Electronic Journal of Plant Breeding, 2(4):527-530 (Dec 2011)
ISSN 0975-928X

Research Note

Studies on hybrid sterility in rice (*Oryza sativa* L.) under temperate conditions of Kashmir

S. Najeeb, A.G.Rather , M.A.Zargar, , F.A.Sheikh, S.M. Razvi1 , Badrul Hassan[2], Gulzaffer[1], M.A. Ahanger and N.A.Teeli

Rice ,Research and Regional Station, S.K. University of Agricultural Sciences & Technology of Kashmir Khudwani, Anantnag,192102

[1]Division of Plant Breeding and Genetics, S.K. University of Agricultural Sciences & Technology of Kashmir, Shalimar Srinagar,J and K

[2]Division of Agronomy,S.K. University of Agricultural Sciences & Technology of Kashmir, Shalimar Srinagar,J and K

(Received: 09 Aug 2011; Accepted: 29 Oct 2011)

Abstract:

The inter sub- specific variability generated has been advanced at two experimental farms constituting two locations in order to study for more promising although less frequent segregants and New Plant Types for two agro ecologies of Kashmir. Besides intervarietal *indica* and intervarietal *japonica* variability has been evaluated at 4500 and 7500 feet MSL respectively based on their different degree of tolerance to cold, biotic and abiotic stresses viz-a-viz their growth duration in terms of earliness to flowering and maturity, the most important criteria for selecting a genotype for agro ecology like Kashmir.

Key words: Rice, hybrid sterility, Kashnir

Number of varieties have been developed in rice throughout the world by utilizing intervarietal variability generated through *indica* x *indica* and *japonica* x *japonica* crosses followed by handling the material through conventional methods of breeding (Pedigree/bulk method). In the past two decades a stronger heterosis of inter- subspecific hybrids between *indica* and *japonica* varieties highlighted the importance for super rice/ super hybrid rice breeding. In addition to this development of new plant types (NPTs) or ideal genotypes specific for particular agro ecology have been initiated by optimization of source and maximization of sink so as to harness more benefits per unit area. The novel attempt in this direction under temperate Kashmir conditions were made by affecting hybridization program between *indica*/ *indica*, *japonica*/ *japonica* and *indica*/ *japonica* genotypes. To combine the traits or to broaden the variability across the sub-species of rice the hybrid sterility is the popularly studied genetic impediment (Ikehashi,1982). Hence the objective behind the study was to observe the nature and magnitude of hybrid sterility (in terms of pollen and spikelet sterilities)among various crossing blocks generated through two half diallel and one line x tester mating design in *Kharif* 2008 and evaluated under two agro- ecologies of Kashmir (4500 and 7500 feet amsl) during *Kharif* 2009.

It was observed that estimates of pollen and spikelet sterilities were high in inter-sub specific crosses (*i* x *j*) with values of 58.26 and 76.7 percent respectively followed by intervarietal indica (*i* x *i)* crosses (30.25 and 27.31%) and intervarietal *japonica* crosses (10.97 and16.78 %)(Table-1). The distribution range was again wider for inter-subspecific crosses for both types of sterilities. It ranged between 8. 3- 96.3 per cent and 31.80- 96.6 per cent for pollen and spikelet sterility respectively followed by relatively shorter range for intervarietal *japonica* crosses i. e, 6.99-19.60 and 6.50- 32.07 per cent. The distribution range for both types of sterilities were unexpectedly wider for intervarietal *indica* crosses i. e.,9.27- 85.4 per cent and 13.11- 74.00 per cent . The non uniform trend for pollen and spikelet sterility among and within the crosses for different crossing blocks attribute the phenomenon to manifold reasons. The possible reasons might be differential degrees of pollen and female gamete abortions, role of environment and effect of different genetic backgrounds. In some crosses, the male and female gamete abortion was positively and highly correlated. The magnitude of pollen and spikelet sterilities were registered high for some inter-subspecific cross combinations namely L1 x T1, L4 x T3, L1 x T3, L5 x T2 and L3 x T1. The only one inter-varietal *indica* cross i. e., P2 x P6 recorded higher estimates for both types of sterilities. Barring some contradictory reports, the results obtained in the present study were similar to the results of Oka (1988), Liu *et. al*. (1996) and Zhang *et. al*. (1997).

The inter sub- specific variability generated has been advanced at two experimental farms constituting two locations in order to look for more promising although less frequent segregants and NPTs for two agro ecologies of Kashmir. Besides intervarietal *indica* and intervarietal *japonica* variability has been evaluated at 4500 and 7500 feet amsl respectively based on their different degree of tolerance to cold, biotic and abiotic stresses viz-a-viz their growth duration in terms of earliness to flowering and maturity, the most important criteria for selecting a genotype for agro ecology like Kashmir. The results of wide compatibility variety (WCV) used and to overcome hybrid sterility through three- way crosses and development of broad spectrum *indica* compatible *japonica* and *vice- versa* has been discussed in a separate note.

References

Ikehashi, H. 1982. Prospects for overcoming barrier in utilization of *indica-japonica* crosses in rice breeding. *Oryza,* **19** : 69-77.

Liu, K.D., Zhou, Z.Q., Zu, C.G., Zhang, Q. and Maroof, M.A.S. 1996. An analysis of hybrid sterility in rice using a diallel cross of 21 parents involving *indica*, *japonica* and wide compatibility varieties. *Euphytica,* **90** : 257-280.

Oka, H.I. 1988. Origin of cultivated rice. Elsevier Japan Science Society Press, Tokyo, pp 181-209.

Zhang, Q., Liu, K.D., Yang, G.P., Saghai, M., Xu, C.G. and Zhou, Z.Q. 1997. Molecular marker diversity and hybrid sterility in *indica-japonica* rice crosses. *Theo. Appl. Genet.,* **95** : 112-118.

Table 1. Relative comparison of pollen and spikelet sterility for *indica / indica*, *japonica / japonica* and *indica / japonica* crosses of rice

Indica x Indica	Pollen sterility (%)	Spikelet sterility (%)	*Japonica x Japonica*	Pollen sterility (%)	Spikelet sterility (%)	*Indica x Japonica*	Pollen sterility (%)	Spikelet sterility (%)
Jhelum x SK-382 P_1 x P_2	25.12 (30.07)	14.35 (22.26)	Koshihikari x K-332 P_7 x P_8	15.21 (22.95)	32.07 (34.49)	Jhelum x Koshihikari L_1 x T_1	95.85 (78.23)	75.81 (60.54)
Jhelum x SR-1 P_1 x P_3	30.49 (33.51)	13.11 (21.22)	Koshihikari x GS-503 P_7 x P_9	8.19 (16.62)	11.91 (20.17)	Jhelum x K-332 L_1 x T_2	47.05 (43.32)	31.80 (34.32)
Jhelum x Ch-1039 P_1 x P_4	14.36 (22.25)	24.11 (29.31)	Koshihikari x GS-504 P_7 x P_{10}	11.25 (19.59)	9.79 (18.22)	Jhelum x Kohsar L_1 x T_3	92.03 (73.00)	86.08 (68.10)
Jhelum x Chenab P_1 x P_5	37.13 (37.54)	17.5 (24.78)	Koshihikari x Kohsar P_7 x P_{11}	14.09 (22.04)	25.05 (30.03)	SK-382 x Koshihikari L_2 x T_1	62.06 (52.34)	60.58 (51.11)
Jhelum x Dular P_1 x P_6	24.27 (29.51)	15.85 (23.45)	Koshihikari x K-508 P_7 x P_{12}	6.99 (15.32)	31.74 (34.28)	SK-382 x K-332 L_2 x T_2	17.25 (24.56)	81.09 (64.22)
SK-382 x SR-1 P_2 x P_3	16.9 (24.27)	19.82 (26.43)	K-332 x GS-503 P_8 x P_9	11.83 (20.12)	9.79 (18.23)	SK-382 x Kohsar L_2 x T_3	37.21 (37.58)	82.56 (65.32)
SK-382 x Ch-1039 P_2 x P_4	16.9 (37.41)	27.16 (31.41)	K-332 x GS-504 P_8 x P_{10}	10.77 (19.16)	10.80 (19.90)	SR-1 x Koshihikari L_3 x T_1	91.66 (73.23)	84.20 (66.58)
SK-382 x Chenab P_2 x P_5	28.15 (32.04)	32.33 (34.65)	K-332 x Kohsar P_8 x P_{11}	19.6 (26.28)	10.84 (19.21)	SR-1 x K-332 L_3 x T_2	20.79 (27.12)	85.64 (67.73)
SK-382 x Dular P_2 x P_6	85.4 (67.53)	74.00 (59.35)	K-332 x K-508 P_8 x P_{12}	11.98 (20.24)	10.75 (19.13)	SR-1 x Kohsar L_3 x T_3	44.65 (41.93)	69.52 (56.49)
SR-1 x Ch-1039 P_3 x P_4	26.74 (31.13)	21.99 (27.963)	GS-503 x GS-504 P_9 x P_{10}	7.33 (15.70)	25.29 (30.19)	Ch-1039 x Koshihikari L_4 x T_1	55.43 (48.12)	44.77 (56.49)
SR-1 x Chenab P_3 x P_5	9.27 (17.72)	19.29 (26.05)	GS-503 x Kohsar P_9 x P_{11}	7.72 (16.66)	26.55 (31.01)	Ch-1039 x K-332 L_4 x T_2	61.67 (51.75)	96.60 (79.30)
SR-1 x Dular P_3 x P_6	28.00 (31.94)	59.87 (50.69)	GS-503 x K-508 P_9 x P_{12}	9.37 (17.82)	9.35 (17.82)	Ch-1039 x Kohsar L_4 x T_3	96.3 (78.91)	93.05 (74.74)
Ch-1039 x Chenab P_4 x P_5	31.51 (34.14)	15.91 (23.50)	GS-504 x Kohsar P_{10} x P_{11}	9.35 (17.80)	13.75 (21.76)	Chenab x Koshihikari L_5 x T_1	8.3 (16.73)	83.22 (65.81)
Ch-1039 x Dular P_4 x P_6	26.87 (31.22)	15.17 (22.92)	GS-504 x K-508 P_{10} x P_{12}	7.08 (15.43)	17.63 (24.82)	Chenab x K-332 L_5 x T_2	92.60 (74.21)	91.50 (73.06)
Chenab x Dular P_5 x P_6	32.72 (34.89)	39.42 (38.89)	Kohsar x K-508 P_{11} x P_{12}	13.88 (21.88)	6.50 (14.76)	Chenab x Kohsar L_5 x T_3	51.10 (49.08)	81.35 (64.42)
Mean	**30.25**	**27.32**		**10.97**	**16.78**		**58.26**	**76.51**
Range	9.27-85.40	13.11-74.00		6.99-19.60	6.50-32.07		8.3- 96.3	31.80-96.60
CD at 5% level	**4.30**	**1.216**		**4.044**	**8.632**		**7.97**	**7.22**

Table 1. Contd..

Parents	**Pollen sterility**	**Spikelets sterility**	**Parents**	**Pollen sterility**	**Spikelet sterility**
P_1 (Jhelum)	7.35 (15.76)	6.59 (14.86)	P_7 (Koshihikari)	6.80 (15.10)	51.40 (45.80)
P_2 (SK-332)	9.55 (18.00)	7.26 (15.63)	P_8 (K-332)	4.88 (12.76)	11.88 (20.14)
P_3 (SR-1)	12.20 (20.44)	10.12 (18.54)	P_9 (GS-503)	7.49 (15.86)	55.29 (48.03)
P_4 (China-1039)	8.30 (16.73)	6.91 (15.24)	P_{10} (GS-504)	6.66 (14.95)	60.18 (50.87)
P_5 (Chenab)	12.65 (20.40)	9.28 (17.73)	P_{11} (Kohsar)	3.86 (11.53)	8.62 (17.07)
P_6 (Dular)	6.29 (15.09)	6.46 (14.72)	P_{12} (K-508)	4.65 (12.43)	9.57 (18.02)
Mean	**9.39 (17.74)**	**7.77 (16.79)**	**Mean**	**5.72 (13.77)**	**32.82 (33.32)**

[Fig. in parenthesis denote transformed figures (arc sine transformation)]