ASSOCIATION BETWEEN PARENT AND PROGENY PERFORMANCE AND THEIR RELEVANCE IN HETEROSIS BREEDING OF SUNFLOWER

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Abstract

A study was made in sunflower to assess the need for maintenance breeding of parental lines, the variability within the male parent of a sunflower hybrid and its contribution in the performance of the hybrid. Eighty plants of RHA 272 were crossed with single plants of CMS 234A (male and female parent of TCSH 1 respectively). All the 80 selfed single plants of RHA 272 and their corresponding hybrids were evaluated. Observations on days to 50% flowering, plant height (cm), head diameter (cm) and seed yield /plant (g) were made. In general, hybrids showed a higher mean than single plants of the male parent for plant height, head diameter and seed yield with the exception of 50% flowering. This indicated that the level of variability among single plants of parental lines for all characters except for seed yield/plant will be reduced in hybrids. Association among characters showed a similar trend within single plants both of the male parent and the hybrids, respectively. The association between days to 50% flowering and plant height, between plant height and head diameter and between head diameter and seed yield showed positive and significant association. However the same trend could not be observed for the association between plant height and seed yield. In the case of association between the performance of single plants of the male parent and its hybrids, all characters recorded significant and positive correlation. A stringent selection in the nucleus seed production of the male parent itself will help to maintain the purity and heterosis of hybrids. Hence paired crosses between single plants of male parents and female parents can be attempted wherever resources are available.

Introduction

Sunflower (*Helianthus annuus* L.) is an important oilseed crop in the world and in India. It occupies 2.1 million ha in India with a productivity of 570 kg/ha (DOR, 2003). In India, though open-pollinated varieties are in cultivation, about 80 per cent of the area is under hybrids only. Many hybrids were released by private, as well as public research organizations. Poor quality of seed is one of several factors limiting the full realization of genetic potentiality of the released hybrids. Hence, it is essential to maintain the purity and vigour of hybrids. Seetharam and Virupakshappa (1993) emphasized the need for proper

maintenance breeding of the parental lines. They have also presented data to demonstrate that the hybrids showed a rapid genetic deterioration after few years of release, thereby defeating the purpose of hybrid breeding research (DOR, 2003). It is mainly due to the inadequate care in the maintenance breeding of parental lines of hybrids. The maintenance breeding requires systematic selection of single plants of parental lines, selfing of single plants, paired crossing between them and evaluation of the selfed plants of parental lines and their paired crosses. It requires lot of resources and many times the breeder is unable to do all these steps, which will result in deterioration of hybrids. Hence, an attempt has been made to assess need for maintenance breeding of parental lines, the variability within the male parent (RHA 272) of TCSH 1 (released by Tamil Nadu Agricultural University, Coimbatore, India) and its contribution in the performance of the hybrid.

Materials and Methods

Eighty plants of RHA 272 were crossed with single plants of CMS 234 A (male and female parent of TCSH 1, respectively) during summer 2003 at Tamil Nadu Agricultural University, Coimbatore, India. All the 80 single plants of RHA 272 were selfed. The selfed single plants of RHA 272 and their corresponding hybrids were evaluated in a plot size of 2.4 m sq. with two replications. Observations on days to 50% flowering, plant height (cm), head diameter (cm) and seed yield/plant (g) were made randomly on five plants. The data were subjected to variability analysis and correlation analysis as per the standard methods.

Results and Discussion

The results are presented in Tables 1 and 2. In general, hybrids show higher mean values than single plants of RHA 272 for plant height, head diameter and seed yield with the exception of days to 50% flowering. The hybrids performed superior to parental lines, which may be due to nonadditive gene effects as observed in the previous studies (Giriraj et al. (1987), Govindaraju et al. (1992) and Shekar et al. (1998) for plant height; Sudhakar et al. (1984), Cruz (1986) and Shekar et al. (1998) for head diameter; Giriraj et al. (1987), Gupta and Singh (1988), Govindaraju et al. (1992), Rao et al. (1992), Marinkovic (1993), Bajaj et al. (1997), Gangappa et al. (1997), Shekar et al. (1998) and Singh et al. (1999) for seed yield/ plant). The range between minimum and maximum values is narrower in hybrids than in single plants of the male parent for 50% flowering and plant height. This indicated that the level of variability among single plants of parental lines for all characters except for seed yield/plant will be reduced in hybrids. This was also indicated by the lesser coefficient of variation in hybrids than in single plants of the male parent for all characters.

In Table 2, the correlation coefficients between single plants of the male parent and their hybrids with CMS 234A are presented. In general, the association among characters showed a similar trend within single plants of the male parent and hybrids, respectively. The association between days to 50% flowering and plant height, between plant height and head diameter and between head diameter and seed yield showed positive and significant association. However the same trend could not be observed for the association between plant height and seed yield.

Table 1. Mean and variability parameters of single plants of the male parent (RHA 272) and their hybrids with CMS 234 A (TCSH 1).

	Days to 50% flowering		Plant height (cm)		Head diameter (cm)		Seed yield/ plant (g)	
	MP	H	MP	H	MP	H	MP	H
Mean	56.3	52.3	140.5	169.3	7.9	12.0	10.8	36.7
S.E.	0.3	0.2	2.1	1.3	0.1	0.2	0.4	1.0
CV(%)	3.9	2.3	11.3	5.8	12.3	10.1	28.6	20.6
Min.	51.0	50.0	109.1	145.6	5.5	10.0	5.6	20.4
Max.	61.0	56.0	173.2	193.6	10.0	15.4	17.6	55.8

Table 2. Correlation among characters within and between single plants of the male parent (RHA 272) and their hybrids with CMS 234 A (TCSH 1).

	Days to 50% flowering	Plant height (cm)	Head diameter (cm)	Seed yield/ plant (g)
Single plants of male parent				
Days to 50% flowering	1.00	-	-	-
Plant height (cm)	0.36**	1.00	-	-
Head diameter (cm)	0.15	0.52**	1.00	-
Seed yield/ plant (g)	0.14	0.41**	0.49**	1.00
Hybrids of Single plants of male parent with CMS 234 A				
Days to 50% flowering	1.00	-	-	-
Plant height (cm)	0.22*	1.00	-	-
Head diameter (cm)	0.08	0.30**	1.00	-
Seed yield/ plant (g)	0.03	-0.01	0.59**	1.00
Between Single plants of male parent and their hybrid with CMS 234 A				
	0.24*	0.51**	0.42**	0.22*

In the case of association between the performance of single plants of the male parent and their hybrids, all characters recorded significant and positive correlation. A stringent selection in the nucleus seed production of the male parent itself will help to maintain the purity and heterosis of hybrids. Hence paired crosses between single plants of male parents and female parents can be attempted wherever resources are available.

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