

## Heterosis for Yield and Its Component Traits In Sunflower (*Helianthus Annuus L.*)

Sarode Hemal Narendra, Dr. C. B. Salunke

Department Of Agricultural Botany (Genetics And Plant Breeding), Pgi Mpkv , Rahuri, Dist - Ahmadnagar - 413722

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### ABSTRACT

The experiment was conducted at PGI MPKV, Rahuri to study heterotic performance of 40 sunflower hybrids over the checks (Standard heterosis) during Rabi 2022 using randomized block design with three replications. It consist of four CMS lines and 10 testers used in line x tester fashion to produce 40 hybrid combinations. These 40 hybrid combinations were studied for heterosis performance over two checks Phule Raviraj and Ajeet 531 respectively. The mean sum of square due to parents, crosses and parents vs crosses were found highly significant for all the characters studied indicating the presence of heterosis for recorded traits. The highest positive significant heterosis over both the checks of hybrids CMS-7-1-A x GMU 1199, CMS 7-1-A X PR64 NB, CMS 234A X GMU

242, CMS 7-1-A X GMU 42 and CMS 7-1-A X NO-2 for seed yield per plant. Four hybrids CMS 89A X NO-2 and CMS 7-1-A X AKSF 190B, CMS 234A GMU 830 and CMS ND2A X AKSF 190B exhibited significant and positive heterosis over check Phule raviraj.

**KEYWORDS :** Heterosis, Hybrids, Line x Tester.

### I. INTRODUCTION

Sunflower (*Helianthus annuus L.*) is the fourth important oilseed crop in the world next to soybean, rapeseed and groundnut popularly known as "Surajmukhi." It belongs to the genus *Helianthus*, family Asteraceae which includes 20 genera with 400 sub-species. The genus includes diploid ( $2n = 2x = 34$ ), tetraploid and hexaploid species it is cross pollinated crop. The wild sunflower is native of North America (Heiser, 1951) and was domesticated as a food crop as early as 3000 BC.

It is rich source of edible oil from 40 to 50 % in seeds. Sunflower oil is considered as good quality oil from health point of view due to higher proportion of poly unsaturated fatty acids

(55-60 per cent linoleic acid and 25-30 per cent oleic acid). It is a highly cross pollinated crop, which can be adapted to a various environmental conditions having high yield potential. Due to its photo insensitiveness it can be grown in all seasons and can be taken in various inter and sequence cropping systems. The average productivity of crop is a major concern in India, which is less than half the world's average yield due to its cultivation under rainfed situation. Hence Heterosis is the most important contributions towards improvisation in agriculture with respect to yield. Since farmers mainly prefer hybrids to cultivate in larger areas, this heterosis exploitation is best suited for increase in the yield of the crop. However, the EC 68414 (Peredovik), EC 68415 (Armaviriski, 3497) and Morden (Cermianka- 66) are the open pollinated varieties through which the commercial cultivation of sunflower started in our country.

Scientists reported that heterotic hybrids have been obtained by crossing inbred CMS female and restorer lines having high GCA (General Combining Ability) and SCA (Specific Combining Ability) values. This higher GCA variance refers to additive gene action depicting breeding value of the particular line, while higher SCA variance indicates the greater role of non-additive gene action, which is of great importance in heterosis breeding (Shabbir et al., 2016).

### II. MATERIAL AND METHODS

The 40 hybrids along with checks (Phule raviraj and Ajeet 531) were evaluated at PGI farm, Department of Agril. Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, during Rabi 2022 in randomized block design. Two rows of each hybrid were sown with a spacing of 60 cm x 30 cm and row length of 4 m. All the standard agronomic and plant protection measures were used. The experimental material was obtained from Agriculture Research Station, Savalivihir (MS). Four CMS lines of leading hybrids viz., CMS-89A, ND- 2A, CMS- 234A and CMS- 7- 1A were

crossed with ten restorer lines viz., GMU-42, AKSF 190B, GMU- 830,NO-2,PR 64 NB,GMU-1131, GMU-242,GMU-336,GMU-1199 and GP6 271 in a L x T fashion to produce forty crosses during Rabi- 2019.

The following observations of nine different quantitative characters were recorded: viz., days to 50 percent flowering, days to maturity, plant height, head diameter, 100 seed weight, total seeds per head, seed filling %, seed yield per plant, and oil content.

### III. RESULT AND DISCUSSION

Heterosis is the superiority of F1 over the mid parent, better parent or standard check in either direction, i.e it may be positive or negative heterosis. The present study included heterosis over standard checks (Hayes et al., 1956). Heterosis is the driving force globally for acceptance of sunflower as a major oilseed crop with its high potential for enhancing the productivity. The variance due to additive and non additive gene actions are important considerations for identification of best heterotic combination with its magnitude of expression for yield and its related traits.

The analysis of variance for various characters under study is presented in Table 1. The variation among treatments was highly significant for all of the characters. The mean sum of square due to parents, crosses and parents vs crosses were also found highly significant for all the characters studied. This indicates presence of substantial genetic variability for the characters studied.

The standard heterosis percentage estimated for different traits studied are depicted under Table 1 to Table 5. In sunflower, positive heterosis is desirable for all the characters studied except days to 50% flowering, days to maturity where negative heterosis is desirable. The crosses CMS- 234A x GMU 1131 followed by CMS 89A X GMU 1131, CMS 234A X NO-2, CMS 234A X GMU 242 has

marked significant and negative heterosis over both the check for days to 50% flowering. Similar findings of earliness was found by S. V. Yamgar et al. (2015) and Harshavardhan Hilliet al. (2020). The crosses CMS 89 X GMU 1131 followed by CMS 89A X GMU 336, CMS-ND2A x GMU 1199, CMS 234A X

NO-2, CMS 89A X NO-2 has marked significant and negative heterosis over both the check for days to maturity. Similar finding by

Radhika et al. (2001), and S.R. Rathi et al. (2016).

The plant height is one of the important contributor towards the yield related trait which was reported by Manivannan et al. (2005). Highest positive significant economic heterosis was exhibited by CMS7-1-A X GMU 830, CMS7-1-A X GMU 1131, CMS 234A X PR64 NB over two checks Phule Raviraj and Ajeet 531. Plant height has been reported by several workers (Jayalakshmi et al., 2000; Bajaj et al., 2003 and Manivannan et al., 2005).

For head diameter, Five crosses observed positive significant heterosis over both the checks. The highest positive significant heterosis over both the check recorded in cross CMS 7-1 A X GMU 42 followed by CMS 7-1-A X GMU 242, CMS- ND 2 A x GMU 336. Nehru et al. (2000), S. V. Yamgar et al. (2015) and Harshavardhan Hilliet al. (2020) reported significant and positive heterosis.

For Total no. of seeds per head, The number of hybrids exhibiting positive and significant heterosis over standard checks Phule Raviraj and Ajeet 531 were 10 and 12, respectively. The crosses CMS- 234A x GMU 336 and 234A x NO-2 were consistently significant positive over both the checks.

The highest positive significant heterosis over both the checks of hybrids CMS- 89A x GMU 1199, CMS ND2A X AKSF 190B and CMS ND2A X PR64

NB for seed filling %. For 100 seed weight, The highest significant positive heterosis over both the checks of hybrids CMS 7-1-A X GMU 1131, CMS ND2A X GMU 1199, CMS 7-1-A X GMU 242 for 100 seed weight.

The highest positive significant heterosis over both the checks of hybrids CMS- 7-1-A x GMU 1199, CMS 7-1-A X PR64 NB, CMS 234A X GMU

242, CMS 7-1-A X GMU 42 and CMS 7-1-A X NO-2 for seed yield per plant. Similar findings by Sawant et al. (2007), Sujatha et al. (2009) Usatov (2014) in their respective studies have reported high levels of standard heterosis for seed yield.

Four hybrids CMS 89A X NO-2 and CMS 7-1-A X AKSF 190B, CMS

234A GMU 830 and CMS ND2A X AKSF 190B exhibited significant and positive heterosis over check Phule Raviraj. None of the cross exhibited positive heterosis over check Ajeet 531.

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