HETEROSIS AND COMBINING ABILITY FOR GRAIN YIELD, ITS
ATTRIBUTES AND MICRO NUTRIENTS (Fe AND Zn CONTENT)
IN PEARL MILLET [Pennisetum glaucum (L.) R. Br.]

ABSTRACT

Key words: Combining ability, heterobeltiosis, line x tester mating design, standard heterosis

The present investigation on “Heterosis and combining ability for grain yield, its attributes and micro nutrients (Fe and Zn content) in pearl millet [Pennisetum glaucum (L.) R. Br.]” was carried out at Pearl Millet Research Station Jamnagar, Junagadh Agricultural University, Jamnagar during kharif-2017. The experimental material comprising by 4 female (testers), 7 male (lines), their resulting 28 hybrids and two standard checks GHB-732 for grain yield and Dhanshakti for Fe and Zn content were grown in order to estimate heterosis, combining ability and nature of gene action involved in the inheritance of grain yield and its components viz., days to flowering, days to maturity, plant height (cm), number of effective tillers per plant, ear head length (cm), ear head diameter (cm), test weight (g), dry fodder yield per plant (g), grain yield per plant (g), harvest index (%), Fe content (ppm) and Zn content (ppm). The experiment was conducted in Randomized Block Design with three replications. Observations on five competitive randomly selected plants per replication per treatment were recorded on 12 characters and the mean values were subjected to analysis of variance, estimation of heterosis and combining ability analysis.

The analysis of variance for experimental design revealed highly significant differences among genotypes and hybrids for all the characters indicating the presence of sufficient amount of genetic variability for the twelve traits studied. While, differences among parents were also found highly significant for all traits except for only test weight. Mean squares due to parents vs hybrids were also found significant for all the characters except for number of effective tillers per plant.
High magnitude of heterosis was observed for days to flowering, days to maturity, plant height, number of effective tillers per dry fodder yield per plant, grain yield per plant and Fe content. Whereas, the magnitude of heterosis was moderate for ear head length, ear head diameter, test weight, and Zn content. The heterobeltiosis for grain yield per plant ranged from -31.36 to 23.32%, while the standard heterosis ranged from -22.14 to 65.22%. The cross JMSA$_5$ 20171×153-SB-17 recorded the highest standard heterosis for grain yield per plant followed by ICMA$_1$ 10222×127-SB-17 and JMSA$_5$ 20171×54-SB-17, ICMA$_1$ 10222×128-SB-17. These crosses also exhibited desirable heterosis for important yield attributes suggesting that the heterosis for grain yield was associated with heterosis for component characters.

Analysis of variance for combining ability revealed that the mean squares due to female (testers) were significant for ear head length, test weight, dry fodder yield per plant and harvest index. Whereas, the mean square due to male (lines) were significant for only Zn content. The mean square due to line × testers were found significant for days to flowering, days to maturity, plant height, dry fodder yield per plant, grain yield per plant and Fe content. The results indicated the importance of both additive and non-additive genetic variances in the expression of these characters.

Higher magnitude of $\sigma^2$gca as compared to $\sigma^2$sca for five characters viz., ear head length, ear head diameter, test weight, harvest index and Zn content indicated the involvement of additive gene action. Higher magnitude of $\sigma^2$sca than $\sigma^2$gca observed for all the characters except above five characters. Which indicated that the predominance of non-additive gene effect in the inheritance of these characters.

The female ICMA$_1$ 10222 and JMSA$_5$ 20171 and one male 128-SB-17 displayed high gca effect and for grain yield per plant and some desirable traits. These parents possessed high concentration of favourable genes for more number of traits and should be utilized in multiple crossing programmes.

The sca effect of the crosses indicated that two hybrids JMSA$_5$ 20171 x 153-SB-17 and ICMA$_1$ 12444 x 118-SB-17 manifested significant and positive sca effect for grain yield per plant and one hybrid JMSA$_5$ 20155 x 54-SB-17 exhibited significant and highest positive sca effect for Fe content and another hybrid ICMA$_1$ 10222 x 130-SB-17 exhibited significant and highest positive sca effect for Zn content. These crosses also showed desirable sca effect for important yield traits and quality traits. The crosses exhibiting high sca effect involved either good x poor, poor x poor or good x good and average x average general combiners for majority of characters indicating the presence of additive x dominance, dominance x dominance and additive x additive type of gene interactions. The use of recurrent selection or biparental mating followed by pedigree selection may prove to be effective in the improvement of parental lines used in the present study for improvement of grain yield and its attributes and those improved parental lines can be used for the development of best heterotic hybrids.