	0.07	0.06	0.07	0.63	0.54	0.27	0.59				
Sowing date												
1 June / 15 Dec.	3.78	4.13	4.05	3.78	36.5	35.3	35.6	37.0				
15 June / 1 Jan	3.67	3.90	3.95	3.80	35.4	34.3	34.8	37.6				
1 July / 15 Jan	3.58	3.77	3.87	3.67	34.3	33.1	33.8	37.6				
15 July / 1 Feb	3.53	3.65	3.73	3.68	33.9	32.3	33.6	38.0				
CD	0.10	0.11	0.08	0.10	0.90	0.76	0.39	0.84				
Inter CD	NS	NS	NS	NS	NS	NS	NS	NS				

S : Summer; K : Kharif; NS : Not-Significant.

### Seed yield

Results revealed that hybrids and times of sowing had altered the seed yield of sunflower significantly (Table 2). Highest seed yield was registered under the hybrid MSFH 17. In both a summer and Kharif season, the yield was extremely better at first date of sowing and the yield reduction was drastic during later sowings.

Decrease in yields due to delayed sowings was also reported by Varisai Muhammed and Sivasubramanian (1973) and Venkateswarlu (1973).

### Test weight

Both hybrid and different times of sowing influenced the test weight of sunflower (Table 2). As explained earlier the hybrid MSFH 17 and early sowings both in Kharif and summer registered higher filling rate which in turn resulted in higher

### Oil Content

Highest oil content was estimated in summer sowings than kharif sowings and it was more in MSFH 17. There were no appreciable differences in oil content due to time of sowing.

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