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Heterosis, Heritability and Genetic Advance for Yield and Quality Parameters of Rabi Maize (*Zea Mays L.*) in Normal and Drought Stress

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Abstract

41 genotypes were made using line x tester involving 9 lines, 3 testers, 27 crosses and 2 checks. Analysis of variance exhibited highly significant differences among themselves.

Keywords:-Genetic advance, heterosis, heritability

Introduction

Maize is one of the important cereals grown throughout the world. It has highest production and productivity among food cereals. It is widely adapted to diverse climatic conditions. Heterosis is an important tool for enhancing hybrid vigour for yield and quality parameters. Heteritabilty and genetic advance helps in choosing best parents and crosses for further breeding programmes. Water is one of the limiting factor for plant growth. Keeping this in consideration the present study was carried out to find out the heterosis, heritability and genetic advance of selected genotypes in normal and drought stress.

Materials and Methods

The experiment consists of 9 lines, 3 testers, 27 crosses and 2 checks. Line x tester design was followed and they were evaluated in randomized block design in Rabi 2022 at maize section of Bihar Agricultural University, Sabour, Bhagalpur. Observations recorded were days to 50 % tasseling, Days to 50 % silking, anthesis-silking interval, days to 75 % brown husk, plant height, ear height, canopy temperature, chlorophyll content, pollen viability, leafsenescence,leafrolling,leaffiring,cobweight,coblength,cobgirth,kernel row spercob,grain sperrow, protein content and grain yield.

Results and Discussion

TABLE.1. Pedigree of inbred lines, testers and checks.

S.NO	INBREDS	CODES
1	CL02450	L1
2	AMDROUGHT 2C2-3-B-2-BBB	L2
3	(CML451-13*4//CM2451-BBB/DRB-F2-60-1-1-1-BBB-3-B///CML4S1-Bx4//CML4S1-BBB/Laposta seq C7-F86-3-1-2-1Bx6)-1-8-B-1-BB	L3
4	LAMDROUGHT(DT–Tester)C1F2-36-1B*51CML 4SI/LH82//CM24SI-B-8-1-1-1-B3-B-3-B-31-13	L4
5	(HSBCIFI-8)DH6-B#BBB	L5
6	(CML4SI-B*4//CM4SI-BBB/Lapostaser 7-F18-3-2-3-2-B*7/// CML451B*4//CM451-BBB/DRB-F2-60-1-1-1-BBB-3B)-BB/LPSC7-F96-1-2-1-HBBB*/OPP39-6-1-1-2-BB-B-11-1-BB-B2-B	L6
7	BML-7	L7
8	(CML161xCML4S1)-B-18-1-BB/CML161-B13-BB-BBB//CLA37/CLA42-BBB-441CLA18-B*4-31-B-4-BB	L8
9	LM13	L9

S.NO	TESTERS	CODE
1	CML465/CML165-B//CML465-BB-36-B*6	T1
2	(HYDTSym16HG)DH67-B	T2
3	CH500	T3
	CHECKS	
1	BHM117	C1
2	B3355	C2

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Heterosis

Innormal

For grain yield in mid and better parent's significant results were shown by thecrosses L8 x T1, L8 x T2, L8 x T3. In check 1 cross L5 x T3 and L8 x T1 showed significant results and there was no significant results in check 2.

For protein content mid parent show significant results for most of the crossesexceptL2xT2,L3x T1,L4xT2,L5xT2,L6x T3,L7xT1,L7x T2,L7xT3,L8x T1,L8 x T2, L8 x T3, L9 x T3. The better parent show significant results for most of the crosses except L1 x T1, L2 x T1, L3 x T2, L9 x T2. Both check 1 and 2 were showing significant results for most of the crosses except L2xT1, L3 xT2, L9xT2.

Table.2.Heterosis in normal

	Grain yield				Protein content			
	Mid	Better	Check1	Check2	Mid	Better	Check1	Check2
1*101Line* 1Tester	6.15	5.26	0.94	5.94	1.75**	-0.34	-1.02	-1.36*
1*111Line* 2Tester	10.94	7.44	3.03	8.13	-3.17**	-5.50**	-6.14**	-6.46**
1*121Line* 3Tester	10.66	3.84	-0.42	4.51	-3.30**	-4.47**	-5.12**	-5.44**
2*102Line* 1Tester	6.47	5.37	1.44	6.46	5.42**	4.66**	-0.34	-0.68
2*112Line* 2Tester	9.93	6.26	2.3	7.36	0.72	0.36	-5.12**	-5.44**
2*122Line* 3Tester	10.83	3.81	-0.06	4.89	3.04**	1.41*	-1.71*	-2.04**
3*103Line* 1Tester	4.88	1.18	-4.6	0.12	-0.72	-1.43 *	-6.14**	-6.46**
3*113Line* 2Tester	7.38	6.06	-4.71	0	6.16**	5.78**	0	-0.34
3*123Line* 3Tester	-1.82	-3.81	-15.71	-11.54	-1.61**	-3.17**	-6.14**	-6.46**
4*104Line* 1Tester	-3.9	-4.26	-9.04	-4.54	-1.96**	-2.48**	-6.14**	-6.46 **
4*114Line*	1.42	-1.34	-6.27	-1.63	-0.89	-1.77*	-5.46**	-5.78**

2Tester								
4*124Line* 3Tester	11.61	5.2	-0.06	4.89	-2.12**	-2.46**	-5.46**	-5.78**
5*105Line* 1Tester	7.08	6.45	1.55	6.58	1.26*	0.72	-4.10**	-4.42**
5*115Line* 2Tester	3.66	0.64	-3.99	0.76	0.18	0	-5.46**	-5.78**
5*125Line* 3Tester	-12.79	-17.97	-21.74*	-17.87	-1.79**	-3.17**	-6.14**	-6.46**
6*106Line* 1Tester	-13.76	-16.6	-15.82	-11.65	-1.60**	-2.46**	-5.46**	-5.78**
6*116Line* 2Tester	0.53	-5	-4.1	0.64	-1.25*	-2.46**	-5.46**	-5.78**
6*126Line* 3Tester	3.91	-4.77	-3.87	0.88	1.06	1.06	-2.05**	-2.38**
7*107Line* 1Tester	9.84	7.06	0.94	5.94	0.18	0	-4.44**	-4.76**
7*117Line* 2Tester	10.63	10.43	-0.79	4.12	-0.9	-1.43*	-5.80**	-6.12**
7*127Line* 3Tester	8.63	5.33	-5.71	-1.05	0.71	0	-3.07**	-3.40**
8*108Line* 1Tester	-85.61 **	-92.09 **	-25.01*	-21.3	-0.36	-0.72	-5.46**	-5.78**
8*118Line* 2Tester	-81.52 **	-89.88 **	-4.12	0.63	0.36	0.36	-5.12**	-5.44**
8*128Line* 3Tester	-81.61 **	-89.99 **	-5.1	-0.41	-0.89	-2.11**	-5.12**	-5.44**
9*109Line* 1Tester	-1.21	-1.59	-6.5	-1.87	-1.44*	-1.79*	-6.48**	-6.80**
9*119Line* 2Tester	2.02	-0.76	-5.71	-1.05	4.69**	4.69 **	-1.02	-1.36*
9*129Line* 3Tester	-1.15	-6.83	-11.48	-7.1	-0.89	-2.11**	-5.12**	-5.44**

In drought

Mid parent show significance for most of the crosses except L1 x T1, L1 x T3, L2 xT1,L2xT2,L2xT3,L3x T3,L4xT1,L5x T2,L5xT3,L6xT2,L7x T1,L9x T1,L9 x T2. Better parent showed significance for L1 x T2, L4 x T2, L4 x T3, L5 x T2, L5 x T3,L6 x T1, L7 x T2, L8 x T1, L8 x T2.Check 1 showed significance for most of the crossesexceptL3xT2,L5xT1,L6x T2,L6xT3,L7xT1,L7x T3,L8xT3,L9x T2,L9xT3.

Check 2 showed significance for most of the crosses except L2 x T2, L2 x T3, L3 x T2, L4xT3,L5xT1,L6xT2,L6xT3,L7xT1,L7xT3,L8xT3,L9xT1,L9xT2,L9xT3.

For protein content mid parent showed significance for L1 x T3, L2 x T1, L4 x T3,L5 x T3, L6 x T1, L7 x T1, L8 x T3, L9 x T2, L9 x T3. Better parent showed significanceforL3x T1,L3xT2,L4xT1,L4xT3,L5xT3,L6x T1,L7x T2,L8xT1,L8xT2,L8 x T3, L9 x T1, L9 x T2, L9 x T3. Both the checks 1 and 2 showed significance for most of the crosses exceptL1xT3,L6xT1 ,L6xT3,L7xT1.

Table3.Heterosis in drought

	Grainyield				Proteinconten t			
	Mid	Better	Check1	Check2	Mid	Better	Check1	Check2
1*101Line* 1Tester	-6.08	-10.12	-20.06 **	-16.36 **	0.2	-0.78	-5.93**	-5.93**
1*111Line* 2Tester	-9.83*	-10.85*	-18.88 **	-15.13 **	-0.78	-1.16	-5.56**	-5.56**
1*121Line* 3Tester	4.07	-6.97	-17.26 **	-13.43*	1.92*	0.38	-1.85	-1.85
2*102Line* 1Tester	-0.65	-6.17	-14.18 **	-10.21*	2.36*	1.17	-3.70**	-3.70**
2*112Line* 2Tester	-4.84	-5.08	-13.18 **	-9.17	1.75	1.55	-2.96**	-2.96**
2*122Line* 3Tester	7.4	-5.17	-13.26 **	-9.25	0.58	-0.76	-2.96**	-2.96**
3*103Line* 1Tester	-5.43	-9.23	-26.20 **	-22.79 **	-0.39	-3.02**	-4.81**	-4.81**
3*113Line* 2Tester	10.50*	0.64	-8.42	-4.18	-1.72	-3.02**	-4.81**	-4.81**

3*123Line* 3Tester	7.61	4.23	-22.08 **	-18.47 **	-0.95	-1.13	-2.96**	-2.96**
4*104Line* 1Tester	-9.62	-10.92	-27.59 **	-24.24 **	-0.39	-3.02**	-4.81**	-4.81**
4*114Line* 2Tester	-10.48*	-16.41 **	-23.93 **	-20.42**	-0.19	-1.51	-3.33**	-3.33**
4*124Line* 3Tester	20.89**	14.09*	-9.93*	-5.76	-4.35**	-4.53**	-6.30**	-6.30**
5*105Line* 1Tester	15.35**	11.76	-9.15	-4.94	0.78	-0.77	-4.81**	-4.81**
5*115Line* 2Tester	-9.83	-17.14 **	-24.60 **	-21.11 **	-1.74	-1.93	-5.93**	-5.93**
5*125Line* 3Tester	5.85	1.57	-22.57 **	-18.99 **	-2.49*	-3.41**	-5.56**	-5.56**
6*106Line* 1Tester	-46.82 **	-50.28 **	-53.54 **	-51.39 **	4.31**	2.70*	-1.48	-1.48
6*116Line* 2Tester	2.52	1.18	-5.46	-1.08	0.97	0.77	-3.33**	-3.33**
6*126Line* 3Tester	13.92**	-0.33	-6.86	-2.56	1.72	0.76	-1.48	-1.48
7*107Line* 1Tester	5.69	-1.58	-7.23	-2.94	2.91**	0.38	-1.85	-1.85
7*117Line* 2Tester	-22.94 **	-24.27 **	-28.62 **	-25.32 **	-1.15	-2.27*	-4.44**	-4.44**
7*127Line* 3Tester	10.60*	-3.59	-9.13	-4.93	-0.38	-0.38	-2.59*	-2.59*
8*108Line* 1Tester	-66.70 **	-68.33 **	-71.46 **	-70.14 **	-1.74	-4.51**	-5.93**	-5.93**
8*118Line* 2Tester	-20.03 **	-20.42 **	-27.59 **	-24.24 **	-3.82**	-5.26**	-6.67**	-6.67**
8*128Line* 3Tester	14.35**	1.64	-8.42	-4.18	-4.15**	-4.51**	-5.93**	-5.93**
9*109Line* 1Tester	7.54	4.43	-9.89*	-5.72	-0.98	-2.69*	-6.30**	-6.30**
9*119Line* 2Tester	4.99	2.28	-6.93	-2.63	-1.93*	-2.31*	-5.93**	-5.93**

9*129Line* 3Tester	18.64**	7.49	-7.25	-2.96	-3.44**	-4.17**	-6.30**	-6.30**

Estimation of heritability and genetic advance

Heritability has decreased considerably in drought compared to normal in most of the traits except days to 75 % brown husk in which it remains same, plant height, ear height, chlorophyll content, leaf rolling, cob weight, cob girth in which the heritability has been increased. Genetic advancement at 5% has decreased considerably in drought compared to normal in most of the traits except days to 75 % brown husk, plant height, ear height, chlorophyll content, leaf rolling, cob girth in which there was a decrease and in cob weight genetic advancement at 5% was same. Genetic advancement at 1% has decreased considerably in drought compared to normal in most of the traits except days to 75 %brown husk, plant height, ear height, chlorophyll content, leaf rolling, cob girth which show a decrease in its value.

Table 4. Heritability and genetic advance for normal and drought

	Normal			Drought		
	Heritability	Genetic advanceme nt at 5%	Genetic advancement at 1%	Heritability	Genetic advancement at 5%	Genetic advanceme nt at 1%
DT50%	0.5	2.34	3.0	0.29	1.67	2.14
DS50%	0.62	3.05	3.9	0.32	1.99	2.5
ASI	0.20	0.35	0.45	0.04	0.11	0.14
DBH 75%	0.11	0.44	0.57	0.11	0.84	1.08
PH	0.46	21.06	27	0.75	38.5	49.4
EH	0.05	1.02	1.3	0.57	12.3	15.7
CT	0.8	2.89	3.7	0.61	1.2	1.62
CC	0.73	0.05	0.07	0.92	0.13	0.16
PV	0.8	11.9	15.3	0.69	9.8	12.5
LR	0.211	0.24	0.3	0.24	0.31	0.4
LS	0.21	0.33	0.42	0.19	0.26	0.34
LF	0.34	0.43	0.55	0.32	0.38	0.49
CW	0.54	0.14	0.19	0.61	0.14	0.18
CL	0.94	8.6	11.13	0.82	3.5	4.48
CG	0.5	0.46	0.59	0.57	0.5	0.65
KR/C	0.3	0.67	0.86	0.19	0.46	0.59

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G/R	0.81	7.24	9.2	0.64	5.6	7.23

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