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An Effort for Producing Disease Free High Yielding F_2 Grains from F_1 Seeds Evolved through CMS Breeding Technology

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Research Article

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Abstract

CMS A-lines (IR 58025 A) and KMR-3 as R- line were procured from the State Rice Research Station, Chin surah, Hooghly during December 2011. The seeds of A-line and R-line were sown in the seed bed at the research field of the Crop Research Farm (CRF) under The Department of Botany, The University of Burdwan on 18/12/2011 following anorms of CMS breeding technology. These seedlings were transplanted accordingly for raising F_2 plant population. These F_1 seeds were undertaken for F_2 population which was observed critically during its growth and developmental phase till harvesting. These F_1 seeds were sown in the seed bed maintaining three types of spacing. Five organic manure treatments viz. T_0, T_1, T_2, T_3, T_4 were applied in the soil of each variety and spacing sub plot i.e total 30 sub plots were maintained following Randomized Block Design (RBD) in four replications. various metrical characters viz. No. of tillers, No. of total leaves, plant height, No. of tillers bearing inflorescence, total yield per bight were studied critically and recorded all the data carefully for further calculations, no disease occurrence was found in the field of F2 generations. The main aims and objectives of this experimentation were to study the yield attributes and disease free F2 seed from the hybrid F1 rice population evolved through CMS breeding technology.

Keywords: Reflection Treatment Error; CMS Breeding Technolgy; F_2 Grains

Introduction

As rice is our staple food, it is first and foremost duty to the scientists to meet up the demand of required rice grain quantity of recurrently growing population, at present rice is the most widely cultivated crop and the longest running cereal in the world. it constitutes 23% of the global cereal acreage (860 million hector) and contributes 29% of the global cereal production (2064 m tones). After independence, the Government of India took emphasis for food production which we have achieved from green revolution of the '60s could have met up the present food scarcity of these 120 crores of people of our country. The traditional high yielding rice cultivars are not in a position to produce adequate quantity of rice grains to meet up the food demand of the country. Although CMS system has been found effective to develop tropical rice hybrids yet Thermo Sensitive Genic Male Sterility (TGMS) is also being deployed to increase hybrid breeding efficiency. It is the need of the hour to standardize the disease free maximum production in a particular unit area (FAO).

Material and Methods

Two rice cultivars were selected for conducting this programme viz. KRH- 2 and CNRH- 102. These two rice cultivars were sown in the seed bed having 250g in $1m^2$, 250 g in $1.5m^2$, and 250 g in $2\ m^2$. Again organic manures, single, combined, with chemical fertilizers were applied in the fields in the following manner as cited below in the table.

Manure	Quantity
Cow dung compost	200 kg / bigha
Vermi compost	200 kg / bigha
Cowdung compost + Vermi compost	(100+100) kg / bigha
Cowdung compost + Vermi compost+ Chemical fertilizer	[(100+100)+ (urea 3 kg + super phosphate 6 kg + muriate of potash 6 kg)]

Table1: Quantity of manure applications in the field.

Name	Variety	Spacing	Treatments
$V_1S_1T_0$ $V_1S_1T_1$ $V_1S_1T_2$ $V_1S_1T_3$ $V_1S_1T_4$	KRH-2	1.5	Control Compost Vermi Compost+vermi Compost+vermi+chemical
$V1S_2T_0$ $V1S_2T_1$ $V1S_2T_2$ $V1S_2T_3$ $V1S_2T_4$	KRH-2	2	Control Compost Vermi Compost+vermi Compost+vermi+chemical
$V_1 S_3T_0$ $V_1 S_3T_1$ $V_1 S_3T_2$ $V_1 S_3T_3$ $V_1 S_3T_4$	KRH-2	2	Control Compost Vermi Compost+vermi Compost+vermi+chemical
$V_2S_1T_0$ $V_2S_1T_1$ $V_2S_1T_2$ $V_2S_1T_3$ $V_2S_1T_4$	CNRH-102	1.5	Control Compost Vermi Compost+vermi Compost+vermi+chemical
$V_2S_2T_0$ $V_2S_2T_1$ $V_2S_2T_2$ $V_2S_2T_3$ $V_2S_2T_4$	CNRH-102	2	Control Compost Vermi Compost+vermi Compost+vermi+chemical
$V_2S_3T_0$ $V_2S_3T_1$ $V_2S_3T_2$ $V_2S_3T_3$ $V_2S_3T_4$	CNRH-102	2	Control Compost Vermi Compost+vermi Compost+vermi+chemical

Table 2: Treatments of cultivars.

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The total quantity of organic manure and chemical fertilizer as stated in the above table were applied to the soil in two phases 80% quantity was applied as basal dose and 20% was applied as second dose i.e at the time of weeding (25 days after transplantation). Recorded data were analyzed following Singh and Chowdhury [1]. RBD layout design having 4 replications was followed for the experiment.

Results and Discussion

Results

The two way table of each treatment were computed considering it's replication and manures. df were 3 and 4 respectively. All these completed ANOVA data have been cited in Table-3 as combined ANOVA table.

Treatment	S.V	df	SS	MS	F	CD	CV
	Replication	3	1274476.88	424825.62	3.89		
1	Treatment	4	34018.12	8504.53	0.07	-	1387.39
	Error	12	1308453.1	109037.75			
	Replication	3	41066.83	13866.94	2.28		
2	Treatment	4	30820.49	7705.12	1.28	-	341.58
	Error	12	71832.99	5986.08			
	Replication	3	42482.46	14160.82	16.08**		
3	Treatment	4	31883.03	7970.75	9.05**	126.08	128.79
	Error	12	10567.2	880.6			
	Replication	3	41081.09	13693.69	2.28		
4	Treatment	4	30830.87	7707.71	1.28	-	341.72
	Error	12	71892.31	5991.02			
	Replication	3	39596.39	13198.79	2.28		
5	Treatment	4	29733.97	7433.49	1.28	-	341.81
	Error	12	69284.38	5773.69			
	Replication	3	42356.27	14118.75	2.28		
6	Treatment	4	31801.94	7950.48	1.28	-	387.84
	Error	12	74091.34	6174.27			
	Replication	3	5651.55	1883.85	2.31		
7	Treatment	4	4196.13	1049.03	1.28	-	345.03
	Error	12	9770.51	814.20			
	Replication	3	3901.25	1300.41	2.30		
8	Treatment	4	2918.68	729.67	1.29	-	389.22
	Error	12	6773.83	564.48			
	Replication	3	2507.58	835086	2.58		
9	Treatment	4	1411.31	352.82	1.09	-	336.62
	Error	12	3884.21	323.68			
	Replication	3	2031.14	677.04	3.52		
10	Treatment	4	1553.07	388.26	2.02	-	391.73
	Error	12	2303.01	191.91			
	Replication	3	2026.56	675.52	2.28		
11	Treatment	4	1534.50	383.62	1.29	-	342.44
	Error	12	3546.31	295.52			
	Replication	3	2125.82	708.60	2.14		
12	Treatment	4	1946.33	486.58	1.47	-	354.99
	Error	12	3964.3	330.35			
	Replication	3	62587.16	20862.38	17.7**		
13	Treatment	4	63060.30	15765.07	13.40**	74.05	106.75
	Error	12	14109.44	1175.78			
	Replication	3	51097.69	17032.56	2.32		
14	Treatment	4	37414.42	9353.60	1.27	-	343.50
	Error	12	88002.82	7333.56			

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15	Replication Treatment Error	3 4 12	32814.51 25262.79 57649.87	10947.17 6315.69 4804.15	2.27 1.31	-	344.83
16	Replication Treatment Error	3 4 12	27456.37 20915.27 47946.46	9152.12 5228.81 3995.53	2.29 1.30	-	342.04
17	Replication Treatment Error	3 4 12	26146.72 19792.74 45791.5	8721.57 4948.18 3815.95	2.28 1.29	-	341.85
18	Replication Treatment Error	3 4 12	35495.98 26861.53 61941.6	11831.99 6715.38 5161.8	2.29 1.30	-	343.10
19	Replication Treatment Error	3 4 12	106010.51 79552.17 179960.29	35336.83 19888.04 14996.69	2.35 1.32	-	336.52
20	Replication Treatment Error	3 4 12	98030.27 73611.99 171591.8	32676.75 18402.99 14299.31	2.28 1.28	-	341.60
21	Replication Treatment Error	3 4 12	102812.72 77171.20 179936.7	34270.90 19292.8 14994.72	2.28 1.28	-	341.66
22	Replication Treatment Error	3 4 12	95078.78 52321.97 146269.42	31692.92 13080.49 12189.11	2.60 1.07	-	320.29
23	Replication Treatment Error	3 4 12	93774.32 70326.46 163923.51	31258.10 17581.61 13660.29	2.28 1.28	-	341.84
24	Replication Treatment Error	3 4 12	92929.31 69782.79 162584.61	30976.43 17445.69 13548.71	2.28 1.28	-	341.64
25	Replication Treatment Error	3 4 12	4080.14 3136.49 7150.76	1360.04 784.12 595.89	2.28 1.31	-	342.36
26	Replication Treatment Error	3 4 12	2860.45 2208.53 5037.25	953.48 552.13 419.77	2.27 1.31	-	343.18
27	Replication Treatment Error	3 4 12	2103.93 1715.55 3768.1	701.31 428.88 314	2.23 1.36	-	346.77
28	Replication Treatment Error	3 4 12	2963.10 2209.94 5121.09	987.7 552.4 426.75	2.31 1.29	-	342.58
29	Replication Treatment Error	3 4 12	2948.29 2213.09 5095.55	982.76 553.27 424.62	2.31 1.30	-	341.72
30	Replication Treatment Error	3 4 12	3373.34 2583.84 5914.02	1124.44 645.96 429.83	2.61 1.50	-	319.94
31	Replication Treatment Error	3 4 12	1260.65 964.68 2203	420.21 241.17 183.58	2.28 1.31	-	345.64
32	Replication	3	641.79	213.93	2.31	-	344.44

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	Treatment Error	4 12	481.04 1108.28	120.26 92.35	1.30		
33	Replication Treatment Error	3 4 12	486.73 373.28 849.85	162.24 93.32 70.82	2.29 1.31	-	344.89
34	Replication Treatment Error	3 4 12	1023.41 755.97 1743.65	341.13 188.99 145.30	2.34 1.30	-	342.44
35	Replication Treatment Error	3 4 12	542.52 411.07 931.82	180.84 102.76 77.65	2.31 1.32	-	340.22
36	Replication Treatment Error	3 4 12	969.31 751.86 1690.76	323.10 187.96 140.89	2.29 1.33	-	343.05

Table 3: Combined ANOVA table for metrical characters studied.

Treatment	$\sigma^2 g$	$\sigma^2 p$	$\sigma^2 e$
1	-25133.30	83904.44	109037.75
2	429.76	6415.84	5986.08
3	1772.53	2653.13	880.6
4	429.17	6420.19	5991.02
5	414.95	6188.64	5773.69
6	444.05	6618.64	6174.27
7	58.70	872.9	814.20
8	41.29	605.77	564.48
9	7.28	330.96	323.68
10	49.08	240.99	191.91
11	22.02	317.54	295.52
12	39.05	369.40	369.40
13	3647.32	4823.1	1175.78
14	2020.04	9353.6	7333.56
15	377.88	5182.03	4804.15
16	308.32	4303.85	3995.53
17	283.05	4099	3815.95
18	97.09	5258.89	5161.8
19	1222.83	16219.52	14996.69
20	4103.68	18402.99	14299.31
21	1074.52	16069.24	14994.72
22	222.84	12411.95	12189.11
23	980.33	14640.62	13660.29
24	974.24	14522.95	13548.71
25	47.05	642.94	595.89
26	33.09	452.86	419.77
27	28.72	342.72	314
28	31.41	458.16	426.75
29	32.16	456.78	424.62
30	54.03	483.78	429.86
31	14.39	197.97	183.58
32	6.97	99.32	92.35
33	5.62	76.44	70.82

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34	10.92	156.22	145.30
35	6.27	83.92	77.65
36	11.76	152.65	140.89

Table 4: Components of variances.

Treatment	GCV	PCV	h^2
1	666.11	1217.06	-0.29
2	91.52	353.63	-0.066
3	182.73	223.55	0.668
4	91.46	353.75	0.066
5	91.63	353.88	0.067
6	91.65	353.86	0.067
7	92.64	357	0.067
8	92.58	354.64	0.068
9	48.35	326.02	0.021
10	139.27	308.62	0.203
11	93.47	354.97	0.069
12	122.05	357.38	0.105
13	188.02	216.21	0.075
14	180.28	387.94	0.215
15	96.71	358.14	0.072
16	95.01	354.9	0.071
17	93.10	354.30	0.069
18	47.05	346.31	0.018
19	96.09	349.97	0.075
20	183	387.53	0.022
21	91.46	353.69	0.066
22	43.30	323.20	0.017
23	91.57	353.90	0.066
24	91.61	353.71	0.067
25	96.20	355.62	0.073
26	96.35	356.45	0.073
27	104.87	362.28	0.083
28	92.94	354.96	0.068
29	94.04	354.43	0.070
30	113.43	339.45	0.011
31	96.77	358.93	0.072
32	94.62	357.20	0.070
33	97.15	358.31	0.073
34	93.87	355.07	0.069
35	96.67	353.69	0.074
36	99.11	357.08	0.077

Table 5: Calculations of genotypic, phenotypic and heritability values.

Discussion

The value of variance ratio CD and CV have been cited in Table-3. In only two cases CD value have been exhibited, which means that only in these two cases the F value were significant at 5% and 1% level of probability. The variances of genotypic phenotypic and environmental were furnished in table-4. Similarly genotypic and phenotypic co-efficiency and heritability's were also calculated and furnished in table-5 treatment wise. And this table-5 in a few cases has indicated the negative heritability and other remaining were positive values,

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which indicated the potentiality and adaptability over the environment in this location. Virmani, et al. [2] published the paper in Hybrid rice for food security, poverty alleviation, and environmental protection for grain quality in rice. Another pioneer worker Khush, et al. [3] revealed that the diverse parental lines potentiality. Many other reports appearing later have also revealed that hybrids and such did not show impaired grain quality and hybrids with desired grain quality can be developed by careful selection of parents [4].

The works on good grain quality as well as milling, cooking, palatability quality were counted by Sobha Rani, et al. [5].

Comments

Recurrent CMS technology is helpful to produce 30% more production in each F_2 generation where parental R-lines are stronger genetic make-up. Proper fertilizer management can also enhance the optimum production of the crop.

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