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Combining Ability in Indian Bean (*Lablab purpureus* (L). Sweet)*

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ABSTRACT

Combining ability and gene actions for six characters including pod yield in Indian bean were studied in a half diallel crosses of seven diverse lines. Analysis of variance revealed significant mean sum of square due to gca as well sca for all the characters. The higher magnitude of gca variance compared to sca variance signified the predominant role of additive type of gene action in the expression of all the characters. It is suggested that breeding for high yielding varieties in Indian bean may become more effective if additive gene action is more appropriately exploited alongwith non-additive gene effects. It could be achieved by selecting desirable segregants from the segregating population by applying progeny selection technique.

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INTRODUCTION

In a crop improvement programme, the success rests upon isolation of valuable gene combinations as determined in the form of lines with high combining ability. The lines which produce good progenies on crossing, are most desired by the plant breeder. The knowledge of gene action and combining ability not only helps in identifying the best combiners which may be hybridized either to exploit heterosis or to accumulate fixable genes through selection but also helps in understanding the inheritance of quantitative characters, so as to choose the proper selection method to be followed in future breeding programmes. There are only a few reports available on these aspects for Indian bean. With this in view, results on the estimates of combining ability and variances for pod yield and yield contributing characters from 7 x 7 diallel (without reciprocals) experiment are presented here.

MATERIALS AND METHODS

Seven diverse lines of *Lablab purpureus* viz., G. P. L. No. 83, G.P.L. No. 88, JIB (P)-2, G.P.L. No. 36, JDL-79, G.P.L. No. 48 and JIB (P)-6 were crossed in all possible combinations (excluding reciprocals). The 21 F_1s and 7 parents were grown in a randomized block design with three replications at Vegetable Research Station, Gujarat Agricultural University, Junagadh during *rabi* 1997-98. Each parent and F_1, was

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planted in one row plot of 7.5 m long with inter and intra-row distance of 0.90 m x 0.75 m. Observations were recorded on five randomly selected plants from each replication, for six traits viz., days to first picking, number of branches per plant, pod length (cm), number of seeds per pod, number of pods per plant and pod yield per plant (g). Mean values were used for statistical analysis. The gca and sca variances and effects were worked out using Model-1, Method-2 of Griffing (1956).

RESULTS AND DISCUSSION

The analysis of variance for combining ability for different traits (Table 1) was highly significant for all the characters except days to first picking. These suggested the role of both additive and non-additive genetic components in the expression of all the characters. However higher magnitude of gca variance over sca variances for all traits indicated that the additive components of genetic variance were predominantly involved in the expression of yield and its attributing characters. Similar results were reported by Singh *et al.* (1980) and Singh and Singh (1981). It is evident from these observations that breeding for high yielding varieties in Indian bean may become more effective if additive gene effects are more appropriately exploited alongwith non-additive gene effects. In Indian bean, it could be achieved by the use of good general combining parents in hybridization and selecting desirable segregants from the segregating generations by adopting progeny selection technique which is meant for exploiting additive genetic variance.

Estimates of gca effects for parents (Table 2) indicated that JIB(P)-2 was the good general combiner for the characters like days to first picking, number of branches per plant and pod yield per plant, G. P. L. No.-88 and G. P. L. No.-48 were good general combiner for pod length, number of seeds per pod. The parent JDL-79 was average combiner for number of branches per plant, pod length and number of seeds per pod. None of the parents was good general combiner for all the traits.

TABLE 1

Analysis of variance for combining ability for different economic traits studied in Indian bean.

Characters	*Mean squares*			
	gca	*sca*	*Error*	*gca/sca*
d.f.	*6*	*21*	*54*	
Days to first picking	20.17*	19.34**	6.92	1.04
No. of branches per plant	2.27**	1.14**	0.36	1.99
Pod length	18.05**	1.13**	0.06	15.95
No. of seeds per pod	0.47**	0.05**	0.01	9.10
No. of pods per plant	2718.45**	1072.80**	51.63	2.53
Pod yield per plant	12222.95**	19865.59**	640.01	0.62

*, ** indicates significance at 5 and 1 per cent, respectively.

TABLE 2

General combining ability effects of yield components Indian bean.

Parents	*Days to first picking*	*No. of branches per plant*	*Pod length (cm)*	*No. of seeds per pod*	*No. of pods per plant*	*Pod yield per plant*
G. P. Line No. 83	-2.49*	-0.06	-1.44**	-0.06	16.75**	31.29**
G. P. Line No. 88	-0.20	-0.20	1.56**	0.27**	-15.68**	-32.08**
JIB (P)-2	1.17	-0.75**	-1.63**	-0.32**	26.19**	65.18**
G. P. Line No. 36	1.17	-0.14	0.78**	0.15**	-8.61**	-8.38
JDL-79	0.66	0.91**	0.79**	0.14**	12.68**	3.96
G. P. Line No. 48	-1.57	-0.03	1.32**	0.11	-16.17**	-31.93
JIB (P)-6	1.25	0.27	-1.38**	-0.29**	10.19**	-28.04*
S. E. (gi)	0.88	0.18	0.08	0.04	2.22	7.81
C. D. at 5%	2.16	0.45	0.18	0.08	5.40	19.10
S. E. (gi-gi)	1.24	0.28	0.12	0.05	3.39	11.93
C. D. at 1%	3.03	0.69	0.34	0.13	8.29	29.18

*, ** indicates significance at 5 and 1 per cent, respectively.

No cross combination was consistenly good for all the characters (Table 3). The cross combination G.P.L. No.-83 x JIB (P)-2 manifested significant positive effect in desirable direction for pod yield per plant, number of branches per plant, pod length and number of pods per plant. The cross G.P. L. No.-88 x JIB (P)-2 showed significant sca effect in desired direction for number of branches per plant, pod length, number of seeds per pod, number of pods per plant and pod yield per plant. The cross combination JIB (P)-2 x G. P. L. No.-36 exhibited significant sca effect in desired direction for number of branches per plant, pod length, number of seeds per pod, number of pods per plant and pod yield per plant. The hybrid G. P. L. No-36 x JDL-79 recorded the highest significant sca effects in desired direction for number of pods per plant. The cross combination JDL-79 x G. P. L. No.-48 had significant sca effects in desired direction for pod length, number of pods per plant and pod yield per plant.

The crosses exhibiting high sca effects for different characters indicate the possibility of improving these characters by selection and hybridization.

TABLE 3

List of crosses showing good specific combining ability effects for yield and its attributes in Indian bean.

Crosses	*Days to first picking*	*No. of branches per plant*	*Pod length (cm)*	*No. of seeds per pod*	*No. of pods per plant*	*Pod yield per plant (g)*
G. P. L. No. 83 x JIB(P)2	-2.94	1.29*	0.85**	0.08	62.70**	104.65**
G. P. L. No. 88 x JIB(P)-2	2.43	-0.50	0.20	0.34**	4.05	177.69**
G. P. L. No. 88 x JIB (P)-6	-0.17	1.52**	0.99**	0.23*	17.01*	104.80*
JIB(P)-2 x G. P. L. No. 36	3.39	2.37**	0.34	0.22*	19.66**	139.65**
G.P.L. No. 36 x JDL-79	-3.76	0.25	0.07	0.11	38.42**	192.54**
JDL-79 x G. P. L. No. 48	-3.35	-0.52	0.50*	0.15	21.01**	144.76**
S. E. (Sij)	2.36	0.54	0.22	0.10	6.45	22.71
C. D. at 5%	4.91	1.12	0.46	0.21	13.41	47.23
S. E. (Sij-Slk)	3.51	0.80	0.33	0.15	9.58	33.73
C. D. at 5%	7.29	1.66	0.69	0.32	19.93	70.16
S.E. (sij-slk)	3.28	0.75	0.98	0.14	8.96	31.55
C. D. at 5%	6.82	1.55	2.04	0.30	18.64	65.63

*, ** indicates significance at 5 and 1 per cent, respectively.

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