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HETEROSIS FOR MAYDIS LEAF BLIGHT DISEASE RESISTANCE AND GRAIN YIELD IN MAIZE

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ABSTRACT

Heterotic response of 50 crosses from 10 lines × 5 testers mating design was worked out over mid parent, better parent and best check for the disease maydis leaf blight and grain yield in maize. Only eight crosses showed standard heterosis for grain yield and disease resistance over the best check Pratap for disease resistance and 23 crosses showed standard heterosis over the best check KH 510. Heterotic response obtained over better parents were more realistic.

Key Words: Maize, heterosis, Maydis leaf blight, yield.

The *per se* performance of parents may not be a reliable indicator of the genetic worth of their crosses, the results from heterotic response will be more reliable. Most of the studies reveal that majority of the crosses excel in their performance with respect to heterotic response over mid parent for various character in different crop plants. So, heterosis obtained over mid parent is not likely to serve a useful purpose. Therefore, in present study heterotic effects were worked out over best check, better and mid parents for drawing proper inference.

MATERIALS AND METHODS

The experimental material comprised ten female parents (L1 to L10) namely K701-4, K702, K707-7, K708-12, K710-2, K14-5-3, K718-3, K618-4-2, K668-3, CH-7 and five male parents (T1 to T5) viz., CHY 2-3, CHY 6-4, K 727-3-4, K709-4 and CH-6. These were crossed in line x tester mating design. The disease reaction of female and male parents is given in Table 1. The complete set of 70 entries with 50 F_1, 15 parents and 5 checks were sown at Haryana Agricultural University, Regional Research Station, Uchani, Karnal in randomized block design with three replications with a plot of one row of 5 m length. Row to row and plant to plant spacing were 60 cm and 20 cm respectively. For disease, artificial inoculation was done after 30 days of sowing. Disease was recorded after 40 days of sowing and at maturity and the

Table 1. Disease prevalence (% infected plants) of male and female lines and checks

S.No.	Lines	Pedigree	Disease prevalence (% infected plants)	Disease reaction
LINES				
1.	L_1	K701-4	27.21	S
2.	L_2	K702-4-2	12.13	R
3.	L_3	K707	20.08	S
4.	L_4	K708-12	0.90	HR
5.	L_5	K710-2	0.90	HR
6.	L_6	K714-5-3	0.90	HR
7.	L_7	K718-3	0.90	HR
8.	L_8	K618-4-2	46.82	HS
9.	L_9	K668-3	39.32	HS
10.	L_{10}	CH-7	10.71	R
TESTERS				
1.	T_1	CHY2-3	52.54	HS
2,	T_2	CHY6-4	46.83	HS
3.	T_3	K727-3-4	60.04	HS
4.	T_4	K709-4	34.34	HS
5.	T_5	CH-6	11.70	R
CHECKS				
1.		KH510	14.01	R
2.		G-11	23.09	S
3.		PARTAP	12.39	R
4.		NAVJOT	22.29	S
5.		D103	34.96	HS

HS = Highly Resistant, R = Resistant, HS = Highly Susceptible S = Susceptible

data recorded for two different plant growth stages was pooled and analysed. For disease observation, all plants were taken into consideration. However, for grain yield observation on ten competitive plants were taken at random. The analysis of variance was carried out, for testing the significance of genotypic differences. Heterotic effects over better parent, mid parent and best check were worked out for both the characters.

RESULTS AND DISCUSSION

Data on disease prevalence revealed that the four hybrids namely L9 × T1, L9 × T2, L10 × T1 and L10 × T2 had practically no incidence of maydis leaf blight as against standard check Partap (Table 2). The mean values revealed that the hybrid L7 × T4 had the highest yield per plant (Table 3) as compared to standard check KH510. Crosses L1 × T5, L5 × T3 and L5 × T5 were other high yielding hybrids.

Table 2. Heterosis of the promising crosses over Better Parent (BP), Mid Parent (MP) and Best Check (BC), mean performance, sca effects and gca of parents in respect of maydis leaf blight disease (%)

Crosses	Mean (%)	Better Parent	Mid Parent	Best Check	sca Effects	gca of Parents
$L_7 \times T_1$	10.69	108.77	–59.99	–13.72	0.98	H × H
$L_7 \times T_2$	9.70	47.77	–59.34	–21.71	–0.22	H × H
$L_9 \times T_1$	0.90	–939.61	–98.61	–92.73	–2.94	H × H
$L_9 \times T_2$	0.90	–939.61	–98.04	–92.73	–2.94	H × H
$L_9 \times T_3$	17.62	60.08	–66.55	42.21	–0.50	H × L
$L_9 \times T_4$	12.84	–60.80	–67.76	3.63	3.09	H × L
$L_9 \times T_5$	7.71	–75.20	–79.97	–37.77	3.09	H × H
$L_{10} \times T_1$	0.90	–1261.11	–97.15	–92.73	–1.99	H × H
$L_{10} \times T_2$	0.90	–1261.11	–92.67	–92.73	–2.94	H × H
$L_{10} \times T_5$	4.74	–61.30	–77.64	–61.74	1.02	H × H
Best Check (Partap)	20.72	2.84	2.47	2.84	2.94	
C.D. at 5%	12.39					

Negative heterosis is desirable for disease resistance. Out of 50 crosses, thirteen crosses showed significant negative heterobelteotic response when measured over better parent. Highest heterobelteotic values were exhibited by crosses L10 × T1, L10 × T2, L9 × T1 and L9 × T2. Most of the crosses showed significant negative heterosis over mid parent. Eight crosses showed standard negative heterosis over the best check Partap (Table 2). For grain yield heterosis forty crosses had expressed significant heterosis

Table 3. Heterosis for the promising crosses over Better Parent, Mid Parent and Best Check, mean performance, sca effects and gca of parents in respect of grain yield (g/plant)

Crosses	Mean (g/plant)	Heterosis over			sca Effects	gca of Parents
		Better parent	Mid parent	Best check		
$L_1 \times T_1$	107.33	65.12	98.75	26.77	14.64	A × A
$L_1 \times T_5$	110.66	54.41	93.02	30.70	16.78	A × H
$L_3 \times T_2$	98.66	33.33	68.18	16.53	14.41	L × A
$L_3 \times T_3$	93.00	26.81	58.43	9.84	3.28	A × A
$L_3 \times T_5$	106.66	48.83	15.52	25.98	16.84	A × H
$L_4 \times T_3$	105.00	43.18	86.40	24.01	10.21	A × A
$L_4 \times T_4$	105.00	100.63	129.10	24.01	10.21	A × A
$L_4 \times T_5$	100.66	40.46	81.40	18.89	5.78	A × H
$L_5 \times T_3$	110.00	50.00	80.83	29.92	3.48	H × A
$L_5 \times T_1$	95.00	46.15	67.66	12.20	10.42	H × A
$L_5 \times T_4$	100.66	92.35	100.00	18.89	21.28	H × A
$L_5 \times T_5$	110.00	53.48	83.36	29.92	3.38	H × A
$L_6 \times T_2$	95.00	28.37	48.73	12.20	2.68	H × L
$L_6 \times T_3$	110.00	50.00	72.79	29.92	12.21	H × A
$L_6 \times T_5$	106.66	48.83	69.75	25.98	8.78	H × H
$L_7 \times T_1$	103.33	65.04	55.78	22.04	6.58	H × A
$L_7 \times T_4$	111.33	62.13	84.04	21.49	16.61	H × A
$L_7 \times T_5$	107.66	50.23	53.44	27.16	9.71	H × H
$L_8 \times T_1$	107.33	65.12	86.66	26.77	15.84	A × A
$L_8 \times T_2$	99.66	34.68	60.74	17.71	12.21	A × L
$L_9 \times T_1$	93.33	43.58	53.00	10.23	10.04	L × A
$L_{10} \times T_2$	107.33	45.04	88.29	26.77	22.21	A × L
$L_{10} \times T_5$	97.33	35.81	74.33	14.96	12.02	A × H
Best Check (KH510)	90.14	8.33	7.21	8.33	8.48	
CD at 5%	84.66					

H = high; A = average; L = low

over better parent. The hybrid L4 × T4 showed the highest heterobelteotic value followed by hybrids L5 × T4, L1 × T1 and L7 × T1. The hybrid involving the testers T1 and T4 showed comparatively a high amount of heterose. Over mid parent, forty seven showed significant positive heterosis. The highest heterosis was observed for L4 × T4 followed by L5 × T4, L1 × T1, L1 × T5. Over best check KH510 maximum standard heterosis was noticed in cross L1 × T5 followed by L5 × T3, L5 × T5 and L6 × T3.

Results were more reliable when comparison was made among the best cross combinations based on mid parent, better parent and best check with *per se* performance. Cross combination L3 × T4 which gave the highest heterotic effect for yield over better parent was ranked fourth over the best check. Cross L1 × T5 which gave high heterotic response over best check was ranked 10 over the better parent. But the *per se* performance of the cross was very close to the highest yielding hybrid (L7 × T4). L5 × T3 was the next best cross combination with high heterotic response with good yield. Ranking on the basis of various heterotic responses and their *per se* performance was not similar.

Further, the high *per se* performance and high sca effects was observed in certain crosses for grain yield (L6 × T1, L1 × T5, L6 × T3, L7 × T4, L10 × T2) and disease resistance (L9 × T1, L10 × T2). These crosses also possessed high standard heterosis or superiority over the best check. L10 × T2 exhibited high *per se* performance, high sca effects and high standard heterosis for both grain yield per plant and disease resistance. This cross combination, therefore, can be utilized for general cultivation after its confirmation through multi location testing. Crosses L1 × T1, L1 × T5, L9 × T1 and L10 × T2 can also be exploited for further breeding programme through reciprocal recurrent selection.

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