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Evaluation of Maize Genotypes under Rice Fallow Situation

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A B S T R A C T

The present investigation was carried out to identify maize hybrids suitable under rice fallow situation since rice fallow maize is gaining more popularity among the farming community in recent years. The results obtained in the present investigation are quite encouraging as the hybrids excelled in their performance under rice fallow condition and may offer a vast scope for breeders to work on the genetic studies under such situation. Based on mean performance it can be concluded that the parents BML 2, BML 14 and BML 6 and the hybrids BML 7 × BML 15, BML 2 × BML 7, BML 7 × BML 14, BML 6 × BML 7 and BML 7 × CM 118 were adjudged as the best parents and hybrids respectively, under rice fallow situation.

Keywords

Rice fallow maize, Mean performance, Hybrids

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Introduction

Maize is the third most important cereal crop after rice and wheat and referred as ‘Queen of cereals’ due to its high yield potential among cereals. Maize is cultivated in an area of 9.63 million hectares, with a production of 25.90 million tonnes and with the productivity of 2689 kg ha^{-1} in India (Indiastat.com, 2016-17). While, in Andhra Pradesh it is grown in an area of 2.50 lakh hectares, with a production of 16.53 lakh tonnes and with the productivity of 6604 kg ha^{-1} (Directorate of Economics & Statistics, Govt. of Andhra Pradesh, 2016-17).

Through exploitation of single cross hybrids in maize, the production and productivity has been increased significantly in traditional areas and different cropping systems. Still there is a dramatic increase of maize demand in our country and the current trend appears to be unable to keep pace. Since, the option of further increasing the maize area is limited, the viable option left is increasing the production and productivity by growing hybrid maize in different cropping systems. Earlier rice-pulse system was adopted by the farmers especially in Godavari, Krishna and Guntur districts of Andhra Pradesh. But pulses productivity has decreased due to the incidence of yellow mosaic and leaf curl viruses. Hence, instead of pulses, irrigated dry crops like sunflower and maize were recommended but farmers are not willing to take up because lot of time and labour are required to make the soil suitable for sowing. Hence, Zero tillage (No till) technology has come into practice which not only has short term benefits like saving of 25-30 % of energy for field preparation, advancement in sowings by 20-25 days but also long term benefits like improvement in the organic carbon content of the soil, checking soil erosion *etc*. Due to higher productivity, profitability and assured alternative *rabi* crop after rice, acreage of maize has shown an increasing trend and rice-maize emerged as a potential cropping system. No-till maize in rice fallows demonstrated a potential benefit of saving on cost of production ranging from Rs.3,800-5,500/ha. This system was mainly followed in coastal districts of Andhra Pradesh and Warangal and Khammam districts of Telangana states. But rice fallow maize trend was slowly acquiring its pace throughout the districts of Andhra Pradesh and Telangana.

To overcome the agronomic and soil management constraints in productivity of maize in rice fallows, development of right type of genotypes appears to be the only alternative. Hence, an attempt was made to understand the mechanism of adaptation to such conditions and studying its genetics and breeding to improve maize for rice based cropping systems.

Materials and Methods

The experimental material for this study comprised of eleven inbred lines *viz.,* BML 51, BML 5, CM 105, BML 2, BML 6, BML 7, BML 15, BML 14, CM 118, CM 119 and CML 124 and their 55 F_1s derived by crossing in 11 × 11 half diallel fashion. Eleven parents and 55 F_1s were evaluated in randomized block design with three replications at Sri Venkateswara Agricultural College Farm, Tirupati, Andhra Pradesh in *rabi,* 2016-17. The plot size for each entry was one row of five meter length, with a spacing of 60 cm and 20 cm between row to row and plant to plant, respectively. In rice fallow system, maize seeds were sown at optimum moisture condition immediately after harvesting of the *kharif* rice crop. The maize seeds were sown by dibbling method with the help of a wooden peg. The recommended dose of fertilizers used were same as normal *rabi* maize (120:80:60 kg ha^{-1}), but the first dose of fertilizers applied immediately after sowing by making a furrow parallel and 5 cm apart from seeds sown. For weed management atrazine @ 2.5 kg and paraquate @ 2.5 lt per hectare were mixed in 200 lt of water and sprayed on same day after sowing. The remaining agronomical practices followed were similar to normal maize cultivation.

The observations on seventeen yield and yield component traits *viz.,* days to 50 per cent tasseling, days to 50 per cent silking, anthesis-silking interval, days to maturity, SPAD chlorophyll meter reading (SCMR), specific leaf area, relative water content, leaf area index, plant height, tassel length, ear length, ear girth, number of kernel rows per ear, number of kernels per ear row, 100 kernel weight, protein content and kernel yield per plant were recorded on five randomly tagged competitive plants in each genotype in each replication. The mean of these five plants were used in the statistical analysis.

However, for days to 50% tasseling, days to 50% silking, anthesis-silking interval and days to maturity the observations were recorded on plot basis. The data were subjected to analysis of variance as per the method suggested by Panse and Sukhatme (1985).

Results and Discussion

The analysis of variance of the parents and the hybrids for yield and yield component traits are presented in Table 1 and 2.

Table.1 Analysis of variance for seventeen quantitative traits in eleven parents of maize under rice fallow situation

S. No.	Characters	Mean sum of squares		
		Replications (df: 2)	Parents (df: 10)	Error (df: 20)
1.	Days to 50% tasseling	1.12	11.12**	0.32
2.	Days to 50% silking	2.55	18.79**	0.88
3.	Anthesis silking interval	0.39	1.93**	0.26
4.	Days to maturity	1.49	35.03**	0.79
5.	SPAD Chlorophyll Meter Reading	0.57	49.39**	1.80
6.	Specific leaf area (cm^2 g^{-1})	133.03	644.04**	79.77
7.	Relative water content (%)	0.53	36.20**	7.14
8.	Leaf area index	0.02	0.72**	0.02
9.	Plant height (cm)	81.95	1654.73**	66.34
10.	Tassel length (cm)	11.90	47.51**	2.81
11.	Ear length (cm)	0.10	15.08**	0.70
12.	Ear girth (cm)	0.16	3.20**	0.56
13.	No. of kernel rows/ear	1.34	3.03**	0.38
14.	No. of kernels/ear row	1.43	41.51**	1.10
15.	100 kernel weight (g)	0.98	55.53**	1.02
16.	Protein content (%)	0.01	1.80**	0.01
17.	Kernel yield per plant (g)	5.85	771.08**	13.55

* Significant at 5% level; ** Significant at 1% level

Table.2 Analysis of variance for seventeen quantitative traits in fifty five hybrids of maize under rice fallow situation

S. No.	Characters	Mean sum of squares		
		Replications (df: 2)	Hybrids (df: 54)	Error (df: 108)
1.	Days to 50% tasseling	9.02	4.58**	0.83
2.	Days to 50% silking	10.15	6.24**	1.34
3.	Anthesis silking interval	0.26	0.59*	0.42
4.	Days to maturity	11.25	14.10**	0.84
5.	SPAD Chlorophyll Meter Reading	33.35	37.21**	4.82
6.	Specific leaf area (cm^2 g^{-1})	136.56	434.61**	150.50
7.	Relative water content (%)	139.84	46.46**	8.96
8.	Leaf area index	0.09	1.23**	0.01
9.	Plant height (cm)	528.89	673.95**	88.65
10.	Tassel length (cm)	8.60	16.77**	6.44
11.	Ear length (cm)	1.91	5.00**	0.86
12.	Ear girth (cm)	1.28	0.86**	0.31
13.	No. of kernel rows/ear	1.45	1.42**	0.43
14.	No. of kernels/ear row	22.23	37.69**	3.90
15.	100 kernel weight (g)	0.68	20.26**	0.96
16.	Protein content (%)	0.45	2.44**	0.01
17.	Kernel yield per plant (g)	73.32	629.17**	19.85

* Significant at 5% level; ** Significant at 1% level

Table.3 Mean performance of eleven parents of maize for seventeen quantitative characters under rice fallow situation

S. No.	Parent	DFT	DFS	ASI	DM	SCMR	SLA	RWC	LAI	PH	TL	EL	EG	KR/E	K/ER	100 KW	PC	KYD
1	BML 51	71.00	73.00	2.00	103.00	48.80	161.11	86.42	1.90	174.87	32.93	16.27	13.00	11.87	23.00	27.16	8.50	70.68
2	BML 5	70.33	73.00	2.67	104.33	41.00	160.15	78.25	1.32	188.27	35.33	18.27	13.07	12.40	21.60	19.64	8.56	55.55
3	CM 105	67.67	69.67	2.00	105.00	45.97	170.60	82.22	1.57	174.87	35.27	17.27	13.40	12.13	23.73	23.76	8.47	59.37
4	BML 2	67.67	70.33	2.67	108.67	52.63	180.94	86.02	2.20	208.67	43.20	19.47	14.40	13.47	28.80	30.56	9.18	90.51
5	BML 6	69.67	72.67	3.00	108.33	51.83	191.12	86.01	2.09	195.33	40.93	18.53	14.67	14.00	25.60	26.36	8.50	83.55
6	BML 7	72.67	77.33	4.67	110.00	51.57	188.36	88.61	1.89	177.87	37.00	15.67	13.33	12.00	21.27	26.63	8.21	64.00
7	BML 15	70.67	72.67	2.00	108.33	46.53	162.09	83.24	1.09	192.80	35.07	17.60	14.07	13.73	27.13	22.08	7.91	81.60
8	BML 14	67.67	70.00	2.33	101.67	54.00	197.82	85.59	2.79	194.47	41.47	19.40	14.33	14.13	25.47	28.92	7.66	87.95
9	CM 118	67.67	69.67	2.00	100.67	52.10	193.42	83.04	1.53	119.53	29.40	13.47	12.13	12.40	19.40	17.03	7.78	48.64
10	CM 119	68.33	71.00	2.67	100.33	54.23	193.85	91.52	1.27	163.73	36.67	14.60	12.40	13.33	18.47	19.42	9.56	47.70
11	CML 124	72.33	75.67	3.33	105.00	48.05	169.30	84.24	1.91	171.73	37.93	13.20	11.40	11.07	17.00	26.07	10.18	53.80
	Grand mean	**69.61**	**72.27**	**2.67**	**105.03**	**49.70**	**178.98**	**85.01**	**1.78**	**178.38**	**36.84**	**16.70**	**13.29**	**12.78**	**22.86**	**24.33**	**8.59**	**67.58**
	Range (Min.)	67.67	69.67	2.00	100.33	41.00	160.15	78.25	1.09	119.53	29.40	13.20	11.40	11.07	17.00	17.03	7.66	47.70
	Range (Max.)	72.67	77.33	4.67	110.00	54.23	197.82	91.52	2.79	208.67	43.20	19.47	14.67	14.13	28.80	30.56	10.18	90.51
	C.D.	0.97	1.61	0.88	1.52	2.30	15.32	4.58	0.22	13.97	2.88	1.43	1.28	1.04	1.80	1.74	0.24	6.31
	S.E(m)	0.33	0.54	0.30	0.51	0.78	5.16	1.54	0.07	4.70	0.97	0.48	0.43	0.35	0.61	0.59	0.08	2.13
	C.V.	0.81	1.30	19.14	0.84	2.70	4.99	3.14	7.17	4.57	4.55	4.98	5.61	4.74	4.59	4.16	1.61	5.45

DFT – Days to 50% Tasseling, DFS - Days to 50% Silking, ASI – Anthesis Silking Interval, DM – Days to Maturity, SCMR – SPAD Chlorophyll Meter Reading SLA – Specific Leaf Area ($cm^2 g^{-1}$), RWC – Relative Water Content (%), LAI – Leaf Area Index, PH – Plant Height (cm), TL – Tassel Length (cm), EL – Ear Length (cm), EG – Ear girth (cm), KR/E - No. of Kernel Rows per Ear, K/ER - No. of Kernels per Ear Row, 100 KW – 100 Kernel Weight (g), PC – Protein Content (%), KYD - Kernel Yield per Plant (g)

Table.4 Mean performance of fifty five hybrids of maize for seventeen quantitative characters under rice fallow situation

S. No.	Hybrid	DFT	DFS	ASI	DM	SCMR	SLA	RWC	LAI	PH	TL	EL	EG	KR/E	K/ER	100 KW	PC	KYD
1	BML 51 × BML 5	71.33	73.67	2.33	107.33	49.20	180.17	88.46	2.45	205.33	40.07	19.33	14.27	12.93	24.87	25.69	10.34	98.36
2	BML 51 × CM 105	66.67	69.33	2.67	103.33	53.80	176.16	89.46	2.80	187.73	38.47	17.93	13.33	12.13	24.73	24.19	8.66	93.54
3	BML 51 × BML 2	65.00	67.33	2.33	103.00	50.53	193.48	85.14	1.79	231.53	40.47	20.33	14.47	12.80	32.27	28.72	10.41	108.19
4	BML 51 × BML 6	67.33	69.33	2.00	102.67	52.07	173.48	90.26	2.28	220.13	39.13	18.53	14.33	13.87	32.20	30.19	8.97	109.54
5	BML 51 × BML 7	68.67	70.67	2.00	100.67	54.80	166.41	83.85	1.61	206.93	42.40	20.20	15.80	14.27	31.13	31.84	8.85	120.14
6	BML 51 × BML 15	69.33	71.67	2.33	103.33	50.20	159.85	84.82	2.49	221.40	39.20	19.87	14.07	12.93	31.73	22.21	8.85	102.72
7	BML 51 × BML 14	69.00	71.00	2.00	106.67	51.13	175.29	84.15	2.46	212.80	40.60	18.80	14.53	12.67	26.93	30.23	8.65	96.33
8	BML 51 × CM 118	68.00	70.00	2.00	106.67	52.20	161.49	86.11	3.07	235.73	40.00	19.87	14.73	13.73	30.07	31.62	9.64	104.95
9	BML 51 × CM 119	67.67	70.00	2.33	103.33	53.87	172.47	86.62	2.79	224.27	42.27	16.67	14.00	13.33	23.47	26.24	9.07	87.07
10	BML 51 × CML 124	69.33	71.33	2.00	103.00	55.80	182.58	79.80	1.13	218.40	38.20	19.40	14.67	13.20	30.33	27.76	8.34	103.70
11	BML 5 × CM 105	67.33	69.33	2.00	104.00	53.47	160.33	86.94	2.11	199.53	35.13	19.67	15.40	14.13	29.93	31.07	9.52	123.31
12	BML 5 × BML 2	69.00	72.00	3.00	103.00	52.30	178.00	86.26	1.47	209.73	41.67	20.93	14.60	12.67	32.20	28.29	8.73	108.28
13	BML 5 × BML 6	69.67	73.00	3.33	103.33	45.23	187.72	90.79	2.73	229.33	37.80	20.40	15.27	13.73	33.87	27.26	9.46	110.11
14	BML 5 × BML 7	68.00	70.67	2.67	99.33	50.50	172.83	77.67	2.83	231.33	43.07	20.60	14.67	13.87	34.27	28.76	8.54	121.32
15	BML 5 × BML 15	69.33	71.67	2.33	98.67	48.23	182.72	86.43	1.50	221.67	39.87	20.73	14.67	12.53	35.87	29.50	9.74	118.75
16	BML 5 × BML 14	65.00	67.33	2.33	101.33	45.80	166.20	83.97	2.54	220.33	45.47	20.73	14.60	12.80	32.87	29.91	10.73	109.39
17	BML 5 × CM 118	67.33	69.33	2.00	104.00	48.67	169.20	71.03	1.11	199.77	39.20	19.60	14.53	14.13	21.13	19.77	8.15	79.34
18	BML 5 × CM 119	69.00	71.00	2.00	102.33	50.47	186.17	82.43	2.18	225.07	44.40	19.13	14.13	13.60	28.53	27.26	10.66	98.72
19	BML 5 × CML 124	69.33	72.00	2.67	104.00	42.67	173.94	85.62	3.03	212.93	42.07	19.33	14.60	13.47	33.00	27.10	10.33	103.62
20	CM 105 × BML 2	68.67	71.00	2.33	102.67	43.20	162.53	90.35	1.23	186.20	36.67	17.93	14.40	12.27	28.73	24.12	8.54	92.21
21	CM 105 × BML 6	67.67	70.67	3.00	106.33	49.63	160.95	86.46	2.29	204.27	38.53	17.07	14.53	14.53	26.93	23.40	8.33	89.44
22	CM 105 × BML 7	68.67	71.33	2.67	105.67	50.27	168.46	81.62	2.20	202.87	41.73	17.27	13.93	13.20	22.00	26.02	7.89	76.17
23	CM 105 × BML 15	68.67	71.33	2.67	102.00	38.91	174.57	86.68	1.85	211.93	35.20	18.80	15.27	14.53	31.53	24.17	8.93	108.69
24	CM 105 × BML 14	67.33	69.33	2.00	100.33	48.60	165.62	89.99	3.21	204.60	42.60	17.47	15.07	14.40	26.27	27.95	7.99	95.20
25	CM 105 × CM 118	68.00	70.00	2.00	102.33	52.00	190.45	85.73	1.93	202.87	39.40	17.40	14.27	13.87	27.07	28.07	7.87	95.74
26	CM 105 × CM 119	68.67	71.67	3.00	103.67	48.57	186.55	83.68	3.53	207.33	40.00	18.27	15.07	13.33	28.87	29.03	7.78	98.37
27	CM 105 × CML 124	67.67	70.00	2.33	103.00	47.93	169.76	84.90	2.78	213.73	39.07	16.87	14.47	13.33	28.31	29.61	8.38	104.36
28	BML 2 × BML 6	66.33	68.33	2.00	100.00	50.83	182.63	82.83	2.56	192.13	40.87	17.60	14.53	13.87	28.33	26.27	8.63	97.08
29	BML 2 × BML 7	69.00	72.33	3.33	100.33	49.17	205.75	90.66	2.17	227.37	41.53	20.13	14.60	13.87	34.33	31.45	7.54	138.31
30	BML 2 × BML 15	68.00	70.33	2.33	99.33	51.17	182.00	82.96	2.31	222.80	37.00	19.53	14.47	12.93	33.13	30.63	9.58	112.34

Cont…

S. No.	Hybrid	DFT	DFS	ASI	DM	SCMR	SLA	RWC	LAI	PH	TL	EL	EG	KR/E	K/ER	100 KW	PC	KYD
31	BML 2 × BML 14	67.33	69.67	2.33	101.33	47.37	197.61	87.18	2.23	194.80	36.93	17.80	13.33	13.60	29.67	27.61	9.51	105.33
32	BML 2 × CM 118	66.67	69.33	2.67	102.67	53.27	201.31	86.63	1.73	205.27	40.00	17.40	13.47	13.47	26.27	24.97	9.08	89.30
33	BML 2 × CM 119	66.00	68.00	2.00	100.00	46.70	173.94	86.95	3.37	214.53	42.93	18.60	13.67	13.33	29.87	29.02	7.53	109.99
34	BML 2 × CML 124	68.67	71.67	3.00	101.33	50.00	178.21	82.78	2.84	209.53	41.87	18.53	14.27	12.80	32.13	29.81	9.12	105.81
35	BML 6 × BML 7	68.00	70.33	2.33	103.67	48.03	186.04	83.06	3.12	209.80	39.33	19.67	15.13	14.93	35.67	31.05	8.69	129.57
36	BML 6 × BML 15	69.00	72.00	3.00	105.67	45.53	200.17	81.57	2.12	222.67	37.53	19.87	15.07	13.73	36.13	27.07	9.21	118.43
37	BML 6 × BML 14	67.67	70.33	2.67	100.67	51.57	170.85	77.19	2.66	204.00	41.53	17.20	14.13	13.73	26.47	27.22	8.55	95.80
38	BML 6 × CM 118	65.00	67.00	2.00	99.67	54.37	178.22	82.18	2.64	184.87	42.93	17.53	14.27	14.67	29.13	26.34	8.01	98.64
39	BML 6 × CM 119	67.67	70.00	2.33	100.00	56.77	189.75	84.88	1.42	171.27	38.60	16.67	14.80	15.07	26.00	25.90	10.10	94.49
40	BML 6 × CML 124	69.00	72.00	3.00	105.00	47.40	202.68	77.71	1.49	192.93	40.13	16.87	14.53	14.00	26.40	26.18	8.31	98.23
41	BML 7 × BML 15	69.67	72.00	2.33	104.33	53.00	168.92	87.77	1.64	225.67	41.33	19.13	14.93	14.13	36.31	31.64	8.09	143.33
42	BML 7 × BML 14	68.00	69.67	1.67	102.67	52.10	173.42	87.27	1.79	211.80	44.33	18.87	15.40	13.20	32.80	31.75	11.04	132.39
43	BML 7 × CM 118	68.33	70.33	2.00	102.67	48.10	191.67	86.57	1.87	198.87	40.33	18.27	14.87	14.80	31.40	29.77	9.64	124.64
44	BML 7 × CM 119	67.00	69.00	2.00	104.00	53.23	170.41	81.34	2.88	218.60	41.87	18.67	14.60	14.13	31.20	27.25	10.70	111.97
45	BML 7 × CML 124	68.67	72.00	3.33	104.67	54.47	168.04	81.51	2.71	202.87	43.80	16.60	14.60	12.80	27.33	26.45	8.26	84.25
46	BML 15 × BML 14	69.33	71.67	2.33	104.67	53.93	179.58	86.20	2.77	190.27	40.73	17.93	14.00	13.73	29.93	26.15	8.81	106.21
47	BML 15 × CM 118	68.33	70.67	2.33	102.67	50.27	183.27	83.29	3.28	200.67	39.00	17.07	14.07	14.40	30.93	27.16	7.86	105.25
48	BML 15 × CM 119	67.67	69.67	2.00	100.33	54.00	164.75	89.11	2.71	181.07	38.87	17.13	14.60	14.80	27.67	26.87	8.18	98.94
49	BML 15 × CML 124	68.33	70.33	2.00	100.67	52.70	169.89	77.52	3.66	224.07	40.93	19.00	14.73	13.20	29.73	27.56	9.77	97.22
50	BML 14 × CM 118	68.67	71.33	2.67	101.33	51.00	169.23	85.38	1.38	197.13	37.80	15.80	13.67	14.00	23.00	23.31	7.35	76.96
51	BML 14 × CM 119	66.00	68.00	2.00	100.00	49.40	168.43	83.80	1.90	189.40	41.73	17.93	14.13	13.07	27.60	24.45	8.54	89.42
52	BML 14 × CML 124	68.33	70.67	2.33	99.67	53.60	160.62	80.61	1.74	208.93	45.87	17.93	15.00	13.20	29.00	27.50	8.63	107.27
53	CM 118 × CM 119	68.00	69.33	1.33	100.33	54.57	168.22	84.91	2.82	183.47	38.73	16.67	13.40	13.47	28.07	25.42	8.14	83.81
54	CM 118 × CML 124	68.00	70.00	2.00	100.00	54.43	196.14	80.03	3.03	235.93	43.40	18.60	14.27	13.33	27.93	26.89	8.91	90.72
55	CM 119 × CML 124	66.67	68.33	1.67	99.33	54.67	162.37	78.86	2.32	220.00	40.20	18.27	15.07	13.73	27.47	28.08	8.19	93.13
	Grand mean	**68.02**	**70.37**	**2.35**	**102.42**	**50.58**	**177.12**	**84.36**	**2.34**	**208.88**	**40.41**	**18.52**	**14.50**	**13.60**	**29.51**	**27.52**	**8.90**	**103.57**
	Range (Min.)	65.00	67.00	1.33	98.67	38.91	159.85	71.03	1.11	171.27	35.13	15.80	13.33	12.13	21.13	19.77	7.35	76.17
	Range (Max.)	71.33	73.67	3.33	107.33	56.77	205.75	90.79	3.66	235.93	45.87	20.93	15.80	15.07	36.31	31.84	11.04	143.33
	C.D.	1.47	1.88	0.63	1.48	3.56	19.88	4.85	0.19	15.26	4.11	1.50	0.90	1.06	3.20	1.59	0.15	7.22
	S.E(m)	0.53	0.67	0.38	0.53	1.27	7.08	1.73	0.07	5.44	1.47	0.53	0.32	0.38	1.14	0.57	0.05	2.57
	C.V.	1.34	1.65	22.60	0.89	4.34	6.93	3.55	4.91	4.51	6.28	5.00	3.81	4.81	6.69	3.56	1.03	4.30

DFT – Days to 50% Tasseling, DFS - Days to 50% Silking, ASI – Anthesis Silking Interval, DM – Days to Maturity, SCMR – SPAD Chlorophyll Meter Reading SLA – Specific Leaf Area ($cm^2 g^{-1}$), RWC – Relative Water Content (%), LAI – Leaf Area Index, PH – Plant Height (cm), TL – Tassel Length (cm), EL – Ear Length (cm), EG – Ear Girth (cm), KR/E - No. of Kernel Rows per Ear, K/ER - No. of Kernels per Ear Row, 100 KW – 100 Kernel Weight (g), PC – Protein Content (%), KYD - Kernel Yield per Plant (g)

Table.5 Top five promising hybrids identified based on mean performance for yield and yield components in maize under rice fallow situations

S. No.	Character	Top five hybrids	S. No.	Character	Top five hybrids
1	Days to 50% tasseling	BML 6 × CM 118 BML 51 × BML 2 BML 5 × BML 14 BML 2 × CM 119 BML 14 × CM 119	10	Tassel length (cm)	BML 14 × CML 124 BML 5 × BML 14 BML 5 × CM 119 BML 7 × BML 14 BML 7 × CML 124
2	Days to 50% silking	BML 6 × CM 118 BML 51 × BML 2 BML 5 × BML 14 BML 2 × CM 119 BML 14 × CM 119	11	Ear length (cm)	BML 5 × BML 2 BML 5 × BML 15 BML 5 × BML 14 BML 5 × BML 7 BML 5 × BML 6
3	Anthesis silking interval	CM 118 × CM 119 BML 7 × BML 14 CM 119 × CML 124 BML 51 × BML 6 BML 51 × BML 7	12	Ear girth (cm)	BML 51 × BML 7 BML 5 × CM 105 BML 7 × BML 14 BML 5 × BML 6 CM 105 × BML 15
4	Days to maturity	BML 5 × BML 15 BML 5 × BML 7 BML 2 × BML 15 CM 119 × CML 124 BML 6 × CM 118 BML 14 × CML 124	13	No. of kernel rows/ear	BML 6 × CM 119 BML 6 × BML 7 BML 7 × CM 118 BML 15 × CM 119 BML 6 × CM 118
5	SPAD Chlorophyll Meter Reading	BML 6 × CM 119 BML 51 × CML 124 BML 51 × BML 7 CM 119 × CML 124 CM 118 × CM 119	14	No. of kernels/ear row	BML 7 × BML 15 BML 6 × BML 15 BML 5 × BML 15 BML 6 × BML 7 BML 2 × BML 7
6	Specific leaf area (cm^2 g^{-1})	BML 51 × BML 15 BML 5 × CM 105 BML 14 × CML 124 CM 105 × BML 6 BML 51 × CM 118	15	100 kernel weight (g)	BML 51 × BML 7 BML 7 × BML 14 BML 7 × BML 15 BML 51 × CM 118 BML 2 × BML 7
7	Relative water content (%)	BML 5 × BML 6 BML 2 × BML 7 CM 105 × BML 2 BML 51 × BML 6 CM 105 × BML 14	16	Protein content (%)	BML 7 × BML 14 BML 5 × BML 14 BML 7 × CM 119 BML 5 × CM 119 BML 51 × BML 2
8	Leaf area index	BML 15 × CML 124 CM 105 × CM 119 BML 2 × CM 119 BML 15 × CM 118 CM 105 × BML 14	17	Kernel yield per plant (g)	BML 7 × BML 15 BML 2 × BML 7 BML 7 × BML 14 BML 6 × BML 7 BML 7 × CM 118
9	Plant height (cm)	CM 118 × CML 124 BML 51 × CM 118 BML 51 × BML 2 BML 5 × BML 7 BML 5 × BML 6			

The mean sum of squares due to genotypes (parents and hybrids) was highly significant for all the traits studied, there by indicating the existence of sufficient variability in the material studied.

In any plant breeding programme for developing high yielding hybrids or varieties, the basic need is the choice of parents with high mean values as they are expected to produce desirable segregants upon crossing (Gilbert, 1958). In the present investigation several parents showed high mean performance for more than one character (Table 3). Among the eleven parents, the parent BML 2 exhibited high *per se* performance for seven traits *viz.*, kernel yield per plant, 100 kernel weight, number of kernels per ear row, ear length, plant height, tassel length and days to 50% tasseling and it is also exhibited good *per se* performance for protein content, ear girth, leaf area index, SCMR and days to 50% silking and hence adjudged as best parent among the eleven parents.

Next to this the parent BML 14 showed high *per se* performance for three traits *viz.*, number of kernel rows per ear, leaf area index and days to 50% tasseling and it also showed good *per se* performance for kernel yield per plant, 100 kernel weight, ear length, ear girth, plant height, tassel length, SCMR and days to 50% silking.

The parent BML 6 exhibited good *per se* performance for kernel yield per plant, ear girth, ear length, number of kernel rows per ear, number of kernels per ear row, plant height, tassel length and leaf area index, while the parents CM 105, CM 118 and CM 119 were found to be the early inbred lines since they exhibited early anthesis, early silking, less anthesis-silking interval and early maturity. Hence it could be suggested that selection of these parents *viz.*, BML 2, BML 14, BML 6, CM 105, CM 118 and CM 119 in hybridization programme would be effective for improvement of maturity, yield and yield components under rice fallow situation.

Based on mean performance of hybrids it could be revealed that no single cross hybrid was found significant for all yield and yield component traits (Table 4). The top five promising hybrids identified for yield and various yield component traits are presented in Table 5. Among the 55 hybrids, the hybrid BML 7 × BML 15 recorded high *per se* performance for kernel yield per plant followed by BML 2 × BML 7, BML 7 × BML 14, BML 6 × BML 7 and BML 7 × CM 118. Besides kernel yield, the hybrids BML 7 × BML 15 and BML 2 × BML 7 also recorded good *per se* performance for number of kernels per ear row, 100 kernel weight. Similarly the hybrid BML 7 × BML 14 also recorded good *per se* performance for 100 kernel weight, protein content, ear girth, tassel length and anthesis silking interval besides kernel yield. Likewise, the hybrid BML 6 × BML 7 showed good *per se* performance for number of kernel rows per ear, number of kernels per ear row, 100 kernel weight and ear girth besides kernel yield. The hybrid BML 7 × CM 118 showed good *per se* performance for ear girth and number of kernel rows per ear besides kernel yield. Hence, selection would be effective for these five crosses as they exhibited good *per se* performance for yield and most of the yield components. It was interesting to note that in all these superior hybrids BML 7 was one of the parents which indicated that this parent might be the best general combiner and could be included in future breeding programmes. Similarly, Naik (2012), Karki and Shrestha (2014), Rao *et al.*, (2016) and Govardhanrao and Ramana (2017) also conducted similar studies under rice fallow situation and reported the applicability of maize cultivation under rice fallow situation.

The results obtained in the present investigation are quite encouraging as the hybrids excelled in their performance under rice fallow condition and may offer a vast scope for breeders to work on the genetic studies under such situation. Based on mean performance it could be concluded that the parents BML 2, BML 14 and BML 6 and the hybrids BML 7 × BML 15, BML 2 × BML 7, BML 7 × BML 14, BML 6 × BML 7 and BML 7 × CM 118 were adjudged as the best parents and hybrids respectively, under rice fallow situation.

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