RESEARCH ARTICLE

Evaluation of newly developed mustard lines for yield contributing traits

Nair Beena, Sapakal Ravindra and Nartam Abhijit

AICRP on Rapeseed-Mustard, College Of Agriculture, Nagpur
*Corresponding author Email: beenanair2007@rediffmail.com

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ABSTRACT

Crosses were attempted at farm of Botany Section, College of Agriculture, Nagpur in rabi 2013 including 48 lines and two testers in Line x Tester fashion. Ninety six crosses thus obtained were sown during year rabi 2014 to assess the possibility of estimating the general combining ability of parents and specific combining ability of crosses to isolate superior crosses. These parents and crosses were grown in randomized complete block design replicated thrice and observations were taken on days to 50% flowering, days to maturity, plant height at maturity (cm), number of branches plant^{-1}, number of siliquae plant^{-1}, seed yield plant^{-1} (g), and oil content (%). Estimated predictability ratio showed the importance of gca effects for judging the performance of the progeny. The parent Pusa Bold was identified a good general combiner in number of siliqua plant^{-1}. The crosses ACN-9 x ACN-164, ACN-9 x ACN-184, Pusa bold x ACN-169 and Pusa bold x ACN-152 were identified as the best F_1 crosses which can be forwarded to the next generation with aim to get useful transgrates in succeeding generation.

Keywords: Mustard, gca effects, sca effects and combining ability

INTRODUCTION

Brassica (rapeseed-mustard) is the second most important edible oilseed crop in India.Rapeseed-mustard oil has the lowest amount of harmful saturated fatty acids. It also contains adequate amounts of the two essential fatty acids, linoleic and linolenic which are not present in many of the other edible oils. Line x tester is one of the efficient, convenient and often used biometrical tools that provides information on the parents from the study of F_1 itself. This is widely employed in estimating the extent of general combining ability of the parents and specific combining ability of their hybrids and is useful to assess the nature of inheritance of a character.

MATERIAL AND METHODS

During *rabi* 2013-14, 96 crosses were obtained by crossing 48 lines with two testers in L **x** T mating design. Crossed seeds of these 96 hybrids crosses, along with 50 parents were planted in randomized block design with three replications in *rabi* 2014-15 for evaluation. The data were recorded on five randomly selected plants from each genotype on following seven characters *viz.,* days to 50% flowering, days to maturity, plant height at maturity (cm), number of branches plant^{-1} at maturity stage, number of siliqua plant^{-1}, seed yield plant^{-1} (g) and oil content (%). The analysis of variance for experimental design was analysed by the method given by Panse and Sukhatme (1954) and combining ability analysis was carried out by following the methodology of Kempthorne, (1957). with fixed effects model (model I) of Eisenhart (1947).

RESULT AND DISSCUSION

Pusa bold exhibited significant positives gca effects for number of siliqua plant^{-1}, non significant positive gca effects for seed yield plant^{-1} and non significant negative gca effects for days to maturity..Predictability ratio ranged from 0.54 for number of branches plant^{-1} to 0.98 for days to maturity. The estimates of these ratios in the present study indicated predictability ratio closer to unity for all characters except number of branches plant^{-1}. Under such situation the

Table 1. Analysis of variance for combining ability

Source	d.f.	Days to 50% flowering	Days to maturity	Plant height at maturity (cm)	Number of branches plant^{-1}	Number of siliqua plant^{-1}	Seed yield plant^{-1} (g)
Replication	2	24.35**	51.50**	288.68	0.57*	281.84	2.30
Crosses	95	20.33**	21.13**	429.08**	0.37**	9128.42**	29.35**
Line	47	14.78	13.45	400.27	0.23	5900.91	27.05
Testers	1	561.12	763.75**	1274.28**	0.15	77749.38**	263.58**
Line x Tester	47	14.37*	13.00	439.91*	0.51*	10895.92**	26.66**
Error	290	2.95	3.89	98.24	0.12	198.00	2.24
Predictability ratio (GCA vs SCA)		0.97	0.98	0.83	0.54	0.89	0.92

*,** = significant at 5% and 1% level respectively

Table 2. General combining ability effects of parents

Sr. No.	Parent Testers	Days to maturity	Plant height at maturity (cm)	Number of siliquae plant^{-1}	Seed yield plant^{-1}
1	**ACN-9**	1.62**	-2.10	-16.43**	-0.96**
2	**Pusa bold**	-1.62**	2.10	16.43**	0.96**

** = significant at 1% level

Note: GCA effects of lines for all the characters, gca effects of tester for days to 50% flowering , number of branches plant^{-1} were not calculated as their respective mean squares were non- significant .

Table 3. Specific combining ability effects of crosses

Sr . No.	Crosses	Days to maturity	Plant height at maturity (cm)	Number of branches plant^{-1}	Number of siliquae plant^{-1}	Seed yield plant^{-1}
1	ACN -9 X ACN-141	0.53	7.57	0.02	26.56	1.54
2	ACN -9 X ACN-142	0.03	10.67	-0.01	113.13**	-0.46
3	ACN -9 X ACN-143	0.20	-4.92	0.18	-8.50	3.24
4	ACN -9 X ACN-144	1.03	-7.22	0.35	-25.13	-0.72
5	ACN -9 X ACN-145	3.03	6.40	0.38	48.46**	0.85
6	ACN -9 X ACN-146	1.20	21.90	0.58	50.86**	1.02
7	ACN -9 X ACN-147	-0.46	4..13	0.28	17.56	1.12
8	ACN -9 X ACN-148	3.03	5.57	-0.04	5.73	1.04
9	ACN -9 X ACN-149	2.20	5.77	0.05	58.26**	1.95
10	ACN -9 X ACN-150	2.03	9.37	0.15	61.36**	1.95
11	ACN -9 X ACN-151	2.03	3.00	-0.01	58.33**	2.67
12	ACN -9 X ACN-152	-0.46	11.27	0.45	69.63**	3.28
13	ACN -9 X ACN-153	1.20	-6.66	-0.11	3.03	-1.11
14	ACN -9 X ACN-154	-0.62	-5.56	-0.16	-19.16	-0.69
15	ACN -9 X ACN-155	0.03	6.20	0.42	-34.66*	2.97

Table 3: Continued…

Sr . No.	Crosses	Days to maturity	Plant height at maturity (cm)	Number of branches plant-1	Number of siliquae plant-1	Seed yield plant-1
16	ACN -9 X ACN-156	-0.12	0.13	-0.01	1.89	1.45
17	ACN -9 X ACN-157	-0.46	2.70	0.22	-36.80*	-0.78
18	ACN -9 X ANC-158	0.70	-4.89	0.05	50.83**	-0.49
19	ACN -9 X ACN-159	0.87	-9.16	-0.46	-7.80	-0.54
20	ACN -9 X ACN-160	0.70	-0.42	0.25	-51.63**	-0.97
21	ACN -9 X ACN-161	-2.29	-16.62	-0.24	-16.83	-1.02
22	ACN -9 X ACN-162	-1.12	-11.59	-0.14	-89.20**	2.69
23	ACN -9 X ACN-163	-0.29	3.17	-0.01	7.49	0.97
24	ACN -9 X ACN-164	1.37	-12.49	-0.51	-43.73**	-3.84**
25	ACN -9 X ACN-165	0.03	-0.32	0.15	19.86	-0.74
26	ACN -9 X ACN-166	1.37	-0.29	-0.11	-39.60*	-0.46
27	ACN -9 X ACN-167	0.70	9.03	-0.27	-43.53*	-1.64
28	ACN -9 X ACN-168	0.37	1.73	0.05	2.13	-1.04
29	ACN -9 X ACN-169	-0.29	-0.62	0.18	79.26**	6.09**
30	ACN -9 X ACN-170	0.37	13.03	0.35	46.53**	1.42
31	ACN -9 X ACN-171	2.20	7.77	0.08*	19.99	-1.46
32	ACN -9 X ACN-172	0.20	3.43	0.08*	20.96	-0.60
33	ACN -9 X ACN-173	0.37	-11.99	-0.37	-27.76	-2.07
34	ACN -9 X ACN-174	0.20	2.20	-0.54	1.76	-1.06
35	ACN -9 X ACN-175	-1.12	-24.82*	-0.11	5.46	1.79
36	ACN -9 X ACN-176	-1.29	11.23	-0.59	-27.53	-3.11
37	ACN -9 X ACN-177	-1.46	-3.46	-0.37	-52.26**	1.37
38	ACN -9 X ACN-178	-2.79	-0.59	-0.11	10.69	2.42
39	ACN -9 X ACN-179	-1.12	-4.46	0.08	7.89	-2.01
40	ACN -9 X ACN-180	-1.46	2.93	0.22	32.49	-1.71
41	ACN -9 X ACN-181	-0.29	7.97	0.22	-25.26	-0.44
42	ACN -9 X ACN-182	-1.46	-3.32	0.15	-1.06	0.70
43	ACN -9 X ACN-183	-4.46	-7.06	0.08	-51.30**	-2.54
44	ACN -9 X ACN-184	-1.79	-8.19	-0.57	-61.86**	-3.81**
45	ACN -9 X ACN-185	-0.96	-4.92	-0.57	-68.06**	-2.53
46	ACN -9 X ACN-186	-0.29	4.37	0.08	-18.86	1.19
47	ACN -9 X ACN-187	0.53	-6.02	0.22	-10.26	-2.29
48	ACN -9 X ACN-188	-1.96	-5.86	-0.14	-49.30**	-3.57**
49	Pusa bold X ACN-141	-0.53	-7.57	-0.02	-26.56	1.54
50	Pusa bold X ACN-142	-0.03	-10.67	-0.01	-113.13**	0.46
51	Pusa bold X ACN-143	-0.20	4.92	-0.18	8.50	-3.24
52	Pusa bold X ACN-144	-1.03	7.22	-0.35	25.13	0.72
53	Pusa bold X ACN-145	-3.03	-6.40	-0.38	-48.46**	-0.85
54	Pusa bold X ACN-146	-1.20	-21.90	-0.58	-50.86**	-1.02
55	Pusa bold X ACN-147	0.46	-4.13	-0.28	-17.56	-1.12
56	Pusa bold X ACN-148	-3.03	-5.57	0.04	-5.73	-1.04
57	Pusa bold X ACN-149	-2.20	-5.57	-0.05	-58.26**	-1.95
58	Pusa bold X ACN-150	-2.03	-9.37	-0.15	-61.36**	-1.95
59	Pusa bold X ACN-151	-2.03	-3.00	0.01	-58.33**	-2.67
60	Pusa bold X ACN-152	0.46	-11.27	-0.45	-59.63**	-3.28
61	Pusa bold X ACN-153	-1.20	6.66	0.11	-3.03	1.11
62	Pusa bold X ACN-154	0.62	5.56	0.16	19.16	0.69
63	Pusa bold X ACN-155	-0.03	-6.20	-0.42	34.66*	-2.97
64	Pusa bold X ACN-156	0.12	-0.13	0.01	-1.89	-1.45
65	Pusa bold X ACN-157	0.46	-2.70	-0.22	36.80*	0.78
66	Pusa bold X ACN-158	-0.70	4.89	-0.05	-50.83**	0.49
67	Pusa bold X ACN-159	-0.87	9.16	0.46	7.80	0.54
68	Pusa bold X ACN-160	-0.70	0.42	-0.25	51.53**	0.97
69	Pusa bold X ACN-161	2.29	16.62	0.24	16.83	1.02

Table 3: Continued..

Sr . No.	Crosses	Days to maturity	Plant height at maturity (cm)	Number of branches plant-1	Number of siliquae plant-1	Seed yield plant-1
70	Pusa bold X ACN-162	1.12	11.59	0.14	89.20**	-2.69
71	Pusa bold X ACN-163	0.29	-3.17	0.01	-7.89	-0.97
72	Pusa bold X ACN-164	-1.37	12.49	0.51	43.73**	3.84**
73	Pusa bold X ACN-165	-0.03	0.32	-0.15	-19.86	0.74
74	Pusa bold X ACN-166	-1.37	0.29	0.11	39.60*	0.46
75	Pusa bold X ACN-167	-0.70	-9.03	0.27	43.53**	1.64
76	Pusa bold X ACN-168	-0.37	-1.73	-0.05	-2.13	1.04
77	Pusa bold X ACN-169	0.29	0.62	-0.18	-79.26**	-6.09**
78	Pusa bold X ACN-170	-0.37	-13.03	-0.35	-46.53**	-1.42
79	Pusa bold X ACN-171	-2.20	-7.77	-0.08	-19.99	1.46
80	Pusa bold X ACN-172	-0.20	-3.43	-0.08	-20.96	0.60
81	Pusa bold X ACN-173	-0.37	11.99	0.37	27.76	2.07
82	Pusa bold X ACN-174	-0.20	-2.20	0.54	-1.76	1.06
83	Pusa bold X ACN-175	1.28	24.82*	0.11	-5.46	-1.79
84	Pusa bold X ACN-176	1.29	-11.23	0.59	27.53	3.11
85	Pusa bold X ACN-177	1.46	3.46	0.37	52.26**	-1.37
86	Pusa bold X ACN-178	2.79	0.59	0.11	-10.59	-2.42
87	Pusa bold X ACN-179	1.12	4.46	-0.08	-7.89	2.01
88	Pusa bold X ACN-180	1.46	-2.93	-0.22	-32.49	1.71
89	Pusa bold X ACN-181	0.29	-7.97	-0.22	25.26	0.44
90	Pusa bold X ACN-182	1.46	3.32	-0.15	1.06	-0.70
91	Pusa bold X ACN-183	4.46	7.06	-0.08	51.30**	2.54
92	Pusa bold X ACN-184	1.79	8.19	0.57	61.86**	3.81**
93	Pusa bold X ACN-185	0.96	4.92	0.57	68.06**	2.53
94	Pusa bold X ACN-186	0.29	-4.37	-0.08	18.86	-1.19
95	Pusa bold X ACN-187	-0.53	6.02	-0.22	10.26	2.29
96	Pusa bold XACN-188	1.96	5.86	0.14	49.30**	3.57**

*,** = significant at 5% and 1% level respectively.

performance of the progeny be predicted on the basis gca for these traits. Significant combining ability effects generally do not contribute a lot the improvement of self pollinated crops except where commercial exploitation heterosis is feasible. Sca effects of crosses revealed that the crosses ACN-9 X ACN-169 and Pusa bold X ACN-164 exhibited significant positive sca effects for seed yield plant^{-1} and number of branches plant^{-1} while, the crosses Pusa bold x ACN-169, ACN-9 XACN-184 and ACN-9 X ACN-164 exhibited significant negative sca effects for seed yield plant^{-1} and number of siliqua plant^{-1}.

CONCLUSION

Among ninety six crosses studied cross ACN-9 x ACN-164, ACN-9 x ACN-184, Pusa bold x ACN-152 and Pusa bold x ACN-152 showed negative significant sca effects for seed yield plant^{-1} and number of siliqua plant^{-1} and significant mean seed yield plant^{-1}. The presence of sca effects for seed yield and number of siliqua plant^{-1} in the above crosses indicated the predominant role of additive gene action for yield components which is a general situation observed in self pollinated crops. Due the presence of additive gene action in these crosses, the genotypes of inherent superiority can be produced from the population by blending and fixing maximum favorable genes.

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