IDENTIFICATION OF PARENTS FOR HYBRIDIZATION THROUGH COMBINING ABILITY ANALYSIS IN BROWN SARSON /BRASSICA CAMPESTRIS L. VAR BROWN SARSON/ IN SODIC SOIL

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Abstract

A line x tester analysis for combining ability in brown sarson /Brassica campestris L. var brown sarson/ in sodic soils indicated the preponderance of non-additive gene effects in the expression of seed yield, plant height, number of secondary branches per plant, number of seeds per pod and 1000-seed weight. The genotype BSH-1 among the males and IB-1 among the females were the best general combiners for seed yield and yield components. The crosses IB-5 x Pusa Kalyani, IB-7 x Assam Selection, IB-3 x Pusa Kalyani, IB-2 x Assam Selection possessed significant positive sca effects for seed yield.

Introduction

In rapeseed and mustard group, brown sarson /Brassica campestris L. var. brown sarson/ is reckoned as a rich source of edible oil /44-48%/ and is cultivated under rainfed condition but its yield potential is low. Exploitation of heterosis and the selection of parents for hybridization on the basis of their combining ability are possible methods for accelerating the pace of genetic improvement. Little information is available on the nature and extent of combining ability and gene effect operating on the expression of seed yield /Patnaik and Murty, 1978/. Brown sarson is rated as susceptible to soil sodicity /Kumar et al., 1984/. There is no information on the nature and extent of combining ability on sodic soils in this crop.

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Hence, efforts on breeding for tolerance to soil sodicity which forms the major part of the soil adversities have not been shaped in this oil rich crop. Present investigation was, therefore, set out to furnish information on combining ability in brown sarson grown in sodic soil.

Materials and methods

From the 40 inbreds developed at this station by four cycles of selfing the best 9 inbreds on the basis of vigour viz; MPS Med x 1-84-63 /IB-1/, BSH-46 x 6835 /IB-2/, Comp. III-79 x BS-5/IB-3/, Assam Selection x BS-5/IB-4/, 6835 /IB-5/, Assam Selection x BSH-1/IB-6/, BSH-1 x Pusa Kalyani /IB-7/, Comp.III-79 x BSH-40/IB-8/ and MPS Med. x 1-15-135 /IB-9/ were used as female parents and three widely adapted varieties viz; Assam Selection, BSH-1 and Pusa Kalyani were used as males in a line x tester set of crosses.

The 27 F_1's and their 12 parents were raised in single row plots of 5m length spaced 30cm apart in sodic soils in rabi 1982-83. The sodic soil was characterised with pH 9.0, ESP 30.0, EC 2.5 mmho/cm, organic matter 50 per cent and CEC 6.0 meq/100g. One month after sowing 50 plants were retained in each row. Two irrigations including the pre-sowing one were applied. RSC value of irrigation water from tubewell was 11.8.

Data on 10 random plants were selected for plant height /cm/, number of secondary branches/plant, number of seeds/pod, 1000-seed weight /g/ and seed yield/plant /g/. Analysis of variance for combining ability was done following Kempthorne /1957/ using means of 10 plants.

Results and discussion

Mean squares due to males, females, females x males and crosses were significant for all the traits. Mean squares due to females were larger than those due to males and females x males, indicating more diversity among the lines for the traits under study. The estimates of variance /GCA/, variance /SCA/ and the ratio lesser than unity indicated the preponderance of non-additive gene effects in the

inheritance of these traits. Earlier reports of Rishi Pal et al., /1981/ on toria and Patnaik and Murty /1978/ on brown sarson in normal soil agree with the present result that the yield and its components are mainly governed by non-additive gene effects in brown sarson.

General Combining Ability: -

The tester BSH-1 had significant positive GCA effects for seed yield/plant /Table 2/. This was a good combiner for 1000 seed weight also.

Of the 9 inbreds, IB-1, IB-3 and IB-8 showed significant positive GCA for seed yield. IB-1, the best combiner for seed yield also gave significant positive GCA for plant height, secondary branches/plant and 1000 seed weight. Parent IB-3 with significant positive GCA effect for seed yield also had high GCA for plant height, seed/pod and 1000 seed weight. Another parent IB-8 which showed high GCA for seed yield was also marked with high GCA for 1000 seed weight. Parents IB-1 and BSH-1 were good general combiners for seed yield and other characters. Since high GCA effect is related to additive or additive x additive component of genetic variation /Griffing, 1956/ which represents fixable genetic component, these parents hold great promise for breeding in sodic soils.

Specific Combining Ability: -

The SCA effects were estimated in all the 27 crosses, however, data on 5 top ranking crosses based on SCA for seed yield are given in Table 3. The cross IB-5 x Pusa Kalyani followed by IB-7 x Assam Selection IB-3 x Pusa Kalyani, IB-2 x Assam Selection and IB-9 x BSH-1 had the highest significant positive SCA effects on seed yield. The cross IB-5 x Pusa Kalyani also had significant SCA effects on number of seeds per pod while cross IB-7 x Assam Selection showed significant SCA effects on all the traits except for plant height. IB x Pusa Kalyani was the cross which showed significant SCA effects on number of seeds per pod and 1000-seed weight also while the cross IB-9 x BSH-1 had significant SCA effects on plant height

and number of secondary branches/plant. The high SCA observed in these crosses reflected the operation on non - - additive gene effects in the expression of seed yield and other traits.

Additive gene effects were involved for yield in IB-3 x x BSH-1. Both the parents though had high GCA, did not show marked SCA, high yielding segregants may, therefore, be exploited from this cross.

Non-additive gene effects appear to be involved in the crosses viz; IB-7 x Assam Selection, IB-9 x BSH-1 and IB-3 x Pusa Kalyani. These crosses showed high SCA effects but low GCA observed in these crosses reflected the operation of non-additive gene effects in the expression of seed yield.

In a situation, where additive and non-additive genetic variance are significant, the most suitable breeding procedure would be one which mops up the additive genetic variance and at the same time maintains heterozygosity. Therefore, it is desirable to practise recurrent selection by intermating the most desirable segregants, alternately with selection. This would lead to an elevation of the genetic plateau by accumulating favourable additive genes and simultaneously exploiting the dominance variance.

References

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Table 1. Analysis of variance for combining ability and the componets of genetic variance for certain traits in sodic soil.

Source		Plant height	Secondary branches per plant	No. of seeds per pod	1000-seed weight	Seed yield per plant
Lines	8	110.15^{xx}	27.11^{xx}	180.16^{xx}	18.59^{xx}	0.66^{xx}
Testers	2	11.32^{x}	11.86^{xx}	82.73^{xx}	19.43^{xx}	0.57^{xx}
Lines x Testers	16	64.41^{xx}	6.52^{xx}	100.09^{xx}	12.97^{xx}	0.42^{xx}
Crosses	26	74.40^{xx}	13.26^{xx}	123.39^{xx}	15.20^{xx}	0.51^{xx}
Error	52	3.75	2.25	4.19	0.43	0.06
Var /GCA/	-	-0,82	2.88	6.97	1.34	0.04
Var /SCA/	-	80.87	5.69	127.87	16.73	0.48
Var /GCA/SCA/	-	-0.01	0.50	0.05	0.08	0.08

xx Significant at 1% level.

x Significant at 5% level

Table 2. General combining ability effects for certain traits in sodic soil.

Source	Plant height	Secondary branches per plant	No. of seeds per pod	1000-seed weight	Seed yield per plant
Testers					
Assam	0.52	0.32	0.06	-0.52^{xx}	-0.15^{xx}
Selection BSH-1	0.20	-0.76^{xx}	0.03	0.97^{xx}	0.13^{xx}
Pusa Kalyani	-0.73^{x}	0.44^{x}	-0.10	-0.46^{xx}	0.02
SE /gi/ ±	0.25	0.20	0.27	0.09	0.03
Lines					
IB-1	4.07^{xx}	2.77^{xx}	-0.76	2.16^{xx}	0.42^{xx}
IB-2	2.92^{xx}	-1.42^{xx}	-0.30	0.92^{xx}	-0.07
IB-3	3.12^{xx}	-0.02	11.68^{xx}	1.58^{xx}	0.17^{xx}
IB-4	-1.75^{xx}	-0.42	-3.07^{xx}	-1.55^{xx}	-0.36^{xx}
IB-5	1.07^{x}	-0.78^{x}	-0.37	0.005	-0.10
IB-6	-6.09^{xx}	-0.77^{x}	-1.14^{x}	-2.16^{xx}	-0.36^{xx}
IB-7	1.33^{xx}	3.12^{xx}	-2.05^{xx}	-0.85^{xx}	0.07
IB-8	-4.46^{xx}	-1.46^{xx}	-1.95^{xx}	0.51^{xx}	0.28^{xx}
IB-9	-0.20^{x}	-1.00^{x}	-2.01^{xx}	-0.63^{xx}	-8.05
SE /gi/ ±	0.51	0.39	0.54	0.17	0.06

x Significant at 5% level. xx Significant at 1% level.

Table 3. Specific combining ability effects of 5 top ranking crosses on the basis of seed yield.

Crosses	Plant height	No.of Secondary branches/plant	No. of seeds per pod	1000-seed weight	Seed yield per plant
IB-5 x Pusa Kalyani	-1.38	0.27	-3.08^{xx}	0.35	0.58^{xx}
IB-7 x Assam Selection	1.30	-1.71^{xx}	5.12^{xx}	2.98^{xx}	0.51^{xx}
IB-3 x Pusa Kalyani	0.28	1.09	16.60^{xx}	3.21^{xx}	0.44^{xx}
IB-2 x Assam Selection	-1.60	-0.24	-0.08	-0.17	0.42^{xx}
IB-9 x BSH-1	-4.36^{xx}	1.18^{x}	1.03	0.09	0.39^{xx}

xx Significant at 1% level.