

Heterosis studies in rice hybrids involving diverse cytoosteriles

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ABSTRACT

Forty hybrids were developed utilizing five cytoplasmic male sterile lines of four different sources and eight effective restorers and they were studied for the extent of heterosis for eight different quantitative characters over popular commercial rice hybrid Sahyadri as a standard check. Seven hybrids viz., IR 58025 A/ Panvel - 1 (41.90%), IR 58025 A/ IR 5 (36.43%), IR 58025 A/ Ratnagiri 3 (33.81 %), PMS 2 A / IR 54 (33.57 %), PMS 2A / IR 5 (30.95%), PMS 2A / Ratnagiri 3 (30.48%), WA base hybrids and G 46 / Ratnagiri 3 (24.05%) - Gambiaca base hybrid, expressed highly significant positive heterosis for grain yield over rice hybrid Sahyadri.

Key words: rice, heterosis, hybrids, cytoplasmic male sterile line

Hybrid technology has been widely acclaimed as a modern approach for the genetic improvement of yield in various crop species including rice. Rice hybrids are commercially cultivated in China, India and Vietnam. Several national and international rice improvement programmes are associated with commercial exploitation of heterosis. The objectives of the present investigation were, therefore to find out the extent of heterosis over popular commercial rice hybrid Sahyadri and to identify heterotic hybrids for yield and yield component using CMS lines.

Five CMS lines of four different cytoosterile viz., IR 58025 A, PMS 2A (Wild rice with abortive pollen), IR 68885 A (Induced by gamma irradiation of IR 62829 B), G 46 A (Gambiaca) and D297 A (Dissi) were crossed with eight effective restorers viz., IR 36, IR 64, Panvel 1, IR 46, IR 54, Ratnagiri 3, Swarna and IR 5. The resulting 40 CMS based F₁'s and parents including popular commercial rice hybrid Sahyadri as a standard check were evaluated in RBD design having two replications at Agricultural Research Station Shirgaon (Ratnagiri) during wet season. Each treatment consisted of three row of 3.00 m length and single seedling hill⁻¹ with 20 x 15 cm spacing. Observations were recorded on randomly selected ten plants in each genotype in each replication for eight characters. The magnitudes of heterosis in hybrids were estimated as percent

increase or decrease over the most popular commercial rice hybrid Sahyadri as standard check.

The analysis of variance revealed highly significant variances due to genotypes for all the traits. The nature and magnitude of heterosis (Table 1) revealed that among 40 rice hybrids, D297A / Panvel 1 recorded maximum negative heterosis (-16.89%) for days to 50 % flowering over standard check (Table 2). Total sixteen crosses exhibited significant negative (desirable) heterosis over standard check Sahyadri. The early flowering in hybrid has also been reported by Hariprasanna *et al.* (2001), Singh *et al.* (2002), Joshi *et al.* (2004), Datt and Mani (2004) and Kshirsagar *et al.* (2005).

The extent of heterosis for plant height ranged from -23.02 to 15.53 % over rice hybrid Sahyadri. The hybrid IR 68885 A/IR 36 (-23.02 %) recorded maximum negative heterosis over standard check. Best hybrids for tall stature with significantly positive heterosis were G 46 A / IR 5 (15.53 %) and IR 58025 A / IR 5 (11.19%). However, dwarf stature is preferable as it is less prone to lodging. Yadav *et al.* (2004) and Kshirsagar *et al.* (2005) have also reported negative standard heterosis for this trait.

Number of productive tillers is generally associated with higher productivity. Among the hybrids

Table 1. Analysis of variance for yield and its attributing characters in rice hybrid.

Source of variation	d.f	Plant height (cm)	Number of productive tillers plant ⁻¹	Days to 50% flowering	Panicle length (cm)	No. of fertile spikelets panicle ⁻¹	Spikelet fertility %	1000grain weight(g)	Grain yield Plant ⁻¹ (g)
Replication	1	0.148	31.148	0.750	0.002	3.343	0.205	0.049	16.333
Treatment	53	19.794**	185.226**	200.649**	9.602**	2506.946**	79.869**	15.882**	165.409**
Error	107	3.695	11.380	1.844	0.101	218.758	8.641	0.090	13.579

*Significant at 5% level, ** Significant at 1% level.

under investigations, four rice hybrids viz., IR 58025 A/Ratnagiri 3 (32.74 %), IR 58025 A/IR 54 (32.14 %), IR 58025A/IR 46 (30.95 %) and IR 68885A/IR 54 (30.95%) showed significant and positive heterosis over rice hybrid Sahyadri. Larger panicle length is associated with high number of spikelets panicle⁻¹ resulting in higher productivity. Estimates of standard heterosis for panicle length were highly significant and positive for 23 hybrids. Among these hybrids IR 58025 A/IR 54 (17.76%) and IR 68885A/Swarna (15.10%) were found to be the best hybrids for this trait. Significant heterosis for panicle length over standard check has been reported by Yadav *et al.* (2004) and Kshirsagar *et al.* (2005).

Number of fertile spikelets panicle⁻¹ is one of the most important yield components. Total 15 rice hybrids showed positive and significant heterosis over the rice hybrid Sahyadri. Heterosis for fertile spikelets panicle⁻¹ contributing increased yield was also reported by Singh *et al.* (2002), Datt *et al.* (2004), Yadav *et al.* (2004) and Kshirsagar *et al.* (2005). None of the hybrid showed significant positive standard heterosis, indicating little scope for improving this trait through exploitation of heterosis. Joshi *et al.* (2004) has also reported similar results. The extent of heterosis for test weight ranged from -22.32 to 14.18 %. Occurrence of negative heterosis for test weight was reported by Joshi *et al.* (2004) and Kshirsagar *et al.* (2005), whereas, positive heterosis was reported by Singh *et al.* (2002) and Datt *et al.* (2004).

Heterosis for grain yield plant⁻¹ ranged between -69.52 to 41.90% over the rice hybrid Sahyadri. Seven

hybrids viz., IR 58025 A/Panvel-1(41.90%), IR 58025A/IR 5(36.43), IR 58025A/Ratnagiri 3 (33.81%), PMS 2A/IR 54 (33.57%), PMS 2A/IR 5 (30.95%), PMS 2A/Ratnagiri 3 (30.48%) and G 46 A/Ratnagiri 3 (24.05%) expressed highly significant positive heterosis for grain yield over most popular rice hybrid Sahyadri. This result is comparable with work done by Singh *et al.* (2002), Datt *et al.* (2004) and Kshirsagar *et al.* (2005) with more than 24 % standard heterosis for grain yield over most popular commercial rice hybrid Sahyadri, offer greater scope for exploitation of the hybrid vigour. Grain yield plant⁻¹ is a multiplicative product of several basic components of yield. Positive magnitude of heterosis for productive tillers plant⁻¹, panicle length, fertile spikelets panicle⁻¹ and test weight has lead to higher grain yield in the above seven rice hybrids.

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