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To study the Ranking of desirable parents on the basis of per se performance and GCA effects for 11 characters in F1 and F2 generation of 10 parent diallel cross in Indian mustard

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Abstract
This study carried out at Genetics and Plant Breeding on the research farm of BNPG Collage Rath, Hamirpur (UP) keeping in mind for selection of parents and their hybrid combinations per se performance, GCA effects, and involvement of desirable specific combinations which give the idea about the potentiality of the parents. The best per se performance in 11 out of 12 cases showed best general combiner in both the generations. The best common parents on the basis of per se performance and significant (general combining ability) gca effects in both the generations were CSR 1020, CSR 1014, CSR 1102 and CSR 1104 for days to flowering, CSR 1102 for number of primary branches per plant CSR 1025, CSR 1118 and CSR 1102 for number of secondary branches per plant; CSR 1025 and CSR 1020 for number of siliquae per main shoot; CSR 1066, CSR 1020, CSR 1118 and CSR 1027 for number of seeds per siliqua; CSR 1066 and CSR 1020 for siliquae length; CSR 1020 for biological yield; CSR 1088, CSR 1082 and CSR 1020, CSR 1014 and CSR 1088 for 1000-seed weight; CSR 1027, CSR 1088 and CSR 1118 for oil content and CSR 1020 for seed yield per plant

Keywords: Ranking of desirable combiners, SE, Seed yield, Diallel cross and F_1 and F_2 generation

Introduction
Indian mustard is an important *rabi* oil seed crop in India and occupies a premier position among the oilseed crops. The oil obtained is the main cooking medium in Northern India and cannot be easily replaced by any other edible oil. Majority of the cultivation is still dependent on rainfall and conserved moisture. Mustard was originated in China and from there; it was introduced to India (Vaughan, 1977) [6]. Indian mustard is mostly grown timely as well as late sown crops. About 40 per cent of the total crop in the country is occupied under late sown irrigated conditions. These crops have been found to suffer from terminal heat stresses and also poor grain filling. Therefore, it becomes necessary to produce such varieties, which thrive reasonably well under timely and late sown situations (Singh, 2004) [5].

Methods and Material
Ten parents *viz*; CSR 1020, CSR 1088, CSR 1027, CSR 1014, CSR 1082, CSR 1025, CSR 1066, CSR 1118, CSR 1104 and CSR 1102 were crossed in diallel fashion to produce 45 F1’s during *rabi SEASON* 1997-1998. The resultant F1 seed of each cross were raised at research farm of Brahmanand Mahavidyalya Rath, Hamirpur UP, India, to obtain F2’s in off season nursery in summer 1998. The parents and their 45 F1’s and 45 F2’s were grown in randomized block design with three replications. Observations were recorded on days to flowering, plant height (cm), number of primary branches per plant, number of siliqua/ plant, number of seeds per siliqua, siliqua length, days to maturity, 1000-seed weight (g), oil content (%) and seed yield per plant (g). Mean value of sample for various traits were subjected to combining ability analysis method II model I of Griffing [3].

Results and Discussion
There are several criteria for selection of parents and their hybrid combinations namely, per se performance, GCA effects, and involvement of desirable specific combinations which

give the idea about the potentiality of the parents/progenies for mobilizing them in a systematic breeding programme. The various methods Gardner and Lonnquist (1959) [2] may or may not be compatible with one another with equal weightage and result in placing parents with different combining ability effects in the same order of ranking. Even though a plant breeder is primarily interested in the relative and significant combining abilities rather than absolute combining abilities.

The per se performance of the parents was compared to their gca effects in both the generations for all the 11 characters (Table-1). It was found that the best per se performance in 11 out of 12 cases showed best general combiner in both the generations. In no case, the poor epr se performance was the best general combiner. Therefore, under the present situation when the character is uni-directionally controlled by a set of alleles and additive effects are important, the choice of parents on the basis of per se performance may be quite useful. However, in certain cases, where non-allelic interactions are playing role the choice of the parents should be based on their combining ability estimates.

The best common parents on the basis of per se performance and significant gca effects in both the generations were CSR 1020, CSR 1014, CSR 1102 and CSR 1104 for days to flowering, CSR 1102 for number of primary branches per plant CSR 1025, CSR 1118 and CSR 1102 for number of secondary branches per plant; CSR 1025 and CSR 1020 for number of siliquae per main shoot; CSR 1066, CSR 1020, CSR 1118 and CSR 1027 for number of seeds per siliqua; CSR 1066 and CSR 1020 for siliquae length; CSR 1020 for biological yield; CSR 1088, CSR 1082 and CSR 1020, CSR 1014 and CSR 1088 for 1000-seed weight; CSR 1027, CSR 1088 and CSR 1118 for oil content and CSR 1020 for seed yield per plant.

In case of gca effects of the parents, it was observed that none of the parents was identified as good general combiner for all the 11 attributes. However, CSR 1020 for days to flowering, number of siliquae per main shoot, number of seeds per siliqua, siliqua length, days to maturity and seed yield per plant. CSR 1088, 1000-seed weight and oil content; CSR 118 and CSR 1027 for number of secondary branches per plant, number of seeds per siliqua and oil content; CSR 1102 for days to flowering, number of primary braches per plant and number of secondary branches per plant; CSR 1066 for number of secondary branches per plant and siliqua length; CSR 1014 for days to flowering and 1000-seed weight were found to be good general combiners.

Almost the equal magnitude of estimates of GCA effects in F_1 and F_2 generations revealed that the best general combiners were also stable in their performance over generations. It might be due to diversity of parents, diverse eco-geographical origin and variability in other agronomic attributes. The performance of poor general combiners was not consistent over the generations. Stability of agronomic traits has always been one of the important parameters in breeding objective.

GCA effects consist of both additive and additive x additive components of gene action was fixable in nature. The additive effects of parents due to GCA are of practical use, whereas, non-allelic interaction are not predictable and could not be easily manipulated. An examination of the best combiners has revealed that majority of them are derivatives of Indian origin. Hence, the derivatives present in mustard varieties/strains did not lower the yield and its contributing traits. The parents namely, CSR 1020, CSR 1027, CSR 1088, CSR 1118, CSR 1102 and CSR 1066 were observed good general combiners for three to six characters associated with seed yield per plant. Therefore, it is suggested to the use f these strains/varieties in further hybridization programme. The improvement will not be made only for seed yield but also for oil content, in this oil producing species. The good general combiners may be utilized in developing population involving all possible crosses among themselves and may be subjected to bi-parental mating in early generations which helps in releasing latent genetic variability due to faster rate of recombination. Singh *et al.* (1983) [4] advocated this idea in other oil producing crop on the ground of GCA effects. There is provision in the method to make all possible bi-parental combinations among selected parents depending upon the number of F_1's. A diallel or partial diallel set or crosses among F_1s would be the material for initiating the breeding population. Such scheme was suggested by Frey and Horner (1957) [1] in self-pollinated crops.

Table 1: Ranking of desirable parents on the basis of per se performance and GCA effects for 11 characters in F1 and F2 generation of 10 parent diallel cross in Indian mustard.

Character	Best per se performance (@)	Best general combiner F_1 (@)	F_2 (@)	Best common parents (@)
Days to flowering	CSR 1025, CSR 1066, CSR 1118, CSR 1082, CSR 1014, CSR 1027, CSR 1102 and CSR 1020	CSR 1020, CSR 1014, CSR 1102, CSR 1104	CSR 1104, CSR 1020, CSR 1088, CSR 1014, CSR 1102	CSR 1020, CSR 1102, CSR 1014, CSR 1104
Plant height (cm)	CSR 1104	-	-	-
No. of Primary branches	CSR 1025, CSR 1066, CSR 1118, B.85 CSR 1020	CSR 1118, CSR 1102	CSR 1025, CSR 1066, CSR 1102, CSR 1014	CSR 1102
No. of secondary branches	CSR 1025, CSR 1102, CSR 1020, CSR 1066, CSR 1104	CSR 1025, CSR 1102	CSR 1014, CSR 1020, CSR 1102, CSR 1025, CSR 1088, CSR 1118	CSR 1025, CSR 1102, CSR 1118
No. of siliquae/ plant	CSR 1102, CSR 1118, CSR 1020, CSR 1027, CSR 1025, CSR 1182	CSR 1102, CSR 1025, CSR 1118, CSR 1027, CSR 1020	CSR 1020, CSR 1088, CSR 1025	CSR 1020, CSR 1025
No. of seeds / siliqua	CSR 1066, CSR 1118, CSR 1027, CSR 1104, CSR 1088	CSR 1066, CSR 1118, CSR 1020, CSR 1027	CSR 1066, CSR 1020, CSR 1027, CSR 1118	CSR 106, CSR 1020, CSR 1118, CSR 1027
Siliqua length	CSR 1066, CSR 1020, CSR 1118, CSR 1027, CSR 1025	CSR 1066, CSR 1020, CSR 1027	CSR 1066, CSR 1118, CSR 1020	CSR 1066, CSR 1020
Days to maturity	CSR 1118, CSR 1020, CSR 1104, CSR 1102, CSR 1182	CSR 118, CSR 1020, CSR 1104, CSR 1102, CSR 1182	CSR 1102, CSR 1104, CSR 1118	CSR 1104
1000- seed weight (g)	CSR 1020, CSR 1088, CSR 1014, CSR 1025, CSR 1027	CSR 1020, CSR 1014, CSR 1088, CSR 1182	CSR 1020, CSR 1088, CSR 1182, CSR 1014,	CSR 1020, CSR 1088, CSR 1014

			CSR 1104	
Oil content (%)	CSR 1027, CSR 1088, CSR 1014, CSR 1118, CSR 1020	CSR 1027, CSR 1088, CSR 1014, CSR 1118	CSR 1027, CSR 1182, CSR 1088, CSR 1118	CSR 1027, CSR 1088, CSR 1118
Seed yield / plant	CSR 1020, CSR 1088, CSR 1027 CSR 1014, CSR 1118, CSR 1066	CSR 1020, CSR 1027, CSR 1066, CSR 1118, CSR 1102	CSR 1020, CSR 1088	CSR 1020

(@) Desirable and significant only.

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