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HETEROSIS STUDIES FOR YIELD AND QUALITY TRAITS IN RABI QUALITY PROTEIN MAIZE

Mohan Lal*, Dhirendra singh and Sain Dass**

Department of Genetics and plant breeding
Janta Vedic collage, Baraut - 221 502, India

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ABSTRACT

A study was conducted of the heterosis in QPM maize, following line x tester analysis. The performance of fifty QPM maize hybrids along with their parents and checks were evaluated during *rabi* 2005-06. The analysis of variance revealed significant differences among the parents and F1 hybrids for all the characters. For days to 50% silking, thirteen hybrids exhibited negative significant heterobeltiosis. For days to 50% tasseling one hybrid (L4 xT5) exhibited negative significant economic heterosis in relation to best check, while none of the hybrids had given this indication for the days to silking. For grain yield per plant, hybrid L4 x T2 exhibited the highest heterosis (236.46 per cent) over better parent and checks. For protein content, thirteen hybrids depicted positive significant heterobeltiosis one hybrid exhibited positive significant economic heterosis over the best checks with magnitude was 9.18 percent (L2 X T5). For tryptophan content thirty two hybrids depicted positive significant heterobeltiosis, while four hybrids exhibited positive economic heterosis over the best checks. For lysine content only six hybrids depicted positive significant heterosis. The desirable crosses combination L 4 x T2, L7 x T3, L5 x T5, L4 x T3, and L7 xT1, L4 x T4, L7 x T4, L6 x T5 and L6 x T4 showed high magnitude of heterosis over better parents for yield along with quality characters.

Key words : Heterosis, QPM, *Zea mays* L.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important crops of the world. It is globally the top ranking cereals both in term of productivity and production. Several million people in the developing world consume maize as important staple food and derive their protein and calorie requirement from it. High protein content is a desirable character of the quality protein maize (QPM) particularly in south Asia and Africa where malnutrition of children, lactating mothers and pregnant woman is prevalent. Discovery of opaque-2 (o2) and floury (fl2) mutant opened up possibilities for improvement of protein quality with 70 - 100% higher lysine and tryptophan which later Red to the development of quality protein maize. Heterosis breeding, however, seems to be a good approach for this purpose, the present study was undertaken to measures the heterosis for yield and its component traits in quality protein maize.

MATERIALS AND METHODS

Fifty hybrids of QPM maize (*Zea mays* L.) resulting from 10 QPM inbred lines and 5 QPM testers along with their 15 parents and two checks were evaluated in randomized block design with

Present address:-* Seed production unit CSSRI Karnal, ** Project director DMR New Delhi

three replications during *rabi* 2005-06 at the Research Farm Janta Vedic collage Baraut Dist. Bagphat U.P. Each entry was grown in single row with row to row and plant to plant spacing of 75 cm and 22 cm respectively. The data were recorded on ten random competitive plants for day to 50% silking, days to 50% tasseling, grain yield per plant, 1000 - grain weight, protein content, lysine content and tryptophan content. Heterosis was estimated over the better parent (Heterobeltiosis) and over the checks (Economic heterosis) and test of significance was carried out.

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the parents and F1 hybrids for all the characters. The estimates of heterosis are presented in Table-1. For days to 50% silking, thirteen hybrids exhibited negative signisficant heterobeltiosis with the magnitude varying from –3.37 (L2 xT2) to –1.00 percent (L6 x L4). Where as none of the hybrids exhibited negative significant economic heterosis in relation to the best checks. For days to 50% tasseling eight hybrids exhibited negative significant heterobeltiosis with range of –2.67 (L2 x T2) to 1.60 per cent (L2 x T5). One hybrid (L4 xT5) exhibited negative significant economic heterosis in relation to best check, while none of the hybrids had given this indication for the days to silking. For 1000-grain weight, forty four hybrids exhibited positive significant heterobeltiosis with large magnitude of variation viz., 1.31 (L4 x T1) to 103.18 per cent (L5 x T4), while ten hybrids exhibited positive significant economic heterosis over the best checks with a short range of 1.17 (L7 x T5) to 21.00 percent (L5 xT2). These results are in agreement with the earlier finding Dubey (2001), Dubey *et al* (2009), Rao (1996) and Marker *et al* (2002).

For grain yield per plant, the heterobeltiosis ranged from 47.98 (L8 xT5) to 236.46 per cent (L4xT2). The economic heterosis varied between1.47 (L6xT5) and 18.39 per cent (L4xT2). The hybrid L4 x T2 exhibited the highest heterosis (236.46 per cent) over better parent and checks. These results are in conformity with the earlier reports Dubey (2001), Dubey *et al* (2009), Pandiya (1996), Vasal *et a*l (1995), Rao (1996) and Marker *et al* (2002) for grain yield.

For protein content, thirteen hybrids depicted positive significant heterobeltiosis with magnitude ranged from 2.44 (L8 x T1) to 24.71per cent (L2xT5). Whereas one hybrid exhibited positive significant economic heterosis over the best checks with magnitude was 9.18 percent (L2 X T5). These results are of particular relevance as the parental differences on phenotypic basis turned out to be non significant. For tryptophan content thirty two hybrids depicted positive significant heterobeltiosis with a range of 2.16 (L2 x T1) to 30.97 (L10 x T1), while four hybrids exhibited positive economic heterosis over the best checks with magnitude of 4.10 (L10 x T5) to 21.31 percent (L10 x T1).

For lysine content only six hybrids depicted positive significant heterosis of 8.29 (L6 x T4) to 15.78 per cent (L5 x T2) but none of the hybrids exhibited positive significant economic heterosis over the best check.

From results, appreciable amount of heterobeltiosis and economic heterosis was evident for certain characters. This indicates the amount of genetic diversity of the parents involved in the crosses in determining the heterotic effects. The desirable crosses combination L 4 x T2, L7 x T3, L5 x T5, L4 x T3, and L7 xT1, L4 x T4, L7 x T4, L6 x T5 and L6 x T4. showed high magnitude of heterosis over better parents for yield along with quality characters and offer a ample scope of commercial exploitation of heterosis in QPM lines . Some of the selected single cross hybrids and study of heterotic response to the 10-18% (L4 x T2,L7 xT1 and L4 x T1)as such we can adopt the option of developing single cross QPM hybrids from the material under study that belong to high quality protein maize.

Table I : Percent heterosis in rabi-QPM maize our better parent (Hb) and over check (E.h). heterosis for yield and quality traits for yield and quality traits.

Crossess	Days to 50% silking		Days to 50% tasselling		1000 grain wt(gm)		Grain Yield/plant (gm)		Protein content		Tryptophan content		Lysine Content	
	Hb	EH	Hb	EH	Hb	EH	Hb	EH	Hb	EH	Hb	EH	Hb	EH
L1 x T1	-0.52	-	-	-	-	-	60.40**	-	-	-	7.52**	-	-	-
L2 x T1	-1.81**	-	-0.53	-	-	-	109.88**	-	-	-	2.16**	-	1.53	-
L3 x T1	-	-	-	-	-	-	97.46**	-	-	-	7.96**	0	12.30**	3.27
L4 x T1	-	-	-	-	1.31**	-	199.18**	10.32**	2.02	-	-	-	-	-
L5 x T1	-0.26	-	-1.31**	-	8.31**	-	183.67**	4.60**	-	-	7.96**	0	6.42	-
L6 x T1	-	-	-	-	4.19**	-	185.42**	5.25**	-	-	8.41**	0.41	6.45	-
L7 x T1	-	-	-	-	17.15**	8.08**	217.48**	17.07**	-	-	8.41**	0.41	1.96	-
L8 x T1	-	-	-	-	6.23**	-	183.87**	4.68**	2.44*	-	7.08**	-	5.9	-
L9 x T1	-	-	-	-	-	-	99.52**	-	4.98**	-	6.64**	-	3.55	-
L10 x T1	-	-	-0.27	-	15.59**	6.64**	155.91**	-	-	-	30.97**	21.31**	3.83	-
L1 x T2	-2.59**	-	-	-	4.75**	-	49.02**	-	-	-	8.88**	-	-	-
L2 x T2	-3.37**	-	-2.67**	-	-	-	155.52**	-	-	-	-	-	4	-
L3 x T2	-	-	-	-	0.04	-	128.08**	-	-	-	13.08**	-	-	-
L4 x T2	-	-	-	-	18.17**	-	236.46**	18.39**	1.39	-	-	-	-	-
L5 x T2	-2.30**	-	-2.08**	-	51.24**	21.04**	168.04**	-	18.47**	-	14.80**	4.92**	15.78**	5.56
L6 x T2	-1.79**	-	-	-	40.31**	12.29**	107.39**	-	4.51**	0.19	13.08**	-	11.38**	0
L7 x T2	-	-	-0.26	-	25.04**	0.07	97.33**	-	14.14**	-	14.49**	0.41	6.86	-
L8 x T2	-1.30**	-	-0.27	-	24.91**	-	120.45**	-	2.04	-	13.08**	-	6.33	-
L9 x T2	-1.53**	-	-2.60**	-	28.68**	2.99**	57.76**	-	0.31	-	13.49**	0	4.41	-
L10 x T2	-	-	-	-	42.80**	14.29**	176.40**	-	11.24**	-	6.36**	-	10.89*	-

Cont.....

L1 x T3	-2.07**	-	-	-	28.54**	-	82.51**	-	-	-	9.22**	-	-	-
L2 x T3	-2.59**	-	-2.13**	-	18.00**	-	206.24**	-	-	-	-	-	-	-
L3 x T3	-	-	-	-	21.98**	-	161.66**	-	-	-	6.80**	-	-	-
L4 x T3	-	-	-	-	35.28**	-	219.00**	-	-	-	-	-	-	-
L5 x T3	-2.81**	-	-2.08**	-	56.36**	0.22	187.41**	-	-	-	8.07**	-	-	-
L6 x T3	-	-	-	-	61.20**	3.32**	205.56**	-	-	-	5.83**	-	2.83	-
L7 x T3	-	-	-	-	48.96**	-	233.36**	-	12.65**	-	10.68**	-	0.65	-
L8 x T3	-	-	-	-	46.20**	-	159.12**	-	-	-	11.79**	-	2.72	-
L9 x T3	-	-	-0.52	-	54.28**	-	125.13**	-	-	-	2.33**	-	-	-
L10 x T3	-	-	-	-	34.45**	-	95.58**	-	-	-	20.00**	8.20**	4.57	-
L1 x T4	0	-	-	-	83.04**	-	48.56**	-	-	-	23.35**	-	-	-
L2 x T4	-	-	-	-	54.27**	-	151.52**	-	3.96**	-	-	-	6.34	-
L3 x T4	-	-	-	-	40.50**	-	183.45**	-	-	-	9.31**	-	-	-
L4 x T4	-	-	-	-	51.89**	-	217.45**	-	-	-	0	0	-	-
L5 x T4	-	-	-	-	103.94**	3.21**	140.38**	-	-	-	6.28**	-	-	-
L6 x T4	-1.00*	-	-	-	47.15**	-	207.39**	-	-	-	21.93**	-	8.29*	-
L7 x T4	-	-	-	-	69.88**	-	207.94**	-	8.82**	-	3.40**	-	-	-
L8 x T4	-	-	-	-	85.37**	-	125.70**	-	-	-	-	-	2.18	-
L9 x T4	-1.75**	-	-	-	89.56**	-	124.76**	-	-	-	-	-	-	-
L10 x T4	-	-	-	-	34.13**	-	54.67**	-	-	-	11.36**	0.41	6.17	-
L1 x T5	-	-	-	-	26.16**	-	58.56**	-	-	-	-	-	-	-
L2 x T5	-0.52	-	-1.60**	-	20.06**	-	107.51**	-	24.71**	9.18**	-	-	4.88	-
L3 x T5	-	-	-	-	22.95**	-	121.21**	-	3.51**	-	-	-	-	-
L4 x T5	-1.07*	-	-2.18**	-1.10*	35.15**	-	189.90**	-	-	-	0	0	-	-
L5 x T5	-0.52	-	-0.53	-	37.88**	-	230.39**	8.99**	8.34**	-	1.26	-	-	-
L6 x T5	-	-	-	-	54.90**	6.87**	207.60**	1.47**	-	-	-	-	11.68**	4.37
L7 x T5	-	-	-	-	46.64**	1.17**	201.43**	-	9.33**	-	-	-	-	-
L8 x T5	-	-	-	-	45.05**	0.08	47.98**	-	1.97	-	1.26	-	3.18	-
L9 x T5	-	-	-	-	35.52**	-	145.12**	-	-	-	-	-	-	-
L10 x T5	-	-	-	-	41.31**	-	100.75**	-	1.18	-	6.28**	4.10**	-	-

* significant at5%,** significant at 1%.

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