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GENETICS AND PLANT BREEDING

Variation and Character Association in Seed Yield and Related Traits in Rice Bean (*Vigna umbellata)*

H.L. Raiger[1], P.K. Sahu[2*], M.P. Behera[2] and N.K. Jajoriya[3]

[1]National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi – 110012, India
[2]Orissa University of Agriculture and Technology, Bhubaneswar-751003, Orissa, India
[3]BFIT, HNB Garwal Central University, Dehradun, Uttarakhand, India

*Corresponding author: drhanumanlal@yahoo.co.in (**ORCID ID:** 0000-0003-0421-6573)

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ABSTRACT

One hundred and twenty rice bean genotypes were assessed for 11 agronomic traits against three different elite varieties RBL-6, RBL-35, RBL-50 in Augmented Design during the *Kharif* 2005. There was no significant difference among the blocks and as well as checks. The variety RBL-50 among the checks registered highest seed yield (q/ha). The nineteen test entries viz. BRB10, LRB115, BRB06, BRB15, LRB109, BRB19, BRB14, LRB081, BRB08, BRB01, BRB03, LRB110, LRB118, BRB09, BRB07, BRB05, LRB043, LRB020, LRB075-1 showed higher seed yield (q/ha) than the best check variety RBL-50 (9.21 q/ha).

Highlights

- 120 Rice bean genotypes and four released varieties were evaluated for genetic variation and correlation.
- The results of this study indicate that these rice bean genotypes can be used for future breeding programs to enhance the seed yield of Rice bean in India.

Keywords: Genetic resources, germplasm, rice bean

Rice bean is an important grain legume of low and mid-hill region have multifarious utility. It is mainly suitable for mid-hills were traditional pulses like a black gram, green gram can not be grown successfully. The efforts have been made to evaluate, characterize, preserve and catalogue the genetic resources of rice bean. The improvement of the seed and protein yield in this crop to meet the increasing the demand is foremost. Hence there is a need to intensify efforts to search for appropriate donor for utilization in the locations specific breeding programme. In the present paper an attempt has been made to evaluate the genetic resources of a rice bean maintained under the All India Coordinate Research Network to assess their potential use in varietal development programme for rice bean.

MATERIALS AND METHODS

One hundred and twenty accessions rice bean along with three standard check varieties were evaluated in Augmented Block Design (1 & 2) during the *Kharif* 2005 at OUAT, Bhubaneshwar. The accessions were grown in two rows of 3 m length with 45 × 15 cm spacing. The standard agronomic practices were followed and plant protection measures were adopted as and when required. The observation were recorded on five competitive randomly selected plants for 11 yield attributes. The one hundred and twenty test entries were equally distributed in eight block containing 15 entries per block. The three different checks namely RBL-6, RBL-35 and RBL-50 were randomly distributed in each block. The total plots per block were 18. The total number of plots in eight blocks were 144 (3). Correlation and direct and indirect effects were computed by using standard statistical methods (4).

RESULTS AND DISCUSSION

The results have been calculated on the basis of 11

Table 1: Means values for seven characters of three checks

S. No.	Checks	Days to flowering	Days to maturity	Plant height (cm)	Branches per plant	Cluster per plant	Pods per plant	Pod length (cm)	Seeds per pod	100 seed weight (g)	Seed yield per plant (g)	Yield (q/ha)
1	RBL 6	45.50	99.13	61.65	2.35	10.18	26.75	8.58	6.41	6.31	7.22	7.55
2	RBL 35	44.63	98.00	58.43	2.60	10.75	28.78	8.79	6.29	6.63	8.26	8.68
3	RBL 50	49.75	98.50	60.05	2.48	11.63	27.80	8.91	6.60	5.97	8.08	9.21

Table 2: ANOVA for check varieties

Source of Variation	df	Days to flowering	Days to maturity	Plant height (cm)	Branches per plant	Cluster per plant	Pods per plant	Pod length (cm)	Seeds per pod	100 seed weight (g)	Seed yield per plant (g)	Yield (q/ha)
		MSS	MSS	MSS	MSS	MSS	MSS	MSS	MSS	MSS	MSS	MSS
Checks	2.00	60.12*	2.54	20.80	0.13	4.27	8.20	0.23	0.20	0.88	**2.46**	***5.74***
Blocks	7.00	1.95	9.33	15.31	0.14	**4.68***	**44.83***	0.30	0.05	0.20	0.46	1.62
Error	14.00	4.84	8.26	72.13	0.18	1.40	8.37	0.21	0.18	0.09	0.39	1.12
Total	23.00	6.79	20.13	108.25	0.45	10.35	61.40	0.75	0.43	1.17	3.30	8.48

** Significant at 5% level.*

Table 3: Correlations among the different agro-morphological trials in Ricebean germplasm

Characters	Days to flowering	Days to maturity	Plant height	Branches per plant	Clusters per plant	Pods per plant	Pod length (cm)	Seeds per pod	100 seed weight (g)	Seed yield per plant (g)	Yield (q/ha)
Days to flowering	1.0000										
Days to maturity	-0.2769 **	1.0000									
Plant height	-0.2705 **	0.4748 **	1.0000								
Branches per plant	-0.1845 *	0.5004 **	0.6710 **	1.0000							
Clusters per plant	-0.1116	0.4305 **	0.5899 **	0.7669 **	1.0000						
Pods per plant	-0.1604	0.5667 **	0.5718 **	0.6635 **	0.8311 **	1.0000					
Pod length	0.0065	0.3189 **	0.2060 **	0.2612 **	0.2558 **	0.2568 **	1.0000				
Seed per pod	-0.0367	0.0810	-0.1512	-0.1394	-0.0239	0.0331	0.1088	1.0000			
100 seed weight(g)	-0.0994	0.3528 **	0.1650	0.1997 *	0.0764	0.1294	0.3690 **	-0.0809	1.0000		
Seed yield per plant (g)	-0.1489	0.4220 **	0.5215 **	0.5980 **	0.8120 **	0.7883	0.2815 **	0.1321	0.1147	1.0000	
Yield (q/ha)	-0.1492	0.4542 **	0.4684 *	0.5013	0.6538 **	0.8055 **	0.1617	0.1327	0.0109	0.7166 **	1.0000

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

attributes but no significant difference among the test entries was observed for days to flowering and maturity. Therefore, nine characters were studied for selecting the promising lines. The mean for nine characters of three checks over the blocks and ANOVA have been given in table 1 and 2, respectively. No significant difference was observed among the blocks and as well checks for days to flowering, days to maturity, plant height, number of branches per plant, pod length (cm), seeds per pod, 100 seed weight, seed yield per plant and seed yield (q/ha). Since, there is a no block effect on the test entries, the observed value of test entries will be the actual performance of particular genotypes while the significant difference was observed among the blocks for number of clusters per plant and

Table 4: Direct and indirect effects of different agro-morphological trails in Ricebean germplasm

Characters	Days to flowering	Days to maturity	Plant height (cm)	Branches per plant	Clusters per plant	Pods per plant	Pod length (cm)	Seeds per pod	100 seed weight (g)	Seed yield per plant (g)	Correlation on with yield (q/ha)
Days to flowering	**0.0007**	-0.0088	-0.0120	0.0011	0.0218	-0.1164	-0.0003	-0.0024	0.00096	-0.0425	-0.1492
Days to maturity	-0.0002	**0.0317**	0.0211	-0.0031	-0.0842	-0.4112	-0.0141	0.0054	-0.0339	0.1204	0.4542**
Plant height	-0.0002	0.0150	**0.0445**	-0.0042	-0.1154	0.4149	-0.0091	-0.0101	-0.0159	0.1488	0.4684*
Branches per plant	-0.0001	0.0158	0.0299	**-0.0062**	-0.1501	0.4814	-0.0116	-0.0093	-0.0192	0.1707	0.5013
Clusters per plant	-0.0001	0.0136	0.0263	-0.0048	**-0.1957**	0.6030	-0.0113	-0.0016	-0.0074	0.2317	0.6538**
Pods per plant	-0.0001	0.0179	0.0254	-0.0041	-0.1626	**0.7256**	-0.0114	0.0022	-0.0124	0.225	0.8055**
Pod length	0.0000	0.0101	0.0092	-0.0016	-0.0501	0.1863	**-0.0443**	0.0073	-0.0355	0.0804	0.1617
Seed per pod	0.0000	0.0026	-0.0067	0.0009	0.0047	0.024	-0.0048	**0.0667**	0.0078	0.0377	0.1327
100 seed weight (g)	-0.0001	0.0112	0.0073	-0.0012	-0.015	0.0939	-0.0164	-0.0054	**-0.0962**	0.0327	0.0109
Seed yield per plant (g)	-0.0001	0.0134	0.0232	-0.0037	-0.1589	0.5720	-0.0125	0.0088	-0.011	**0.2854**	0.7166**

*Residual effects = 0.306; Figures are bold indicated direct effects; * Significant at 5% level; ** Significant at 1% level.*

Table 5: Promising genotypes against best check

Sl. No.	Characters	Genotypes	Best check value	C.D (0.05)
1	Plant height (cm)	LRB031, BRB08, BRB10 > 82.12 cm	RBL-6 (61.65 cm)	20.42
2	Branches per plant	BRB20, LRB047, BRB18, BRB08, BRB07, LRB074-1, BRB17, LRB048 LRB110, LRB079 > 3.78	RBL-35 (2.60)	1.18
3	Cluster per plant	BRB19, BRB14, BRB20, LRB006, BRB08, LRB077, BRB10, LRB118, LRB065, BRB15, BRB17, LRB043, LRB047 > 16.46	RBL-50 (11.63)	4.86
4	Pods per plant	BRB06, BRB15, BRB19, BRB14, LRB118, BRB10, LRB043 > 41.93	RBL-35 (28.78)	14.13
5	Seed per pod	LRB093, BRB10, BRB03, LRB031-1, BRB04, LRB010, BRB05, BRB01, LRB025, LRB099, LRB002 > 7.74	RBL-50 (6.60)	1.14
6	100 seed weight (g)	LRB065, BRB13, LRB117, LRB118, LRB049, LRB085 > 7.65	RBL-35 (6.63 g)	0.46
7	Seed yield per plant (g)	BRB10, BRB20, BRB15, LRB118, LRB018, BRB08, LRB085, LRB077, BRB06, LRB006, BRB01, BRB19, BRB03, LRB102, LRB033-1, LRB115, LRB110, BRB04, BRB14, LRB109, LRB002 > 10.02	RBL-35 (8.26 g)	0.80
8	Yield (q/ha)	BRB10, LRB115, BRB06, BRB15, LRB109, BRB19, BRB14, LRB081, BRB08, BRB01, BRB03, LRB110, LRB118, BRB09, BRB07, BRB05, LRB043, LRB020, LRB075-1 > 12.6	RBL-50 (9.21 q/ha)	3.4

number of pods per plant. The adjusted values of these characters were calculated. The observed value of 120 test entries for different nine agronomic traits and adjusted value for two characters and different standard error have been given in table 3 and 4 respectively. The highest check mean value along with the standard error for different characters have been obtained here as a criteria for selecting the better performing genotypes on the basis of observed values for seven characters and adjusted values for two characters. The list of promising genotypes for different yield attributes (better than check values) is given in table 5.

Correlation coefficients for eleven matrix traits in rice bean are presented in table 3. Seed yield (q/ha) was positively and highly (significantly correlated with all the characters except days to flowering, pod length, seeds per pod and 100 seed weight. However, the positive correlation of seed yield were observed with days to maturity (0.4542), plant height (0.4604), number of branches per plant (0.5013), clusters/plant (0.6538), pods/plant (0.8015), pod length (0.1617 cm), seeds per pod (0.1327), 100 seed weight (0.0109 g) and seed yield/plant (0.7166 g). Therefore selection of high value for these characters will ultimately increase the seed

yield. The pod length (cm), seeds/pod and 100 seed weight (g) have the non significant association with seed yield. The contribution of these characters was further analyzed by computing their direct and indirect effects on seed yield (q/ha) and is presented in Table 4. The pods per plant, 100 seed weight and seed yield per plant had direct positive effect. The direct effect of remaining characters were very low in magnitude. The characters showing high positive direct effect and indirect effect via each other. The number of branches per plant, clusters per plant, pod length and 100 seed weight had negative direct effect but correlation with seed yield in positive owing to high indirect effect through all other characters. The number of pods per plant showed the highest indirect effects on seed yield through days to maturity, plant height, number of branches per plant and number of clusters per plant, whereas, pod length showed negative indirect effects on the seed yield through all the characters. Results of the present investigation suggested in the selection programme the plant more with plant height, number of branches per plant, number of clusters per plant and bold seed should be selected for increasing the seed yield.

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