SHORT COMMUNICATION

Variability in Sunflower Inbreds for Physiological Characters

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Key Words: Inbreds, Physiological characters, Sunflower, Variability

Sunflower has gained much popularity because of its short duration, wider adaptability to varied agro-climatic conditions, high yield potential and for its oil rich in PUFA content. In spite of its wide spread cultivation, the productivity of the crop in the country is low when compared to its yield potential. Development of good hybrids and varieties depend on the availability of variation in the germplasm for different characters. Therefore, in the present investigation, emphasis was given for characterization of the inbreds developed at Directorate of Oilseeds Research (DOR), Hyderabad for selecting physiologically efficient types for further use in breeding programmes.

Thirty elite inbreds developed at DOR along with two checks, KBSH 1 and Morden (Table 1) were sown in Randomized Block Design during *rabi* 2001 with three replications. Crop was sown at a spacing of 45 x 30 cm. Recommended dose of N-P-K (60-30-30 kg/ha) were applied. Irrigation and plant protection measures were given as and when required. Five rows or 4m length constituted one replication. In each replication observations were recorded on five plants.

The variation available and the promising inbreds for different characters have been represented in Table 2 and 3. It was observed that considerable amount of variability exists in the inbreds studied which offers scope for selection and utilization in further hybrization programme.

Though there is possibility to improve crop yield by reducing plant height via increasing HI, the decreased plant height causes reduction in internodal length thereby causing shading of leaves. Therefore, medium plant height is preferred (Skoric, 1980). Plant height in different inbreds ranged from 77-165 cm with a mean of 116. There is only one genotype, DSI 78 which recorded <80 cm height other than Morden (77cm) and in GP 774 and Acc 226 it's more than 150 cm. Three inbreds DSI 41, DSI 57, DSI 55 recorded less than 100 cm height. Majority of the inbreds are in the range of 100-130 cm. This character has been found significantly correlated with seed yield (Punia and Gill, 1994) by influencing head diameter (Doddamani *et al.*, 1997).

Stem girth indicates strength of stem to withstand lodging. Therefore while selection, short and firm stems were preferred. Girth varied from 5.0-6.7 cm with a mean of 5.8 cm. Variation for stem girth is not much among genotypes. Both positive (Jayarame Gowda, 1994) and negative (Doddamani *et al.*, 1997) effects of stem girth on seed yield were reported.

Leaf number and area are important as they decide the size of assimilating area. The highest leaf of 32 was recorded in inbred DSI 103 and the lowest (20) in DSI 57. Leaf number varied between 20-32 whereas LAI ranged from 1.0 to 3.5. In only three genotypes viz., Acc 226, DSI 103, GP 774 the leaf number recorded was higher than KBSH 1(28). However, LAI crossed 2.5 only in DSI 38, DSI 45, DSI 36, and DSI 198. Other than the number and area, leaf orientation that results in least shading is the character to be considered while selection. Inbreds with < 25 leaves has lower LAI. As there was positive

Table 1. List of inbreds studied

S.No.	Inbred	S.No.	Inbred	S.No.	Inbred	S.No.	Inbred
1	Acc226	9	DSI 45	17	DSI 60	25	DSI 78
2	DSI 16	10	DSI 48	18	DSI 63	26	DSI 103
3	DSI 36	11	DSI 49	19	DSI 65	27	DSI 198
4	DSI 37	12	DSI 50	20	DSI 67	28	GP -774
5	DSI 38	13	DSI 51	21	DSI 69	29	GP -761
6	DSI 41	14	DSI 54	22	DSI 70	30	GP -771
7	DSI 42	15	DSI 55	23	DSI 71	31	KBSH-1(C)
8	DSI 44	16	DSI 57	24	DSI 73	32	MORDEN(C)

Table 2. Variation among inbreds for different characters

S.No	Character	Mean ± S.E	Range	KBSH 1	Morden	C.V (%)
1	Plant height (cm)	116 ± 8.2	77-165	144	77	10
2	Leaf number	25 ± 1.18	20-32	28	21	7
3	LAI at flowering	1.9 ± 0.26	1.0-3.5	2.8	2.5	19
4	TDMat flowering(g/plant)	49 ± 6.5	19-85	56	53	19
5	TDM at harvest (g/plant)	86 ± 7.2	53-115	115	100	14
6	Head diameter (cm)	14.3 ± 0.78	11.6-17.3	15.2	14.9	9
7	Diameter of unfilled area (cm)	5.3 ± 0.67	1.0-7.1	5.0	5.7	22
8	Stem girth (cm)	5.8 ± 0.32	5.0-6.7	6.2	6.0	10
9	Days to flowering	61 ± 1.2	55-66	55	55	3
10	Days to maturity	98 ± 1.3	92-102	102	95	4
11	Seed yield (g/plant)	25 ± 3.11	16-45	45	44	21
12	HI (%)	29 ± 3.9	18-44	41	44	22

Table 3. Promising inbreds for various characters

S.No	Character	Inbreds
1	Plant height (cm)	
	Short <100	DSI 41, DSI 55, DSI 57, DSI 78
	Tall >120	Acc 226, DSI 16,DSI 38, DSI 45, DSI 63, DSI 73, DSI 103, GP 774
2	Leaf number >27	Acc 226, DSI 38, DSI 45, DSI 63, DSI 67, DSI 103, GP 774
3	LAI at flowering >2.5	DSI 36, DSI 38, DSI 45, DSI 198
4	TDM at flowering > 60 g/plant	Acc 226, DSI 36, GP 761, DSI 198
5	TDM at harvest>100 g/plant	Acc 226, DSI 63, DSI 65, GP 761, DSI 198
6	Head diameter (=15cm)	DSI 37, DSI 38, DSI 44, DSI 45, DSI 63, DSI 67, DSI 69, GP 761, DSI 198
7	Diameter of unfilled area < 4cm	DSI 37, DSI 42, DSI 48, DSI 49, DSI 67
8	Stem girth > 6cm	Acc 226, DSI 37, DSI 38, DSI 45, DSI 51, DSI 55, DSI 63, DSI 69, GP 774
9	Days to flowering < 60 days	Acc 226, DSI 37, DSI 41, DSI 44, DSI 57, DSI 103, GP 761, GP 771
10	Days to harvesting < 95 days	DSI 37, DSI 41, DSI 50, DSI 57, DSI 103, GP 761, GP 771
11	Seed yield	
	>30g/plant	DSI 50, DSI 63, DSI 67, GP 761
	>25	DSI 65, DSI 70, DSI 103,GP 774, DSI 198
12	HI >30%	DSI 16, DSI 37, DSI 41, DSI 49, DSI 50, DSI 54, DSI 63, DSI 65, DSI 67, DSI 70, DSI 71, DSI 103, GP 761,GP 771, GP 774

relationship between assimilating area and seed yield, LAI can be used as a selection parameter (Nanjareddy *et al.*, 1994). Another advantage in selection for LAI is that it is superdominantly heritable character (Skoric, 1985).

Days to flowering ranged from 55-66 days and to maturity from 92-102 days. However, these two characters did not show any significant association with seed yield (Doddamani *et al.*, 1997).

Direct relation between total dry matter (TDM) production and seed yield was reported (Nanjareddy *et al.*, 1994). High TDM at anthesis would lead to remobilization of stored carbohydrates from stem to seed which is more important during periods of stress. In this study, TDM ranged from 19-85 at flowering with a mean of 49 and 53-115 at harvest with a mean of 86g/plant. Inbreds that recorded >60 g weight at flowering are Acc 226, GP 761, DSI 36, DSI 198 and at harvest >100 g/plant are Acc 226, GP 761, DSI 63, DSI 198. Therefore, selection for high pre-anthesis storage drymatter coupled with active current assimilation during seed development contributes significantly towards improvement of productivity (Nanjareddy *et al.*, 1996).

Head diameter and diameter of unfilled zone are important characters that have direct bearing on seed yield. Maximum head diameter of 17.3 cm was recorded in DSI 67 and lowest, 11.6 cm was recorded in DSI 78 with a mean of 14.3cm. Though variation for head diameter among inbreds was not much, considerable variation was observed for the central unfilled zone (from 1.0 to 7.1cm). Seed yield was negatively and significantly associated with unfilled seed percentage (Punia and Gill, 1994). Therefore, yield can be improved by minimizing the area of this unfilled zone. This central unfilled area is > 4cm in 25 genotypes and in only 5 inbreds viz., DSI 67, DSI 37, DSI 42, DSI 48, DSI 49 it is < 4 cm.

Seed yield per plant ranged from 16-45 g with a mean of 25 g. Highest seed yield was recorded in inbred GP 761 and the lowest in DSI 78. In 9 inbreds, DSI 103, GP 761, GP 774, DSI 50, DSI 70, DSI 67, DSI 65, DSI 63 and DSI 198, the seed yield was >25g/plant. None of the inbreds tested were superior to KBSH 1 and Morden, which recorded > 40g/plant yield. Seed yield showed

significant positive correlation with plant height, number of filled seeds, head diameter, test weight and HI (Teklewold *et al* 2000).

HI ranged from 18-44% with a mean of 29%. Inbred GP 761 recorded highest HI of 37% and lowest 18% in DSI 78. Inbreds with HI ≥ 30% include DSI 41, DSI 103, GP 761, GP 771, GP 774, DSI 50, DSI 70, DSI 71, DSI 67, DSI 65, DSI 63, DSI 54, DSI 16, DSI 37 and DSI 49. Inbreds Acc 226, DSI 38, and DSI 45 though have high TDM and LAI, their seed yield and HI are low because of poor translocation from stem. Acc 226 is a tall type and 47% of total dry matter is found in stem only. Nanjareddy *et al.*, (1994), Tanimu and Ado (1988) and Teklewold *et al.*, (2000) and many others also reported similar ranges for the above characters.

Based on the overall performance, DSI 103, GP 774, GP 761, DSI 198, DSI 67 and DSI 63 were identified as physiologically efficient with high seed yield, HI coupled with high LAI. However, based on the requirement, inbreds with specific characters can be selected.

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