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Combining ability studies for yield and its component in short duration maize (*Zea mays* L.)

VP Mani, NK Singh, BK Sarma, Rajesh Singh

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ABSTRACT

Combining ability analysis using diallel mating (10 x10) design over two locations in 10 short duration open pollinated maize populations and their 45 F_1's was conducted for grain yield and five other related characters. The study on combining ability in maize revealed that variations due to both general combining ability (gca) and specific combining ability (sca) at the two locations viz; Almora and Bajaura, were significant, indicating the importance of additive and non-additive gene effects. L 4 was observed to possess high and significant gca effects for grain yield, ear length, 100-kernel weight and early maturity; Pool 33 (Alm) for grain yield, ear diameter and 100-kernel weight, whereas, VL 88 and Surya for earliness. None of the crosses combination of VL 16 x L 4 showed high sca effects and desirable per se performance for grain yield.

Keywords: Diallel, GCA, Maize, SCA

Introduction

Maize *(Zea mays* L.) is the third most important cereal crop among the cereals grown in India and is one of the promising crops for food, feed, fodder and industrial utilization. The choice of parents in the breeding programme is of paramount importance. Maize is prone to a number of biotic stresses like, foliar diseases, ear rot and stalk rot caused by fungi and bacteria, under favorable environmental conditions. These pathogens are capable of causing severe losses and deteriorate the quality of the produce. Maize breeding requires vigorous field and greenhouse testing to determine the kind and level of resistance to different diseases. Combining ability analysis provides help in selecting desirable parents in terms of their genetic value and identifying superior cross combinations. In maize, considerable efforts are being directed towards the development of high yielding short duration hybrids and composites to realize sustainability in production and productivity, particularly under rainfed condition. The present investigation was undertaken to assess the nature of gene action involved in the expression of grain yield and five other characters in 10 short duration open pollinated maize populations which have undergone various cycles of selection in the past to identify good early maturing general combiners and heterotic cross combinations.

VP Mani
Former Principle Scientists, Indian council of Agriculture Research, New Delhi

NK Singh, BK Sharma
Vivekanand Institute of Hill Agriculture (ICAR) Almora

Rajesh Singh (✉)
Genetics and Plant Breeding, IAS, BHU, Varanasi-221005

e-mail: rsingh6361@gmail.com

Materials and methods

A diallel set of 10 yellow maize populations (Table 1) including 7 early namely: VL88, D 823, L 21, VL 16, L 4, Surya, J 660 and 3 early medium namely: Pool 17 (Alm), Pool 33(Alm) & VL Pool 3(Y) and their 45 F1's was evaluated in a randomized complete block design with four replications at Almora (U.P. hills) and Bajaura (Himachal Pradesh) during *Kharif* season. Each plot comprised two rows of 3 m length,

with inter and intra rows spacing of 60 and 25 cm, respectively. Observations on siz quantitative characters viz., days to silk, ear length (cm), ear diameter (cm), kernel rows/ear, 100-kernel weight (g) and grain yield (kg/plant) were recorded on five random plants in each plot and their mean values were used for combining ability analysis (Model I, Method II of Griffing, 1956). Homogeneity of error variances at the two locations was tested by Bartlett's test.

Results and discussions

Location-wise analysis of variance used for testing homogeneity of the error variances revealed heterogeneous error variances for all the characters. The analysis of variance for combining ability revealed that variances due to gca among parents and sca for crosses were highly significant for all characters at both the locations, indicating thereby the importance of both additive and non-additive components of genetic variance in the inheritance of the traits studied. However, estimates of gca:sca ratio suggested prevalence of additive genetic variance for grain yield, days to silk and 100 kernel weight. Equal importance of additive as well as non-additive component was also observed by Singh et al. (1974) and Beck et al (1991) for the characters studied, while Shahi and Singh (1986), Beck et al. (1991) and Alika (1994) have reported more importance of additive component for grain yield, days to silk and 100-kernel weight. The estimates of GCA effects at the two locations indicated that L 4 was good general combiner for grain yield, ear length, ear diameter and 100-kernel weight. On the other hand , VL 88, D 823 and surya exhibited good gca effects for kernel rows/ears and earliness. Considering the sca effects at the two locations together in the present investigation, VL 16 x L4 showed best sca effects as well as higher *per se* performance for yield. The cross combinations D 823 x Pool 33 (Alm) also exhibited significant positive sca effects for grain yield (Alm), ear diameter (Baj) and 100-kernel weight at the two locations. In addition to these crosses, D 823X Surya, and Surya X J 660 showed favourable sca effects for earliness. Possibilities of these heterotic combinations as early maturing varietal hybrids for direct commercial use is recommended. These hybrids also found to possess significant sca effects for yield and earliness together. The results of this study suggest equal importance of additive and non-additive genetic components in the present short duration populations. However, the development of extra-early open pollinated varieties and hybrids with higher yields was not foreseeable from the population selected for the study. Nevertheless, Considerable improvement for grain yield and grain yield contributing character could be achieved by resorting to appropriate recurrent selection schemes, particularly reciprocal recurrent selections which exploit both additive as well as non-additive components of genetic variance for developing superior early maturing open pollinated varieties and hybrids.

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