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PAVING THE PATH OF DURUM WHEAT HYBRID: IDENTIFICATION OF HETEROTIC COMBINATIONS AND FLOWERING GENES.

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The combined challenge of population growth and climate change has been forecasted to exert tremendous pressure on global food supply. To meet this challenge, a paradigm shift is required in our approach to continuously generate more productive technologies using novel approaches. One such approach is to tap the hybrid technology. The present study examined the magnitude of heterosis in durum wheat through evaluation of 18 parents along with 53 F_1 hybrids. The hybrids along with their parents were also evaluated in precision phenotyping platform (Lemnatec) at different levels of water stress and in near-field condition. Combining ability analysis suggested predominance of non-additive gene action as underlying principle in the expression of heterosis for grain yield and its components in durum wheat. The results showed >13% best-parent heterosis, indicating the scope for exploitation of heterosis in durum wheat. Among the hybrid combinations, Valnova x Miki followed by Iride x Miki, Svevo x Miki and Valnova x Svevo were the best for all the traits studied. However, there was no correlation between genetic similarity of different sub-populations and heterosis. Another aspect of hybrid technology is to ensure adequate pollination between heterotic parents which require overlapping flowering time. To understand the genetic control of flowering time, a genome wide association study (GWAS) was conducted to identify genomic regions associated with the control of flowering time in durum wheat. A total of 384 landraces and modern germplasm were assessed in 13 environments to determine five pheno-environments based on temperatures, day length and other climatic variables. Genotyping was conducted with 35K Axiom array to generate 7,740 polymorphic SNPs. In total, 14 significant QTLs for landraces and 26 QTLs for modern germplasm were identified for flowering time consistently across the environments. Some QTLs had strong association with previously identified genes at defined confidence interval. The results obtained from these experiments indicated sufficient heterosis and few heterotic combinations could be exploited for hybrid breeding program in durum wheat.

Keywords: *durum, heterosis, heterotic combination, flowering time.*